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PRODUCTION OF ARTIFICIAL MATERIALS

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This invention relates to the production of artificial materials and more particularly to the treatment of staple fibres having a basis of an organic derivative of cellulose.

According to the invention staple fibres which have a basis of an organic derivative of cellulose and which have been produced by cutting filamentary materials are subjected, while in a condition in which they are substantially free to contract, to the action of a crinkling medium which is substantially, and preferably entirely, free from water. It is found that by this treatment the fibers acquire a crinkled form which greatly improves their spinning qualities.

The cut staple fibres which are treated may be produced from any suitable filamentary material having a basis of an organic derivative of cellulose, particularly cellulose acetate. For example, continuous filaments or waste filaments may be cut into short lengths of 1½ to 2 inches or more, or into longer fibres of 4, 7, 9 or 12 inches or more, according to the use for which they are required. The staple fibres may be produced in a number of ways, e. g. by means of the methods and apparatus described in U. S. Patents Nos. 2,220,022, 2,079,094 and 2,010,078 and British Patents Nos. 394,702, 357,565, 317,026 and 317,025, or by cutting the bundles of filaments produced according to the process of U. S. Patent No. 2,067,251.

The invention is of particular value in connection with staple fibres which have been produced from filamentary material which has been subjected to a stretching operation to increase its tenacity. Thus the staple fibres advantageously have been produced by cutting continuous filaments which have been stretched, e. g. to 200, 500 or 1000% or more of their original length, especially in the presence of wet steam or hot water, as described, for example, in British Patents Nos. 438,584, 438,585, 438,586, 438,587, 438,655 and 438,656. The continuous filaments may, however, have been stretched by other processes. For example, subsequent to their production by dry or wet spinning processes they may have been stretched in the presence of softening agents such as, for example, dioxane or acetone. Alternatively, when produced by wet spinning processes, filaments may have been stretched in a coagulating bath containing a high proportion of a softening agent, e. g. glycol monoacetate.

While particular reference has been made above to cellulose acetate as the basis of the staple fibres it is to be understood that the fibres may have a basis of other organic derivatives of cellulose, e. g. other esters such as, for example, cellulose

propionate, cellulose butyrate, and cellulose aceto-propionate, ethers, for example, ethyl cellulose, methyl cellulose, benzyl cellulose and oxyethyl cellulose, and ether-esters.

The active agents in the crinkling media employed according to the invention are preferably latent solvents, i. e. swelling agents which, though incapable in the pure condition of dissolving the cellulose derivative, become solvents when mixed with a comparatively small proportion of another liquid. Among such latent solvents are, for example, methylene chloride, ethylene chloride and ethyl acetate. The swelling agents should, in general, have their action modified by being diluted with one or more relatively inert liquids. Such diluents may be immiscible with water, e. g. benzene, toluene, xylene and other cyclic hydrocarbons, benzine, petrol ether, kerosene, and other aliphatic hydrocarbons, carbon tetrachloride, trichlorethylene, and other halogenated compounds, or they may be water-miscible, e. g. alcohol. Diluents should be employed in proportions sufficiently high to ensure that the treatment does not bring about coalescence of the fibers. For example, mixtures containing about 50-70% by volume of methylene chloride and 50-30% of benzene are of particular value. Especially good results, particularly when treating staple fibres cut from stretched materials, are secured by using mixtures containing 60-70% of methylene chloride and 40-30% of benzene. Other mixtures giving especially useful results are those of 2-20% by volume of ethyl acetate and 98-80% of ethyl alcohol. The actual concentration of the active agent employed will depend upon the nature of the treated material and upon the degree of crinkling which is required.

The temperature of treatment for any particular treatment medium and treated material may be varied according to the degree of crinkling which it is desired to impart to the fibres, since at higher temperatures the crinkle is more pronounced than at lower ones. The results are found to be most generally satisfactory when a temperature of the order of 25° C. is employed in conjunction with the crinkling media specified above.

The fibres are preferably crinkled by immersing them in the crinkling medium until a sufficient degree of crinkle has been secured, e. g. 10 or 20 minutes. Advantageously the fibres are agitated during or throughout the treatment. The fibres are preferably treated as a loose mass, though they may be treated, for example, as bundles of fibres, e. g. a sliver or roving. When treating

slivers or other bundles which it is desired to maintain in form throughout the treatment, it is preferable to support them during the treatment. This may be done, for example, by passing them through a bath of the crinkling medium or by spraying them with the medium while they are supported on a travelling band, e. g. a continuous wire-gauze band or felt sheet, and allowing the bundles to remain on the band under the action of the medium for an appropriate time. After treatment the medium may be run off from the fibres and the latter dried by evaporation, e. g. in a stream of warm air, due regard being paid to the nature of the swelling agent and of any diluents employed so that adhesion of the fibres to each other is avoided. Alternatively, the fibres may be freed from adhering medium by washing with an inert liquid with which the agent is miscible, e. g. one or more of the diluents specified above.

After the staple fibres have been freed or substantially freed from crinkling medium they may be carded, if necessary, and spun into yarn by any suitable method. Preferably conditioning and/or de-electrifying agents are applied to the fibres before carding and spinning so as to facilitate these operations. Such agents may be, for example, hygroscopic polyhydric alcohols or hygroscopic salts. The application of the conditioning and/or de-electrifying agents may be carried out simultaneously with the treatment with the crinkling medium, provided that the agents are soluble or dispersible in the particular medium employed. For example, a proportion of about 3-6% of a suitable agent may be dissolved in the crinkling medium and the resulting solution employed for crinkling according to the invention.

If desired, fibres having a basis of an organic ester of cellulose may be saponified either wholly, partially or superficially to modify their dyeing properties and/or their ironing point. Partial or superficial saponification may be carried out before or after treatment with the crinkling medium; for example superficially saponified staple fibres may be treated with the crinkling medium, and in this case the outer coating of cellulose or of lower ester of cellulose tends to prevent coalescence of the fibres.

The following examples illustrate the invention but are not to be regarded as limiting it in any way:

Example I

Staple fibres, cut from continuous cellulose acetate filaments which have been stretched in wet steam to 200% of their original length, are placed in a container as a loose mass and about 10 times their weight of a mixture of 65% methylene chloride and 35% benzene (percentage by volume) is run in. The fibres are thoroughly agitated by means of a punch or stick for 10 minutes during which the temperature is maintained at 25° C. The liquid is then run off and the fibres dried in a stream of air at 60° C.

The resulting fibres are found to be well crinkled and can readily be worked up into yarn, before or after saponification.

Example II

Staple fibres, cut from continuous cellulose acetate filaments which have been stretched in wet steam to 200% of their original length, are placed in a container as a loose mass and about 12 times their weight of a mixture of 7% ethyl acetate and 93% ethyl alcohol (percentage by

volume) is run in. After thoroughly agitating for 15 minutes at 20° C., the liquid is run off and the fibres dried in a stream of air at 60° C.

The products are similar to those of Example I. Having described my invention, what I desire to secure by Letters Patent is:

1. Process for improving the properties of staple fibres having a basis of an organic derivative of cellulose and produced by cutting filamentary materials, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium which comprises a latent solvent for the cellulose derivative and which is substantially free from water.

2. Process for improving the properties of staple fibers having a basis of an organic derivative of cellulose and produced by cutting filamentary materials, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium which comprises methylene chloride diluted with a hydrophobe organic liquid and which is substantially free from water.

3. Process for improving the properties of staple fibers having a basis of an organic derivative of cellulose and produced by cutting filamentary materials, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium which comprises ethylene dichloride diluted with a hydrophobe organic liquid and which is substantially free from water.

4. Process for improving the properties of staple fibers having a basis of an organic derivative of cellulose and produced by cutting filamentary materials, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium which comprises ethyl acetate diluted with a lower aliphatic alcohol and which is substantially free from water.

5. Process for improving the properties of staple fibers having a basis of cellulose acetate and produced by cutting filamentary materials, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium which comprises methylene chloride diluted with a hydrophobe organic liquid and which is substantially free from water.

6. Process for improving the properties of staple fibers having a basis of cellulose acetate and produced by cutting filamentary materials, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium which comprises ethylene dichloride diluted with a hydrophobe organic liquid and which is substantially free from water.

7. Process for improving the properties of staple fibers having a basis of cellulose acetate and produced by cutting filamentary materials, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium which comprises ethyl acetate diluted with a lower aliphatic alcohol and which is substantially free from water.

8. Process for improving the properties of staple fibers having a basis of cellulose acetate and produced by cutting filamentary materials, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium consist-

ing of 50-70 parts by volume of methylene chloride in admixture with 50-30 parts by volume of benzene.

9. Process for improving the properties of staple fibers having a basis of cellulose acetate and produced by cutting filamentary materials, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium consisting of 2-20 parts by volume of ethyl acetate in admixture with 98-80 parts by volume of ethyl alcohol.

10. Process for improving the properties of staple fibers having a basis of an organic derivative of cellulose and produced by cutting filamentary materials which have been stretched to at least 200% of their original length in the presence of a stretch-assisting medium, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium which comprises a latent solvent for the cellulose derivative and which is substantially free from water.

11. Process for improving the properties of staple fibers having a basis of cellulose acetate and produced by cutting filamentary materials which have been stretched to at least 200% of their original length in the presence of a stretch-assisting medium, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium consisting of 50-70 parts by volume of methylene chloride in admixture with 50-30 parts by volume of benzene.

12. Process for improving the properties of staple fibers having a basis of cellulose acetate and produced by cutting filamentary materials which have been stretched to at least 200% of their original length in the presence of a stretch-assisting medium, which comprises subjecting the fibers, while in a condition in which they are substantially free to contract, to the action of a medium consisting of 2-20 parts by volume of ethyl acetate in admixture with 98-80 parts by volume of ethyl alcohol.

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