

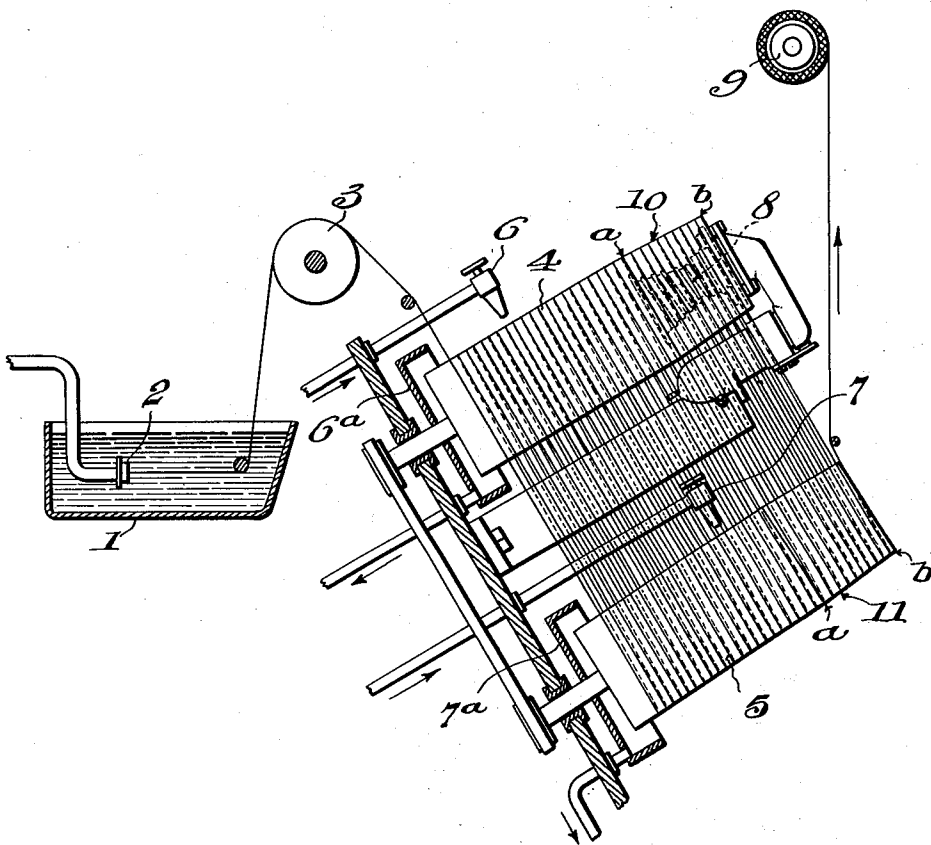
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APPARATUS FOR TREATING AND DRYING THREAD

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APPARATUS FOR TREATING AND DRYING
THREAD

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2 Claims. (Cl. 18—8)

This invention relates to the preparation of filaments of artificial origin and more particularly to the after-treatment of cellulosic filaments prepared by extruding a cellulosic solution through a spinning nozzle. As an illustration of such a procedure, reference will be made to a continuous process for producing and after-treating artificial silk similar to that disclosed in the Hartmann et al. application Serial No. 131,942, filed March 19, 1937, now Patent Number 2,194,470. It is not intended, however, to restrict the invention to such a procedure, since it is obvious that it may be useful with other procedures.

When freshly spun artificial silk is after-treated with liquid and washed, the shrinkage tendency of this freshly spun and washed yarn amounts to about 7 or 8% of the length of the yarn. If the yarn is dried in such a manner that this shrinkage tendency or shrinkage capacity is all taken up during the drying operation, the material produced will have no or a negligible after-shrinkage, i. e., it will have little tendency to shrink further on rewetting and redrying. Thus yarns dried in skein form and freely suspended from a stick will have very little or no after-shrinkage.

If the yarns are dried on equipment on which this shrinkage is resisted, the finished yarn will be stretched relative to its outshrunk length and will consequently retain a certain amount of its shrinkage tendency and is said to have an after-shrinkage capacity. For example, in artificial yarns produced as described in the above mentioned application, the after-shrinkage will amount to about 4 or 5%. It is desirable, particularly for yarns used for weaving, to reduce this after-shrinkage as much as possible and it is an object of the present invention to provide means and a method whereby this may be accomplished. Other objects of the invention will become apparent.

In describing the invention, reference will be made to the drawings in which the figure illustrates a diagrammatic side view of one of the spinning places. In this view, the numeral 1 designates a trough for the spinning solution into which the cellulosic solution is extruded through the spinning nozzle 2. The extruded filaments are then conducted by a driven roller 3 and delivered to driven rotors 4 and 5 of equal size and rotating in the same direction and at the same speed. The axes of these rotors are in the same vertical plane and slightly converge toward their outer ends so that the thread around them as illustrated will advance along the cylinders at

the desired rate. As the thread advances along the cylinders 4 and 5, it is treated with a treating liquid, such as dilute sulfuric acid, supplied through the outlet 6, and with a washing liquid (water) supplied through an outlet 7. The excess liquid from these treatments are collected in troughs 6a and 7a and may be discarded, reused or disposed of in other ways. Obviously other treating steps may also be applied, if desired, to the filaments on the rollers 4 and 5. The thread may be subjected to heat as it advances along the outer end portions of the rotors 4 and 5, for example, by means of a heater 8, which, in the drawing, is an electrical heater positioned within the hollow end of the rotor 4. The dried thread delivered from the end of the rotor 5 may be wound upon a spool 9 or otherwise collected. The collecting or take-up spool 9 should have a take-up speed substantially equal to the speed of the yarn as it leaves the last rotor (5).

If the rotors 4 and 5 are cylindrical throughout their length the shrinkage of the thread during drying will be resisted and the thread will have an after-shrinkage of about 4 to 5%. The present invention is particularly concerned with the provision of a means and method whereby this after-shrinkage may be minimized without causing the yarn to slip on the rotors.

In order to accomplish this result, the outer ends of the uniformly and constantly rotating rotors 4 and 5 are tapered as illustrated at 10 and 11, at the same angle, in order to permit the shrinkage at the desired rate. The rate of the taper of the portions 10 and 11 has been found to have an important effect upon the characteristics of the finished yarn.

It has now been found that the rate of taper of the rotors should be such that the peripheral speed of the surface of the rotor with which the thread is in contact as it leaves the last rotor will be reduced by an amount substantially equal to or slightly less than the total shrinkage capacity of the treated and washed yarn. The amount less than the shrinkage capacity should be such as to assure sufficient gripping of the yarn on the rotors during the drying operation to advance them along the rotors.

Although the shrinkage tendency of the yarn will vary as the heat is supplied, for all practical purposes it is satisfactory to taper the ends of the rollers gradually and in a straight line between the point of initial shrinkage of the yarn and the take-off, the taper being such that the speed of travel of the yarn at the take-off will be less than the speed of travel at the point of initial shrink-

age by an amount slightly less than the total shrinkage capacity of the yarn. Any variations in the shrinkage capacity during the drying operations will automatically be accommodated for by the position assumed by the turns of thread as it advances along the tapered surfaces. Such spacing of the turns of thread may be regulated by shaping and positioning the heating element to apply heat in accordance with the heat units required to liberate moisture from the thread.

If desired, the outer end portion of the rotors may be of varied taper to take care of the differences in rates of shrinkage with uniform application of heat. For example, the taper may be less during the first portion of the drying and greater during the later portion when the shrinkage is more rapid, the rates being such that the peripheral speeds are reduced in direct proportion to the shrinkage capacity of the yarn.

As a specific example of the invention, a viscose thread having a total initial shrinkage capacity, when freshly spun and washed, of about 7 to 8% may be after-treated and dried on a pair of rotors as illustrated in the drawing and having a taper such that the peripheral speed at *b* is 8% less than the peripheral speed at *a*. To accomplish this the diameter of the rotors at *b* will be 8% less than the diameters of the rotors at *a*.

Thus in order to minimize the after-shrinkage of the thread processed and dried on spaced rotors, the outer ends of the rotors are tapered throughout the drying zone at such a rate that the diameters and consequently the peripheral speed of the rotors are reduced by an amount equal to the inherent shrinkage capacity of the freshly spun and washed but undried yarn.

It is obvious that the control of speed of the thread during drying to control the shrinkage capacity of the thread may be utilized in other arrangements for wet treating and drying threads and it is not intended to restrict the invention herein described. An important feature of the invention is the moving of the supported thread through the drying zone in such a way that the rate of speed of the supports will decrease in direct proportion to the shrinking capacity of the thread. For example, the thread may be drawn through a drying chamber positioned between feed rollers and draw-off rollers, the peripheral speed of the latter being less than that of the former by an amount equal to the shrinkage capacity

of the yarn. With such an arrangement the yarn should be supported in the drying chamber; this may be accomplished by spaced support rollers, each rotating at a peripheral speed equal to the speed of the yarn at its point of contact.

Although this application has particular reference to yarn used in the weaving trade, it may be easily seen that by such an accurate control of the shrinkage of yarn in a continuous process it would be possible to produce yarn with very desirable qualities for other purposes. For example, yarn with a strength of 2, 3 or more grams per denier having a capacity of shrinkage not exceeding one or two percent might be produced, which is a very suitable yarn for use in tire cords, belts or the like where the yarn or fabrics made therefrom is to be associated with rubber or latex.

The terms used in describing the invention have been used in their descriptive sense and it is intended that all equivalents thereof be included within the scope of the appended claims.

Having thus described my invention as required by the patent statutes, what I claim is:

1. A thread treating and drying apparatus comprising at least two spaced rotatable thread supporting and propelling elements, means for supporting said elements from one end only thereof, the axes of said elements converging toward the unsupported end, each of said elements including registering cylindrical portions and registering tapering portions, said tapering portions progressively decreasing in diameter toward the unsupported end of the elements, the taper being a curve of progressively decreasing radius, and heating means in the tapered portion of at least one of the elements.

2. A thread treating and drying apparatus comprising at least two spaced rotatable thread supporting and propelling elements, means for supporting said elements from one end only thereof, the axes of the elements converging toward the unsupported end, each of said elements including registering cylindrical portions and at least one of said elements having a tapering portion, said tapering portion progressively decreasing in diameter toward the unsupported end of the element, the taper being a curve of progressively decreasing diameter, and heating means in the tapered portion.

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