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T. F. BARRINGTON
MANUFACTURE OF FILAMENTS, FILMS OR THE LIKE OF
ARTIFICIAL MATERIALS
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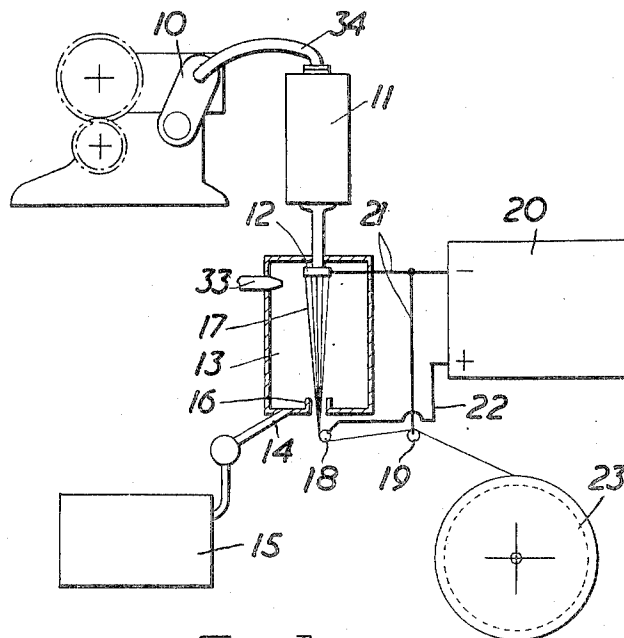


FIG. 1.

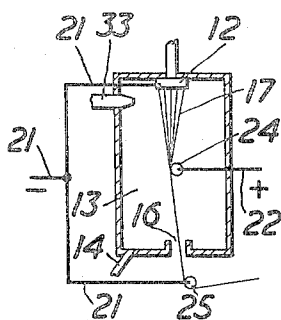


FIG. 2.

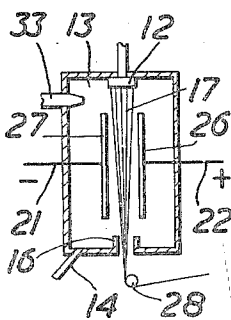


FIG. 3.

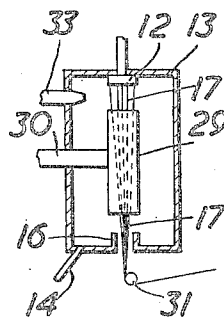


FIG. 4.

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MANUFACTURE OF FILAMENTS, FILMS, OR
THE LIKE OF ARTIFICIAL MATERIALS

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10 Claims. (Cl. 18—8)

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This invention relates to the manufacture of filaments, such as continuous threads, films, strips or bands, of artificial materials. It is particularly concerned with the production of continuous filaments from solutions or suspensions of cellulose derivatives, such as a mixture of acetate-esters of cellulose.

In the production of acetate silk filaments, films or the like the solution or suspension in the spinning bath or casting box is forced by gravity or other means through an orifice of the required dimensions after which the viscous filaments, films or the like are "set" or solidified by evaporating the liquid in which the cellulose derivative is dissolved or suspended. Such evaporation is carried out by subjecting the filaments as they leave the spinning nozzle (or the films issuing from the slit-like orifice) to the action of heat and a current of dry air.

As the process is continuous, the drying operation has to be effected rapidly and in practice warm, dry air is employed in countercurrent to the filaments issuing from the orifice of the spinneret. With a view to expediting the drying process it is also customary to pass the filaments, films or the like through an exhausted chamber to effect evaporation of the acetone solvent as rapidly as possible, the filaments, films or the like being heated by radiation whilst passing through the chamber.

This method of drying is not entirely satisfactory and it is found that, although the outside of the filaments, films or the like can be dried rapidly, the inside remains wet with consequential disadvantageous results in the subsequent winding and/or yarn-forming operations. Two of such disadvantages in the case of filaments are that the filaments tend to become collapsed, almost bone shaped in cross-section, instead of truly circular and that there is loss of acetone by that amount trapped in the filament.

The main objects of the present invention are to avoid these defects in filament manufacture, to speed up the production of films and generally to provide an improved method of and apparatus for manufacturing acetate silk.

Another object is to provide a method of manufacturing filaments for example threads, films or the like in continuous lengths, of artificial materials in which a spinning solution or suspension, is forced through a spinning orifice to produce the filaments, which are subjected as they issue from the spinning orifice to the action of a radio frequency electrostatic field so applied

as to cause substantially even drying of the filaments throughout their section.

If desired, the member in which the spinning orifice is formed and the winding device or guide receiving the filaments from the spinning orifice themselves form heating electrodes supplied with radio frequency energy. Thus, the lines of force are concentrated along the filaments or films instead of running transversely thereto, whereby the maximum heating effect in the filaments is obtained.

According to another feature of the invention the filaments, films or the like are subjected to the action of the radio frequency electrostatic field while passing through a saturated or supersaturated atmosphere of acetone or other suitable solvents. The filaments, films or the like preferably issue from the spinning orifice immediately into the said supersaturated atmosphere so that no initial rapid drying of the outside surface of the filaments, films or the like can take place before the application of the radio frequency heating. By this means substantially even drying of the filaments, films or the like from their centres takes place so that the tendency to collapse of the filaments or films is completely avoided.

Apparatus for carrying the invention into effect will now be described, by way of example, with reference to the accompanying drawings, in which—

Figure 1 is a part sectional diagrammatic view of cellulose spinning apparatus for the manufacture of acetate filaments showing only the parts necessary to illustrate the invention, and

Figures 2, 3 and 4 are diagrammatic sectional views of the cabinet shown in Figure 1 illustrating alternative methods of subjecting the filaments to the radio frequency electrostatic field.

Referring to Figure 1, the spinning solution from the casting box is pumped through a spinning orifice in the form of a multiple spinneret 12 by a metering pump 10, the solution being fed to the spinneret through a conduit 34 and filter 11. The multiplicity of wet filaments 17 issuing from the spinneret 12 are simultaneously and continuously drawn by a winding device 23 through a cabinet 13, having the spinneret 12 centrally disposed near its upper end. Heat is generated in the filaments as they pass through the cabinet 13 by an electrostatic field which is supplied from a source of radio frequency energy 20. The latter is connected to the spinneret 12 and a guide or other device 18 over which the

filaments 17 are drawn and which is insulated from the spinneret and cabinet 13.

This guide 18 is disposed near the lower end of the cabinet 13, a central aperture 16 in the latter allowing egress for the filaments. Thus the lines of force of the radio frequency electrostatic field run vertically through the cabinet from the guide 18 to the spinneret 12, and are substantially parallel to the path of the filaments 17. By using quite moderate powers, almost instantaneous drying of the filaments is obtained right to their centres so that the filaments may be wound, combined to form yarn or subjected to any other desired process without having to allow drying time.

To prevent initial rapid drying of the outside surface of the filaments 17, it may be necessary to keep the cabinet 13 constantly charged during the spinning process with a non-drying atmosphere, for example a saturated or supersaturated atmosphere of acetone. This may be accomplished by injection or other means in the form of a nozzle 33 mounted in the wall of the cabinet 13 for the purpose. Such injection may only be necessary during the initial stages of the spinning process, a saturated atmosphere being thereafter maintained in the cabinet 13 by evaporation of the acetone or like solvent from the filaments 17 during their passage through the cabinet. The base of the cabinet has a drainage tube 14 for draining off the liquid acetone condensing in the cabinet which passes through the tube and is continuously collected in a tank 15.

Owing to difficulties in securing insulation of the cabinet 13 and the metering pump 10 and filter 11, it is preferred to connect the spinneret 12 to the negative or earth side of the source of radio frequency energy 20 by a lead 21. A second lead 22 conveys positive potential to the guide 18. To prevent the filaments 17 being drawn on to the winding device 23 in a positively charged condition after contact with the guide 18, a further guide 19 is interposed between them. This is connected to the negative side of the source of radio frequency energy 20 by an extension of lead 21, the filaments 17 being earthed by contact with this guide.

Figure 2 illustrates an alternative method of subjecting the filaments to a radio frequency electrostatic field. The assembly of the apparatus is similar to that shown in Figure 1, the cabinet 13 having a spinneret 12 centrally disposed near its top and an aperture 16 in its base through which the filaments 17 are drawn, as before. The disposition of the guide is, however, changed in the arrangement shown in Figure 2, a guide 24 being disposed within the cabinet 13 substantially midway between the base of the latter and the spinneret 12 and connected to the positive side of the source of radio frequency energy by a lead 22. A second guide 25 is provided outside the cabinet 13 near the aperture 16 and connected to the negative side of the source of radio frequency energy 20 which is also connected to the spinneret 12. In this example the electrostatic field between the spinneret 12 and the insulated guide 24 is confined within the cabinet and is substantially parallel to the path of the filaments 17.

Figure 3 illustrates another method of applying radio frequency energy to the filaments. In this case spaced heating electrodes 26 and 27 are disposed inside the cabinet 13 and define a channel between the spinneret 12 and the aper-

ture 16 in the base of the cabinet. One electrode 26 is connected to the positive side of the source of radio frequency energy by a lead 22 whilst the other 27 is connected to the negative side by a lead 21. In this example the electrostatic field lies in a transverse plane to the filaments 17 which are drawn from the spinneret 12 through the chamber 13, emerging therefrom through the aperture 16 and over a guide 28 on to the winding device 23.

Figure 4 illustrates a method of heating the filaments 17 by radio frequencies in the microwave regions. The cabinet 13 is charged with a saturated or supersaturated atmosphere of acetone as before and a cavity resonator 29 is axially disposed in the cabinet so that the filaments 17 pass therethrough and emerge through the aperture 16. Microwaves are conveyed from the source of radio frequency energy to the cavity resonator by a wave guide 30 passing through the side of the cabinet 13. A guide 3 is provided at the base of the cabinet 13 over which the filaments 17 are drawn by the winding device 23.

In the foregoing examples the cabinet 13 may be fitted with a sliding or hinged door (not illustrated) which provides access to the spinneret 12 for cleaning purposes. If desired the cabinet may be composed largely of transparent material to enable the spinning process to be watched.

By means of the invention, the drying time for cellulose acetate filaments, films or the like is reduced to a fraction of the time normally occupied and the length of run of the filaments or films between the spinneret 12 and the guide 18 may therefore be correspondingly reduced. The cabinet 13 is thus of considerably less height than usual with consequential saving in space, maintenance and the like. Moreover, filaments or films of the desired even cross-section are obtained with consequential increase in value of the yarns produced from the filaments.

I claim:

1. A method of manufacturing continuous filaments of artificial materials, comprising extruding a spinning solution containing cellulose derivatives through a spinning orifice directly into an isolated space constantly charged with a non-drying atmosphere to prevent initial rapid drying of the outside surface of the extruded products and subjecting said products whilst in said isolated space to the action of a radio frequency electrostatic field to cause substantially even drying of the extruded products from their centres.

2. A method of manufacturing continuous filaments of artificial materials, comprising extruding a spinning solution containing cellulose acetate through a spinning orifice immediately into an isolated space constantly charged with a non-drying atmosphere to prevent initial rapid drying of the outside surface of the extruded products whilst in said isolated space and simultaneously subjecting said products to the action of a radio frequency electrostatic field to cause substantially even drying of the extruded products from their centres.

3. A method according to claim 2, wherein the non-drying atmosphere comprises a saturated atmosphere of acetone, the condensed acetone being continuously collected from the isolated space.

4. An apparatus for manufacturing artificial materials from solutions of cellulose derivatives

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comprising a spinning cabinet, a spinneret in said cabinet, injection means for constantly charging said spinning cabinet with a non-drying atmosphere to prevent initial rapid drying of the outside surface of the extruded products, and means for setting up a radio frequency electrostatic field in said cabinet.

5. An apparatus according to claim 4, wherein said means for setting up a radio frequency electrostatic field comprise a cavity resonator axially disposed in the spinning cabinet, a source of radio frequency energy and a wave guide to convey microwaves from said source of radio frequency energy to said cavity resonator.

6. An apparatus according to claim 4, wherein a guide is provided for said artificial materials and said means for setting up a radio frequency electrostatic field in said cabinet comprise a source of radio frequency energy one pole of which is connected to said spinneret whilst its opposite pole is connected to said guide.

7. An apparatus according to claim 4, wherein a guide is provided for said artificial materials and said spinneret is arranged at one end of the spinning cabinet and said guide is arranged near its opposite end adjacent an aperture.

8. An apparatus according to claim 4, wherein a guide is provided for said artificial materials and said spinneret is arranged at one end of said spinning cabinet and said guide is disposed within the spinning cabinet, a second guide being arranged outside the spinning cabinet at the end of the latter opposite to that at which said spin-

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neret is arranged, said second guide being adjacent an aperture formed in said opposite end.

9. An apparatus according to claim 4, wherein said means for setting up a radio frequency electrostatic field in said cabinet comprise spaced heating electrodes parallelly arranged within said spinning cabinet which define a channel through which said artificial material passes and a source of radio frequency energy connected to said heating electrodes.

10. An apparatus according to claim 4, comprising means for continuously collecting the liquid formed by condensation in the spinning cabinet.

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