March 3, 1936. W. WHITEHEAD 2,032,606

MANUFACTURE OF ARTIFICIAL MATERIALS

Filed Feb. 20, 1934

Fig. 1.

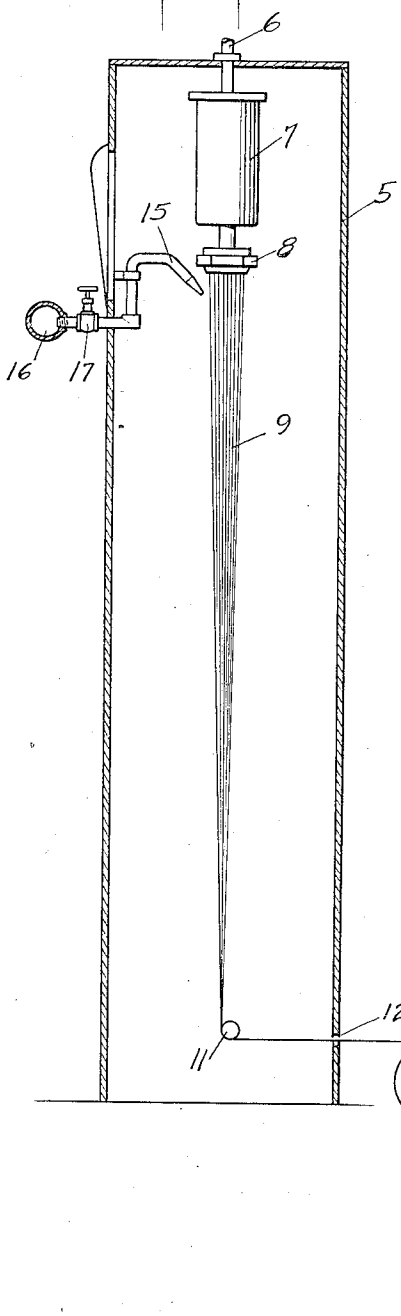


Fig. 2.

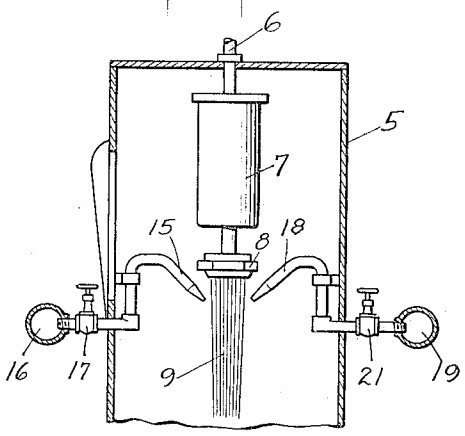


Fig. 3.

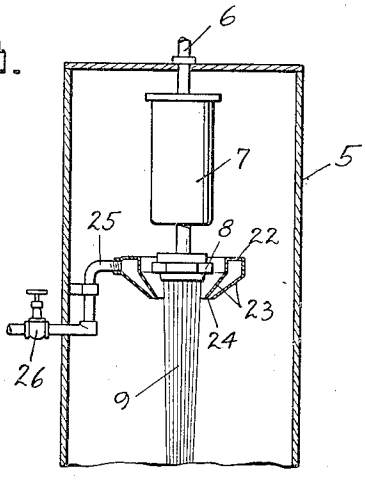
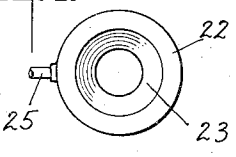


Fig. 4.



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MANUFACTURE OF ARTIFICIAL MATERIALS

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Application February 20, 1934, Serial No. 712,257

9 Claims. (Cl. 18—54)

This invention relates to the production of artificial materials such as filaments, threads, films, foils or the like by the dry or evaporative method of formation, for example the dry spinning of filaments from solutions of cellulose acetate or other derivatives of cellulose such as other cellulose esters, e. g. cellulose formate, cellulose propionate and cellulose butyrate, and cellulose ethers, e. g. methyl cellulose, ethyl cellulose and benzyl cellulose.

In the spinning of artificial filaments or threads by the dry or evaporative method of formation, solutions of cellulose acetate or other derivatives of cellulose in volatile solvents are spun into an evaporative atmosphere which is usually a current of heated air. The filaments or threads so formed are continuously wound up, with or without twisting, on suitable devices situated within or outside the evaporative atmosphere. The filaments or threads produced by the foregoing method of spinning are lustrous in character and have successful application as artificial silk, artificial horsehair and the like.

It is an object of the present invention to produce filaments or threads presenting a dull, matt or lusterless appearance, or of considerably reduced lustre.

Another object of this invention is to produce filaments of reduced lustre and which are substantially flat or ribbon-like.

A further object of the present invention is the provision of a simple apparatus by means of which filaments or threads of reduced lustre and flat or ribbon-like form are produced.

Other objects of this invention will appear from the following detailed description and will be pointed out in the appended claims.

I have found that in the production of filaments or threads by the dry or evaporative method of formation if the spinning is performed in the presence of steam or vapors of other nonsolvents for the organic derivative of cellulose, filaments having substantially reduced lustre and flat sections may be formed. I have also found that the amount of steam fed into the spinning cabinet and the point of application of the steam to the filaments are of great importance with respect to their effect on the characteristics of the filaments produced.

Artificial filaments of reduced lustre produced in accordance with this invention are relatively resistant to the relustering action of dry steam generated when subjected to ironing while damp. Furthermore, the filaments produced by this invention are flat or ribbon-like in cross-section, and therefore having greater covering power and furthermore useful in the production of the so-called novelty textile materials. This flat filament, when cut into short lengths, forms staple fibres that may be easily spun to form superior spun yarns.

In accordance with my invention, I prepare filaments presenting a dull, matt or lusterless appearance, or of considerably reduced lustre, and/or of flat or ribbon-like form by extruding a solution of a cellulose derivative in a volatile solvent through orifices of a spinneret into an evaporative atmosphere comprising steam or vapor of other nonsolvents for the cellulose derivative. The steam should preferably contain an amount of moisture just sufficient to exert a precipitating action on or in the filaments in the natal state of the filaments. The steam may be added to the usual evaporative medium, in which case the heating elements normally employed for heating the evaporative medium are either rendered inoperative or removed, since the steam alone is sufficient to maintain the cabinet at the temperature essential for stable spinning. However, the steam may be employed with less than the usual amount of the evaporative medium normally used or in complete absence of any other evaporative medium.

In performing the invention, steam containing a quantity of moisture just sufficient to exert a precipitating action on the filaments but not enough to affect the drying of the filaments so as to render winding and handling of the yarn more difficult is fed into the spinning cabinet in controlled amounts. Preferably the pipe through which the steam is conducted into the cabinet is provided with a nozzle having an opening comprising a thin slit. In one form of the invention, the nozzle is preferably so arranged that it applies the steam to the filaments at a point less than two inches, say about one-half inch, below the face of the spinning jet and at such an angle to the lengthwise axis of the extruded filament that the stable spinning of the filaments is unaffected. By controlling the speed at which the steam is supplied to the filaments and by arranging the steam nozzle so that the steam passes across the filaments at an angle, turbulence of the filaments is prevented.

According to one form of execution of the invention I spin a solution of a derivative of cellulose such as, for example, cellulose acetate, in a volatile solvent into an evaporative atmosphere comprising steam. In such form of execution, I may conveniently extrude the spinning solution

in known manner from fine orificed spinning jets downwards into a spinning cabinet which may or may not be heated and introduce steam into said cabinet, in a current regulated to the desired quantity, in such a manner that the steam is applied to the filaments at a point just below the face of the spinning jet and at an angle to the lengthwise axis of the filaments. At this point the filaments are substantially wet, since they have lost substantially no proportion of the solvent. In addition to the steam, I may cause a current of air to pass through the spinning cabinet.

While this invention is described with particular reference to the use of steam, such steam may be replaced in whole or in part with vapors of other nonsolvents or precipitants for the derivative of cellulose, such as, in the case of cellulose acetate, ethylene glycol, benzol, xylene, gasoline, or toluene.

The accompanying sheet of drawings serves to illustrate a convenient way of producing artificial filaments of reduced lustre by such a form of execution, i. e. in which the filaments are spun into an evaporative atmosphere of steam or of steam and air. This drawing shows diagrammatically a spinning cabinet provided with a spinning jet in the upper part thereof and with means for causing a controlled amount of steam to pass across the filaments at an angle to the lengthwise axis of the filaments.

Fig. 1 is a side elevational view, partly in section, of a spinning cell provided with means according to the invention;

Figs. 2 and 3 show further methods of application of the invention; and

Fig. 4 is a detail of Fig. 3 showing a top plan view of the device for applying steam to the filaments.

Referring to the drawing, a spinning cell **5** is provided with a supply pipe **6** for spinning solution of cellulose acetate dissolved in acetone which is conducted thereby under pressure through a filter candle **7** to a spinning jet **8**. The filaments **9** extruded from the spinning jet **8** pass down the cell **5** and turn round a guide **11** near the bottom of the cell, leaving the cell by an aperture **12** on their way to a feed roller **13** feeding them to a cap spinning device **14**. The spinning cell is also provided with means (not shown) for allowing air to enter the cell and for drawing off the air. The cell may be provided with any suitable heating means.

The spinning cell is provided with a nozzle **15** serving to introduce steam from the header **16** into the spinning cell. The nozzle **15** is arranged to inject the steam into the path of the filaments issuing from the spinning jet and is fitted at a level at which the filaments are still substantially wet, preferably not more than one-half inch below the level of the spinning jet. As is shown in the drawing, the nozzle is pointed downwardly at an angle to the lengthwise axis of the extruded filaments so that the injected steam passes, preferably in the form of a thin flat stream, across the filaments at an angle and gives rise to no turbulence of the filaments. The flow of the steam from the nozzle **15** is controlled by means of a valve **17**.

Fig. 2 shows a spinning cell which contains two nozzles for applying steam to the filaments, the arrangement being such as to insure a more uniform application of the steam to the filaments. The second nozzle **18** is similar to nozzle **15** both as to structure and as to position relative to the spinning jet. The steam is fed to nozzle **18** from header **19** and the flow is controlled by means of a valve **21**.

Figs. 3 and 4 show still another means for applying steam to the filaments. In this modification, a hollow annular member **22** whose walls **23** are tapered to form a nozzle **24** having an opening in the form of a thin slit. Steam is fed to the annular member by means of a pipe **25** from a header outside of the spinning cell and the flow of the steam is controlled by means of a valve **26**. In the modification shown in Figs. 3 and 4, as in the other arrangements illustrated in the drawing, the steam is applied at an angle to the lengthwise axis of the extruded filaments and at a point not substantially lower than one or one-half inch from the face of the spinning jet. By the arrangement shown in Fig. 3, the steam is applied to the filaments uniformly and, of course, in controlled amount.

It is to be understood that the means for applying the steam to the filaments, such as the nozzles and the like, may be mounted so that they may be adjusted with respect to the face of the spinning jet. Thus the steam may be applied to the filaments at the particular point where the most satisfactory results are obtained.

Filaments or threads produced in accordance with my invention have the very important property of being highly resistant to relustering when they are subjected to ironing while damp.

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 my invention.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. In the process for producing flat, substantially delustered filaments by extruding a solution of an organic derivative of cellulose in a solvent therefor through orifices, the step of directing a current of moist steam on the filaments immediately after the extrusion thereof.

2. In the process for producing flat, substantially delustered filaments by extruding a solution of a cellulose acetate in a solvent therefor through orifices, the step of directing a current of moist steam on the filaments immediately after the extrusion thereof.

3. In the process of producing flat, substantially delustered filaments by extruding a solution of an organic derivative of cellulose in a solvent therefor through orifices, the step of directing a current of moist steam on the filaments at a point not substantially more than two inches from the point of extrusion of the filaments.

4. In the process for producing flat, substantially delustered filaments by extruding a solution of a cellulose acetate in a solvent therefor through orifices, the step of directing a current of moist steam on the filaments at a point not substantially more than two inches from the point of extrusion of the filaments.

5. In the process for producing flat, substantially delustered filaments by extruding a solution of a cellulose acetate in a solvent therefor through orifices, the step of directing a current of moist steam on the filaments at a point within one-half inch of the point of extrusion of the filaments.

6. In the process for producing flat, substantially delustered filaments by extruding a solution of an organic derivative of cellulose in a solvent therefor through orifices, the step of di-

recting a current of moist steam on the filaments near the point of extrusion of the filaments at an oblique angle to the lengthwise axis of the filaments and in the general direction of their travel.

7. In the process for producing flat, substantially delustered filaments by extruding a solution of a cellulose acetate in a solvent therefor through orifices, the step of directing a current of moist steam on the filaments near the point of extrusion of the filaments at an oblique angle to the lengthwise axis of the filaments and in the general direction of their travel.

8. Process for producing flat, substantially delustered filaments containing organic derivatives of cellulose, which comprises extruding in the form of filaments a solution of an organic derivative of cellulose in a volatile solvent into a chamber and subjecting said filaments immediately after the extrusion thereof to steam, said steam being the sole source of heat in the atmosphere of said chamber.

9. Process for producing flat, substantially delustered filaments containing cellulose acetate, which comprises extruding in the form of filaments a solution of cellulose acetate in a volatile solvent into a chamber and subjecting said filaments immediately after the extrusion thereof to steam, said steam being the sole source of heat in the atmosphere of said chamber.

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