May 31, 1927. 1,631,071

W. O. SNELLING

PROCESS OF MAKING HOLLOW RAYON FIBERS

Filed May 11, 1925

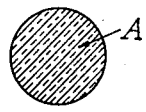


Figure 1

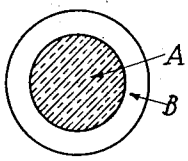


Figure 2

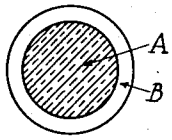


Figure 3

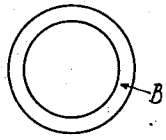


Figure 4

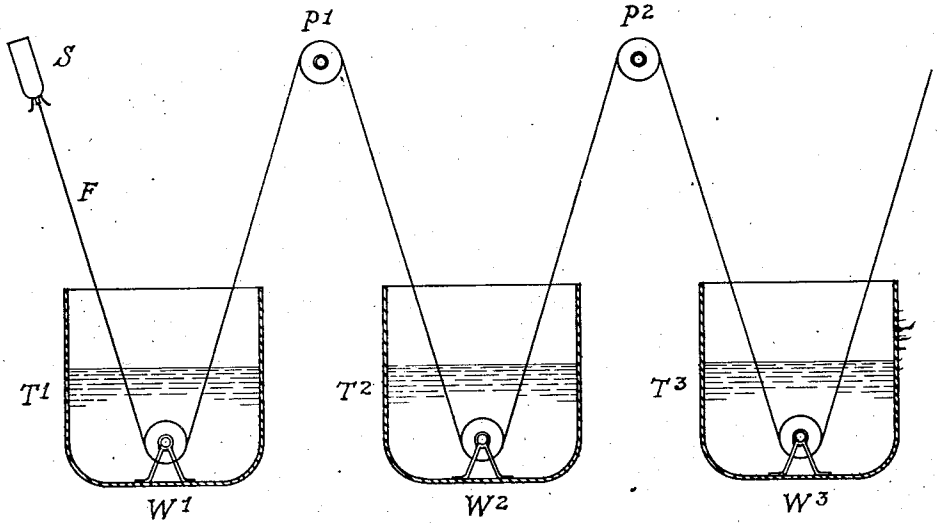


Figure 5

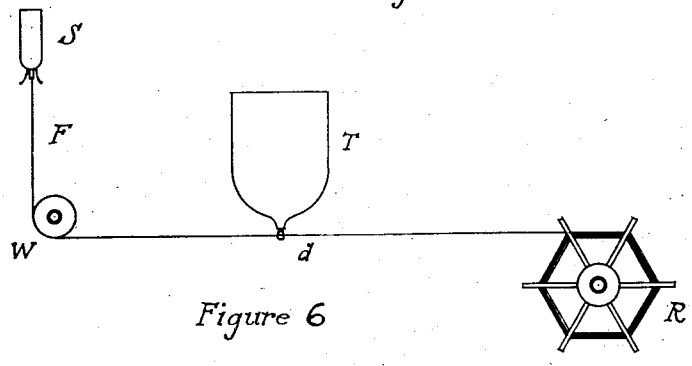


Figure 6

INVENTOR

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UNITED STATES PATENT OFFICE.

WALTER O. SNELLING, OF ALLENTOWN, PENNSYLVANIA.

PROCESS OF MAKING HOLLOW RAYON FIBERS.

Application filed May 11, 1925. Serial No. 29,309.

My invention relates to improvements in the manufacture of fibers of rayon or artificial silk, and more particularly refers to an improved process for obtaining textile fibers of hollow structure and great strength.

I have discovered that by preparing a preliminary fiber of any suitable material, such as melted sugar for example, and then coating such fiber with a nitrocellulose solution, a cupra-ammonia solution of cellulose, or with viscose or any other suitable material, and subsequently dissolving in any suitable solvent the preliminary fiber after hardening or coagulating the coating layer, I can obtain textile fibers having many advantages over the solid fibers of rayon or artificial silk produced by methods at present known.

There are many materials which may be very readily drawn into filamentous or fiber form, but which do not have such properties of permanence as to make them of value in the preparation of textile fibers. Sugar at its melting point, for example, may be readily drawn into very thin fibers, but these fibers have relatively little strength, and soon deteriorate in moist air. Sulfur at certain temperatures is quite viscous and may similarly be drawn into thin fibers, but these fibers soon become brittle and lose their structural strength. Rosin and many resins may similarly be drawn into fibers at suitable temperatures, but these fibers also become fragile and brittle a short time after they have been formed. By my invention I employ any of the materials named, or many other materials such as glue, casein, and the like, as the base for a preliminary fiber and upon this preliminary fiber I build up a coating of a material having such characteristics of permanence and strength as makes it suitable for textile uses. After properly hardening or conditioning the coating or outer layer on my preliminary fiber, I dissolve the preliminary fiber in any suitable material, thus obtaining a permanent hollow fiber of nitrocellulose, cellulose or other suitable material.

In a drawing which forms a part of this application, Fig. 1 shows on a greatly enlarged scale, a cross sectional view through a fiber of sugar such as I may use as the preliminary fiber in the practice of my present invention, A representing the solid fiber. Fig. 2 shows this fiber after it has received a coating of nitrocellulose solution, but before the drying of the solvent, A again representing the solid fiber, and B representing the overlying coating. Fig. 3 shows the same fiber as is shown in Fig. 2, after the solvent has evaporated and the nitrocellulose has dried to its maximum density, the letters having the significance as before. Fig. 4 shows the resulting hollow fiber after the fiber shown in Fig. 3 has been soaked in water to dissolve the preliminary sugar fiber, leaving only the hollow tube B.

In Fig. 5 I have shown diagrammatically the steps involved in the preparation of the fibers shown in Figs. 1 to 4. In this figure s represents a spinneret or spinning nozzle, from which a fiber f of sugar is continuously drawn, the spinneret s being maintained by electrically heating or other means at a suitable temperature. T^1 is a tank holding nitrocellulose solution, and by means of a wheel W^1 within this tank the sugar fiber is caused to receive a coating of the nitrocellulose solution contained in the tank. The fiber then passes through the air to pulley P^1, and down to a tank T^2, containing water. The distance from the wheel W^1 to the pulley P^1 and back to the wheel W^2 which is immersed in the tank T^2, is sufficient to permit of the desired drying of the solvent from the nitrocellulose solution. In passing through tank T^2 the preliminary fiber of sugar is dissolved, and the hollow fiber resulting passes on over a pulley P^2 and down to a tank T^3 containing a solution of sodium sulfide or other denitrating material, maintained at a suitable temperature to reduce the nitrocellulose of the hollow fiber to cellulose.

Fig. 6 shows an alternative form of apparatus which I have found very convenient in experimental work, and which may also be used in suitably modified form in practical manufacture. In this figure s represents a spinneret from which a fiber f is continuously drawn by the motion of the reel r. This fiber passes over a wheel W, and then through a suspended drop, d, of coating solution hanging or suspended from a tank T. It is a very simple matter by the use of one or more pulleys to cause the fiber f to travel through the suspended drop d, and during its travel through this suspended drop of coating material to receive a suitable coating of the coating agent. The distance from the suspended drop of coating material d to the reel r should be such as to permit of the proper drying of the solvent

for the nitrocellulose used, ordinary collodion solution being used in my application of the method described.

Although in the diagrammatic sketches I have shown the formation of a preliminary fiber of sugar, and a coating fiber of nitrocellulose, it will be evident that the principle of my invention is broadly applicable to the use of many materials as the preliminary fiber, and to many coating materials in the preparation of the final hollow fiber. As preliminary fibers I have successfully used sugar, rosin, sulfur, casein, glue and many other materials, and still other materials may be used, and as coating materials cellulose nitrate, cellulose acetate, cellulose xanthate, cupra-ammonium solutions of cellulose and many other like materials may be used. In all cases it is essential that the preliminary fiber should be of a soluble material, and that the solvent used in dissolving this material should not dissolve the coated material. For preliminary fibers of sugar I use water as my solvent, for preliminary fibers of rosin or resins I use alcohol as my solvent, and in all cases I select a solvent for my preliminary fiber which is without dissolving or other harmful action on my coating material. When coating a preliminary fiber with cellulose xanthate or with cupra-ammonia solutions of cellulose, I pass my fiber through a bath of any suitable coagulating or hardening material, either before or after the dissolving out of my preliminary fiber. Under certain circumstances, I find it convenient, instead of passing my preliminary fiber through a bath of a coating agent, to pass the preliminary fiber through a spray or mist of a coating agent, the excess coating agent being collected and reused, and in a similar way I may coagulate or harden the coating on my prepared fiber by the use of a gaseous or vaporous reagent, instead of using a coagulating bath of liquid material.

It will be evident that my invention may be applied to a wide variety of materials and in the preparation of many different types of fibers, and accordingly no limitation should be implied except such as are indicated in the appended claims.

I claim:

1. In the preparation of hollow fibers, the process which comprises forming a preliminary fiber, coating this preliminary fiber with a solid cellulose covering, and dissolving the preliminary fiber in a solvent in which the coating is insoluble.

2. In the preparation of hollow fibers, the process which comprises forming a preliminary fiber of a water soluble material, coating this preliminary fiber with a solid covering insoluble in water, and soaking the resulting product in water until the preliminary fiber has dissolved.

3. In the preparation of hollow fibers of artificial silk the process which comprises forming a preliminary fiber, coating this preliminary fiber with a cellulose product, and dissolving the preliminary fiber.

4. In the preparation of hollow fibers of artificial silk, the process which comprises forming a preliminary fiber, coating this preliminary fiber with a liquid cellulose product, transforming this liquid cellulose product to solid condition, and dissolving the preliminary fiber.

In testimony whereof, I have hereunto subscribed my name this 7th day of May, 1925.

WALTER O. SNELLING.