July 30, 1940. J. P. McHUGH 2,209,841

MULTIPLE DOWN-SPINNING APPARATUS

Filed June 12, 1936 5 Sheets-Sheet 1

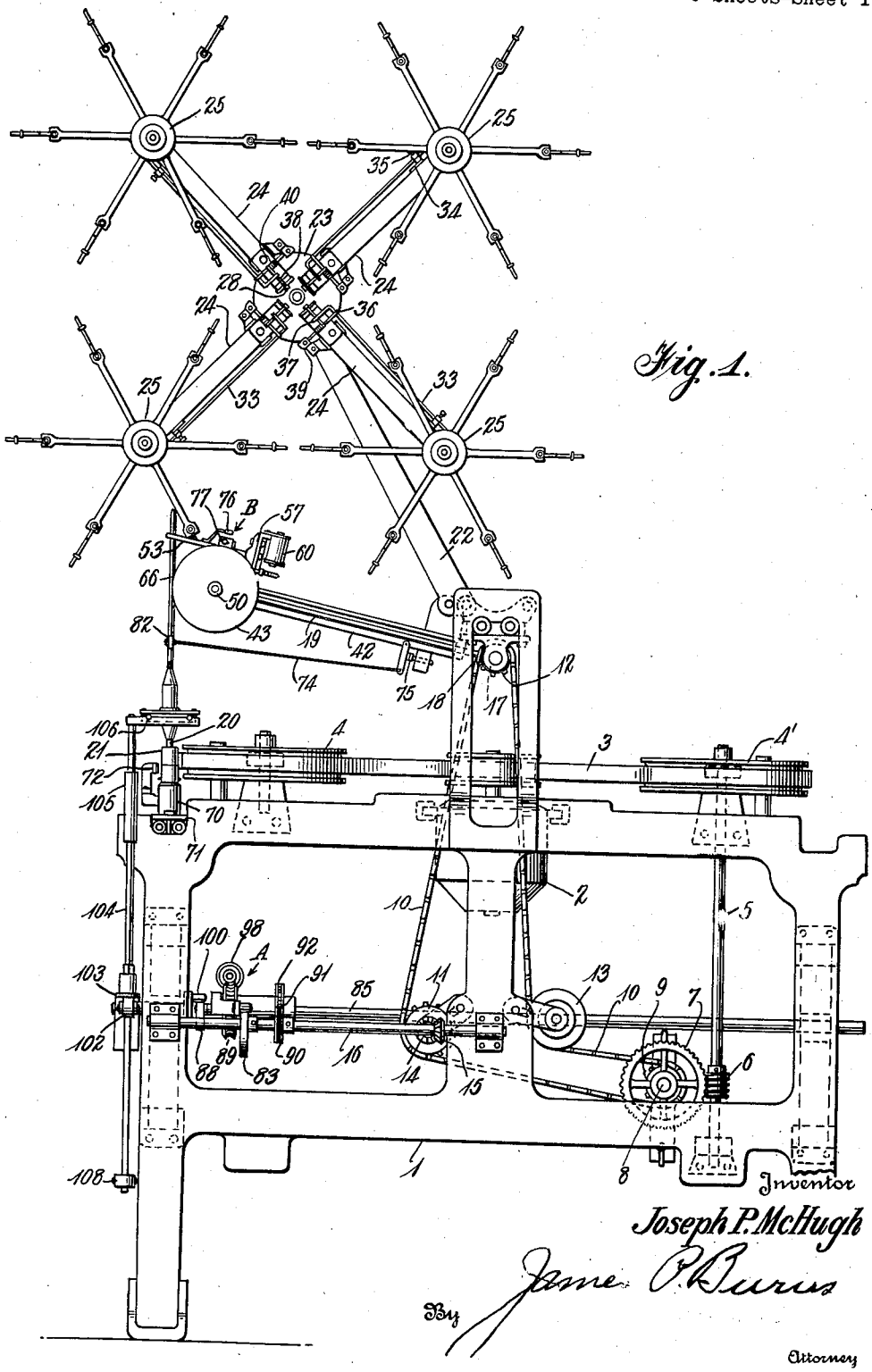


Fig. 1.

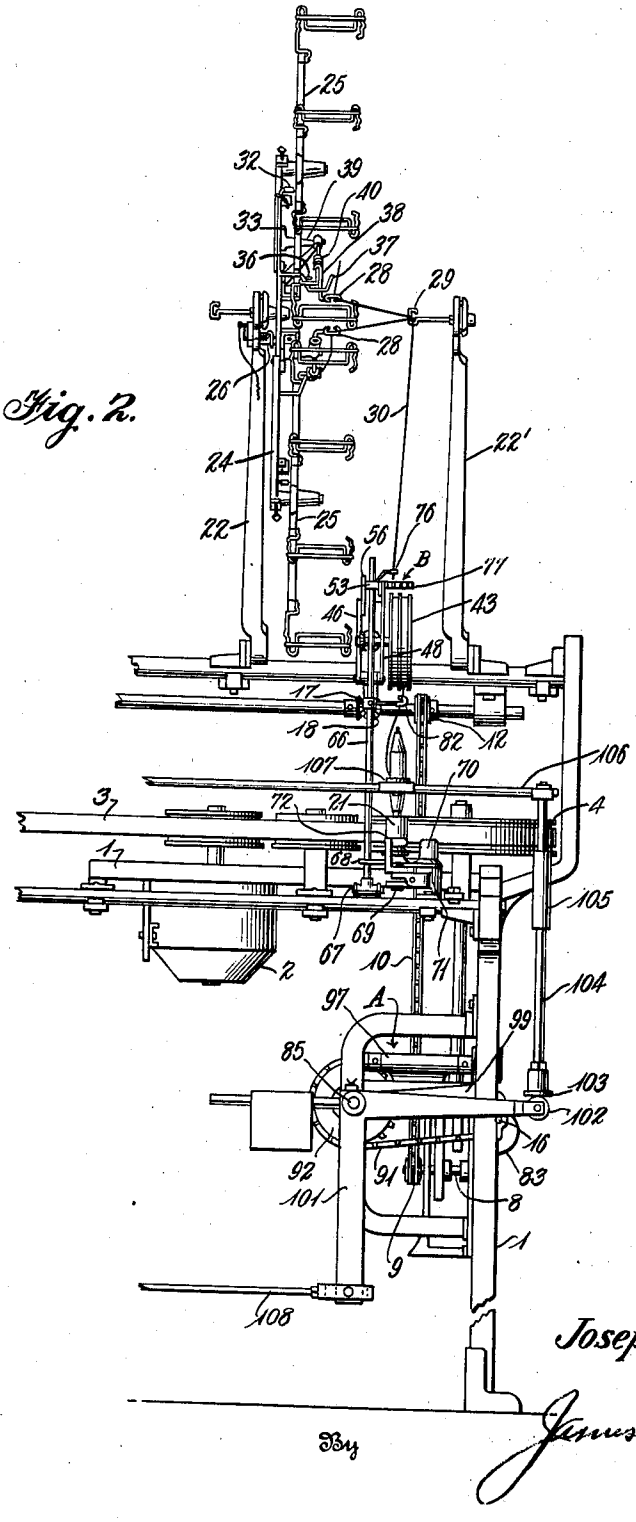
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MULTIPLE DOWN-SPINNING APPARATUS

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Fig. 2.



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MULTIPLE DOWN-SPINNING APPARATUS

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Fig. 3.

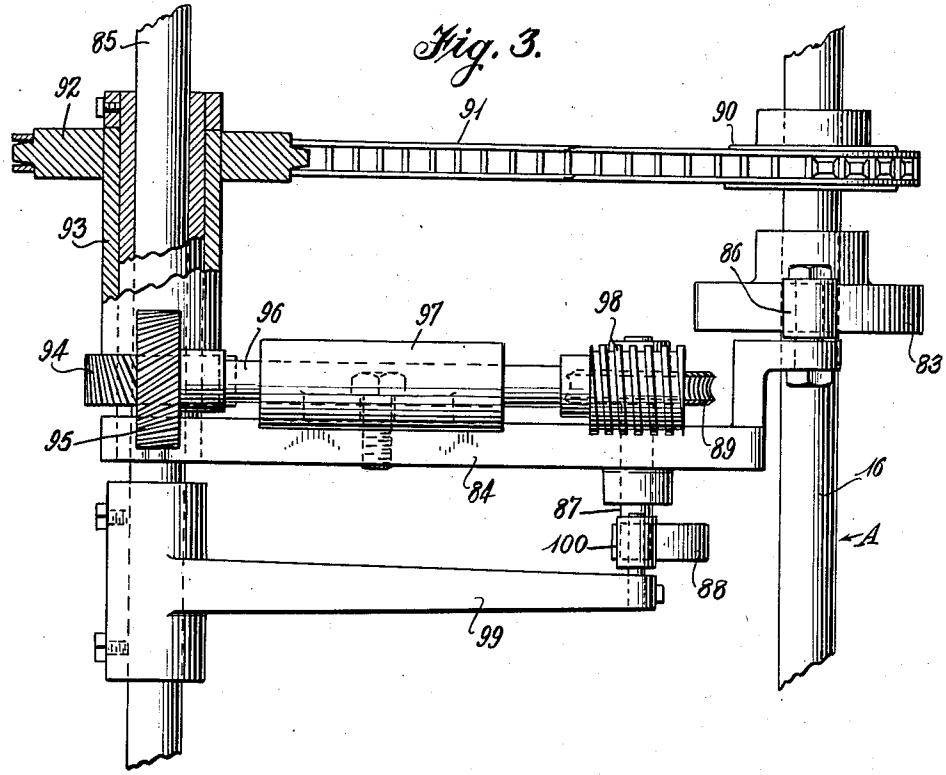
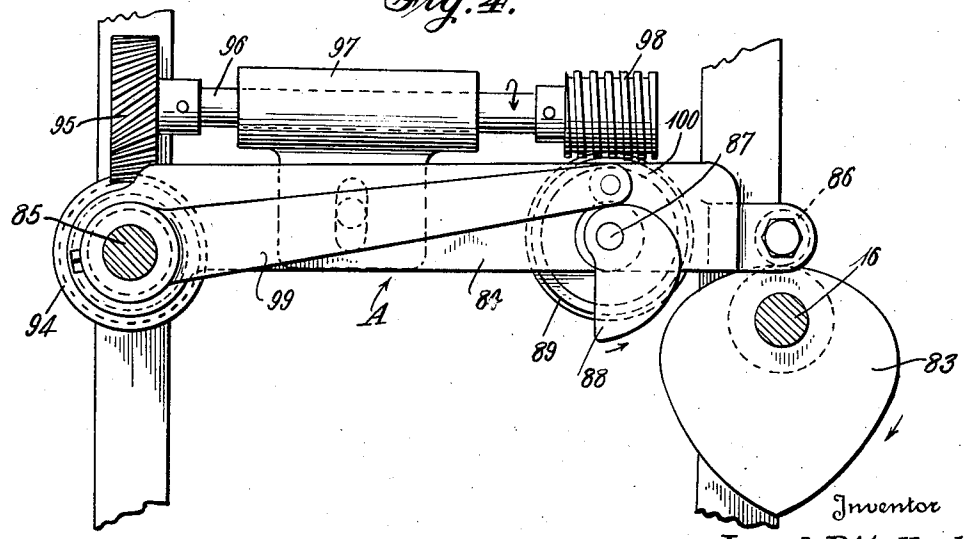


Fig. 4.



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MULTIPLE DOWN-SPINNING APPARATUS

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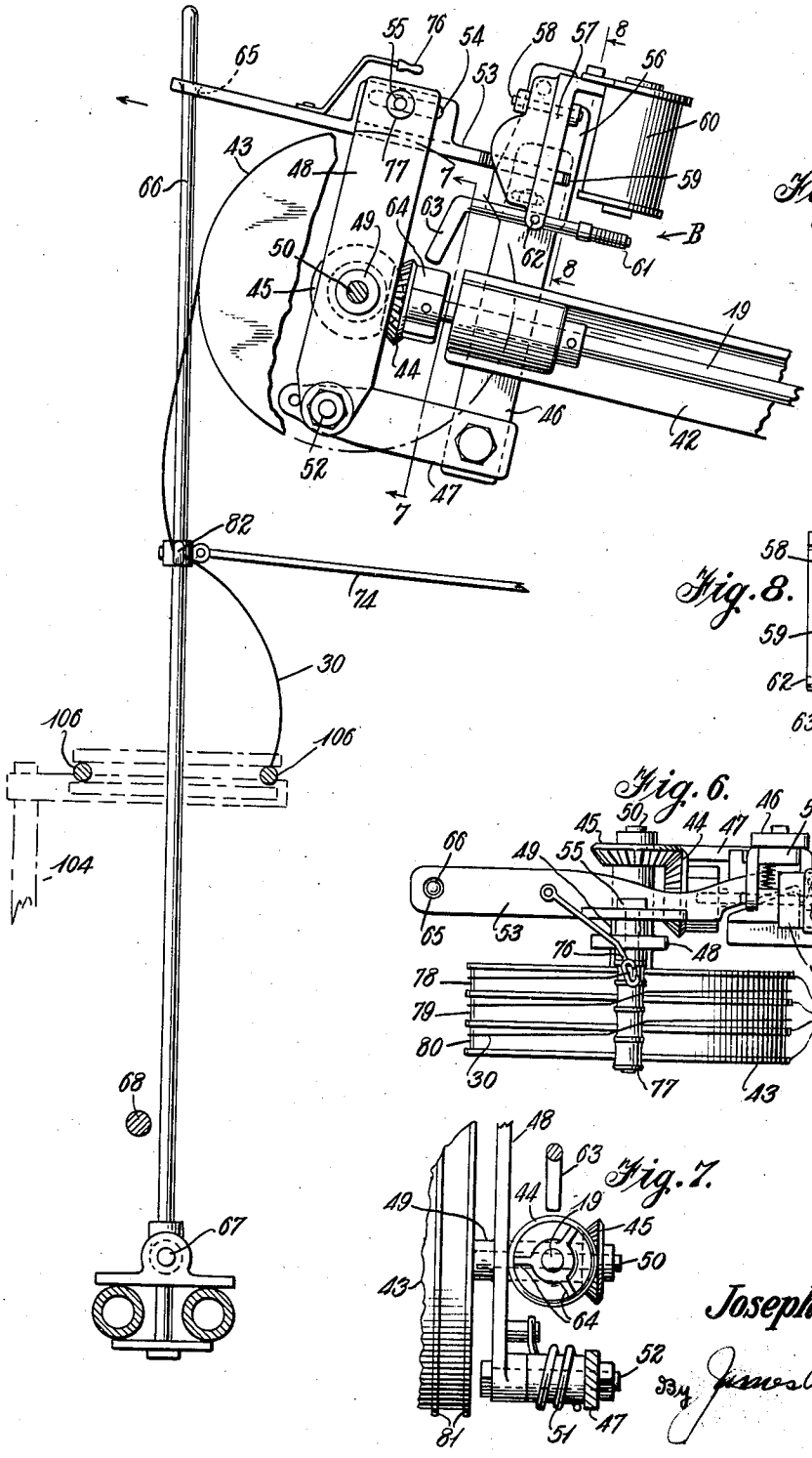


Fig. 5.

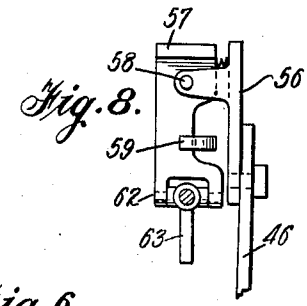


Fig. 8.

Fig. 6.

Fig. 7.

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MULTIPLE DOWN-SPINNING APPARATUS

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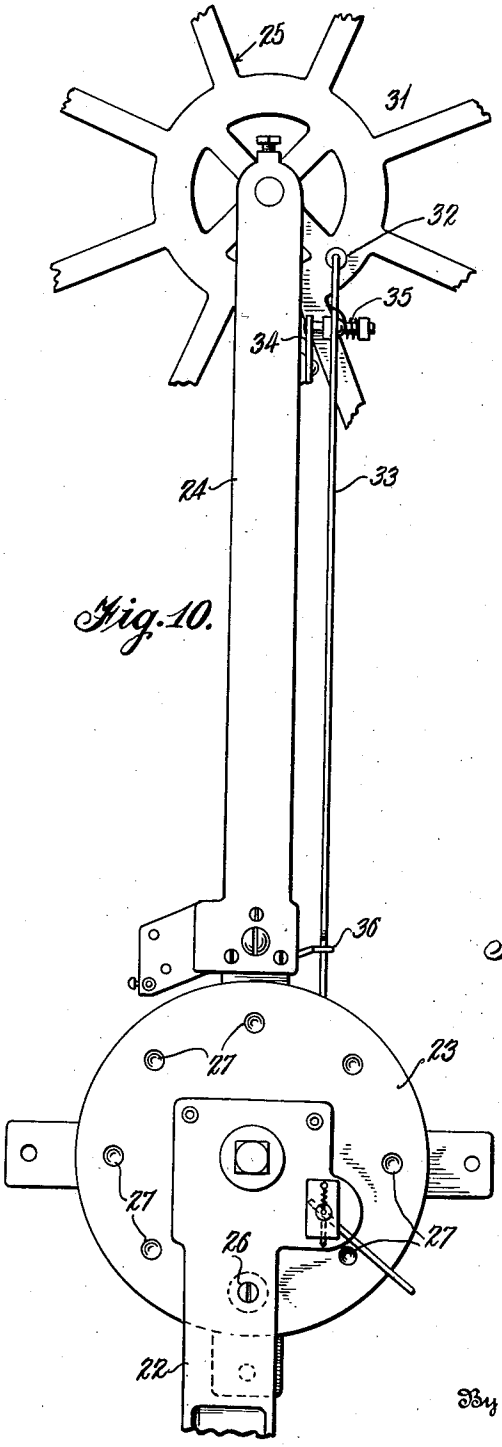


Fig. 10.

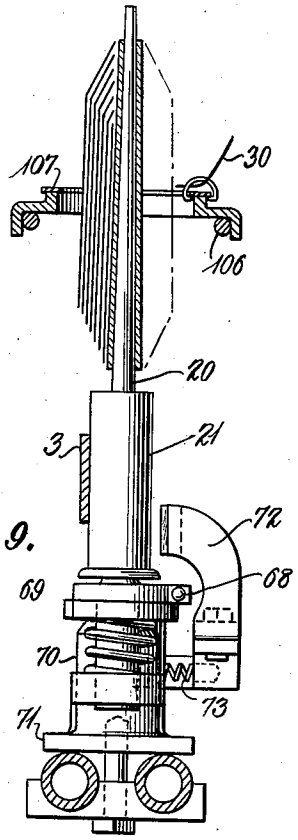


Fig. 9.

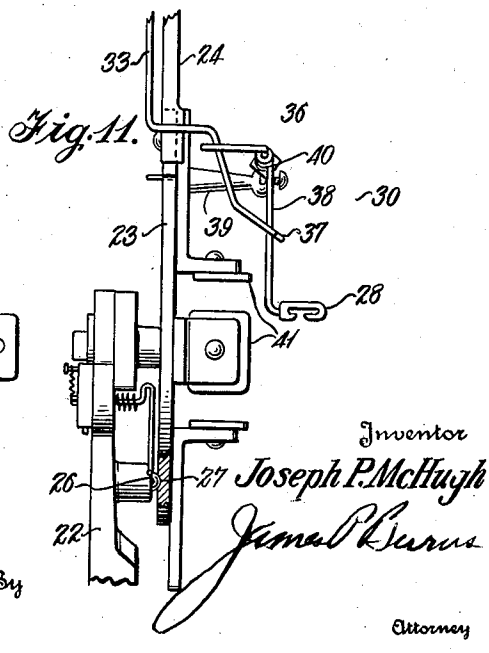


Fig. 11.

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Patented July 30, 1940

2,209,841

UNITED STATES PATENT OFFICE

2,209,841

MULTIPLE DOWN-SPINNING APPARATUS

Joseph P. McHugh, Scranton, Pa., assignor, by mesne assignments, to Industrial Machine Corporation, a corporation of Delaware

Application June 12, 1936, Serial No. 84,958

6 Claims. (Cl. 57—90)

This invention relates to an improved apparatus for throwing lustrous yarn and simultaneously forming finished headless packages in the form of cones or cops ready, without re-drawing, copping, or coning, to directly enter fabric forming machinery.

More specifically, the invention comprises certain improvements in a process and apparatus wherein the lustrous yarn is fully thrown through the medium of a single down-spinning operation.

This application is a continuation-in-part of my copending application Serial No. 674,568, filed June 6, 1933, which matured into Pat. No. 2,044,621 on June 16, 1936.

It is a further purpose and object of the invention to provide a process and apparatus for producing finished headless packages of knot-free yarn. By the term "knot-free" it is intended to mean yarn free from any perceptible knots that will interfere with the knitting or weaving operations in which the yarn is utilized.

It is additionally the purpose and object of the invention to provide an improved process and apparatus for fully throwing lustrous yarn in a single spinning step in such manner as to produce yarn that is of substantially uniform twist, whereby irregularities of and variations in twist are substantially obviated as well as variations in the cross-sectional area of the yarn.

It is also an object of the invention to provide a method and apparatus for concurrently fully throwing silk and forming cones or cops whereby the successive strand layers on the cops or cones formed are effectively interlocked in a manner permitting unwinding in the shuttle on weaving and from the cone on knitting without snarling.

Other and more detailed objects and advantages will become apparent as the description proceeds.

The invention will be described by reference to the accompanying drawings wherein:

Figure 1 is a view in side elevation of a complete quill or cop forming machine unit;

Figure 2 is a front elevation of the machine shown in Figure 1;

Figure 3 is a detailed view showing a part of the traverse drive mechanism;

Figure 4 is a view taken at a right angle to Figure 3 showing the traverse control cams;

Figure 5 is an enlarged detailed view of the roller mechanism and quill spindle release rod mounting;

Figure 6 is a top plan view of the roller mechanism as shown in Figure 5;

Figure 7 is a fragmentary detailed view taken on line 7—7 of Figure 5;

Figure 8 is a detail of the latching mechanism taken on line 8—8 of Figure 5;

Figure 9 is a detailed view showing the quill mounting and drive;

Figure 10 is an enlarged detailed view showing the central skein carrying drum and one skein carrying arm; and

Figure 11 is a fragmentary detailed view taken at a right angle to Figure 10.

Referring to Figure 1, there is a base frame 1 on which the entire mechanism is assembled. A motor 2 is centrally carried on the frame 1 and drives a power belt 3. The frame 1 is designed to carry rows of complementary units at each side thereof. These are, however, constructed in duplication. Therefore, only a single left-hand unit is shown and will be described.

The belt 3 drives pulleys 4 and 4'. The shaft 5 extends down from pulley 4' and carries a worm 6 at the lower end thereof, which meshes with a worm gear 7 mounted on a shaft 8 carrying a sprocket 9. A sprocket chain 10 is trained around the drive sprocket 9. The sprocket chain 10 drives the traverse mechanism, designated broadly A, and also the roller mechanism designated broadly B. Chain 10 passes about sprockets 11, 12, and 13. Sprocket 11 in turn drives bevel gears 14 and 15, transmitting power to shaft 16 suitably carried by the frame 1. Power is transmitted through shaft 16 for controlling the movement of the traverse mechanism A to be later described in detail.

The sprocket 12 drives bevel gears 17 and 18 transmitting power to shaft 19 for driving the roller mechanism B. The quill spindle 20 carries an enlarged hub 21 normally in driving contact with the belt 3. The spindle 20 is so mounted at its base that it can be swung to and from contact with the drive belt 3 so that the spindle of any unit may be removed from driving engagement with the belt without stopping the machine or disturbing other units.

Coming now to a description of the mountings for the swifts or reels for the skeins, there is rigidly secured to the upper end of the frame 1 a main supporting arm 22. The arm 22 carries at its free end a central hub 23. The hub 23 in turn carries four arms 24, each carrying at its free end a swift or reel 25. Each reel 25 is constructed to receive a skein. The central hub 23 is rotatably carried by the arm 22 so that any swift or reel 25 may be brought within reach of the operator for tying broken strands or replacing

skeins. A locking mechanism for holding the hub 23 in any given position of adjustment with respect to the arm 22 is provided and includes the latch detent 26 extending through arm 22 and adapted to be selectively projected into the holes 27 (see Figure 10) of the hub 23.

The manner of taking off the strands from the individual skeins is such that the hub 23 can be moved to and held in any position of adjustment without interfering with the operation of the machine. The end of the strand from each skein is threaded through a porcelain eye 28 carried by hub 23. Each strand then passes transversely of the hub 23 to the single porcelain condensing guide 29 carried by the arm 22' of the next adjacent unit. From the guide 29, the condensed strand designated 30 is passed down to the roller mechanism B (see Figure 2).

Due to the extreme difficulty of providing perfectly balanced reels or swifts and further to the uneven moisture content at different portions of the skeins mounted thereon, it becomes necessary to provide an individual braking mechanism for each swift or reel to insure a uniform tension of the separate strands taken off from the several skeins.

The braking mechanism for each swift or reel is identical, and only one will be described. Each swift 25 is provided with a braking surface 31 (see Figure 10). A rubber brake shoe 32 is adapted to bear against the surface 31. The shoe 32 is carried by a wire rod 33 pivotally supported on an insulating bracket 34 carried by the swift supporting arm 24. A coil spring 35 is connected to the rod 33 and tensioned to normally urge the shoe 32 against the surface 31. The opposite end of the rod 33 (see Figure 11) is bent outwardly and passed through a guide loop 36 and terminates in a right-angularly bent end 37. Now the porcelain eye 28 is carried by a wire rod 38 pivotally mounted in an insulated bracket 39 carried by the central hub 23. A spring 40 normally urges the rod 38 and porcelain eye 28 inwardly toward the hub 23.

The bent end 37 of brake rod 33 extends just outside the rod 38 carrying the eye 28. The arrangement is such that when a strand is being pulled through the eye 28 under normal tension, the eye 28 is pulled outwardly against the tension of spring 40 and in turn pulls the lower end of rod 33 out by virtue of its bent end 37. This causes rod 33 to have pivotal movement on the bracket 34 against the tension of spring 35 and thus release the brake shoe 32.

Now, when the swift or reel rotates too fast due to any unbalanced condition, it tends to cause a slack in the strand and destroys the normal tension. When this happens, the spring 35 immediately applies brake shoe 32 to the swift and slows it down until normal tension of the strand is restored.

At this point it is well to note that the arm 38 carrying eye 28 is also adapted to be forced, when a strand breaks, by spring 40 against contact member 41 to close a circuit for controlling a stop mechanism to be hereinafter described in more detail.

Coming now to the roller mechanism B, a main supporting bracket arm 42 is secured to the upper end of the base frame 1 and supports the entire roller mechanism. The shaft 19 passes longitudinally of the arm 42 to drive the roller 43 through bevel gears 44 and 45 (see Figures 5 and 6). The supporting arm 42 has fixed thereto a right angularly disposed bar 46. At the lower end of bar 46 there is affixed an extension arm 47 in parallelism with the arm 42. Pivotally mounted on the free end of arm 47 is a swinging bar 48. The swinging bar 48 is provided with a bearing 49 for the shaft 50 carrying the roller 43 and the bevel gear 45. The swinging bar 48 is biased away from the bevel gear 44 on shaft 19 by a coil spring 51 surrounding the pivot 52 upon which the bar 48 is journaled.

The swinging bar 48 is normally held in position with the gear 45 in mesh with bevel gear 44 against the tension of spring 51 by a latch bar 53. The latch bar 53 is provided with a slot 54 through which a bolt 55 extends for attaching the latch bar 53 to the swinging bar 48.

Mounted on the upper end of bar 46 (see Figure 8) is a bracket 56 which carries a casting 57, pivoted at 58 and adapted in normal position to cooperate with a projection 59 on the end of latch bar 53 to hold the swinging bar 48 in position with gears 44 and 45 in mesh. The casting 57 also carries an electromagnet 60 and a pivoted armature 61. The armature 61 pivoted at 62 carries a trigger finger 63 adapted, when the magnet 60 is energized, to engage a projection 64 carried by the gear 44 on shaft 19.

The arrangement is such that when the electromagnet 60 is energized through the closing of a circuit due to the breaking of a strand, the armature 61 is attracted and causes the trigger 63 to move into the path of a projection 64 on gear 44.

The projection 64 moves the trigger 63 and rocks the casting 57 about the axis 58 to release the latch bar 53. Release of latch bar 53 allows spring 51 to swing the arm 48 to cause disengagement of bevel gears 44 and 45 and allow roller 43 to stop.

It will be observed from a comparison of the feed roller 43 with the swifts 25 that the feed roller is of substantial size, having a diameter of at least five inches, and is accordingly much larger than feed rollers usually employed on down-spinning machines. It will be additionally observed that the doubled yarn is looped several times around the roller 43. This provides a very substantial length of yarn between the condensing eye 76 and the ring 107.

While I am not completely cognizant of the precise theory of operation responsible for the exceptional success of my improved process and apparatus in the complete throwing of high twist yarn in a single spinning step, I am of the belief that the maintenance of the substantial length of yarn represented by the loops on the large feed roller 43 is of importance. It will be observed that this yarn is in such relation to the ring spinner as to permit the twist to pass up the yarn and around the feed roller whereby the accumulated yarn on the roller may take and absorb a substantial twist without objectionably tensioning the yarn.

This feature is regarded by me as of considerable importance because, first, it causes the yarn to have a substantial twist before it reaches the air and is subjected to the high centrifugal force of the single-step ring-spinning operation; second, it permits the yarn on the roller to absorb the twist and prevents placing excess strain on the length of yarn intermediate the roller and the package; third, it enables the obtaining of a substantially uniform twist at all points in the yarn; and, fourth, it produces a yarn that is substantially free from variation in its cross-sectional dimension throughout its length.

It is apparent that with a long traverse motion

the length of yarn between the roller and the ring is much shorter at the end of the up-stroke of the traverse than at the end of the down-stroke. By providing the extensive yarn supply on the feed roller 43, the twist merely passes further back along the yarn on the up-stroke of the traverse than on the down-stroke, with the result that the thrown yarn wound on the package is substantially free from variations in twist.

Passing now to the means for disconnecting the quill carrying spindle 20 from the driving belt 3, it will be noted that the latch bar 53 is provided at its outer end with an aperture 65 through which extends a spindle releasing rod 66. The rod 66 is pivotally mounted at its lower end on a pivot 67 about which it is moved by the latch arm 53 when swinging arm 48 is released and moved by the spring 51.

As shown in Figure 2, the spindle releasing rod 66 extends behind a finger 68 carried by the mounting 69 for spindle 20. It will be observed that the mounting 69 is journaled upon a vertical pivot 70 which is eccentric to the axis of spindle 20, the vertical pivot 70 being supported by a fixed bracket 71 carried by the frame 1. There is also carried by the bracket 71 a fixed brake shoe 72 (see Figures 2 and 9.)

The action is as follows: The mounting 69 carrying the spindle 20 is normally urged toward the belt 3 by a coil spring 73 (see Figure 9) to insure driving engagement between belt 3 and spindle hub 21. Now, when magnet 60 (Figure 5) causes the release of latch bar 53, the latter, due to the action of spring 51, forces spindle releasing rod 66 outwardly against the finger 68 to swing the spindle mounting 69 about the eccentric pivot 70 and move the spindle hub 21 from engagement with belt 3 and into engagement with fixed brake shoe 72 to stop the spindle.

Before leaving the spindle releasing rod 66, it will be further observed that when this rod is moved to release spindle hub 21 from driving engagement with belt 3, it also, through the medium of rod 74, opens contacts 75 in series with magnet 60 to de-energize the same. The swinging arm 48 and spindle releasing rod 66 remain in their released position, until manually restored by re-engagement of the latch 59 on bar 53 with the pivoted casting 57, to maintain the roller 43 and the spindle 20 inoperative.

Returning to the roller 43, the composite strand 30 coming from the porcelain guide eye 29 is drawn through a porcelain eye 76 supported by the latch bar 53 in a position directly above the left-hand end of roller 43 as viewed from the front. The bolt 55 carries a porcelain guide 77 immediately above the roller 43. The roller 43, which is mounted to rotate with shaft 50 and bevel gear 45, is provided on its circumference with three flat-bottomed grooves or channels 78, 79, and 80 separated by square shouldered flanges 81.

The thread 30 leaves the eye 76, enters the groove 78 adjacent the left side thereof, is carried once around roller 43 in groove 78, passes over porcelain guide 77 into the groove 79 and once again around the roller 43 in groove 79, and thence passes again over porcelain guide 77 to groove 80, thence to porcelain eye 82, and on to the traverse mechanism hereinafter described. The thread is caused to roll axially of the roller 43 in the grooves thereon, whereby the thread delivered to the traverse mechanism is partially twisted. The flat-bottomed grooves 78, 79, and 80, together with the square-shouldered flanges 81, are particularly advantageous in giving a tightly twisted thread and preventing snarling and entangling of the thread upon the roller.

The improved traverse operating and control mechanism by which applicant's novel method of quill forming is accomplished will now be described.

Returning to the driven shaft 16, a heart-shaped cam 83 is carried thereby, which oscillates an arm 84 loosely journaled upon a rocker shaft 85 extending parallel to shaft 16. The arm 84 carries a cam follower roller 86 which rides on cam 83 to cause oscillation of arm 84. The arm 84 also carries a shaft 87 journaled therein, on one end of which is fixed a half-heart cam 88 and on the other end of which there is carried a worm gear 89. The worm gear 89 and half-heart cam 88 are driven from shaft 16 by means of sprocket 90 on shaft 16, chain 91, and sprocket 92 mounted on rotating sleeve 93 loosely journaled upon shaft 85. The sleeve 93 carries at its opposite end a worm gear 94 which drives a worm gear 95 upon a shaft 96 extending at right angles to shaft 85 and journaled in a bearing 97 carried by a rocker arm 84. The shaft 96 carries at its opposite end a worm 98 which drives gear 89 and half-heart cam 88.

The shaft 85 has affixed thereto a rocker arm 99 which carries at its free end a cam follower roller 100 riding upon the half-heart cam 88. Shaft 85 carries at its outer end a bell-crank lever 101 (see Figure 2), the horizontal arm of which carries a roller 102 at its free end. The roller 102 engages a thrust plate 103 on the lower end of the traverse reciprocating rod 104 mounted in a guide bearing 105 supported on frame 1 and carrying horizontal ring supporting rods 106 at its upper end. The rods 106 are common to a plurality of units and carry the ring 107. The vertical arm of bell-crank 101 is pivotally connected to a rod 108 which operates bell-cranks similar to 101, which are individual to other units and cooperate to actuate ring supporting rods 106. The ring 107 receives and guides the thread 30 as it is wound to form a cop or quill on the spindle 20.

The operation of the traverse is as follows: The heart cam 83, directly driven by shaft 16, rotates at a relatively rapid speed and produces, through arms 84, 99, and 101, traverse movement of uniform amplitude. The amplitude of the uniform traverse is controlled by the size of cam 83 and is intentionally always less than the desired length of quill or cop to be formed. The half-heart cam 88 controls the traverse gain on the quill. Cam 88 moves much slower than cam 83. A ratio of 15 to 1 is found to be satisfactory, although this may be varied if desired. On each rotation of cam 83, there is but a small movement of cam 88, which translated to the traverse causes it to gain on each rotation of cam 83 proportioned to the movement and pitch of the cam 88.

The cam 88 is so constructed that the cam follower 100 rides, during seven-eighths of each revolution thereof, on the curved face of the cam and returns to the point of beginning in but one-eighth of a revolution of cam 88. It will thus be observed that after the total gain provided by the curved surface of cam 88 has been effected, there is a quick return to the point of beginning. Due to the form of cam follower 100, the return is effected in much less than one-eighth of a revolution of cam 88. Translated to the quill, cone, or cop the winding commences

at the bottom, the upward traverse is uniform. The downward traverse is also uniform but always shorter than the upward traverse. When the topmost traverse is reached, the thread is rapidly returned to the bottom of the package and the cycle repeated.

The headless cop, cone, or quill is built up from the bottom by successive layers of thread, each layer comprising a plurality of overlapping traverses. This results in the formation of a cop or quill having a very effective interlocking wind and one which will unwind in the shuttle on weaving, or from the cone on knitting, without snarling. This feature of the invention is of great value, and I am not to be limited to the precise form of mechanical movement disclosed by which this advantageous result is obtained, since other mechanism than that shown may be employed.

No electrical diagram of the circuit for the electromagnet **60** of the stop mechanism is shown, it being obvious that this circuit is closed upon the breaking of any one of the strands coming from the skeins on reels **25** through the action of the rod **38** carrying the porcelain eye **28**, as heretofore described, and that the circuit is broken by the spindle release rod **66** when the stop mechanism has been actuated.

The relationship of the skein supports, the feed roller mechanism, and the package constitutes a further important feature of the invention. It is apparent that when a single end breaks at a point above the feed roller, it can be tied as a single end splice. Such splicing of a single end does not form an objectionable knot in the finished yarn. In present-day practice where the thrown yarn is redrawn to shipping bobbins or packaged on copping or coning machines, it is impossible to produce a knotless package. Because of the relationship of the elements in the apparatus of the present invention and further because the yarn is fully thrown in a single spinning step from which it is directly wound on a package ready to be received in the fabric forming machinery, I am able to uniformly obtain knot-free final yarn packages.

Since, in accordance with my invention, the entire twist required to fully throw the yarn is imparted thereto in a single spinning step and, further, since the yarn is directly wound on the finished package, it is possible, even if a break should occur in the composite yarn intermediate the feed roller and the package, to so splice the composite yarn and restore the twist therein as to preclude the presence of any objectionable knots in the yarn on the finished package.

When, for example, a break occurs in the composite yarn intermediate the feed roller and the package on my machine, the operator pulls back a substantial length of yarn from the package, opens up the twist in the free ends, and ties the single ends at longitudinally spaced points along the composite yarn; he then starts the package spindle again, holding the length of yarn between the feed roller and package taut until the twist is restored and the slack taken up. In this way a splice is made in the composite yarn at a point where the twist can be restored thereto, thus permitting the tying of single ends and avoiding an objectionable knot in the composite yarn on the package.

In accordance with the present invention, it is possible to throw silk and produce crepe or high-twist silk or rayon yarn packages in the form of headless cops, cones, or quills in one uninterrupted operation with but one single twisting and winding operation. This has never, to my knowledge, been heretofore accomplished. Crepe silk or rayon, for example, requires around sixty-five twists per linear inch, and no machine has heretofore been devised for both fully throwing the silk and giving a headless cop, cone, or quill of yarn of this character directly ready for the shuttle of the loom or for the knitting machine. According to this invention, the quill spindle may be driven at a very high speed, approximating 15,000 R. P. M. With this permissible speed and the method of twisting and package forming employed, I am able to turn out crepe silk or rayon quills or cops in one operation, taking the rovings from the skeins and producing finished cops through the medium of a single spinning step.

While the invention has been hereinbefore described in connection with a doubling operation, it will be appreciated that in the treatment of certain artificial silks, the strands are of such nature that doubling is not essential. In such cases the invention has unusual merit in the twisting and packaging of single ends. In this case, instead of employing a plurality of skeins associated with each spindle, it is possible to use a single skein and twist and package the single end drawn from such skein.

It will be appreciated that many of the advantages of the instant invention may be obtained even though the single ends employed are not drawn from skeins. In other words, many advantages of the invention can be obtained even though the single ends that are doubled and subsequently twisted and packaged are drawn from bobbins on which they have been previously wound in a conventional winding machine rather than being drawn directly from the skeins. The latter type of operation has merit in the treatment of raw natural silk.

By the term "lustrous yarn" as employed in the appended claims, I mean to embrace such yarns as raw silk, rayon, or artificial silk, spun silk, spun rayon, or yarn made from any of the above fibers, as well as so-called synthetic pigment yarns.

The foregoing description is illustrative only, the invention being limited and restricted only by the scope of the appended claims.

Having thus described my invention, what I claim is:

1. In down-spinning apparatus of the character in which the entire twist necessary to completely throw the yarn is imparted thereto in a single spinning step, the improvement which comprises a feed roller of relatively large diameter having its surface divided into a plurality of longitudinally spaced flat-bottomed channels separated by radially extending ribs, said channels having a width adequate to permit the yarn to roll in the channels under the influence of twist imparted thereto, whereby the yarn supply represented by the loops upon the feed roller will absorb the twist without undue strain on the yarn while being fully thrown in a single spinning step, and thread guiding means associated with the feed roller and constructed and arranged to effect transfer of the yarn between adjacent channels of the roller.

2. In down-spinning apparatus, a feed roller having a large diameter, the peripheral surface of said feed roller being divided into a plurality of longitudinally spaced flat-bottomed channels separated by square shouldered ribs, the

width of the channel floors being adequate to permit the yarn to roll in each channel sufficiently to absorb a substantial part of the twist imparted to the yarn when fully thrown in a single down spinning step, and thread guiding means associated with the feed roller and constructed and arranged to effect transfer of the yarn between adjacent channels of the roller.

3. In multiple down-spinning apparatus, feed rollers having relatively large diameters, the peripheral surface of said feed rollers being divided into a plurality of longitudinally spaced flat-bottomed channels separated by square shouldered ribs, the diameter of the rollers being adequate to collect a sufficient length of yarn to absorb twist to an extent sufficient to permit imparting to the yarn in excess of twenty turns per lineal inch in a single spinning step without substantial variations in the degree of twist longitudinally of the yarn, and thread guiding means associated with each feed roller and constructed and arranged to effect transfer of the yarn between adjacent channels of the roller.

4. In down-spinning apparatus of the character in which the entire twist necessary to completely throw the yarn is imparted thereto in a single spinning step, the improvement which comprises a feed roller of relatively large diameter having its surface divided into a plurality of longitudinally spaced flat-bottomed channels separated by radially extending ribs, said channels having a width adequate to permit the yarn to roll in the channel under the influence of twist imparted thereto, whereby the yarn supply represented by the loops upon the feed roller will absorb the twist without undue strain on the yarn while being fully thrown in a single spinning step, and means positioned above the feed roller and having separated thread guiding surfaces positioned radially of the roller ribs for effecting transfer of the yarn over the ribs separating adjacent channels.

5. In down-spinning apparatus, a feed roller having a large diameter, the peripheral surface of said feed roller being divided into a plurality of longitudinally spaced flat-bottomed channels separated by square shouldered ribs, the width of the channel floors being adequate to permit the yarn to roll in each channel sufficiently to absorb a substantial part of the twist imparted to the yarn when fully thrown in a single down spinning step, and means positioned above the feed roller and having separated thread guiding surfaces positioned radially of the roller ribs for effecting transfer of the yarn over the ribs separating adjacent channels.

6. In multiple down-spinning apparatus, feed rollers having relatively large diameters, the peripheral surface of said feed rollers being divided into a plurality of longitudinally spaced flat-bottomed channels separated by square shouldered ribs, the diameter of the rollers being adequate to collect a sufficient length of yarn to absorb twist to an extent sufficient to permit imparting to the yarn in excess of twenty turns per lineal inch in a single spinning step without substantial variations in the degree of twist longitudinally of the yarn, and means positioned above each feed roller and having separated thread guiding surfaces positioned radially of the roller ribs for effecting transfer of the yarn over the ribs separating adjacent channels.

JOSEPH P. McHUGH.