Our present invention relates to a process of producing artificial fibers resembling wool and more particularly to a process of producing crimped and curly staple fibers from cuprammonia cellulose solutions.

It is an object of the present invention to provide a process by which a pronounced and stable crimping is imparted to the fibers. A further object of the present invention is to provide a process by which the fibers acquire a rough, uneven, knotted surface. Further objects will be seen from the detailed specification following hereafter.

Reference is made to the accompanying drawings which (Fig. 1) show diagrammatically an apparatus for spinning and after-treating fibers from copper-oxide ammonia solutions of cellulose, in which the threads are cut to staples before the actual after-treatment, and Fig. 2 shows diagrammatically a device on which the threads are not cut before but either after the hardening and decoporporizing or not at all, but which enables the threads to be hardened and decoporporized in tensionless condition.

In the figures identical reference numerals denote corresponding parts.

In Fig. 1, 1 represents a container for the precipitating bath, 2 is a multiple spinning nozzle, which reaches into the middle of the tunnel shaped tube 3. The precipitating liquid flows from 1 into 3 and carries the threads 4 downwards till it reaches the guide roller 5 in vessel 6 from where the liquid may be pumped back into 1 (pumping system not shown). The threads 4 then pass between two rollers 7 onto a roller driven (8 and 9) conveyor belt at the end of which they are cut to any desired staple length by the cutting device 10. The cut threads fall into the trough 11, where the threads are hardened. A certain amount of the cut threads assemble in the trough and are then carried onto a second roller driven (12 and 13) perforated conveyor belt 14, where they are decoporporized and washed by the sprinklers 15 and 16. The two vessels marked 17 serve to regain the treating liquids. From the left one the water etc. may be pumped back through tube 18 by the pump 19 into storage vessel 20 and from there back into the trough 11.

The understanding of Figure 2 will be facilitated by a perusal of the description of Figure 1. The reference numerals are identical as is the function of the parts with which they correspond. The cutting device is left out in the apparatus shown in Figure 2. The rollers 13 rotate somewhat what more slowly than rollers 7, which serve to accumulate a certain amount of thread in trough 11 and on conveyor belt 14.

Our invention is based on the observation that very well crimped artificial fibers may be made from cuprammonium cellulose solutions by relieving the tension on the fresh threads which have been spun under tension and during or after this relieving operation subjecting the threads to a treatment with an agent which has a strong swelling or shrinking effect and if desired at the same time have a decomposing action. Preferably the process starts from threads made by the stretch-spinning process. The expression "fresh threads" means threads which still contain chemically bound copper. This is the case, for instance, with threads which have not yet been subjected to a treatment with acid or threads in which the content of chemically bound copper has been only partly removed by a mild acid treatment. The requirement that the treatment in accordance with the invention should be applied to the threads in an unstretched condition may be fulfilled if the threads are first cut to staple length.

In case the threads are treated in uncut condition as endless bundles with the hot aqueous baths there may be used an apparatus such as described in the copending application Ser. No. 116,386 filed December 17, 1936, of which three of us are the inventors, in order to enable the threads to be treated without tension. The fiber is led from the spinneret over a draught and squeezing roller into a gutter, like vat in which the thread is decomposed by the hot aqueous liquid. The endless bundle is then washed onto a perforated conveyor band by the current of treating liquid and is after treated in the usual manner on the conveyor band.

Examples of agents which have a swelling or shrinking action are hot water (temperature 80–100° C.), hot concentrated salt solutions, for example solutions of sodium sulfate, acid sodium sulfate or ammonium sulfate (temperature 80–150° C.).

Following treatment with the shrinking or swelling agent the fibers, if desired after preliminary separation of the agent by washing with water, are subjected to the usual after-treatments, for example treatment with acids and washing baths.

Fibers made by the invention are very well crimped and have a rough, uneven, ribbon-like or knotted and swollen surface. These qualities render the product suitable as a substitute for wool in high degree.
The following examples illustrate the invention:

1. A cuprammonia cellulose solution containing 7.2 per cent of ammonia and 3 per cent of copper is spun in a spinning funnel which is 1.8 meters long by the stretch-spinning method in water at a temperature of 40° C. The thread leaves the spinning tube with a content of copper amounting to 33 per cent calculated on the cellulose. It is next passed to an apparatus for cutting to staple length. In the cut condition the threads are treated in a water bath at 100° C, and then subjected in the usual manner to treatment with acid and water. The dried fibers are found under the microscope to have a varying cross-section and knots and swellings. These qualities and their crimped condition give them a woolly appearance.

2. The operation is the same as that described in Example 1, but there is the variation that during the coagulation in the spinning tube the threads already receive a mild treatment with acid. Corresponding with the concentration of this acid the threads leave the spinning tube with a percentage of copper below 35. The freshly spun threads are then further treated in the manner described in Example 1. Whether a hot water bath or a hot concentrated salt solution is used there is produced a strongly crimped fiber of woolly appearance.

What we claim is:

1. A process which comprises spinning threads from a solution of cuprammonia cellulose, coagulating said threads stretching said threads during coagulation, relieving the stretch on said threads, treating said threads with a hot aqueous liquid at a temperature of from 80 to 130° C, decopperizing and washing said threads.

2. A process which comprises spinning threads from a solution of cuprammonia cellulose, coagulating said threads stretching said threads during coagulation, cutting said threads into staple lengths and subjecting said threads to the action of a hot aqueous liquid at a temperature of from 80 to 130° C, decopperizing and washing said threads.

3. A process which comprises spinning threads from a solution of cuprammonia cellulose, coagulating said threads stretching said threads during coagulation, cutting said threads into staple lengths and subjecting said threads to the action of water of a temperature of 80 to 100° C, decopperizing and washing said threads.

4. A process which comprises spinning threads from a solution of cuprammonia cellulose, coagulating said threads stretching said threads during coagulation, cutting said threads into staple lengths and subjecting said threads to the action of a concentrated aqueous salt solution at a temperature of 80 to 130° C, decopperizing and washing said threads.

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