May 22, 1934. C. DREYFUS ET AL 1,959,414

APPARATUS FOR MAKING YARNS

Filed Nov. 14, 1929

Fig. 1.

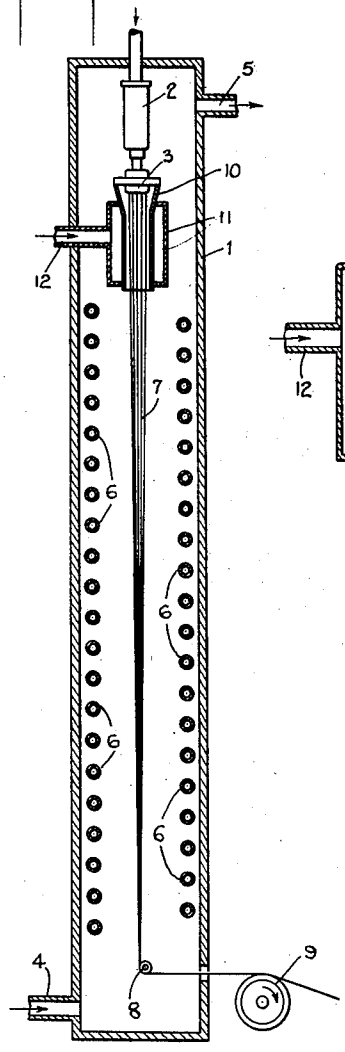


Fig. 2.

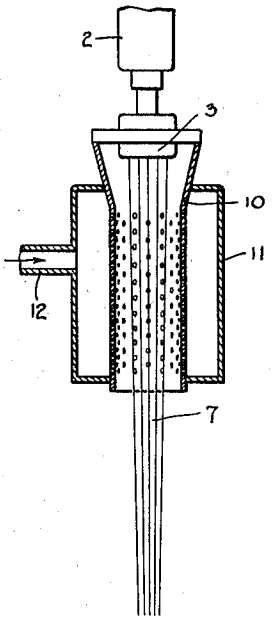


Fig. 3.

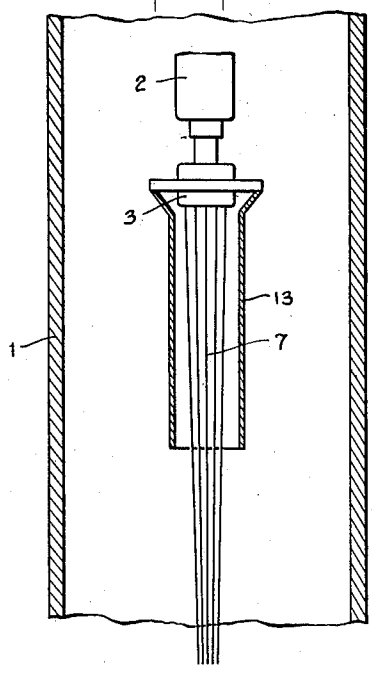
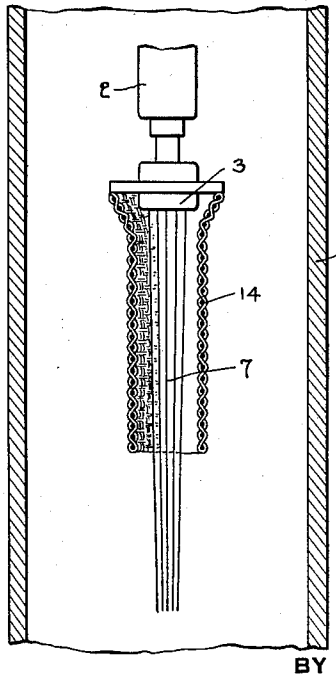


Fig. 4.



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APPARATUS FOR MAKING YARNS

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5 Claims. (Cl. 18—8)

This invention relates to the manufacture of yarns, filaments and the like and relates more particularly to the preparation of yarns of organic derivatives of cellulose that are of subdued lustre or which may be readily delustered.

An object of our invention is to form filaments or yarns that are substantially uniform along their length with respect to their properties, such as degree of delustering or of potential delustering. Other objects of our invention will appear from the following detailed description.

We have found that if a solution of an organic derivative of cellulose in a volatile solvent, which solution also contains a less volatile nonsolvent, is extruded through orifices into a drying evaporative atmosphere, and if the condition of the drying atmosphere at the orifices is kept substantially uniform, yarns or filaments of substantially uniform properties along their length may be formed. Because of the presence of the less volatile material that is a nonsolvent for the derivative of cellulose, the yarns or filaments are either of subdued lustre or may be easily delustered, and because of the substantially uniform conditions of temperature and degree of saturation with respect to vapors of the volatile solvent of the drying atmosphere, the degree of delustre or potential delustre of the yarns or filaments is substantially uniform throughout their length.

In accordance with our invention we prepare yarns or filaments of substantially uniform lustre by extruding a solution of an organic derivative of cellulose in a volatile solvent, which solution preferably contains a less volatile nonsolvent or precipitant for the derivative of cellulose, through orifices of suitable size and shape into an evaporative atmosphere, while maintaining the conditions of the evaporative atmosphere at the zone of the birth of the filaments or yarns substantially uniform.

This invention is of general application and is applicable to making of filaments of 1.5 denier or more which filaments may be associated together by twisting to form yarns. Heavier filaments to be used as bristles or horse-hair may be made by extruding through orifices of larger size, and artificial straw may be made by extruding through orifices having the shape of slits.

Any suitable organic derivative of cellulose may be employed in this invention such as organic esters of cellulose or cellulose ethers. Examples of organic esters of cellulose are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate while examples of cellulose ethers are ethyl cellulose, methyl cellulose and benzyl cellulose. To make the solution, any suitable volatile solvent such as acetone, chloroform, mixtures of methylene chloride and ethyl or methyl alcohol or mixtures of ethylene dichloride and ethyl or methyl alcohol may be employed.

In order to impart to the filaments or yarns, a subdued lustre or ability to become readily delustered, we prefer to add to the solution to be extruded, a material that is a nonsolvent or precipitant for the derivative of cellulose, and which is less volatile than the solvent employed in the solution. Examples of such materials are petroleum hydrocarbons such as kerosene, gasoline, light mineral lubricating oils. Aromatic hydrocarbons such as benzene, toluene or xylene may be employed. Examples of other nonsolvents are carbon tetrachloride and tetra-chlorethylene (CCl_2:CCl_2). Any one or a mixture of two or more of these materials may be employed.

While in the preferred form of our invention, nonsolvents or precipitants are added to the spinning solution, our invention is not limited thereto. Ordinary spinning solutions or dopes may be extruded, in which case yarns or filaments of uniform properties such as cross section, lustre, and pliability throughout their lengths may be made.

Various expedients may be employed to maintain the condition of the evaporative atmosphere at and near the zone of birth of the filaments substantially uniform. Thus in order to avoid the variations of temperature and degree of saturation of the evaporative atmosphere in an ordinary spinning cell, due to convection currents, there is fixed around the spinning jet and the preliminary drying zone a restricting tube, which is of such shape and dimensions as to insure that the preliminary drying zone become saturated or nearly saturated with the solvent vapors evolved from the filaments formed in the zone. In another form a warm evaporative atmosphere of controlled temperature, and containing or not controlled amounts of solvent vapors or precipitating vapors such as steam, may be injected into a restricting tube surrounding the preliminary drying zone of the filaments under formation.

Yarns, filaments, bristles, straw and the like made in accordance with our invention are of uniform properties throughout their length. When a spinning solution containing a precipitant or nonsolvent for the derivative of cellulose is employed, the yarns or filaments have a subdued lustre, or their lustre may be easily reduced by treating with aqueous baths having temperatures as low as 70 to 80° C. Fabrics made of such

yarn readily become delustered when subjected to dyeing and scouring baths ordinarily employed, and because of the mode of manufacture of the yarn, the lustre is uniform. This invention is of great importance in the making of women's hose and underwear or other knit goods, where a material of uniform subdued lustre is required.

As illustrative of apparatus that may be employed for obtaining uniform conditions at the birth of the filaments, reference is had to the accompanying drawing, wherein

Figure 1 is a vertical cross section of a spinning cell provided with a device for injecting air or gas at the spinning jet.

Figure 2 is an enlarged view of the jet and device shown in Figure 1,

Figure 3 is an enlarged view of a jet provided with another mechanism for carrying out the invention, and

Figure 4 is a view of a jet provided with still another modification of this invention.

Referring to Figures 1 and 2, the walls 1 of a spinning cell are shown. Generally a plurality of such cells are employed. The spinning solution is passed through the candle filter 2 to the spinning jet 3 provided with a suitable number of orifices of suitable size and shape. Generally two or more jets 3 are positioned within the spinning cell. The evaporative atmosphere such as air or gas is introduced through the pipe 4 and passes up through the cell 1 to the exit 5. In its passage, air or gas is heated by the steam coil 6. The filaments 7 that are formed are drawn around the roll 8 and passed to the winding device 9, which device may also twist the filaments into yarn.

In the form shown in Figures 1 and 2, in order to maintain uniform conditions around the jet 3, a perforated tube 10 is fitted around the jet 3, and the casing 11 surrounds the tube 10. Heated air or gas may be introduced through the pipe 12 and passes through the slots or perforations in the tube 10.

In Figure 3, a solid tube 13 is fitted around the jet 3, and the atmosphere around the preliminary drying zone of the filaments 7 is thus secluded.

In Figure 4, instead of employing a solid tube, a tube of gauze 14 surrounds the jet 3.

In order further to illustrate our invention, but without being limited thereto, the following specific examples are given.

Example I

A spinning solution is made by dissolving 1 part of an acetone soluble cellulose acetate in 3 parts of acetone and mixing therewith kerosene in amounts equal to 5% of the weight of the cellulose acetate. The solution thus formed is filtered and is then passed through the spinning jet 3 while air is being introduced through the pipe 4 which becomes heated by the steam coils 6 and finds its exit through the pipe 5.

In order to maintain uniform conditions around the spinning jet 3, heated air is injected through the pipe 12 (see Figures 1 and 2), which air is preferably at a temperature of approximately 55° C., rate of feeding being approximately 2 to 3 cubic feet per minute. This heated air passes through the openings of the tube 10, and since it is of uniform temperature, the temperature and other conditions surrounding the filaments at their birth are uniform.

The filaments so formed are drawn down and associated together into yarn and wound. In this manner the yarn produced is substantially uniform along its length as to its physical properties such as degree of precipitation, pliability, strength and ability to deluster at dye-bath temperatures such as 80° C.

Example II

The procedure of Example I is carried out exactly, but instead of injecting fresh gases or air through the pipe 12, part of the gases and vapors exhausted from the spinning cabinets are collected and mixed and conditioned to a suitable temperature and are injected through the pipe 12. Similar results are obtained, except that the filaments are of a flatter cross section and have a greater degree of precipitation or subdued lustre.

Example III

The solution described in Example I is extruded through the orifices of the jet 3 into a zone surrounded by the tube 13 shown in Figure 3. The preliminary drying zone in the cylinder 3 becomes substantially uniform as to temperature and degree of saturation of vapors evolved from the filaments formed. The yarns so formed are uniformly precipitated or potentially precipitated along their length, are uniformly pliable and strong and have the other desirable properties heretofore described.

Example IV

The procedure of Example III is carried out exactly, but instead of employing a cylinder composed of solid sheet metal, a cylinder of wire gauze 14 shown in Figure 4 surrounds the preliminary drying zone. In this case, the preliminary drying zone is not so nearly saturated as in the precipitating example, the filaments are not quite so precipitated, the yarn does not delustre so readily or so much when treated with aqueous baths of 80° C. and the filaments have a less flat cross section.

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 our invention.

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

1. In dry spinning apparatus for the production of yarns or filaments, the combination with a spinning jet having orifices therein, of foraminous means on said jet for maintaining the condition of the atmosphere in the zone of said orifices substantially constant.

2. In dry spinning apparatus for the production of yarns or filaments, the combination with a spinning jet having orifices therein, of perforated means surrounding said jet for maintaining the condition of the atmosphere in the zone of said orifices substantially constant.

3. Dry spinning apparatus for the production of yarns or filaments comprising a spinning chamber, a spinning jet having orifices therein disposed in said chamber, means for causing a current of evaporative medium to pass through said chamber in a direction opposite to the direction of extrusion of the filaments and means on said jet for maintaining the condition of the atmosphere in the zone of said orifices substantially constant, said means including a foraminous tube fitted around said jet.

4. Dry spinning apparatus for the production of yarns or filaments comprising a spinning chamber, a spinning jet having orifices therein disposed in said chamber, means for causing a current of evaporative medium to pass through said chamber

in a direction opposite to the direction of extrusion of the filaments and means for maintaining the condition of the atmosphere in the zone of the orifices substantially constant, said means comprising a perforated tube and means for supplying a heated fluid thereto.

5. Dry spinning apparatus for the production of yarns or filaments comprising a spinning chamber, a spinning jet having orifices therein disposed in said chamber, means for causing a current of evaporative medium to pass through said chamber in a direction opposite to the direction of extrusion of the filaments and means for maintaining the condition of the atmosphere in the zone of the orifices substantially constant, said means comprising a perforated tube and means including a casing for supplying a heated fluid thereto.

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