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MANUFACTURE OF ARTIFICIAL FILAMENTS,
THREADS, AND THE LIKE

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This invention relates to the manufacture of artificial textile materials, and relates more particularly to improvements in the production of filaments, threads, yarns and the like by extruding suitable solutions through orifices into a setting medium.

In the preparation of artificial filaments, threads or yarns a suitable solution is extruded through small orifices of a spinning jet or spinneret into a setting medium which may be gaseous in the dry or evaporative method of spinning, or liquid as in the wet method of spinning. It is of economic importance that the spinning of the filaments proceed without interruption. An all too frequent cause of interruption in the spinning of the filaments is the contamination or clogging of the orifices of the spinning jet by impurities, suspensions or reaction products in the spinning solution. These extraneous substances deposit on the spinning jet and eventually at least partially clog the orifices. The clogging of the orifices is especially prevalent when spinning a solution of cellulose acetate in acetone. This may be due to the presence in the spinning solution of insoluble compounds formed by sulphates in the spinning solution reacting with the metals of the apparatus.

An object of this invention is to provide an improved method of spinning whereby the clogging of the orifices of the spinning jet is substantially eliminated.

A further object of this invention is to treat the spinning solution prior to spinning the same into filaments, threads or yarns with a substance which will have no appreciable effect on the properties of the formed filaments, threads or yarns.

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

We have found that if certain finely divided materials that are not soluble in the base material from which the filaments, threads or yarns are formed are incorporated in the spinning solution, clogging of the orifices of the spinning jet is substantially wholly eliminated. In order that the luster or transparency of the filaments, threads or yarns be unaffected materially, the finely divided substance incorporated in the spinning solution should have an index of refraction not appreciably different from that of the base material of the filaments, threads or yarns and, moreover, the amount incorporated should be very small.

This invention is applicable to the preparation of filaments, threads or yarns from solutions of

any suitable base material. For example, the spinning solution may have as a base material polyvinyl or other synthetic resins, linear condensation polymers such as polyamides derived from amino acids or derived by the condensation of diamines with dicarboxylic acids, e. g. polyhexamethylene adipamide, or it may have a base of the reconstituted cellulose type of material formed by the viscose, Chardonnet or cuprammonium process. However, this invention is particularly applicable to use with spinning solutions of organic derivatives of cellulose, such as organic esters of cellulose and cellulose ethers. Examples of the organic esters of cellulose are cellulose acetate, cellulose propionate and cellulose butyrate, while examples of the cellulose ethers are ethyl cellulose and benzyl cellulose. The organic derivative of cellulose spinning solution may be prepared by dissolving the organic derivative of cellulose in a volatile solvent such as acetone, which solution is extruded into an evaporative atmosphere as in dry spinning or into a precipitating bath as in wet spinning.

As stated, the finely divided material employed is preferably one that has an index of refraction not greatly different from that of the base material of the spinning solution from which the filaments, threads or yarns are to be spun. The finely divided material employed in accordance with this invention may be either of inorganic or organic nature provided that it is insoluble in the spinning solution and is inert with respect to the substances making up the spinning solution and to the reagents with which the material comes in contact during the formation of the filamentary materials or during subsequent treatments. We have obtained very good results by the use of silicon dioxide (preferably silica gel), calcium magnesium silicate, and aluminum oxide or aluminum hydrate. Where the spinning solution comprises cellulose acetate dissolved in acetone, we have found that optimum results are obtained by the use of finely divided aluminum hydrate.

The amount of finely divided material incorporated in the spinning solution is of the utmost importance. If too little material is used, the valuable advantages of our invention, i. e. the keeping of the orifices clear of deposits, will not be attained. Where too large an amount is used, impairment of the product will result, particularly with respect to luster and transparency. We have found that generally good results are obtained by employing the finely divided material in an amount from 0.075 to 0.2%, based on the

weight of the base material. The exact amount of the finely divided material effectively employed in accordance with our invention will vary with the nature of the finely divided material as well as that of the base material. Where cellulose acetate dissolved in acetone is employed as the spinning solution, the addition to said spinning solution of 0.1%, based on the weight of the cellulose acetate, of aluminum hydrate was found to yield the best results.

The finely divided insoluble material preferably has a diameter of from less than 0.1 to 10 microns. Any suitable method may be employed to obtain the insoluble material in this fine state of subdivision. For example, the insoluble material may be ground in water, olive oil or diethylene glycol. Preferably, however, the insoluble material is ground in a solution of the base material in the solvent used in preparing the spinning solution, e. g. a 10-14% solution of cellulose acetate in acetone where cellulose acetate is employed as the base material. Optimum results are obtained when the insoluble material is produced in the desired fineness by subjecting it to a squeezing, rubbing or kneading action while dispersed in a plastic mass comprising, preferably, the same material as the base of the filamentary materials to be prepared, dried and ground fine. The squeezing, rubbing or kneading action may be effected in kneaders and heated malaxating rolls ordinarily employed in the manufacture of cellulose derivative plastics.

The finely divided insoluble material may be incorporated in the spinning solution at any convenient time prior to or after filtration. Preferably, however, it is added prior to the usual filtration through a series of suitable filters, with thorough mixing.

By the use of the insoluble material in the form and in the amount specified, deposits by extraneous substances is substantially avoided, and interruption of spinning by spinning jet blockage is eliminated. Moreover, the filaments, threads and yarns produced from the spinning solution having the insoluble material of our invention incorporated therein are not deleteriously affected by the presence of said insoluble material. The filamentary materials have substantially the same appearance as ordinary products. In fact, their textile properties are enhanced since they develop less tension on guides, tensioning devices, knitting needles or other parts of winding, twisting, wearing or knitting machines, and have a reduced tendency while in transit to cut or abrade such parts of textile machines. Accordingly, our invention also makes possible the production of better textile packages and better fabrics therefrom.

In order further to illustrate our invention, but without being limited thereto, the following specific example is given:

Example

The following ingredients

	Parts by weight
Aluminum hydrate.....	1
Cellulose acetate	1
Acetone	1.5

are kneaded together in a heated kneading machine until a stiff, doughy mass is formed. This mass is then worked between relatively closely

spaced heated malaxating rolls until the product is substantially free of the acetone which is a volatile solvent for the cellulose acetate.

The spinning solution is formed by dissolving cellulose acetate in acetone and to the solution is added a finely ground material prepared as above specified, the amounts of ingredients in the spinning solution being such that it contains 100 parts by weight of cellulose acetate, 300 parts by weight of acetone and 0.1 part by weight of aluminum hydrate. The ingredients are thoroughly mixed, the mixture is then filtered and the filtered spinning dope is extruded through fine orifices of a spinning jet into a heated evaporative atmosphere. The resulting filaments are twisted and wound onto a package.

By the use of a spinning solution having the aluminum hydrate incorporated therein the orifices of the spinneret are maintained substantially free of deposit, the life of the spinning jet is substantially doubled and the filamentary materials formed are more regular in cross-section than those heretofore made. Moreover, the resulting filamentary materials are in no way deleteriously affected by the presence of the aluminum hydrate therein.

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 our invention.

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

1. In a process for the production of filamentary materials by extruding a spinning solution comprising cellulose acetate dissolved in acetone through orifices of a spinning jet into an evaporative medium, the step of preventing formation of deposit in said orifices by incorporating in said spinning solution finely divided aluminum hydrate.

2. In a process for the production of filamentary materials by extruding a spinning solution comprising cellulose acetate dissolved in acetone through orifices of a spinning jet into an evaporative medium, the step of preventing formation of deposit in said orifices by incorporating in said spinning solution from 0.075 to 0.2%, based on the weight of the cellulose acetate, of finely divided aluminum hydrate.

3. In a process for the production of filamentary materials by extruding a spinning solution comprising cellulose acetate dissolved in acetone through orifices of a spinning jet into an evaporative medium, the step of preventing formation of deposit in said orifices by incorporating in said spinning solution 0.1%, based on the weight of the cellulose acetate, of finely divided aluminum hydrate.

4. In a process for the production of filamentary materials by extruding a spinning solution comprising cellulose acetate dissolved in acetone through orifices of a spinning jet into an evaporative medium, the step of preventing formation of deposit in said orifices by incorporating in said spinning solution 0.1%, based on the weight of the cellulose acetate in said spinning solution, of aluminum hydrate and then subjecting the mixture to filtration prior to the extrusion thereof.

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