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MANUFACTURE OF ARTIFICIAL THREAD

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This invention relates to the manufacture of artificial thread. More particularly, it relates to the manufacture of artificial thread formed of an organic derivative of cellulose, such as cellulose acetate, having properties which render it suitable for many purposes for which the artificial threads produced prior to this invention could not be employed.

According to the principles of this invention, there is provided an artificial thread formed of, for example, cellulose acetate, which is characterized by a relatively high dry tenacity, for example, of a magnitude of 1.50 grams per denier or more and a dry elongation of at least 30%, such as 35%, 40% or more. Because of these properties, the thread constituting one phase of the instant invention is capable of more extensive use than the ordinary artificial thread formed of cellulose acetate and having a dry elongation at the breaking point not exceeding 25%. For example, the thread produced in accordance with the instant invention is admirably suitable for application involving a subsequent stretching, the high elongation permitting the securing, after stretching by the various known methods, of fibers which are strong and still possess a capacity for elongation. Consequently, the thread is particularly useful in the manufacture of woven articles. Likewise, this thread can be subjected to a very high degree of twisting and still possess, after the twisting operation, a normal elongation of from 18% to 20%. Also, even though the thread has a high elongation at the breaking point, it is nevertheless adapted to the usual operations of knitting and weaving. Moreover, the thread is particularly suitable for the production of fabrics with crepe effects.

The thread previously described may be produced in accordance with the method hereinafter described and constitutes another phase of the instant invention. In accordance with the principles of the method, a spinning solution, preferably a cellulose acetate solution of suitable concentration, is spun through dies in an evaporative atmosphere, as is well known in the art.

The cellulose acetate solution, which is utilized in the instant invention, is characterized by a viscosity which does not exceed 100 c. g. s. units at the spinning nozzle. In the preferred embodiment of the invention, the desired and proper viscosity of the spinning solution is secured by heating a solution of suitable concentration prior to the extrusion thereof. Obviously, in this exemplification, a preheated solution is spun.

During the spinning operation, the filaments are only subjected to a stretching not exceeding the ratio 2. This ratio of the stretching is defined as the ratio of the length of the finished thread to the length of the thread resulting from the evaporation without stretching of a filament of collodion, assuming that the collodion filament contracts in the same manner in the three dimensions. Mathematically the stretching ratio can be represented by the following formulae:

$$S. R. (\text{stretching ratio}) = \frac{L}{L'}$$

wherein L equals the length of the finished filament and L' equals the length of the filament resulting from the evaporation of the collodion filament without stretching

$$L' = \frac{V''^3}{\pi r^2} \sqrt{\frac{C}{100} \times \frac{D'}{D}}$$

wherein V'' equals the volume of the collodion which is extruded through the spinneret hole, r the radius of the spinneret hole, C the percentage concentration, D' the density of the collodion and D the density of the finished filament.

The evaporative atmosphere in which the solution is spun is maintained at an appropriate temperature, such as 85° C., and contains a relatively small quantity or percentage of solvent vapors. In other words, it may be described as a dilute evaporative atmosphere.

The elongation properties of the threads produced according to this invention are not obtained at the expense of the qualities of resistance, when dry, with respect to those fibers manufactured under the normal conditions of dry spinning. On the contrary, generally, the fibers produced according to this invention have higher resistances to breaking, while their elastic resistances are also better.

A remarkable, unexpected, and indeed surprising feature of the instant invention is that collodions of such viscosities as contemplated by the instant invention can be spun and produce threads having the qualities of resistance and elongation previously referred to.

In order to more clearly explain the instant invention, there is hereafter set forth an illustrative example. It is to be understood that this specific example merely illustrates a specific embodiment of the invention which has given satisfactory results but that the invention is not restricted thereto.

Example—A collodion containing 22.7% of cellulose acetate and 77.3% of a solvent consist-

ing of 85 parts per volume of acetone and 15 parts per volume of ethyl alcohol is heated to a temperature of 67° C. Under these conditions, the collodion has a viscosity of 70 c. g. s. units (ascertained by the method of the ball in a sealed tube). The solution is then extruded under pressure in an evaporative medium through a die containing 18 orifices of 0.06 mm. in diameter and the filaments are collected at the outlet of the spinning cell in the form of a 100 denier thread. The elementary or constituent filaments thereof obviously are $100/18=5.5$ denier.

The stretching ratio as defined above is 1.75. The conditions of temperature in the cell and of the circulation of the air for the evaporation of the solvent may be those which are generally used. Preferably, the cell is heated to a temperature of 85° C., 3500 liters per hour of air are passed therethrough and the spinning carried out at the rate of 100 meters per minute.

The thread obtained has an average elongation of 34% and resistance or tenacity of 1.58 grams per denier for a hygrometrical state of 47° C. and a temperature of 21° C. The corresponding wet elongation and tenacities are 48% and 0.82 gram per denier.

If desired, the spinning solution may contain any modifying agent, such as coloring agents, fillers and low luster-inducing agents, such as pigments, etc. It is to be understood that the above-mentioned properties may be secured without the addition of any plasticizer, although the latter may also be used just as in the case of ordinary cellulose acetate thread.

Since it is obvious that various modifications may be made in the specific details above described, the invention is not restricted thereto except as defined in the appended claims.

I claim:

1. In a method of preparing artificial thread having an elongation in the dry state of at least 30%, the steps of spinning a cellulose acetate spinning solution having a viscosity not exceeding 100 c. g. s. units and stretching the filaments or threads during the spinning operation to such a degree that the stretching ratio does not exceed 2.

2. In a method of preparing artificial thread having an elongation in the dry state of at least 30%, the steps of spinning a preheated cellulose acetate spinning solution having a viscosity not exceeding 100 c. g. s. units and stretching the filaments or threads during the spinning operation to such a degree that the stretching ratio does not exceed 2.

3. In a method of preparing artificial thread having an elongation in the dry state of at least 30%, the steps which comprise spinning a cellulose acetate solution having a viscosity of 70 c. g. s. units and containing 22.7% of cellulose acetate and 77.3% of a solvent consisting of 85 parts per volume of acetone and 15 parts per volume of ethyl alcohol and stretching the filaments or threads during the spinning operation to such a degree that the stretching ratio does not exceed 2.

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