May 2, 1939. R. PICARD 2,156,923

METHOD AND APPARATUS FOR THE PRODUCTION OF CELLULOSIC STRUCTURES

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FIG. 1.

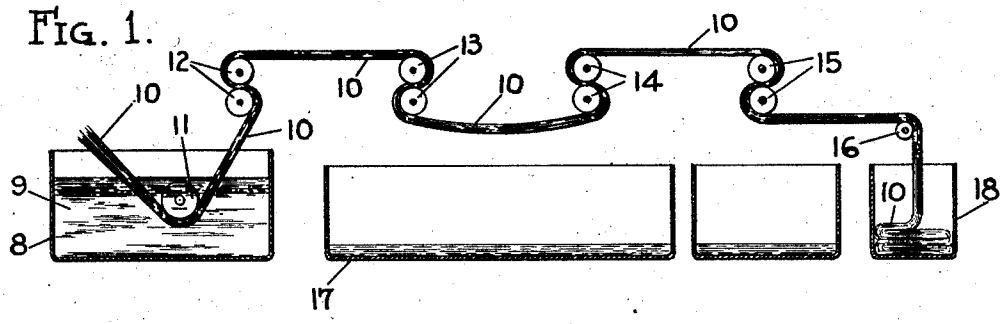
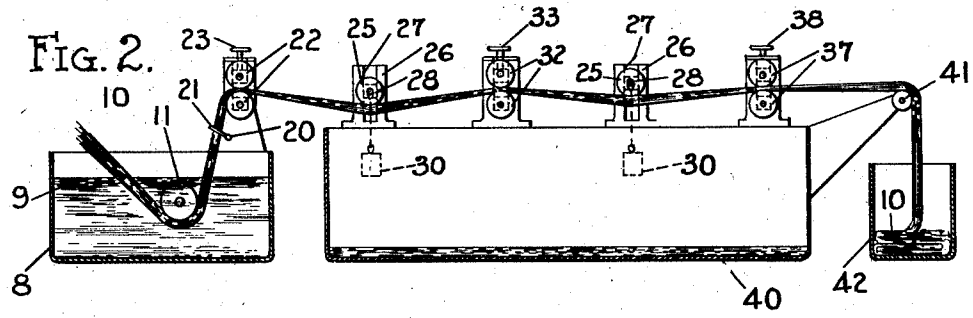



FIG. 2.



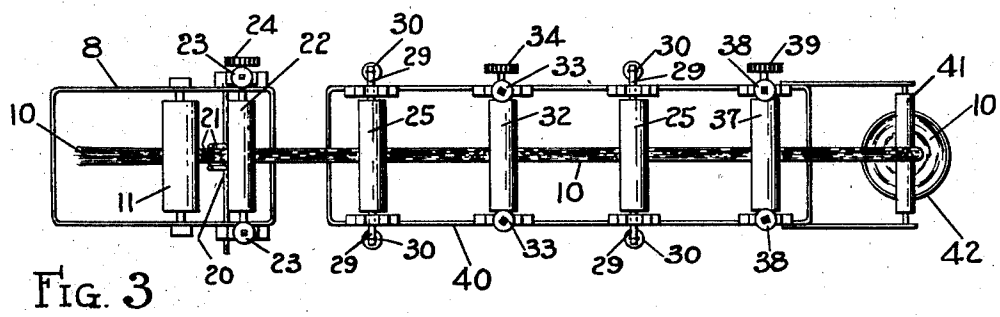




FIG. 3

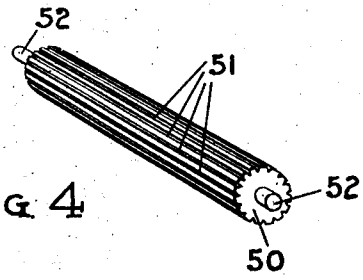



FIG. 4

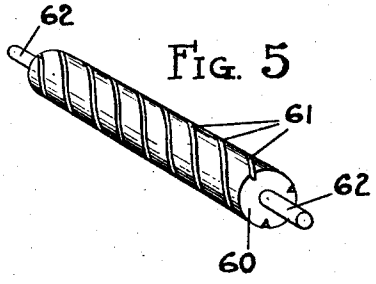



FIG. 5

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## METHOD AND APPARATUS FOR THE PRODUCTION OF CELLULOSIC STRUCTURES

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4 Claims. (Cl. 18—8)

This invention relates to the production of artificial cellulosic thread, and more particularly it relates to a method and apparatus for the production of uniformly stretched artificial staple fiber.

In the manufacture of continuous artificial thread, it is customary to subject the incompletely coagulated filaments to more or less stretching in order to increase the tenacity of the yarn. This stretching is generally produced by tensioning the thread, for example, by passing the thread around a series of two or more rollers in which the succeeding roller revolves at a greater speed than the preceding roller.

In the manufacture of artificial staple fiber, such as, for example, regenerated cellulose staple fiber, the viscose is extruded through a large plurality of spinneret openings so as to produce a bundle of filaments having, for example, 10,000 to 100,000 filaments in a bundle. In the production of such bundles of artificial staple fiber, the stretching processes as known for continuous artificial thread, such as referred to above are found to be entirely inadequate. In fact the procedure of stretching thread by means of passing the thread around a series of two or more rollers in which the rollers are driven at different speeds, is expedient only when the number of unit filaments does not exceed 200 to 300. When a larger number of filaments are submitted to stretching in accordance with the method above referred to, only the outer layers of the bundle undergo sufficient stretching, and when the bundle is flattened or spread out uniformly into a thin layer, there is great danger of fluffing or breaking of filaments. Furthermore, if roller stretching devices as above mentioned are used in the processing of large bundles of thread, it is extremely difficult to prevent slippage of the bundle due to the very large quantities of coagulating and/or regenerating bath carried along by the thread, and consequently the stretching will be irregular and non-uniform.

It is therefore an object of the present invention to provide a method for the production of uniformly stretched, artificial staple fiber.

It is another object of the present invention to provide means for effectively and uniformly stretching artificial staple fiber without substantial damage thereto from breaking of filaments.

It is a further object of this invention to produce artificial staple fiber having a uniform tenacity imparted thereto by stretching of said fiber.

Other objects of the invention will appear hereinafter.

The objects of the present invention are achieved, in general, by passing a bundle of artificial staple fiber from a coagulating and/or regenerating bath to two or more sets of driven calender rolls which are adapted to firmly grip the thread in a continuous manner, and in which on of the succeeding sets of said rolls are driven at a higher speed than one of the preceding sets of said rolls.

The present invention is applicable to the production of large bundles of artificial threads or filaments composed of coagulable cellulosic materials of all types in which it is desired that a stretch be imparted thereto. It is particularly applicable to the production of staple fiber composed of regenerated cellulose and will therefore be described with particular reference thereto.

The purposes and advantages of the invention will become more clearly apparent by reference to the following detailed description taken in connection with the accompanying illustrations of certain specific embodiments thereof, and in which:

Fig. 1 is a diagrammatic elevation, partially in section, showing a series of compressing and stretching calender rolls;

Fig. 2 is a similar view showing a modified form of device;

Fig. 3 is a diagrammatic plan view of Fig. 2;

Figs. 4 and 5 are perspective views showing types of rolls suitable for use in the invention.

Referring to Fig. 1 of the drawing, reference character 8 designates a coagulating and/or regenerating bath tank containing a coagulating and/or regenerating bath liquid 9 of suitable composition. A large plurality of filaments, for example, 10,000 to 100,000 filaments, constituting a bundle of staple fiber, is passed into said coagulating bath by leading the same under the roller 11, from whence it is passed upwardly and between a set of calender rolls 12 which rolls are spaced from each other such a distance as to firmly grip the bundle of filaments. After passing through said calender rolls 12, the bundle of filaments is passed to a second set of calender rolls 13 preferably spaced a distance of from 1 to 6 feet from calender rolls 12. The rolls 13 are also spaced from each other such a distance as to firmly grip the bundle of filaments. The bundle of filaments after passing through the squeeze rolls 13 may if desired be passed to further sets of squeeze or calender rolls 14 and 15 which

are also adapted to firmly grip the bundle of thread, and after which the bundle is passed over a guide roller 16 and into a container 18 in which it may be moved to further processing steps. The calender rolls 12, 13, 14 and 15 are all preferably positively driven in any desired manner well known in the art. The calender rolls 13 are preferably driven at a speed exceeding the speed of calender rolls 12 in order to suitably stretch the bundle of filaments therebetween. The respective speeds between the sets of calender rolls are preferably arranged so as to obtain an elongation of between 5 and 30%, and preferably between 10 and 20%. The calender rolls 14 are preferably driven at a speed equal to the speed of rolls 13 or at a slightly lower speed so as to remove all tension from the bundle of thread between said rolls 13 and 14. Rolls 15 are preferably driven at a speed in excess of the speed of rolls 14 in order to again place a material tension on the bundle of thread 10. Although it is preferred to have all the sets of calender rolls positively driven, it will of course be obvious that rolls 12, for example, may be provided with suitable braking means and the rolls 13 positively driven to draw the bundle of thread through the rolls 12, the braking means being adjusted so as to obtain the desired amount of tension between said sets of calender rolls. Obviously, if desired, rolls 14 may exceed the speed of rolls 13 in order to place a tension on the bundle of filaments in three stages instead of in two stages as is disclosed in Fig. 1.

Referring to the modification illustrated in Fig. 2 of the drawing, the bundle of filaments 10 after passing from the coagulating and/or regenerating bath 9 is passed over a guard 20 between the guiding pegs 21 before passing between the calender rolls 22. The guiding means 21 may, if desired, be shifted transversely to the direction of movement of the thread, so as to vary the contact of the bundle of thread with the surfaces of the rollers to prevent the calender rolls from wearing at any particular section thereof. Calender rolls 22 may be adjusted relative to each other by means of the hand wheels 23 located at opposite ends thereof. Either one or both of the calender rolls 22 may be positively driven by means of a gear or sprocket wheel designated by numeral 24. From the calender rolls 22, the bundle of thread is passed to a second set of calender rolls 32 and thence to a third set of calender rolls 37. Between calender rolls 22 and 32 an idler roll 25 may be positioned whereby to increase the uniformity of tension on the bundle of filaments between the sets of calender rolls. The idler roll comprises roll 25 and shaft 29, which shaft is positioned in bearings 28, the bearings being located in vertical slots 27 of the frame 26. The idler rolls may thereby be moved vertically in accordance with variations in the tension of the bundle between the calender rolls. The idler roll, if desired, may be weighted, such as by means of weights 30 suspended from opposite ends of the shaft 29. A similar idler roll may if desired be positioned between calender rolls 32 and 37, as clearly shown in Fig. 2. The thread bundle is preferably led between the calender rolls by looping the same about the rolls in the manner shown in Fig. 1 whereby to aid in the preventing of slippage between the thread bundle and the rolls. Calender rolls 32 and 37 are relatively adjustable by means of hand wheels 33 and 38 respectively. Either one or both of the sets of calender rolls 32 and 37 may be positively driven in the same manner as calender rolls 22 by any desired driving mechanism, such as, for example, the gear or sprocket wheels designated by numerals 34 and 39 respectively.

The calender rolls may be smooth or slightly roughened as desired; they may be constructed of rigid or flexible material, such as, for example, metal, synthetic resin, hard or soft rubber, wood or any other desired material. They may furthermore if desired be reinforced by cloth or provided with more or less fine grooves parallel to the axis thereof such as shown in Fig. 4 of the drawing, in which reference character 50 designates the roll, 52 the shaft extending therethrough, and 51 parallel grooves extending axially along the outer surface of the roll. The modified form of roll illustrated in Fig. 5 of the drawing comprises a roll 60 provided with a shaft 62 and helicoidal grooves 61 on the external surface of the roll. If desired, the calender rolls may be made hollow and may be weighted on the inside by masses of metal or the like, and may also, if desired, contain heating or cooling elements or fluids whereby to aid in imparting the desired tenacity to the thread by the stretching thereof.

It may in some cases be desirable to apply suitable hot or cold liquids whereby to heat or cool the bundle of fibers during the stretching thereof, or for the purpose of purifying or regenerating the thread during the stretching.

Such hot or cold liquids may be applied by means of spraying devices (not shown) such as are well known in the art, or they may be applied by immersion of the bundle of filaments during the stretching thereof. In some cases, it may be desired to regenerate the cellulose in two phases with a stretching operation between phases, or the stretching may be applied to the bundle of filaments between the coagulation and the regeneration thereof.

It will be obvious that many other changes or modifications may be made in the detailed description of the invention without departing from the nature and spirit of the invention. It will therefore be understood that the invention is not to be limited to the specific details of the description and accompanying illustrations except as set forth in the appended claims.

I claim:

1. In an apparatus for processing a large bundle of artificial continuous filaments, a means for wringing and compressing said bundle of filaments, means for shifting said bundle of filaments along said wringing and compressing means whereby to vary the contact of the thread with the surfaces of the wringing and compressing means, and means cooperating with said first named means for gripping said bundle of filaments at two spaced points in a continuous manner and imparting a substantially constant and uniform stretch thereto between said points of gripping.

2. In an apparatus for processing a large bundle of artificial continuous filaments, a means for positively forwarding, gripping, wringing and compressing said bundle of filaments, means for positively forwarding and gripping said bundle of filaments at a point spaced from said first named means, said two means cooperating to impart a substantially constant and uniform stretch thereto between said points of positively forwarding and gripping, means for imparting a further constant and uniform stretch to said bundle of filaments, and weighted idler rolls contacting with said bundle of filaments between

said stretching means, said idler rollers being freely movable in a vertical direction.

3. The method of processing a large bundle of regenerated cellulose continuous filaments which comprises the steps of drawing the said bundle from a coagulating liquid, gripping, positively forwarding, wringing and compressing said bundle of filaments substantially simultaneously, firmly gripping and positively forwarding said bundle of filaments at a point spaced from the first point of gripping and positively forwarding, continuously imparting a substantially constant and uniform stretch thereto between said points of gripping and forwarding, releasing the tension from said bundle, again firmly gripping and positively forwarding said bundle of filaments at two spaced points in a continuous manner, and imparting a further constant and uniform stretch thereto between said last named points of gripping and forwarding.

4. The method of processing a large bundle of regenerated cellulose continuous filaments which comprises the steps of drawing the said bundle from a coagulating liquid, gripping, positively forwarding, wringing and compressing said bundle of filaments substantially simultaneously, firmly gripping and positively forwarding said bundle of filaments at a point spaced from the first point of gripping and positively forwarding, continuously imparting a substantially constant and uniform stretch thereto between said points of gripping and forwarding, releasing the tension from said bundle, again firmly gripping and positively forwarding said bundle of filaments at two spaced points in a continuous manner, imparting a further constant and uniform stretch thereto between said last named points of gripping and forwarding, and subjecting said bundle of filaments to liquid treatment during at least one of said stretching steps.

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