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2,495,936

APPARATUS FOR MANUFACTURE OR TREATMENT OF THREAD

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2 Sheets-Sheet 1

Fig. 1.

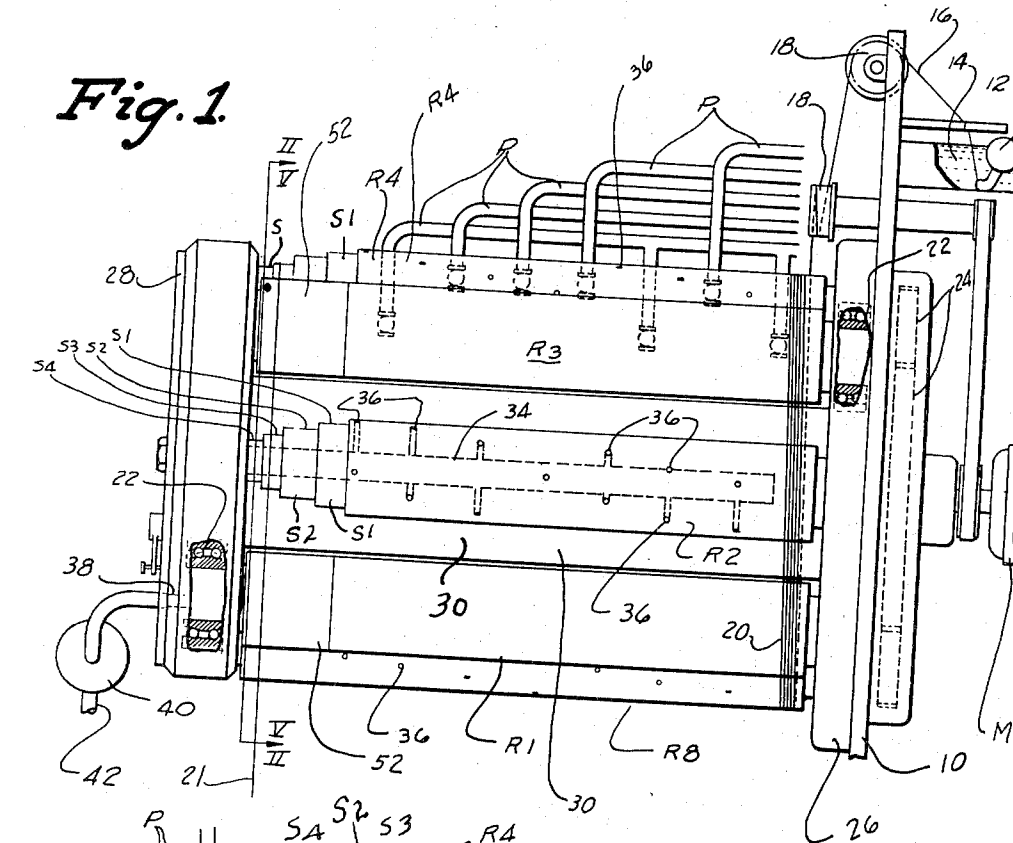
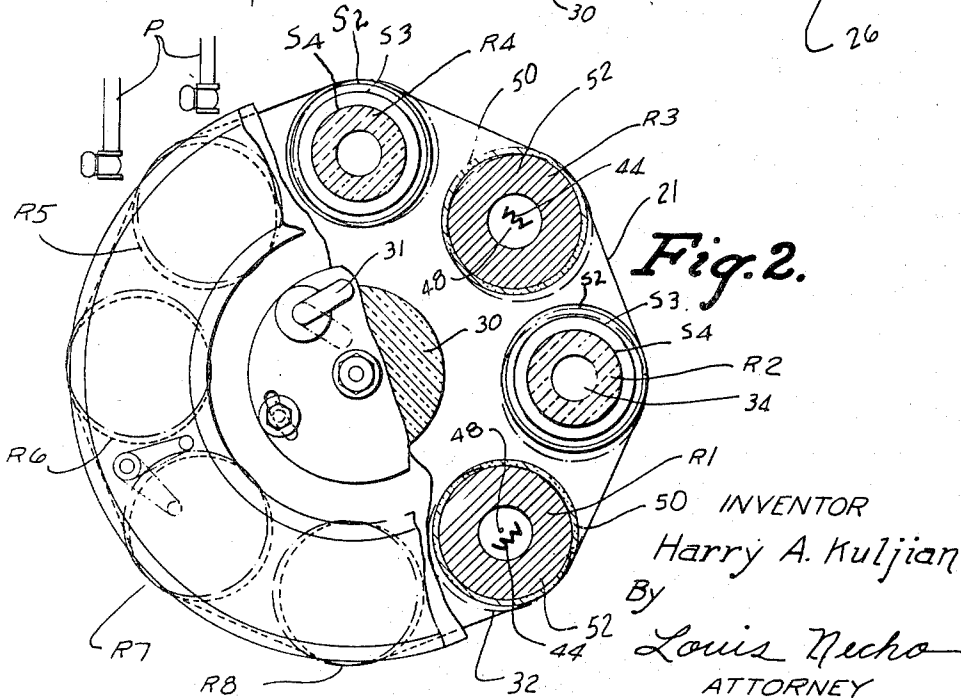


Fig. 2.



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Fig. 3.

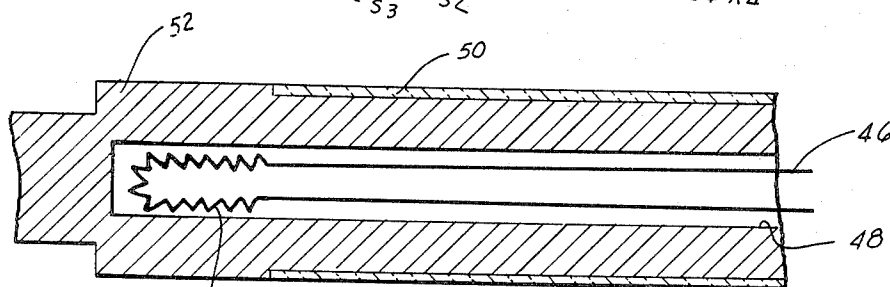
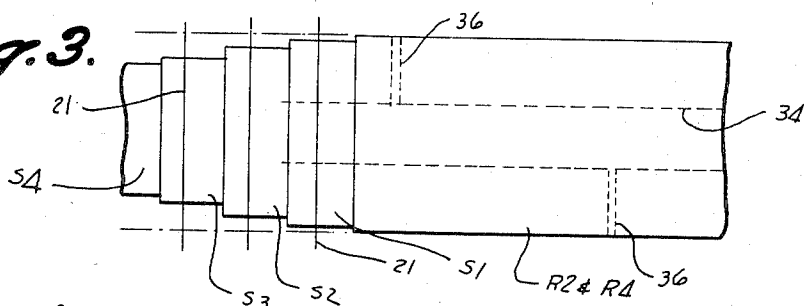


Fig. 4.

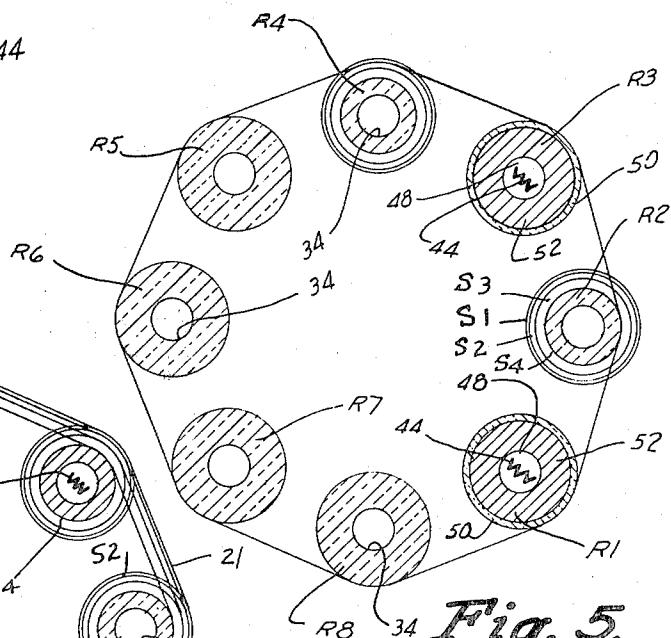
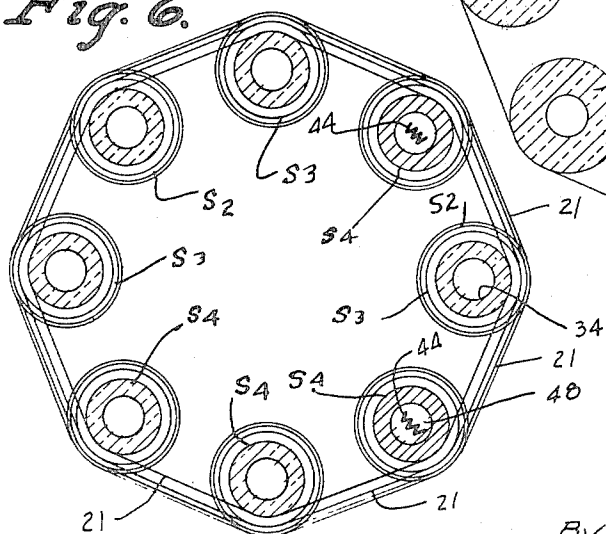


Fig. 5.

Fig. 6.



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APPARATUS FOR MANUFACTURE OR
TREATMENT OF THREAD

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1 Claim. (Cl. 34—153)

1 In the manufacture of synthetic thread, the freshly coagulated, and incompletely regenerated filament should be subjected to a stretching action which strengthens the filament, to chemical treatments for desulphurizing, neutralizing, and otherwise completing its regeneration, and to one or more washings to remove chemical residues. The filament is then dried and, in order to minimize shrinkage of the fabric made from a thread so produced, the filament should be allowed to undergo controlled shrinkage before it is completely dried.

It has heretofore been proposed to effect shrinkage of the filament by causing the filament to travel over a plurality of reels having different diameters or different peripheral speeds or having different contours, as exemplified in U. S. Patent No. 2,429,993 issued to K. M. McLellan on September 23, 1947 and entitled Production of rayon.

It is therefore the object of the invention to produce an improved apparatus whereby the regeneration, washing, drying and controlled shrinkage of the filament are all effected, in a continuous manner, and on a single, relatively compact thread storing and advancing device formed of a plurality of skewed rolls rotating about their respective axes, with or without the thread storing and advancing device itself being rotated, as a unit, about a single, central axis.

A still further object is to produce improved means for drying the wet, completely regenerated filament.

A still further object is to coordinate the drying and shrinkage operations and to graduate the same so as to produce a filament of high and uniform quality.

A still further object is to effect controlled shrinkage of the filament without increasing or decreasing the speed at which the thread advancing device, as such, or the skewed rolls constituting said device are rotated. This is important because, to have to vary the speed of rotation of one or more rolls, or of all of the rolls, or of the thread advancing device as a whole, in a plant employing thousands of producing units, involves gear trains and other apparatus, as well as skilled labor, at prohibitive costs.

A still further object is to effect the desired controlled shrinkage by a simple and automatic manner without the need for constant, skilled attention or supervision.

These and other objects are attained by my invention as set forth in the following specifica-

2 tion and as illustrated in the accompanying drawings in which

Fig. 1 is a diagrammatic side elevational view of a synthetic thread manufacturing apparatus embodying my invention.

Fig. 2 is a view, partly in section and partly in elevation, looking in the direction of line 2—2 of Fig. 1, showing the position of the filament before the shrinking operation has begun.

Fig. 3 is an enlarged, fragmentary, side elevational view of one of the shrinkage rolls forming part of the thread storing and advancing device of Fig. 1.

Fig. 4 is an enlarged, fragmentary, vertical sectional view of the drying rolls forming part of the thread storing and advancing device of Fig. 1.

Fig. 5 is a diagrammatic view, partly in section and partly in end elevation, showing the position of the filament during the shrinking operation.

Fig. 6 is a view similar to Fig. 5, showing a thread storing and advancing device all the rolls of which are stepped off as shown in Fig. 3.

The apparatus illustrated in Fig. 1 includes a supporting frame 10 for a thread storing and advancing device, and for a spinnerette 12 through which an appropriate solution is extruded, under pressure, into a coagulating bath 14, to form a filament (or a bundle of filaments) 16. The filament 16 passes over one or more godet wheels 18 where it is partly stretched and onto a cantilever mounted thread storing and advancing device over which the filament travels in the form of more or less closely spaced helices 20. In Fig. 1 the helices are shown only at the right hand end of the thread storing and advancing device but it will be understood that the helices extend over the entire length of the thread advancing device, with the filament leaving the device at the unsupported end thereof as shown at 21.

The thread advancing device, includes a plurality of rolls R1, R2, R3, R4, R5, R6, R7 and R8 which are rotatable in roller bearings 22 and which are rotated about their respective axes by gears 24 driven by a motor M. The bearings 22 are mounted in opposite end plates 26 and 28 which are carried by a center post 30 carried by the frame 10.

The end plate 28 is rotatably mounted and is turned by means of a handle 31 so as to skew the axes of the rolls R1 to R8 as shown at 32. The skewing of the axes of one or more of the rolls cause a filament circumscribing the rolls to move, longitudinally, and in the form of a plurality of helices, from one end of the rolls to the

other, as for example, from right to left in Fig. 1.

Except for rolls R1 and R3 which are later referred to, the remaining rolls are formed of some non-corrosive material and are provided with central bores 34 and with radial holes 36 leading from the surfaces of the rolls to the bores 34. The bores 34 lead to a manifold 38 to which one or more suitable suction pumps 40 is connected.

Above the rolls R5 and R6, or above either of them, are a plurality of pipes P which discharge various liquids for treating and washing the filament as it moves longitudinally of the thread advancing device. The liquids discharged onto the filament, or the major portions thereof, are sucked off by the pump 40, through the holes 36 and bores 34. The liquids thus sucked off are delivered through pipe 42 to a common point or to separate points of disposal not shown.

The structure and operation of the rolls forming the thread advancing device, and the manner in which the various liquids are applied and sucked off have been only sketchily described as they are not objects of the present application which is directed to the drying and shrinkage of the filament.

In order to dry the filament gradually, one or more rolls R1 and R3 are formed of metal and are heated by means of resistance elements 44 located near the delivery or left hand ends of the rolls. The elements 44 are energized by wires 46 which preferably extend through a bore 48 formed in these rolls. The wires 46 lead to a source of electrical energy, not shown, and the input of energy may be regulated by the capacity of the elements or may be controlled by means of any well known, conventional device, not shown.

In order to prevent over-heating of the filament while it is being regenerated and washed, the rolls R1 and R3 are turned down so as to make a recess or seat for accommodating a covering 50 formed of insulating material such as glass, porcelain, Micarta or the like. It will be noted that the surface of the covering 50 is flush with the surface of the drying zone 52. When the regeneration and washing of the filament are completed, the filament travels over the heating zones 52 of the rolls R1 and R3 where its moisture content is evaporated. In order not to subject the filament to excessive heat, and in order properly to dry the filament, I use two spaced drying rolls R1 and R3, with each of these rolls supplying a part of the heat required, but it is understood that as many heated drying rolls may be used as may be needed.

The spacing of the rolls R1 and R3 permits complete utilization of the heat input of each roll and prevents overheating of the filament.

In order to permit the filament to undergo the desired shrinkage, one or more rolls, such as rolls R2 and R4 have their delivery or left hand ends stepped off, or reduced, as best shown in Figs. 1 and 3. By this arrangement, when the filament moves off the large, uniform diameter surfaces of the rolls onto the stepped, reduced diameter end portions of the rolls R2 and R4, the filament is allowed to shrink to an extent substantially equal to the reduction in the diameter of the helix of the roll travelling over the stepped portions.

The tendency of a wet filament to shrink is inversely proportional to its moisture content in that as the filament dries, its tendency to shrink is, within limits, increased. Therefore, I have placed the stepped, reduced diameter portions of the rolls R2 and R4 adjacent the drying zones

52. By this arrangement, as the filament begins to dry, it begins to ride off the large uniform diameter portions of the rolls onto the stepped portions.

In order to graduate the shrinkage of the filament and in order to synchronize it with the progress of the drying operation, I have graduated the effectiveness of the steps on rolls R2 and R4. As will be seen from Fig. 3, the first step S1 is relatively shallow, that is, the reduction in the diameter of that portion of the roll is relatively small. Progressively, however, the reduction in diameter at steps S2, S3 and S4 is gradually increased so that the driest portion of the filament which leaves the extreme left hand ends of the drying zones 52 will ride on step S4 having the greatest depth and the greatest reduction in diameter. By this means the relatively wet filament, which has a relatively small tendency to shrink, is, by riding on step S1, afforded a relatively limited diameter reduction corresponding to the shrinkage potential then present in the filament.

The contract between the diameter of a helix of the filament circumscribing the large uniform surfaces of all of the rolls and the diameter of a helix circumscribing one or another of steps S1, S2, S3 and S4 can be clearly seen by looking at rolls R2 and R4 in Figs. 2 and 5.

It will be noted that the rolls R2 and R4, which have the stepped portions, alternate with the rolls R1 and R3 which have the heated drying zones so that, as a portion of the filament is heated by roll R1 it is afforded an opportunity to shrink by roll R2 and as it is further heated by roll R3, it is afforded an opportunity for further shrinkage by roll R4.

It is within the scope of my invention to step off the ends of all of the rolls, as shown at S1, S2, S3 and S4, in Fig. 6, and it is within the scope of my invention to heat the ends of alternate rolls, or of all, of the rolls of the thread advancing device depending on requirements. But since the manner in which the rolls are heated is shown by rolls R1 and R3, it is believed unnecessary to show heating elements in each and every one of the rolls in Fig. 6.

From the foregoing it will be seen that as the filament dries, it is permitted to ride on the progressively reduced diameter portions and, therefore, the helices formed by the filament also assume smaller diameters thus producing a corresponding shrinkage in the filament.

It will also be noted that the shrinkage is produced in a progressive manner and synchronously with the progress of the drying operation.

While I have illustrated apparatus for complete manufacture of synthetic filaments, it is within the scope of my invention to omit the spinnerette and to use the remaining apparatus for only shrinking a filament. For example, an already completely regenerated synthetic filament, or a non-synthetic filament, may be wetted and wound on the thread advancing device, or vice versa, and may then be subjected to heat and caused to move over the reduced ends of one or more rolls so as to cause the filament to undergo the desired shrinkage.

What I claim is:

Apparatus for manufacturing or treating thread, said apparatus including a plurality of rolls arranged to produce a thread storing and advancing device, means supporting said device at one end thereof, means for delivering thread to the supported end of said device whereby said

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thread moves, in the form of a helix circumscribing all of said rolls, from the supported, toward the unsupported end of the device, the end portion of at least one of said rolls, near the unsupported end of said device being stepped to form a plurality of sections of successively smaller diameters connected to each other and to the main body of said roll by walls normal to the longitudinal axis of said roll, and means for applying heat to the thread as it moves over said sections, the major portion of at least one of said rolls between the stepped end portion and the supported end of the thread storing and

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advancing device being covered with a material having a low coefficient of heat conductivity.

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The following references are of record in the file of this patent:

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