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PROCESS OF MAKING ARTIFICIAL FILAMENTS AND PRODUCT THEREOF

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This invention relates to the production of artificial filaments, yarns, bristles and the like made of or containing cellulosic material.

An object of our invention is to produce filaments of cellulosic material, which filaments contain lumens or other hollow spaces therein.

Another object of our invention is to produce hollow filaments or bristles from solutions of cellulosic material by forming the same at a lower rate than has been previously employed. Other objects of our invention will appear from the following detailed description.

In the process of making artificial filaments from cellulosic derivatives as now practiced, solutions of cellulosic material are extruded through circular orifices of a spinnerette, either into a precipitating bath, as in wet spinning, or into an evaporative atmosphere, as in dry spinning, and the filaments thus formed are drawn off at a comparatively high speed, ranging from 25 to 200 meters of length of filament per minute. The filaments thus formed, however, have a solid cross section.

We have found that if the rate of spinning is materially reduced, filaments having hollow spaces therein may be formed. Such hollow filaments are preferable to the solid filaments, since for a given weight they have greater covering power than the solid filaments.

In accordance with our invention, we prepare filaments having lumens or hollow spaces therein by the wet or dry spinning of solutions containing cellulosic derivatives at a much lower rate than has been previously employed.

By the process of our invention, filaments, yarns, bristles or artificial horse-hair, etc. may be made. The filaments formed may be of a very fine denier, on the order of less than 2 to 15 or more denier, which filaments may be associated together to form artificial yarns. This process may be employed for preparing strands or single filaments of much heavier denier such as 100, 300 to 1500 denier or more, thus forming stiff bristles or artificial horse-hair that may be used in brushes that are adapted for toilet use. The filaments may also be employed for making braids, ribbons or any other suitable material.

This invention may be applied for making filaments or bristles by the viscose method, wherein a solution of viscose is extruded through spinnerettes into an aqueous bath containing a precipitating agent such as an acid.

The invention is eminently suited for making filaments from organic derivatives of cellulose. Examples of organic derivatives of cellulose are organic esters of cellulose such as cellulose acetate, celluose formate, cellulose propionate, cellulose butyrate, or cellulose ethers, such as ethyl cellulose, methyl cellulose or of benzyl cellulose. These organic derivatives of cellulose are dissolved in a suitable solvent and the solution extruded through orifices of a spinnerette, either into a bath containing a liquid which causes precipitation of the cellulose derivative from the solution, or into a drying and evaporative atmosphere as in dry spinning.

The solvents employed for making solutions of the organic derivatives of cellulose may be any suitable ones, examples of which are acetone, acetone and water, methylene chloride and ethyl alcohol, ethylene dichloride, ethylene dichloride and alcohol (ethyl or methyl), chloroform, or chloroform and ethyl or methyl alcohol.

As to the rate of spinning, this is preferably on the order of 0.025 to 0.1 to 5 meters per minute or more, depending on the size of the filaments to be produced.

The size of the orifices through which the spinning solution is extruded will vary with the heaviness of the filament desired. Moreover, the speed at which the filaments are spun will vary inversely with the weight of the filament to be formed; i. e. the heavier the filament to be formed, the slower the rate of spinning.

The filament after formation is preferably drawn out while it still retains some of the solvent in order to increase its length. By so drawing out, filaments of superior tenacity are produced.

The filaments formed by our process have lumens or hollow spaces therein as shown by

an examination of the cross section thereof, which has distinct holes.

While we do not limit ourselves to this theory, we believe that the formation of hollow filaments by our process is due to the fact that because of the low rate of spinning, the spinning solution after issuing from the jets of the spinnerette first starts to dry or skin at the surface only, as in dry spinning, or coagulate at the surface as in wet spinning, before the interior of the filament sets. Subsequently the interior of the filament dries or coagulates with some shrinkage, which owing to the previous formation of the solid hollow skin or shell of the filament, causes the formation of hollow spaces.

In order further to illustrate our invention without limiting the scope thereof, the following specific example is given.

Example

The following is a description of a method of preparing bristles having hollow spaces therein. A solution is made by dissolving one part of an acetone soluble cellulose acetate having an actyl value of 54.5% in 4 parts of a solvent mixture containing 95% acetone and 5% water.

The solution is extruded through a spinnerette having one or more orifices of 0.8 mm. diameter into an evaporative atmosphere of air, carbon dioxide or other inert gas having a temperature of 40° to 45° C. The filaments thus formed are drawn off by a roller at the rate of 0.1 meters per minute. As a result of this process filaments or bristles are obtained that have a denier of approximately 1300, which bristles have lumens or hollow spaces therein.

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 claim and desire to secure by Letters Patent is:

1. Process of forming hollow filaments, bristles and the like comprising extruding a solution of an organic derivative of cellulose in a volatile solvent through orifices of a spinnerette into an evaporating atmosphere heated to a temperature below the boiling point of the solvent employed in the solution whereby solid cellulosic filaments are formed and drawing off the filament at such slow rate that the solvent evaporates at the surface of the filaments first sufficiently to form a solid skin prior to the substantial evaporation of the solvent in the interior of the filaments, whereby upon the evaporation of the solvent in the interior of the filament hollow filaments are formed.

2. Process of forming hollow filaments, bristles and the like comprising extruding a solution of cellulose acetate in a volatile solvent through orifices of a spinnerette into an evaporative atmosphere heated to a temperature below the boiling point of the solvent employed in the solution whereby solid cellulosic filaments are formed and drawing off the filament at such slow rate that the solvent evaporates at the surface of the filaments first sufficiently to form a solid skin prior to the substantial evaporation of the solvent in the interior of the filaments, whereby upon the evaporation of the solvent in the interior of the filament hollow filaments are formed.

3. Process of forming hollow filaments comprising extruding a solution of cellulose acetate in a volatile solvent through the orifices of a spinnerette into an evaporative atmosphere heated to a temperature below the boiling point of the volatile solvent and drawing off the filaments thus formed at a rate of less than 5 meters per minute.

In testimony whereof, we have hereunto subscribed our names.

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