Aug. 7, 1951 M. L. HUDSON 2,563,039

APPARATUS FOR THE MANUFACTURE OF ARTIFICIAL YARNS

Filed Aug. 1, 1947 3 Sheets-Sheet 1

Fig. 1.

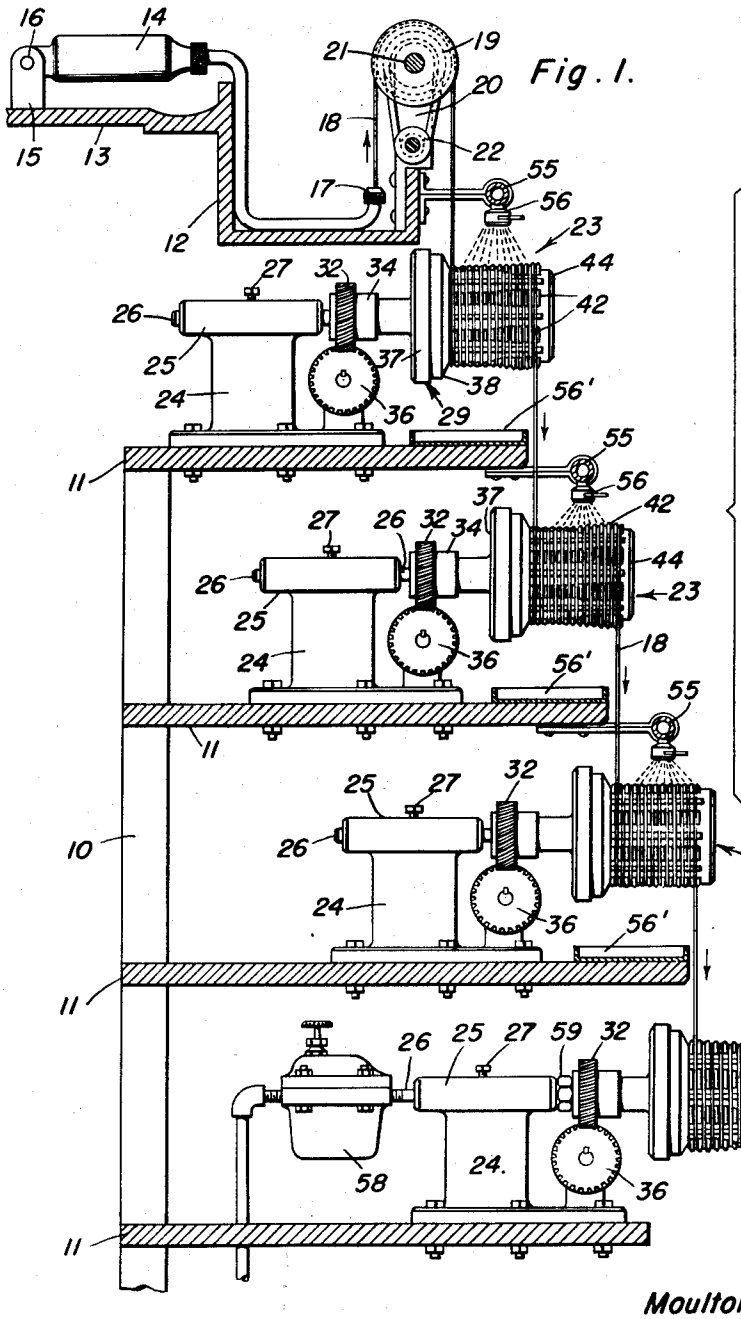
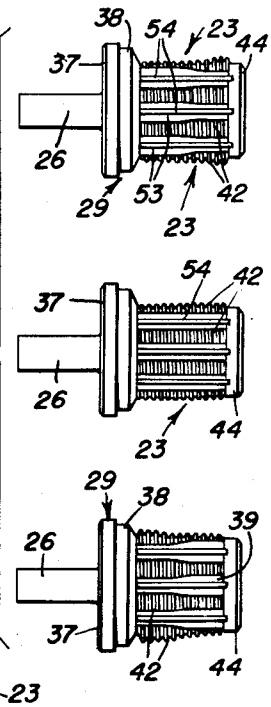


Fig. 8



Inventor

Moulton L. Hudson

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

Aug. 7, 1951 M. L. HUDSON 2,563,039

APPARATUS FOR THE MANUFACTURE OF ARTIFICIAL YARNS

Filed Aug. 1, 1947 3 Sheets-Sheet 2

Fig. 2.

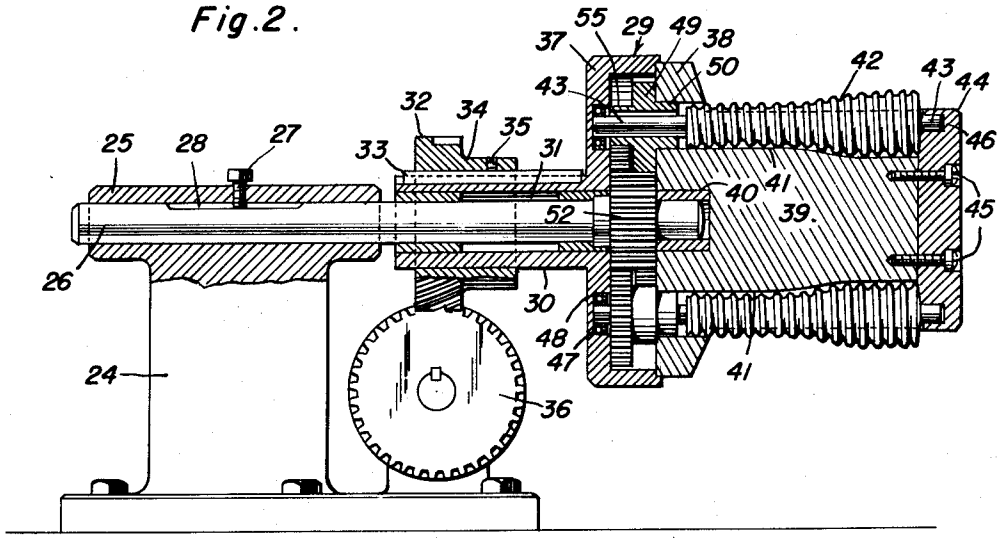
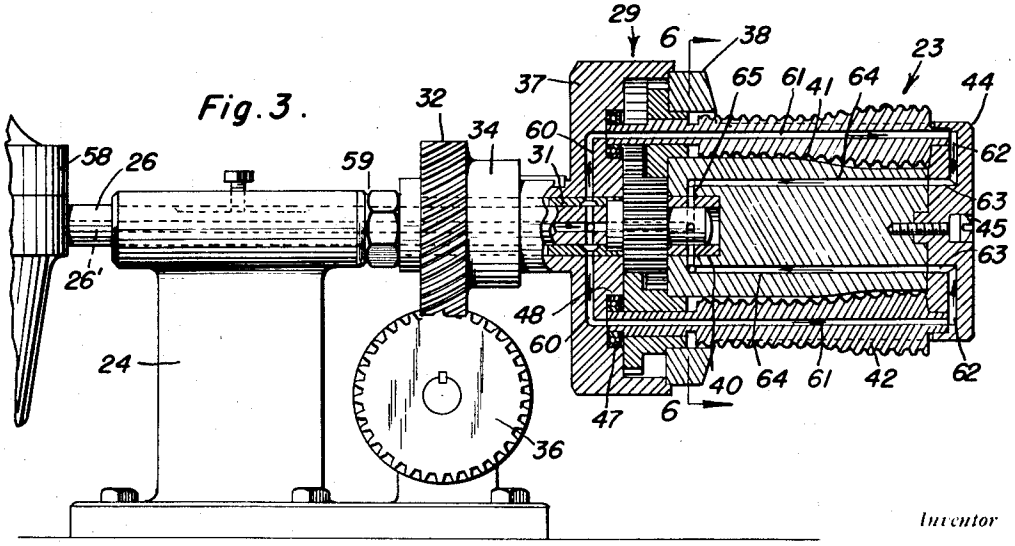


Fig. 3.



Inventor

Moulton L. Hudson

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

Aug. 7, 1951 M. L. HUDSON 2,563,039

APPARATUS FOR THE MANUFACTURE OF ARTIFICIAL YARNS

Filed Aug. 1, 1947 3 Sheets-Sheet 3

Fig. 4.

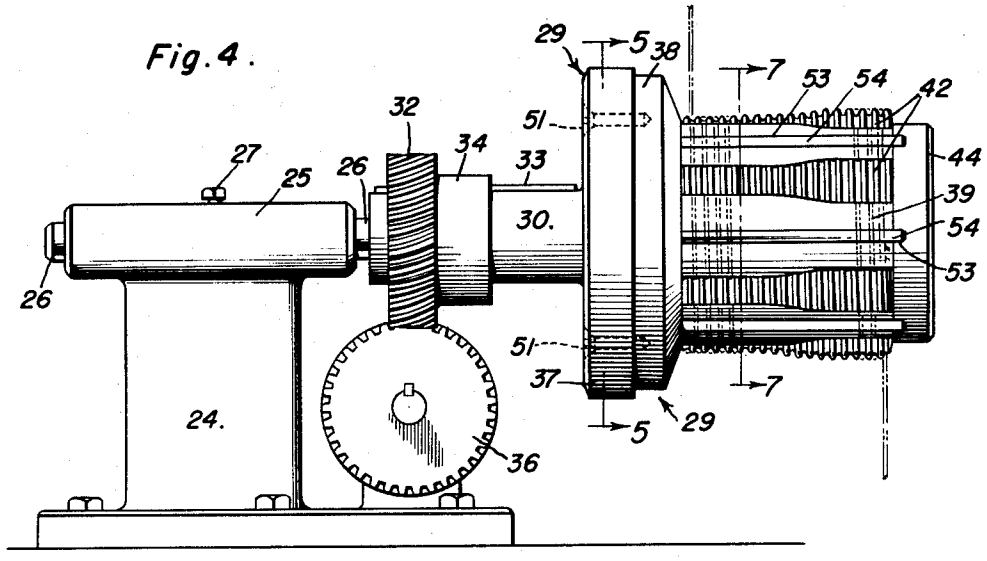


Fig. 5.

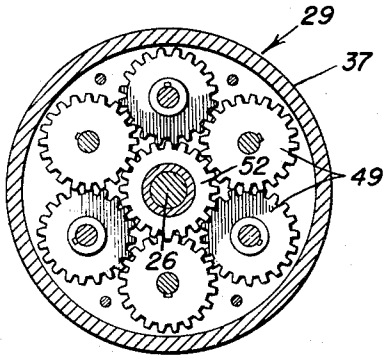
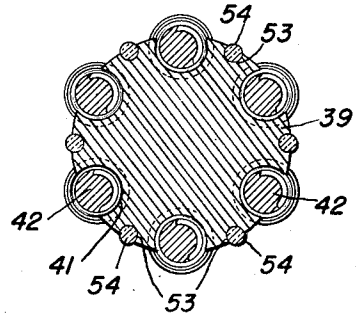


Fig. 7.



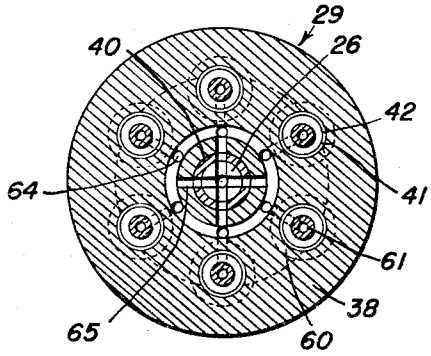


Fig. 6.

Inventor

Moulton L. Hudson

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

Patented Aug. 7, 1951 2,563,039

UNITED STATES PATENT OFFICE

2,563,039

APPARATUS FOR THE MANUFACTURE OF ARTIFICIAL YARNS

Moulton L. Hudson, Shelton, Wash.

Application August 1, 1947, Serial No. 765,304

3 Claims. (Cl. 34—153)

1

This invention relates to spinning machines used in the manufacture of yarns, such as synthetic or artificial rayon, silk yarns, or the like, and the object thereof is to provide for continuous spinning, washing, desulphurizing, further washing, stretching and drying of the yarn, all in one operation as it moves through the machine. At the present time, it is customary in most plants to spin the yarn on a spool or cake, which is doffed and then sent to other departments for washing, finishing and drying. Thus, the present invention is for the purpose of eliminating such doffing and the necessity for sending the spools with the yarn thereon into other compartments, by treating the yarn in various ways as the same is run through the machine in one continuous operation by means of novel screw-like rollers which feed the yarn off as it spins on the spools or bobbins and to retain the yarn on the spool long enough to take the various treatments, including the chemical treatments of desulphurizing and/or bleaching, soaping and any other chemical treatments that may be required, in the manner heretofore stated. Also, the roller is made tapered for the purpose of stretching the yarn and holding it long enough for it to set up, while various arrangements of the screw rollers may be made, with left or right hand thread guides or grooves, in which the yarn travels in concaved grooves to prevent damage to the yarn, or with the screw rollers of uniform diameter, so that various effects may be produced on the yarn as run through the machine, to cause stretching thereof, and in addition to the stretching action, to maintain the tension on the yarn or to relax said tension or stretching action, to remove the tension therefrom, by having the rollers tapered in opposite directions and provide various combinations of arrangements and taper of the rollers, either in opposite directions or without the taper, which may be used in combination with each other so that when the yarn issues from the machine, it will be completely treated in one continuous operation and wound upon the bobbins or spools for use.

The invention further relates to an apparatus for the manufacture of artificial silk yarns, or the like, hereinafter called "yarn," and more particularly to a yarn-advancing mechanism incorporated in the spool or bobbin of a continuous multiple filament type or single filament type spinning machine used in the production of extrusion products manufactured according to any process, such as viscose, casein, cuprammonium, cellulose acetate, or nitro-cellulose process in which a coagulating bath is or can be used.

2

In the operation of a continuous multiple filament type spinning machine, an advancing mechanism is incorporated in the spool or bobbin to control the travel of the turns of yarn across the surface or periphery of the spool or bobbin, during which time of travel, the advancing yarn, wound in a helix made up of a large number of closely spaced turns, is subjected to the various processes in the spinning and finishing steps of such yarns. For purpose of illustration in the viscose process, the first row of a cascade of bobbins upon which the yarn is wound after leaving the coagulating bath would be subjected to a shower of wash water, the second row to a shower of desulphurizing solution, the third row to another shower of wash water, the fourth row of bobbins to a bleach shower, etc., and finally drying the same. The final stage of finishing would be manifested in the drying row of bobbins after which the yarn is handled in the accepted practice of the viscose rayon yarn industry. It should be understood, however, that the present invention is not limited to the spinning and finishing of viscose rayon yarns, but may be employed in the processing of yarn produced by other methods as, for example, from casein, cellulose acetate, $CuNH_4$ cellulose solutions, nitro cellulose solutions, etc. As already indicated, the apparatus herein described does not apply only to the manufacture of multiple filament yarn, but also to the process of yarn-like objects generally.

The travel of the turns of yarn across the surface or periphery of the spool or bobbin is accomplished by means of suitable gearing, continuous conveyor screws suitably placed in the spools or bobbins and other mechanisms, including means for causing a drying fluid, such as hot water or steam, to pass axially through the rollers, in order to dry the yarn thereon. It is therefore an object of this invention to provide means for advancing yarn across the surface or periphery of the spools or bobbins of a continuous-type spinning machine so that the yarn, as it issues from the extrusion member or nozzle in the spin bath in the tub or pot, will be subjected to the various treatments as it travels over the spools or bobbins until finally dried and wound upon a spool or bobbin in the twisting or last step of the process.

Another object of this invention is to provide a simplified or improved means of advancing yarn across the surface or periphery of a bobbin or spool in the operation of a continuous type spinning machine.

Still another object of this invention is to pro-

vide a means of equally spacing the turns of yarn across the surface or periphery of the spools or bobbins of a continuous type spinning machine.

Still another object of the invention is to provide a means of stretching or shrinking the yarn at any stage of the finishing process employed in a continuous type spinning machine.

Other objects and advantages reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a detail sectional elevation of a continuous type spinning machine employing spools or bobbins with screw-type feeding rollers in accordance with the invention, and for subjecting the yarn to the various treatments during the process of spinning the same.

Figure 2 is an enlarged sectional elevation of one of the spools or bobbins and screw-type feeding rollers thereon to cause stretching of the yarn.

Figure 3 is a view similar to Figure 2 but showing the arrangement of the spool or bobbin and rollers for the purpose of circulating a heating fluid such as steam through the rollers, for the purpose of drying the yarn after the various other steps of the treatments.

Figure 4 is an elevation of one of the spools or bobbins and driving means therefor, as shown in Figure 2.

Figure 5 is a sectional view taken on the line 5—5 of Figure 4.

Figure 6 is a sectional view taken on the line 6—6 of Figure 3.

Figure 7 is a sectional view taken on the line 7—7 of Figure 4.

Figure 8 is a diagrammatic view showing one of the various possible arrangements of the spools or bobbins for causing a stretching, a relaxing of the tension on the yarn, or to avoid stretching, when the yarn is fed in the same direction, although it is to be understood that the grooves of the rollers may be right or left hand, the same as threads, to cause the feeding and movement thereof in opposite directions, for different types of spinning machines, such as a pot spinning machine, for use during the various treatments of the yarn during the continuous feeding thereof through the spinning machine.

Referring to the drawings in detail, in which similar reference characters designate corresponding parts throughout the several views, one form of continuous type spinning machine of the character set forth is shown in Figure 1 of the drawings employing spin baths in which the extruded yarn is initially passed to guide rollers or pulleys and then to the spools or bobbins of the present invention, for the various treatments, but it is to be understood that the machine may be of any continuous type such as a pot spinning machine or otherwise. However, in the form shown, the machine includes a frame 10 having a plurality of horizontal supports or shelves 11 above which is supported a longitudinally extending tub or trough 12 with a rear bracket plate or support 13 supporting the pumps 14, from which the synthetic material or plastic forming the artificial silk yarns or the like is forced under pressure in the customary manner. The machine may be of the continuous multiple filament type or single filament type spinning machine and, as shown, the pump 14 is pivoted on a bracket 15, as indicated at 16, any suitable number thereof being provided along the frame adjacent the bath or trough 12 with the spinnerettes 17 positioned therein to issue the yarn 18 which is carried upwardly over grooved rollers or pulleys 19 suitably supported in bearings 20 on the trough 12 and having the shaft 21 thereof idle or driven in any suitable manner. The yarn is then carried downwardly from the rollers, which rollers may be driven by gears, belts or otherwise, and extended downwardly around smaller guide rollers 22 supported by the frame beneath the rollers 19 to secure the necessary drawing or feeding tension. The strands of yarn, in a suitable battery of any desired number along the length of the spin bath trough of the machine, are extended downwardly to the thread advancing reels 23 to successively pass around a series of the latter located one beneath the other in stepped or other fashion for the various treatments of washing, chemical treatment or desulphurizing and another washing with a shower of wash water, and then for bleaching or for stretching or shrinking in a series of successive steps, and finally drying the yarn before being wound on spools or bobbins, or what is commonly known as twisters, in the final operation for preparing the same for market and distribution. As shown, each horizontal support or shelf 11 of the frame 10 has a bearing bracket 24 mounted thereon with a bearing sleeve 25 in which a stationary shaft 26 is fixed by suitable means such as a set screw 27 engaged through the sleeve and with a flattened portion 28 of the shaft to securely hold the latter against rotation. Each reel 23 includes a gear housing 29 having a bearing sleeve 30 with brass or other bushings 31, babbit bearings or the like rotatable on the fixed shaft 26 as secured in the sleeve or casting 25. Suitable gears such as worm gears 32 are splined on the bearing sleeves 30, as indicated at 33, and the hubs 34 thereof may be secured in position as by means of set screws 35. The gears 32 are engaged by gears 36 constituting driving gears of the continuous spinning machine so as to drive the gears 32, the sleeves or hubs 30 and the gear housings 29 of the reels 23. The gear housings include flanged heads or plates 37 formed with the hubs or sleeves 30 and fitting over flanges 38 formed on the bodies 39 of the reels. The bodies are axially bored out, as indicated at 40, to take the projecting end of the stationary shaft 26. The body 39 of each reel is of cylindrical form and may be of suitable plastic or molded material and provided with a plurality of equidistantly spaced longitudinal bores or grooves 41 parallel to the axis thereof and extending through the periphery of the body or housing 39 to take spirally grooved rollers 42 in parallel groups, but having the grooves and peripheries thereof at the threads convexed or rounded, to prevent injury or catching in the yarns. These grooved rollers have shafts 43 at one end journaled in bearing recesses 46 of a head cap or plate 44 removably secured by cap screws 45 in position to the body to removably mount the grooved rollers at that end for rotation. The shafts 43 at the opposite ends of the grooved rollers are journaled in bearings 47 mounted in corresponding circular recesses or counterbores 48 in the flanged plate 37 of the gear housing and the latter shafts have pinions or gears 49 fixed thereto alternately in staggered relation around the reel within the flanged plate 37 and having their hubs projecting into bores 50 of flange 38. The plate 37 is rigidly secured to the inner end of the body 39 in any suitable way, as indicated at 51. The pinions or spur gears

49 mesh with a common central pinion or spur gear 52 fixed to the shaft 26, so as to constitute, with the pinions 49, a planetary gearing whereby, as the reel is driven from the drive gear 36, the pinions 49 will be caused to roll or revolve in an orbital path around the pinion 52 and to turn on their own axes so as to impart rotation to the grooved rollers 42. Also, since the pinions 49 and 52 are the same size and have the same number of teeth, the ratio of the gearing is thus one to one, so that for every one revolution of the reel, the rollers 42 will make one complete revolution as each completes its turn or rolling motion around the pinion 52 with the body 39 and in the same direction. In order to accommodate the pinions 49 around the correspondingly sized pinion 52, the pinions 49 are staggered or offset alternately axially or arranged in two planes perpendicular to the axis of each reel and the stationary shaft 26 on which the same revolves, as well as with respect to the shafts 43, so that a maximum number of pinions 49, namely, six, can be accommodated within the circumference of the body 39 and thus a corresponding number of the threaded or grooved rollers 42. Thus, for every one revolution of the rollers 42, one turn of yarn 18 is moved along the roller and over the same a distance equal to one complete thread or groove thereof. If, for example, the rollers 42 have eight threads per inch, then in eight revolutions of the rollers 42, the yarn will have advanced or moved one inch across any line drawn perpendicular to the ends of the reel or a radial or diametrical line drawn from the axis thereof. Thus, for example, if the reel is six inches long and the grooved rollers 42 operate as stated, then in forty-eight turns of each roller the yarn will have advanced completely across each reel, from a previous reel, from the time that the yarn entered the reel to the time that the yarn leaves the same to enter upon another reel of the mechanism. The pinions 49 are thus approximately one-half the thickness of the pinion 52 and disposed alternately at opposite ends thereof to engage the inner and outer half portions of the pinion 52, with the hubs of the pinions 49 keyed or otherwise fixed to the shafts 43, so as to accommodate all of the pinions 49 around the pinion 52 and within the plate or flanged cap 37 of the housing at the inner end of each reel, thereby permitting the use of six of the pinions 49 and a corresponding number of the grooved rollers 42 around a pinion 52 of the same size and diameter as the pinions 49, with a one to one ratio as specified. Also, it will be noted that the rollers 42 in the bores 41 are positioned with peripheral portions projecting outwardly from the periphery of the reel body 39 in tangential relation thereto, so that the yarn will engage and readily move along the rollers 42 from one end to the other. Equidistantly spaced between the rollers 42, the body 39 is provided with a plurality of smaller bores 53 of circular or concaved form extending through the periphery of the body 39 to receive circular glass or plastic rods or rollers 54 from the inner open ends of the bores 53 so as to be retained in position in the same manner as the rollers 42 by the head or cap plate 44 and designed for the purpose of facilitating the feeding of the yarn along the feed screws or rollers 42 in the spirally arranged grooves of the latter.

As shown in Figure 1 of the drawings, the reels 23 are located in stepped relation, one in advance of the other, so that the yarn will feed from the outer end of the first reel to the inner end of the next reel, and thus the rollers 42 thereon, but this arrangement may be varied as desired, with the reels arranged directly one beneath the other if desired, as in connection with a pot spinning machine. As shown, a supply pipe 55 may be arranged along all but the lowermost reel and supported by the front of the trough 12 or at the horizontal supports or shelves 11, and provided with spray nozzles 56 with valves, arranged above the reels to spray the latter and the yarn wound thereon spirally for the desired treatment, such as washing, or with any suitable chemical treatment such as desulphurizing, again washing, or for stretching and shrinking, and finally drying the yarn for winding the same upon twisters or bobbins 57 for shipment and use in a weaving machine or otherwise.

As illustrated, in order to cause stretching of the yarn during the washing or other treatments, the upper two reels are shown with the rollers 42 tapered from their outer to their inner ends or gradually enlarged in diameter toward said outer ends to a larger circumference causing stretching of the yarn as wound thereon during the continuous spinning so as to be fed from the outer end of one reel to the inner end of the reel therebeneath. The next reel below the first two top reels is shown with the rollers 42 cylindrical and not tapered in either direction, so as to maintain a uniform tension thereon during another treatment, and the rollers of the reel at the bottom are tapered toward their outer ends or in the reverse direction from those of the upper two reels, so as to relax the tension on the yarn. In Figure 8 of the drawings, the reels are shown arranged in series one beneath the other, with the upper reel provided with rollers enlarged toward their outer ends with the next bobbin having rollers 42 of cylindrical or non-tapered form to maintain uniform tension, and with the rollers of the lower reels enlarged inwardly or tapering outwardly so as to release the tension.

Where the reel is constructed to supply a heating medium or fluid for the purpose of drying the yarn, or even shrinking the same, said reel may be formed in the same manner as previously described, but modified as shown in Figures 3 and 6 of the drawings, in which the shaft 26 is made tubular, an inclined passage 26' being provided for supplying a heating fluid such as steam thereto. The inclined passage 26' is connected to a steam trap 58 for return of the condensate, and provided with a packing gland 59 at the point where the hub of the gear 32 is located. The axial passage 26' leads into lateral passages 60 in the plate 37 to points in alignment with the axes of the rollers 42 to communicate with axial passages 61 in the latter for subsequent return through the passages 62 in the plate 44 extending radially inwardly from the ends of the passages 61, then through longitudinal passages 63 and 64 in the plate 44 and body 39 of the reel and then subsequently through radial passages 65 leading to the inclined passage 26' in the shaft 26, through which the steam may travel, for the purpose of heating the rollers, for drying the yarn. Obviously, the treating solutions fed through the pipes 55 supported in any suitable manner and through the nozzles 56 will spray the yarn on the reels as the latter are wound on and off of the said reels, for the various treatments desired, including washing, stretching, shrinking, or chemical treatments such as desulphurizing with a sulphide solution, or otherwise, and subsequently

drying the yarn before being wound on the bobbins or twisters **57**. In Figure 8, the rollers **42** of the top reel are enlarged toward their outer ends to cause stretching and the rollers of the next reel therebeneath are cylindrical to maintain tension or avoid further stretching, no stretching being provided in this instance, and the lower reel has the rollers enlarged inwardly or tapering outwardly, so as to allow slack or release the tension and it is also pointed out that the grooves or threads of the rollers **42** may be right or left hand, so as to feed from the outer end of an upper reel to the outer end of a reel therebeneath and inwardly, or feeding from the outer end of an upper reel to the inner end of the reel therebeneath and reversing the feed outwardly, alternately or otherwise and then inwardly, especially where the reels are arranged one over the other in a corresponding vertical plane, as in the arrangement shown in Figure 8 of the drawings, with the reels supported to be driven from the spinning machine in the same manner as previously shown and described, or otherwise. In this way, the advancing yarn wound in a helix made up of a large number of closely spaced turns, if subjected to the various processes in the spinning and finishing steps of such yarns in the various rows of a cascade of reels upon which the yarn is wound after leaving the coagulating bath so as to be subjected to a wash water shower, a shower of desulphurizing solution, a third shower of wash water, a fourth shower of bleach liquid, and also for the purpose of stretching, shrinking or drying the yarn in one continuous operation of the machine. Thus, it is not necessary to doff the reels on which the yarn is wound and send the same to other departments for washing, chemical treatment, or drying, and especially where the rollers **42** of tapered formation are employed, whether provided with right or left hand threads for causing the movement of the yarn in either direction, the yarn will be held long enough on each reel and the rollers thereof to permit the same to receive and react to the various treatments to which the same is subjected in one single, continuous operation in passing and being delivered from the spinning machine.

In view of the foregoing, it is thought that the construction and operation of the machine and of the reels, as well as the feeding rollers will be clearly understood, and thus further description thereof is omitted.

It is to be understood, however, that even though there is herein shown and described a preferred embodiment of the invention, the same is susceptible to certain changes fully comprehended by the spirit of the invention as herein described and within the scope of the appended claims.

Having described the invention, what is claimed as new is:

1. In a spinning machine, a thread advancing reel comprising a cylindrical body having a flange at one end, a gear housing fitted over said flange and secured to the body, a stationary shaft supporting the body for axial rotation, said gear housing being an axial sleeve member journaled on said shaft, means operatively connected to said sleeve member for rotating said housing and said body, said body having longitudinal bores opening through the periphery thereof, a cap plate secured to the other end of the body, spirally grooved rollers rotatably mounted in said bores of the body and having end shafts journaled in the gear housing and the cap plate, and gearing within said housing and between the stationary shaft and the adjacent shafts of the rollers to cause rotation of the rollers upon rotation of the housing and the body.

2. The construction defined in claim 1, wherein said body is provided with other longitudinal bores smaller than the first-named bores, said smaller bores opening through the periphery of the body and alternating with the first-named bores, and a longitudinal anti-friction element mounted in each of said smaller bores of the body.

3. The construction defined in claim 1, wherein said stationary shaft and said rollers have axial bores, and said body has longitudinal passages connected at corresponding ends to the bore of said shaft, said gear housing having passages connecting the bore of said shaft with the adjacent ends of the bores of said rollers, and said cap plate having passages connecting the other ends of the bores of said rollers with the other ends of the passages of the body, whereby a heating medium may be supplied to the reel for drying the thread.

MOULTON L. HUDSON.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
758,520	Fredenburgh	Apr. 26, 1904
1,847,161	Alden	Mar. 1, 1932
2,210,912	Knebusch	Aug. 13, 1940
2,302,508	Sordelli	Nov. 17, 1942
2,369,481	Modigliani	Feb. 13, 1945
2,421,624	Kline et al.	June 3, 1947
2,421,750	Gannett	June 10, 1947
2,424,490	Henry	July 22, 1947
2,475,483	Dasher	July 5, 1949

FOREIGN PATENTS

Number	Country	Date
233,370	Germany	Oct. 15, 1908
539,200	Great Britain	Sept. 1, 1941