

UNITED STATES PATENT OFFICE

2,159,097

MANUFACTURE OF ARTIFICIAL MATERIALS

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No Drawing. Application May 5, 1937, Serial No.
140,894. In Great Britain May 22, 1936

5 Claims. (Cl. 8—129)

This invention relates to improvements in the manufacture of artificial materials, and particularly to processes for improving the extensibility of filaments, yarns, foils, and similar materials having a basis of organic derivatives of cellulose.

It has been discovered that the extensibility of artificial filaments, yarns, foils, and similar materials having a basis of organic derivatives of cellulose may be increased by treating them with hot aqueous media at a temperature above 100° C. in the absence of tension sufficient to stretch them. The materials which appear to be most susceptible to the treatment are the ordinary dry spun yarns, which usually have an extensibility of about 25%, and by treatment according to the process of the present invention this extensibility may be increased very considerably for example up to 50 or 60% or even more. However, the normal extensibility of dry spun yarns is, in general, sufficient for most purposes, and the most valuable application of the process of the present invention is in connection with stretched yarns, particularly yarns which have been stretched by not more than about 100% of their original length. Stretching to a considerable extent, for example, to 900% of their original length appears to render the materials more resistant to the treatment of the present invention. A very useful increase in extensibility may, however, be imparted to materials which have been stretched, for example, to 150 or 180% of their original length by treatment according to the process of the present invention.

Stretched materials treated according to the process of the present invention may have been obtained by stretching in the presence of steam or hot water, and the process is particularly valuable for the treatment of such materials. Thus they may have been stretched by the processes described in U. S. applications S. Nos. 123,104, 123,105, 123,106 filed January 30, 1937, 121,150, 121,151 and 121,152 filed January 18, 1937, or by a process of simultaneous stretching and low twisting as described in U. S. application S. No. 111,596 filed November 19, 1936. Materials which have been stretched by other processes, e. g. in the presence of organic swelling agents may, however, also be treated according to the process of the present invention.

The hot aqueous media employed in the process of the present invention may be hot water, steam, preferably wet steam, and dilute aqueous solutions of swelling agents, for example dilute aqueous solutions containing about 1-3 or 5%

of acetone, methylene ethylene ether, dioxane, or other neutral swelling agent. Steam containing small proportions of swelling agents, e. g. 2, 5 or 10%, may also be employed. The media may be employed under pressure at temperatures of for example 110° C., 120° C., up to 140° C. or more. Steam, if employed, is preferably of a fairly high degree of wetness, e. g. 5 to 10%.

The time of treatment may vary from a short period of e. g. 1-2 seconds or less up to 10-30 10 seconds or even 15 to 30 minutes or more according to the nature of the materials treated, the treating medium and the increase in extensibility required. While it is usually desirable that a certain amount of shrinkage shall take place it 15 has been found that a considerable increase in extensibility may be obtained with only a relatively small degree of shrinkage, for example shrinkage of only 2 to 5%.

By the process of the present invention an improved extensibility may be obtained under conditions which vary considerably. For example ordinary dry spun yarn may be treated in wet steam at a temperature of 110, 115 or 130° C. or more for 15 to 30 minutes, or yarn which has 25 been stretched in the presence of steam or hot water by 30, 50 or 80% of its original length may be treated in water at a temperature of 105°-110° C. or more for 5 to 10 seconds.

The process of the present invention may be 30 carried out during the travel of the materials from one point to another, and this method is particularly valuable when employed in conjunction with a stretching operation in steam or hot water such as is described in the specifications 35 referred to above. For example, cellulose acetate yarns may be stretched to 150-200% of their original length in the presence of saturated or wet steam as described in U. S. applications S. Nos. 123,104, 123,105 and 123,106 filed January 40 30, 1937, and after passing round the stretching rollers 5 illustrated in Figure 1 of the drawings in U. S. applications S. Nos. 123,104, 123,105 and 123,106 filed January 30, 1937, they may pass through a vessel containing wet steam or hot 45 water which is under pressure and which may be at the same temperature as the steam employed for stretching, and then pass round another pair of rollers driven at the same rate as rollers 5 or, preferably, at a slightly lower rate, 50 so that the materials are free to shrink between the two sets of rollers. The materials may then be dried and collected on a suitable take up device, for example a creel of bobbins as illustrated at 6 in Figure 1 of the above specifica- 55

tions, or they may pass to further treatments, for example to a saponification treatment, in which case drying before the further treatment may be unnecessary.

5 If a hot aqueous medium is used in a closed vessel under such pressure that the medium issues from the inlet and outlet orifices for the materials and exerts a tension on the materials which may prevent shrinkage or the full degree of

10 shrinkage, it is desirable to enclose the rollers before and after the vessel containing the aqueous medium in "end chambers" containing a fluid under pressure and communicating with the vessel through orifices for the passage of the materials

15 as described in U. S. application S. No. 17,242 filed April 19, 1935. By this means tension on the materials during their passage through the shrinking vessel due to flow of fluid medium may be eliminated.

20 Instead of carrying out the treatment on running materials they may be treated in package form, for example in the form of hanks or on bobbins, which are preferably slackly wound and have a quick traverse. Collapsible or compressible

25 bobbins such that shrinkage is not prevented may be employed. Preferably bobbins are so designed that the treatment liquid can be circulated through the materials from the inside to the outside of the bobbins and back again alternately.

30 The following examples illustrate the invention, but are not to be regarded as limiting it:

Example 1

Cellulose acetate yarn which has been stretched to about 135% of its original length in wet steam 35 is treated with water at about 105° C. for 5 to 10 seconds and is then dried.

Example 2

Cellulose acetate yarn which has been stretched 40 to about 180% of its original length in wet steam is subjected to a hot water treatment similar to that described in Example 1.

Example 3

45 Ordinary dry spun cellulose acetate yarn is treated with wet steam at a temperature of about 135° C. for 15 to 30 minutes and is then dried.

In each case the extensibility of the yarn is improved.

50 The materials treated according to the process of the present invention may be subjected to further treatments, either continuously with the hot aqueous treatments or as a separate operation. Such treatment may, for example, be a

saponification treatment as described above or a further esterification process such as is described in U. S. applications S. Nos. 39,290, 39,289 and 39,288 filed September 5, 1935.

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

1. Process for improving the extensibility of artificial materials, which comprises subjecting ordinary dry spun filaments, yarns and similar materials of organic derivatives of cellulose, or 10 filaments, yarns and similar materials or organic derivatives of cellulose which have been stretched to not more than 200% of their original length, to the action of an aqueous medium at a temperature above 100° C. in the absence of tension sufficient 15 to stretch them.

2. Process for improving the extensibility of artificial materials, which comprises subjecting artificial filaments, yarns, foils and similar materials of organic derivatives of cellulose which 20 have been stretched subsequent to their production to not more than 200% of their original length to the action of hot water at a temperature above 100° C. in the absence of tension sufficient to stretch them.

3. Process for improving the extensibility of artificial materials, which comprises subjecting artificial filaments, yarns, foils and similar materials of organic derivatives of cellulose which have been stretched subsequent to their production to not more than 200% of their original length to the 30 action of wet steam at a temperature above 100° C. in the absence of tension sufficient to stretch them.

4. Process for improving the extensibility of artificial materials, which comprises subjecting artificial filaments, yarns, foils and similar materials of cellulose acetate which have been stretched subsequent to their production to not more than 200% of their original length to the 40 action of hot water at a temperature above 110° C. in the absence of tension sufficient to stretch them.

5. Process for improving the extensibility of artificial materials, which comprises subjecting 45 artificial filaments, yarns, foils and similar materials of cellulose acetate which have been stretched subsequent to their production to not more than 200% of their original length to the action of wet steam at a temperature above 110° 50 C. in the absence of tension sufficient to stretch them.

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