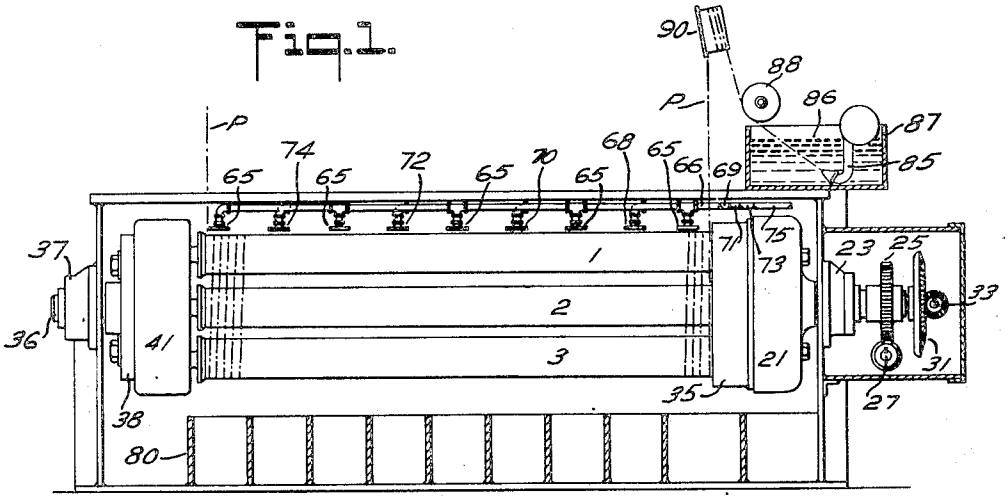
Feb. 27, 1951 H. A. KULJIAN 2,543,031

THREAD ADVANCING REEL

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Fig. 1.



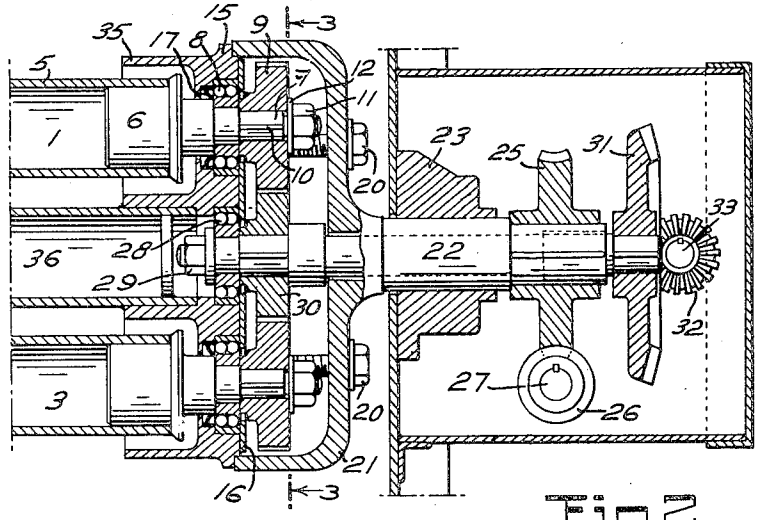


Fig. 2.

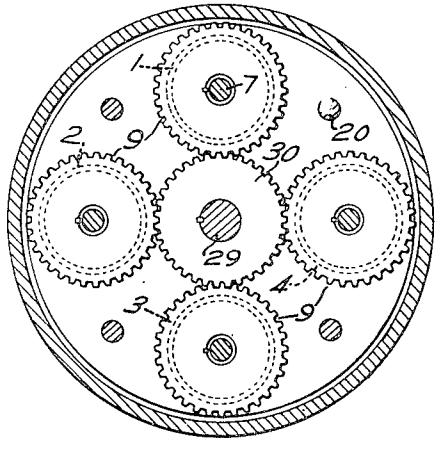


Fig. 3.

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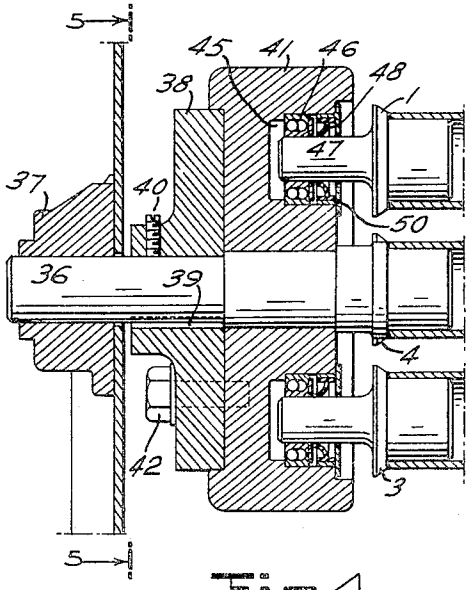


Fig. 4.

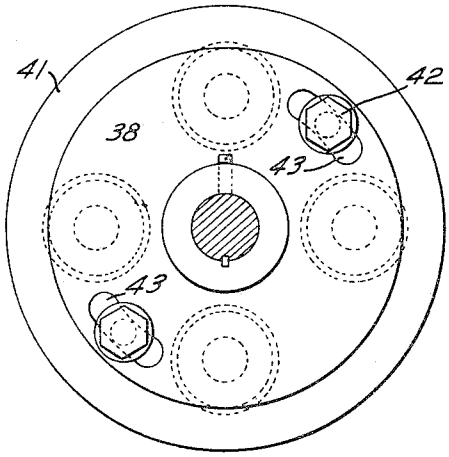


Fig. 5.

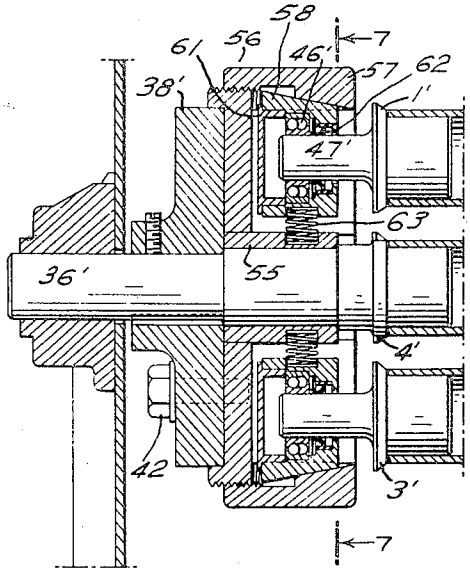


Fig. 6.

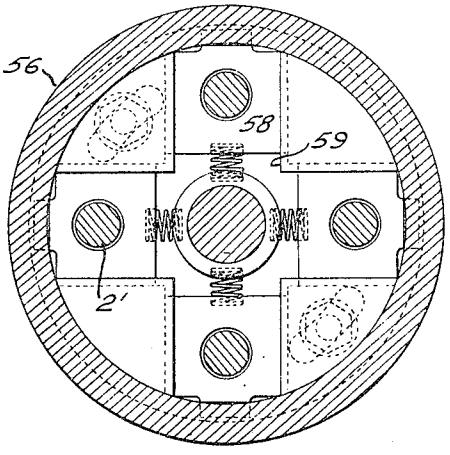


Fig. 7.

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UNITED STATES PATENT OFFICE

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THREAD ADVANCING REEL

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Application April 30, 1946, Serial No. 666,007

8 Claims. (Cl. 28—71.6)

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In the continuous-process manufacture of synthetic thread, an appropriate solution is extruded through a suitable spinnerette into a suitable coagulating bath and the thread thus formed is guided over one or more godet wheels and onto one end of a thread storing and advancing device, which causes the thread to move toward the other end of said device in the form of a helix encircling the thread storing and advancing device. In order to complete the regeneration of the freshly extruded thread, it is subjected, while moving over the thread advancing device to, various washes and chemical treatments.

The thread storing and advancing device may take the form of the well known cage, which is formed of interleaved and interdigitating bars, or it may take the form of a reel formed of a plurality of elongated rolls arranged side by side so that a line passing through the axes of the rolls will describe a circle, the rolls being rotated about their individual axes, and said axes being slightly skewed relative to the axis of such circle. Of the two forms of thread storing and advancing device, I prefer the latter and the object of my invention is to produce an improved apparatus for continuous manufacture of synthetic thread wherein the reel type of thread storing and advancing device is employed.

To be commercially practicable, a reel type thread advancing device should include means to facilitate initial lacing, or winding, of the end of a freshly extruded thread about the device and, when it is remembered that the device is in rotation and when the size and location of the thread storing and advancing device are considered, it will be seen that easy and proper initial winding of the filament about the receiving end of the thread advancing device presents a serious problem. Several prior attempts to solve this problem have been made, but the expedients heretofore suggested are, as far as I am aware, not quite satisfactory.

It is, therefore, a further object of the invention to produce improved means for the facilitating the initial winding of the filament about the thread advancing device.

A reel type thread advancing device should also include means for adjusting the skew of the rolls, while the rolls are in motion, so as to regulate the spacing of the convolutions of the helix and to regulate the speed with which any given point on the helix travels from the receiving end to the discharging end of the device.

It is, therefore, a still further object of the invention to produce an improved reel type thread advancing device in which the skew of the axes

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of the rolls forming said device may be changed irrespective of whether or not the rolls are in motion.

In addition to controlling the speed of movement of the filament by controlling the skew of the axes of the rolls, it is desirable to increase the speed of movement of the filament without correspondingly increasing the R. P. M. of the rolls about their individual axes.

It is, therefore, a still further object of the invention to produce an improved reel type thread advancing device in which the rolls may be rotated, as a unit, about a common axis, or about their own individual axes, or both.

Because, during its regeneration, the filament tends to shrink, it is desirable to guard against overstretching or breaking the thread due to shrinkage.

It is, therefore, a still further object of the invention to produce an improved thread storing and advancing device which will allow the thread to shrink without overstretching or breaking.

These and other objects are attained by my invention so set forth in the following specification and as illustrated in the accompanying drawings in which

Fig. 1 is a somewhat diagrammatic side elevation, partly in vertical section, of said apparatus;

Fig. 2 is a fragmentary enlarged vertical section adjacent the right hand end of Fig. 1;

Fig. 3 is a transverse section on the line 3—3 in Fig. 2;

Fig. 4 is a section similar to Fig. 2 but taken near the left hand end of Fig. 1;

Fig. 5 is a transverse section on the line 5—5 in Fig. 4;

Fig. 6 is a view generally corresponding to Fig. 4 of a slightly modified form of apparatus; and

Fig. 7 is a section on the line 7—7 in Fig. 6.

In the several figures like characters are used to designate the same parts and the arrows on the section lines indicate the directions of the correspondingly numbered sectional views.

Referring now more particularly to the drawings, the apparatus shown in Figs. 1–5 comprises four rollers 1, 2, 3, 4 which are similarly constructed and mounted and need not be individually described, as each preferably comprises a tube 5, having at one end a head 6 from which a spindle 7 projects axially through a self-aligning antifriction bearing 8 into a spur gear 9, to which it is secured by key 10, nut 11 and washer 12. Each bearing 8 is carried in a corresponding recess in a plate 15 apertured therefor and for the passage of the roller spindles therethrough,

all the bearings being held in place by a single retainer disc 16 and each protected from access of fluid by a flexible gasket or packing ring 17. Plate 15 is supported and secured by cap screws 20 in an end cap 21 having an axial sleeve 22 projecting rearwardly from the plate through a bearing support 23; a gear 25 keyed to the sleeve near its outer end and driven from a worm gear 26 on a shaft 27 affords means whereby the rollers may be rotated as a unit about a common axis coincident with that of the end cap when desired.

Plate 15 also supports, through antifriction bearing 28, one end of a drive shaft 29 for a gear 30 meshing with roller spur gears 9 to drive them unitarily on rotation of the shaft, which extends from the plate through and beyond the end of sleeve 22 and is driven by a keyed bevel gear 31 meshing with a bevel pinion 32 on a shaft 33. The shafts 27 and 33 are arranged to be driven independently of each other by any suitable prime movers (not shown). The apparatus further includes a ring 35 which is carried by the plate 15 and which projects axially therefrom so as to overlie the adjacent ends of the rollers. The ring 35 serves to lace, or wind, the filament about the thread storing and advancing device in a manner hereinafter more fully explained. A shaft 36 is seated at the center of the plate 15 and extends axially therefrom, the shaft being so arranged that its axis is at the center of a circle drawn through the axes of the rollers 1, 2, 3 and 4. The other end of the shaft 36 is supported in a bearing 37 and carries an end plate 38 which is secured to the shaft by key 39 and a set screw 40. A bearing carrier 41 is secured to the end plate 38 by means of cap screws 42 passing through arcuate slots 43 in the end plate and threaded into the bearing carrier 41. The bearing carrier 41 is provided with seats 45 for receiving self aligning bearings 46 on the ends of the rollers. Flexible, fluid excluding gaskets 48 close the open ends of the seats or recesses 45 and are held in position by an annular cap 50.

In the drawings, the axes of the rollers are shown parallel to the axis of the shaft 36 and to each other but this is for convenience of illustration only. In practice, when the bearing carrier 41 or 56 is rotated relative to end plate 38 or 38', respectively, the axes of the rolls will be slightly skewed with reference to the axis of the shaft 36. By this means, if the end of a filament is wound about the right hand end of the thread advancing device when the rollers are in motion, the thread will form a helix circumscribing all of the rolls and the filament will move, in a helical path, toward the other end of the thread advancing device.

There is illustrated in Figs. 6 and 7 a somewhat modified mounting for the tail pieces of the rollers 1', 2', 3', 4' of apparatus otherwise similar to that just described, said mounting comprising a sleeve 55 carried on shaft 36' supporting a composite bearing carrier 56 secured to adjusting plate 38' similarly to the connection of plate 38 with carrier 41 in the preceding figures. This bearing carrier comprises an internally tapered collar 57 which maintains bearing blocks 58 within radially adjustable limits in grooved slots 59 formed in the body of the carrier. The bearing blocks respectively support self-aligning antifriction bearings 46' on the ends 47' of the rollers, caps 61 and gaskets 62 excluding foreign matter from the bearings and retaining lubricant therein,

55 and in the several bearing blocks yieldingly bias the latter toward their radial outer limits as fixed by the adjusted position of collar 57. Other than as just described the various structural details of the apparatus may correspond to those shown in Figs. 1–5 inclusive.

In addition to rollers 1, 2, 3, 4 and the supporting and driving means therefor, the apparatus in both of its illustrated embodiments includes means for supplying treating fluids to the filament as it is carried in a helical path about the rollers. Such means may comprise a plurality of jets or spray nozzles disposed generally above the rollers in what may be considered as two groups. In the first group are nozzles 65 adapted for supplying wash water to the filament, and all of these may be connected to a common main 66 through which the water is supplied to them. The nozzles of the other group are arranged longitudinally of the apparatus as a whole and preferably alternately with those of the first group and are mutually independent; they include a nozzle 68 supplied from pipe 69 with a first treating liquid, for example, a desulphurizing one; a nozzle 70, supplied from pipe 71 with a second treating liquid such as a bleaching agent; nozzle 72 supplied from pipe 73 with acid or the like, and nozzle 74 supplied from pipe 75 with a soap solution or other softening medium. It will be observed from Fig. 1 that each treating zone as defined by the space beneath one of the nozzles 68, 70, 72, 74 supplying the treating agents is bounded on either side by a zone in which water is supplied from one of the nozzles 65, whereby the filament may be water washed before and after its passage through each treating zone, while a partitioned trough 80 beneath the rollers affords receptacles for collecting and keeping segregated the effluent from each zone whereby the valuable treating liquids may be separately recovered for re-use, re-generation or other disposition.

At a convenient point adjacent the starting end of the rollers I provide a spinneret 85, immersed in a coagulation bath 86 in a tank 87, and equipped with a filament guide 88 from which the coagulated filament formed by solution extruded through an orifice in the spinneret into the coagulant may be directed by a godet 90 from which it is thereafter led to rollers 1, 2, 3, 4, as will now be more fully described, dot and dash lines in Fig. 1 indicating the path P of the filament, except where for convenience an intermediate portion of its helical part has been omitted.

When the apparatus is to be used for making a thread of filament, the axes of the rollers are skewed, to the desired extent, by rotating the bearing carrier 41 relative to the plate 38, or by rotating the bearing carrier 56 relative to the plate 38', so as to cause a filament wound about the end of the thread advancing device remote from the plates 38 and 38' to move, in the form of a helix circumscribing all of the rolls, toward plates 38 and 38'.

As this adjustment or skewing of the axes of the rollers is effected by mere rotation of the bearing carriers as to their respective end plates, it will be seen that the axes of the rollers can be skewed, as desired, irrespective of whether the rollers are in motion or not.

During its regeneration, a freshly coagulated filament will shrink, more or less, and, as shown

allowing the rollers to move radially inwardly, in response to the compressing action exerted by the filament shrinkage. This guards against overstretching or outright breaking of the filament.

When the apparatus described is ready for use, the rolls are rotated about their axes and the entire reel is rotated about the axis of shaft **36**. The end of a freshly extruded filament now is led over guide **88** and godet **90** and placed upon the lacing ring **35** which over hangs the adjacent ends of the rollers. The rotation of the lacing ring **35** causes the filament to form a band or bundle which is pushed off the lacing ring and onto the adjacent end of the reel. Due to rotation of the rolls about their own axes, the bundle immediately begins to move toward the opposite ends of the rolls and in so doing, it causes the filament to form a helix circumscribing all of the rolls. Alternately, the leading end of the freshly coagulated filament may be wound around the ends of the rolls directly, and after a few turns of the filament have been so wound, the band or bundle thus formed will move toward the opposite end of the thread advancing device in the same manner above described. However, when the diameter of the thread advancing device is considered, and when it is remembered that the rolls are in motion, and that in an average mill there will be hundreds if not thousands of such devices, it will be seen that the provision of the lacing ring **35** which serves automatically to lace or wind the end of a freshly coagulated filament about the end of the thread advancing device is a very important contribution to this art.

The treatments necessary to convert the coagulated filament to a finished condition are carried out while it is moving along its helical path on the rollers through a plurality of zones which may be defined respectively as the zones of influence of the several nozzles from which the appropriate liquids are sprayed or dripped onto the filament. In the first such zone a wash water nozzle may supply water to remove coagulant adhering to the filament before the latter passes to the zone of the first treating solution nozzle **68** supplying a desulphurizing fluid or the like. The next nozzle then supplies wash water to remove the desulphurizing fluid, and so on throughout the several treatments by the bleaching agent, acid, soap solution and so forth, although it will be understood the specific character of the solutions employed and the order in which they are applied during the progress of the filament along its helical path form no part of the invention and may therefore be varied under different conditions and for filaments derived from different solutions.

The time during which any point on the filament is within each zone depends of course on several factors, of which may be mentioned the pitch of the helix of its path and its rate of linear travel along that path. The first of these, namely, the pitch of the helix, is controlled by the adjustment of the angularity of the axes of the individual rollers to the major axis. Obviously no pitch is imparted to the filament path when the roller axes are precisely parallel to the major axis but when adjusting plate **38** or **38'** and bearing carrier **41** or **56** as the case may be are shifted to impart angularity to the roller axes with respect to the major axis a helical path is produced, with pitch varying substantially in proportion to the departure of the former from parallelism with the latter.

The rate of linear travel of the filament may be determined within wide limits by suitable means (not shown) for controlling the speed of shafts **27** and **33**. Thus if desired, linear travel may be derived from rotation of the rollers on their own axes only, or they may be revolved about the major axis, and thus partake of planetary motion through simultaneous rotation of both said shafts, and while the mechanism shown in the drawings does not provide for adjustment of the pitch of the filament path during such planetary motion, such adjustment may be effected while the rollers are rotating on their own axes and shaft **36** is stationary without interrupting the filament treatment. Afer an adjustment has been made, planetary motion may be resumed if desired, but it is not essential that it be employed provided the linear travel of the thread derived alone from rotation of the rollers on their own axes be sufficient with relation to the rate of extrusion of the filament from the spinneret to maintain at least a slight and preferably a constant tension on the filament between the godet **90** and the rollers.

I will be evident fom the foregoing the apparatus of my invention affords great flexibility of conditions of operation as to speed of filament travel and as to duration and extent of treatment while the filament is following its helical path, and while not in all cases essential, in the embodiment of the invention illustrated in Figs. 6 and 7, "internal" tension of the rollers against the helically wound filament may be produced and a helical path provided which tapers slightly from end to end depending on the adjustment of the threaded taper collar **57**.

While I have herein described with considerable particularity certain embodiments of the invention which may be used to advantage in carrying out the method thereof, and the operations deemed appropriate for attaining its objects, it will be understood I do not desire or intend to limit or confine myself thereto in any way, as changes and modifications in the form, construction and relationship of the several parts of the apparatus, their mode of operation and their several functions as well as in the several steps of the said method will readily occur to those skilled in the art and may be made if desired without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

1. Apparatus of the class described comprising a plurality of rolls disposed about a major axis with their axes at equal angles thereto and equidistant therefrom in all planes normal to said axis, driving means for rotating all the rolls at the same speed on their axes, and means operable to shift one end of all the rolls about said major axis relatively to their other ends irrespective of whether the rolls are in motion.

2. Apparatus of the class described comprising a plurality of rolls disposed about a major axis with their axes at equal angles thereto and equidistant therefrom in all planes normal to said axis, driving means for rotating all the rolls at the same speed on their axes, and means supporting the ends of the rolls comprising a self-aligning bearing adjacent each end of each roll and means relatively rotatively movable about said axis respectively embracing the several bearings adjacent the ends of the rolls and effec-

tive by their relative movement to change the angularity of the roll axes to the major axis while maintaining said axes equidistant therefrom in all said planes.

3. Apparatus of the class described comprising a pair of spaced, coaxial, relatively movable bearing carriers, a plurality of rolls, bearings for the rolls supported by the carriers and supporting the rolls at substantially equal distances from the carrier axis in every plane normal thereto, the axis of at least one of said rolls being skewed relative to the axis of the carrier, a gear for rotating each roll on its axis, and a common drive gear meshing with and operable to drive all said roll gears simultaneously.

4. Apparatus of the class described comprising a pair of spaced coaxial relatively movable bearing carriers, a plurality of rolls, bearings for the rolls supported by the carriers and supporting the rolls, at least one of the carriers comprising bearing supporting means movable toward and away from the carrier axis, yielding means biasing said bearing supporting means away from the axis, means for adjustably limiting extent of movement thereby induced, the axes of the rolls being skewed relative to the carrier axis, and means for simultaneously rotating all the rolls on their respective axes.

5. A filament storing and advancing device including a pair of spaced and aligning supports, a plurality of rolls, and plurality of bearings in each of said supports and in which the opposite ends of said rolls are journalled, one of said supports being rotatable relative to the other of said supports about an axis common to said supports, to skew the axes of the rolls relative to said axis.

6. A thread advancing device including a first bearing carrier, a second bearing carrier, a plurality of bearings in each of said carriers, a plurality of rolls extending between said carriers and having their ends journalled in said bearings, said second carrier being rotatable relative to said first carrier, about an axis common to both of said carriers, means for rotating said rolls about their individual axes, a lacing ring near said first carrier and over-hanging the adjacent ends of said rolls, and means for rotating said lacing ring.

7. The structure recited in claim 6 in which said lacing ring is rotated independently of the rotation of said rolls about their individual axes.

8. The structure recited in claim 6 in which said lacing ring and said rolls are rotatable about a common central axis independently of the rotation of said rolls about their individual axes.

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