March 24, 1931. E. J. ABBOTT 1,797,393

APPARATUS FOR PREPARING TEXTILE STRANDS

Filed Feb. 8, 1930 3 Sheets-Sheet 1

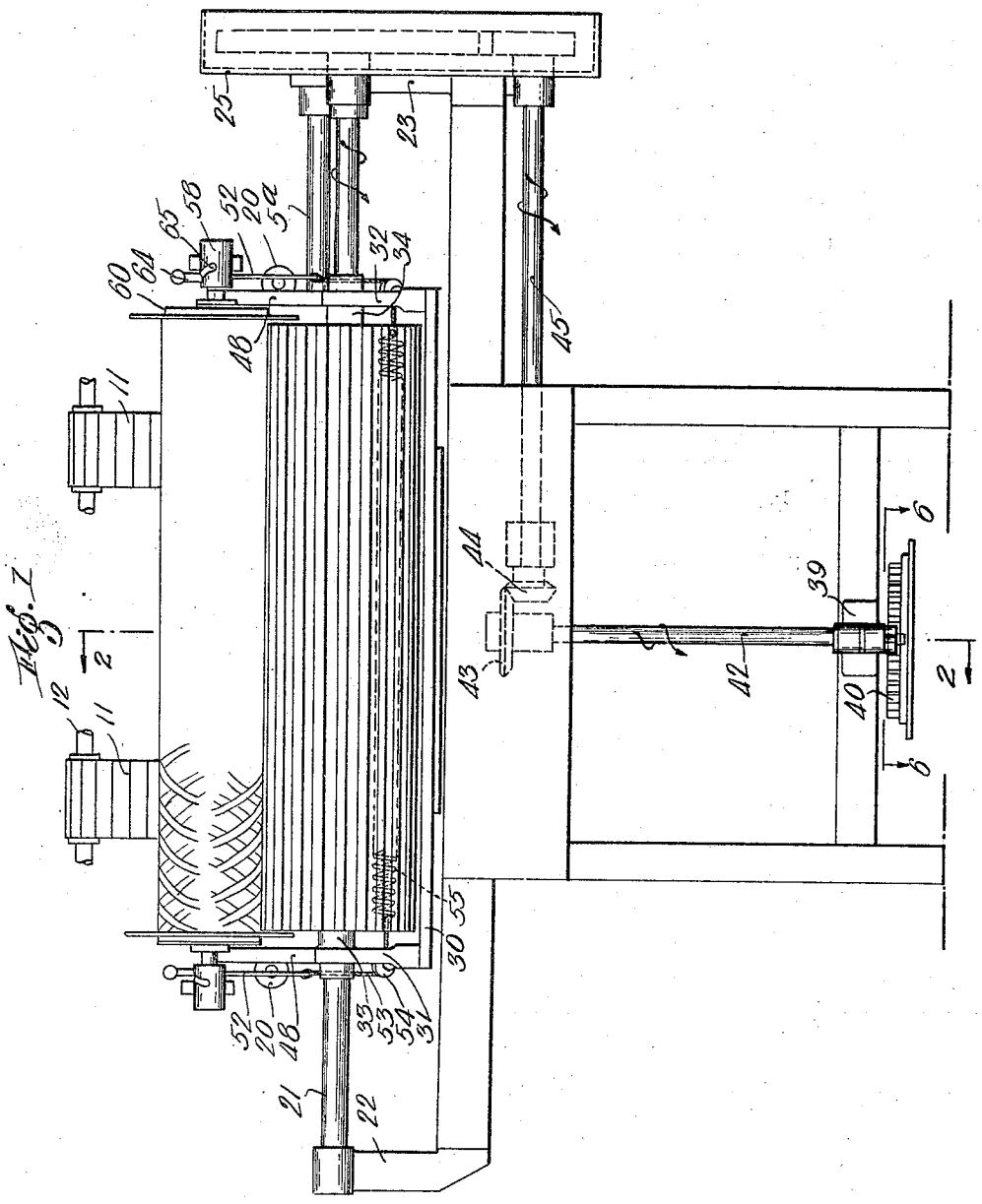

Fig. 1

Inventor
Edward J. Abbott.
By Roberts Cushman & Woodbury
his Attorneys.

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Fig. 2

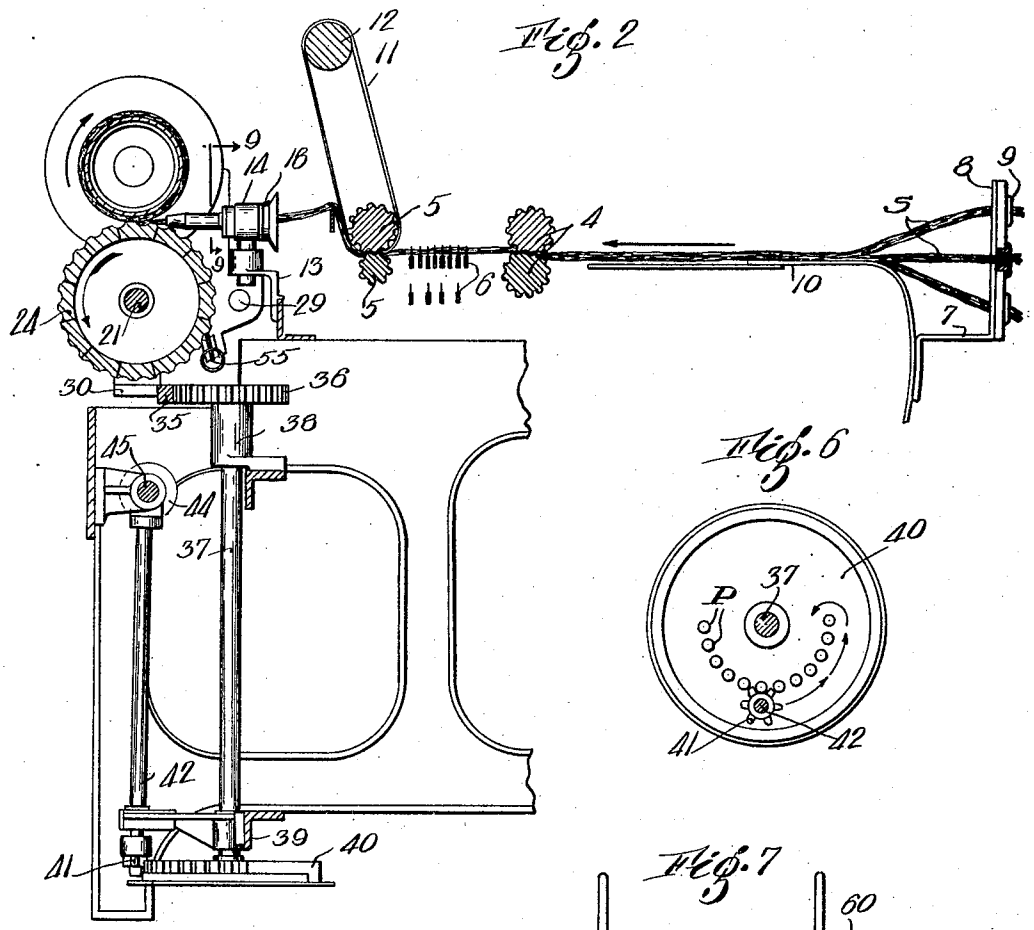


Fig. 6

Fig. 7

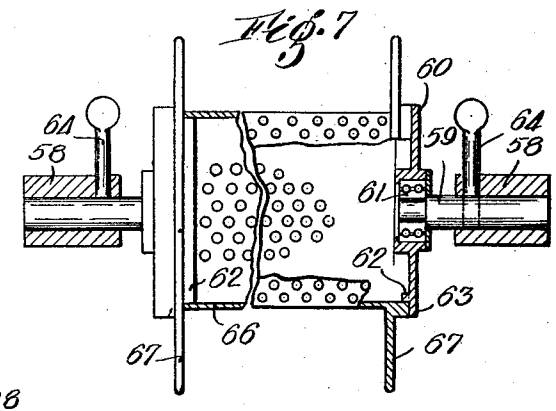
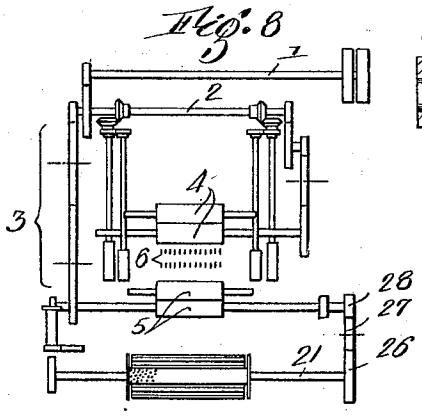


Fig. 8



Inventor
Edward J. Abbott
by Roberts Cushman & Woodbury
his Attorneys.

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APPARATUS FOR PREPARING TEXTILE STRANDS

Filed Feb. 8, 1930 3 Sheets-Sheet 3

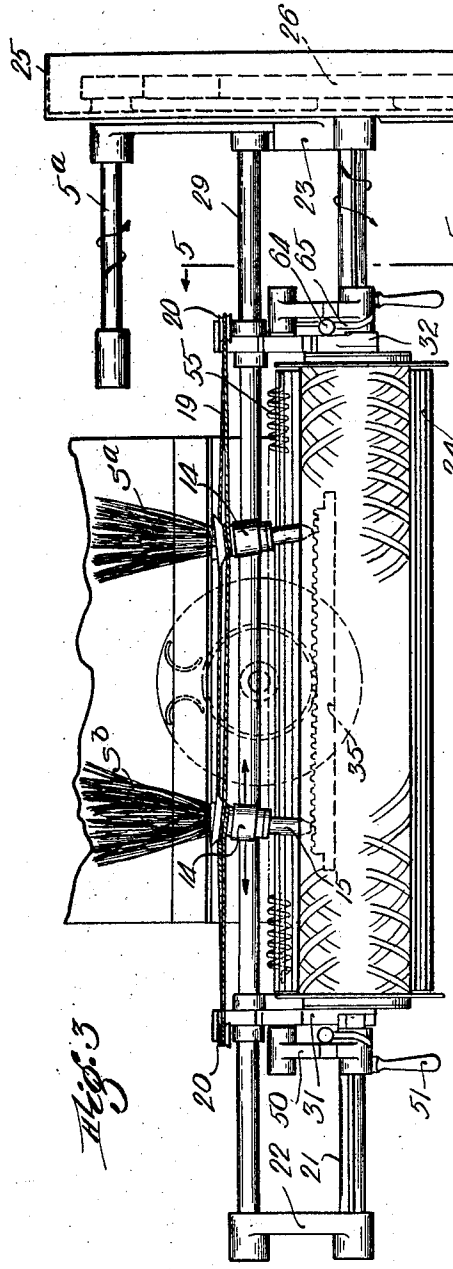

Fig. 3

Fig. 9

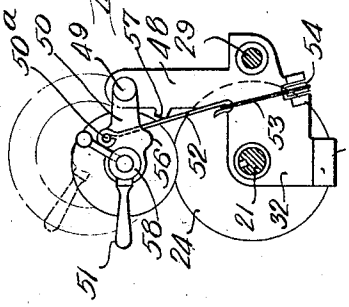

Fig. 5

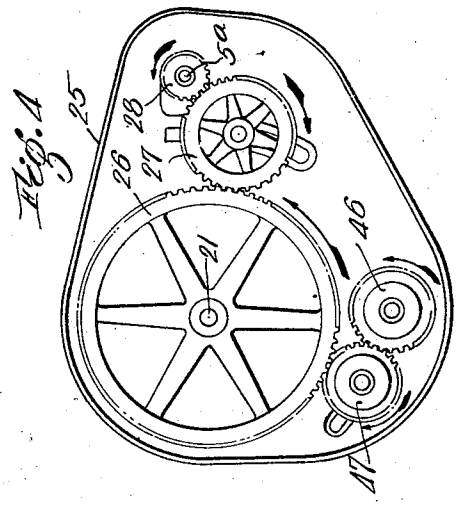

Fig. 4

Inventor
Edward J. Abbott
by Roberts Cushman & Woodberry
his Attorneys.

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UNITED STATES PATENT OFFICE

EDWARD J. ABBOTT, OF WILTON, NEW HAMPSHIRE

APPARATUS FOR PREPARING TEXTILE STRANDS

Application filed February 8, 1930. Serial No. 426,853.

This invention pertains to the manufacture of textiles and more particularly to apparatus for use in the preparation of textile strands preparatory to bleaching, dyeing, or such other processes or conditions as make it necessary or desirable to handle the material in a compact self-sustaining mass adapted to permit ready penetration or passage of reagents, including those of gaseous or fluid character into or through the mass. In my copending application Serial No. 97,588 filed March 26, 1926, (Patent No. 1,746,509, Feb. 11, 1930) of which the present application is a continuation in part, I have disclosed a process of preparing textile strands and a package resulting from the practice of such process, said package consisting of a strand wound upon a spool having heads and a rigid (usually tubular and perforated) barrel to form an elongate hollow cross-wound compact and uniformly dense but porous mass, whose constituent convolutions are laid up under such tension (and radial compression of the winding mass) that each convolution tends to maintain the position in which it was originally laid, so that the package is of self-sustaining character and will not slump down when placed on end and wet, for example, by immersion in a dye bath. By the employment of a perforated hollow spool barrel, the dye liquor, drying medium or other reagent may be passed radially through the mass, either inwardly or outwardly, so that it is possible to treat a large quantity of the textile material in an expeditious manner and with certainty of obtaining uniform results.

The present invention pertains to apparatus useful in performing the above process, and in the production of the package above described. While this apparatus in its broader aspects is useful in winding textile strands, whether spun, twisted, braided, extruded, or otherwise prepared, I have chosen herein to illustrate it as comprising certain adjunctive features particularly useful in the preparation of a package consisting of untwisted, unspun fiber in the form of a sliver or roving having its constituent fibers substantially parallel and straight. Among the desirable features of this apparatus may be mentioned means for removably supporting a hollow core or spool barrel, such as a dresser spool, having an external diameter which may, if desired, be as great as 50% or more of the diameter of the completed package; the provision of means for applying substantially uniform pressure to the package during winding as well as means for subjecting the strand or strands to substantially uniform tension throughout the winding operation an improved form of traverse guide which condenses and compacts the strand so that an unspun, untwisted strand may be subjected to heavy tension during winding; an improved traverse motion; and means for adjustably varying the angle of wind, all of which in the more specific application of the invention, are combined with means for bringing the constituent fibers of the strand into substantially parallel relation just prior to its delivery to the traverse guide. These and other features of improvement will be more fully described hereinafter by reference to the accompanying drawings in which I have illustrated one desirable embodiment of the invention by way of example and in the drawings:

Fig. 1 is a front elevation of a machine embodying the present invention;

Fig. 2 is a fragmentary, and to some extent, diagrammatic vertical section substantially on the line 2—2 of Fig. 1, omitting some of the driving connections;

Fig. 3 is a fragmentary plan view illustrating parts shown in Fig. 2;

Fig. 4 is an end elevation of the gear box at the right-hand side of Fig. 3;

Fig. 5 is a section on the line 5—5 of Fig. 3 omitting certain parts;

Fig. 6 is a section on the line 6—6 of Fig. 1;

Fig. 7 is a section on the axis of the core-supporting trunnions, showing a perforated hollow core supported by the trunnions;

Fig. 8 is a diagrammatic plan view illustrating one desirable arrangement of driving connections; and

Fig. 9 is a fragmentary section on the line 9—9 of Fig. 2.

Referring to Fig. 8 there are illustrated, in diagrammatic plan view, certain driving connections of a kind commonly employed in gill box mechanism of usual type, together with certain adjunctive features pertaining particularly to the present improvements. Thus in Fig. 8 the numeral 1 designates a main drive shaft adapted to receive power from any suitable source and which through proper gearing transmits motion to the back shaft 2 and to the shaft change gears 3. The back drawing rolls are shown at 4, the front drawing rolls at 5, and the gill box fallers at 6, the latter being actuated in any usual manner by means not herein specifically disclosed.

Referring to Fig. 2 the machine frame supports a bracket 7 carrying a vertical board 8 having porcelain pot-eyes 9 suitably arranged to receive and to guide strands S which may be supplied from any suitable source. For convenience in description, but without intent to limit the scope of the invention, these strands S may be considered as slivers of wool or other desired material, which has not yet received any substantial twist or been subjected to a spinning operation. These strands or slivers S, after passing through the pot-eyes 9, are preferably caused to pass over the upper surface of a supporting table 10, the several slivers being arranged in closely adjacent parallel relation.

In the present apparatus these slivers may be divided into two groups as indicated, for example at S^a, S^b (Fig. 3) but any other suitable grouping of the slivers may be employed in accordance with the general arrangement and intended mode of operation of the machine. These groups of slivers next pass through the back draft rolls 4 and, after engagement by the fallers 6 of the gill box, are delivered to the front draft rolls 5. The driving gearing for the draft rolls and fallers may for example be such that the surface speed of the front rolls 5 is approximately six times that of the rear rolls 4, so that the sliver is drawn out and its fibers brought into approximately parallel relation. The fallers 6 preferably have a linear speed slightly greater than that of the rear rolls 4 and the fallers thus assist in laying the fibers in parallel relation. Preferably the front upper roll 5 is provided with one or more endless aprons 11 extending around a roll or rolls on an idle shaft 12, such an apron or aprons assisting the front roll in securing a proper traction upon the sliver.

In the present arrangement the machine frame supports a pair of brackets 13 (Fig. 2) which in turn carry bearings 14 providing trunnions for a pair of guide trumpets 15. Each of these trumpets is designed to receive one of the groups S^a or S^b of slivers and to deliver the slivers of such group to the winding devices as hereinafter more fully described. If but a single group of strands be used, a single guide trumpet will suffice, and on the other hand if a greater number of groups of slivers be used, a correspondingly increased number of trumpets will be employed. Each guide trumpet 15 is provided (Fig. 9) with a longitudinal passage 16 for the strand and such passage is preferably of small diameter, at its delivery end at least, so as to compress and firmly compact the constituent fibers of the strand as the strand is delivered to the spool. While it is not necessary to use a trumpet which oscillates or makes a part turn alternately in opposite directions, I prefer to oscillate it, since the turning of the trumpet tends to smooth and round the sliver and to assist in compacting it. To oscillate the trumpet, it is furnished with a pulley 18 about which is wrapped one run of an endless cord 19, which also passes around pulleys 20 (Fig. 3) mounted upon a reciprocating carriage, hereinafter described. For best results, the delivery end of the trumpet guide is arranged close to the nip of the winding elements, preferably at a distance therefrom less than the length of the normal fiber of the strand being wound. With this arrangement, the strand may be wound under a tension which would break or at least weaken such untwisted material if wound according to usual methods.

A substantially horizontal rotary shaft 21 (Figs. 1 and 3) is mounted at its opposite ends in bearings supported by brackets 22 and 23 respectively extending laterally from opposite sides of the main frame of the machine. This shaft carries a driving drum or roll 24 preferably having a roughened or corrugated surface and which is movable axially of the shaft 21 but is constrained to turn with the shaft by means of a suitable spline connection. At the right-hand side of the machine, as viewed in Fig. 1, the shaft 21 carries a gear 26 which is housed within a gear box 25 supported by the bracket 23. This gear 26 meshes with a change gear 27 carried by an adjustable bracket, and the gear 27 meshes with a gear 28 secured to the end of the shaft 5^a which carries the bottom roll 5.

A fixed guide bar 29 parallel to the shaft 21 is secured at its opposite ends in the brackets 22 and 23, and this bar and the shaft 21 form supports for the reciprocating carriage 30. This carriage is provided with end frame members 31 and 32 (Fig. 1) having hollow bosses 33 and 34 respectively for the passage of the shaft 21. These bosses at their inner ends engage the ends of the roll or drum 24 forming abutments for the latter which constrain the roll or drum to partake of the longitudinal reciprocating movement of the carriage.

Referring to Fig. 2, the lower member of the carriage 30 is provided with a rack bar 35 which meshes with a pinion 36 secured to the upper end of a vertical shaft 37 mounted

in bearings 38 and 39 adapted to permit a slight oscillatory movement of the shaft. A mangle gear 40 is secured to the lower end of the shaft 37, and this gear is provided with a series of pins P (Fig. 6) engaging a toothed pinion 41 secured to the lower end of a shaft 42 journaled in suitable bearings carried by the machine frame. A beveled gear 43 (Fig. 1) is secured to the upper end of the shaft 42 and meshes with a gear 44 on a horizontal shaft 45 which extends into the gear box 25 where it carries a pinion 46. This pinion meshes with a change gear 47 (Fig. 4) mounted upon an adjustable bracket and this gear 47 meshes with the gear 26.

Referring to Figs. 1 and 5, the end members 31 and 32 of the carriage are furnished with upstanding brackets 48 carrying pivot members adapted to support the swinging arms 50. Preferably these arms are provided with handles 51 at their forward ends to permit them to be lifted conveniently. Each of the arms 50 is provided with a pin 50^a to which a force applying element, for example the link 52 is secured. The links 52, connected to the respective arms, are attached to flexible cords or chains 53 passing around idler pulleys 54 and which are secured respectively to the opposite ends of a tension spring 55. This spring, acting through the connections described, tends to swing the arms 50 downwardly in a counterclockwise direction as viewed in Fig. 5, it being noted that by the use of a single spring a substantially equal force will always be applied to the two arms. It is also to be noted that the relative arrangement of the pin 50^a and the fulcrum or pivot 49 is such that when the arm swings upwardly, the force of the spring is applied with a decreasing moment arm or leverage.

Each of the arms 50 is provided with a boss 58 for the reception of a trunnion device which, in its preferred form, comprises a short shaft 59 arranged to slide axially and also to rotate in a bore in the boss 58. This shaft carries a head member 60, preferably in the form of a disk of substantial diameter, mounted upon the shaft 59 with interposed anti-friction bearings 61, so that the head may turn freely with reference to the shaft 59. Preferably this disk 60 is furnished, near its outer edge, with an annular axially extending flange 62, and with a radial marginal flange 63. The shaft 59 is provided with an actuating arm or handle 64 which projects out through a cam slot 65 in the bearing 58, the slot comprising a portion which lies in a plane substantially perpendicular to the axis of the shaft so that when the handle 64 is disposed in this part of the slot the shaft 59 is held against axial movement.

The trunnion devices are adapted to support between them a large spool, for example a dresser spool, having a hollow rigid barrel 66, which may, if desired, be of perforated metal, and having heads 67 fixedly secured to each end of the barrel. The machine is designed to accommodate spools having heads at least as large as the diameter of the completed textile mass. The heads 60 of the trunnion devices are of a diameter to permit the flanges 62 to fit snugly within the hollow barrel, with the flanges 63 engaging the outer ends of the spool. Since the method of winding here employed results in the formation of a dense self-sustaining package, the spool may have a rigid barrel of fixed length with its heads fixed in position, it being unnecessary to compress the package axially during pressure dyeing.

In the operation of the machine the slivers or strands S coming from any suitable source pass through the pot-eyes 9, as above described, through the back and front draft rolls, and across the fallers 6 so that the fibers forming the strand emerge from the front rolls 5 in substantially parallel relation. The groups of slivers now pass through the respective trumpet guides and the carriage 30 being in motion, the cord 19 causes these guides to oscillate on their own axes, thus rounding and smoothing the sliver passing through them. The reciprocating motion of the carriage causes the drum 24 to reciprocate relative to the guides and, it being assumed that a spool has been mounted upon the trunnions, the spool also participates in this reciprocating movement.

The ends of the strands delivered from the trumpet guides are secured to the spool barrel in any usual way, and as the drum 24 revolves it causes the spool also to revolve, the spool barrel resting with substantial pressure against the surface of the drum, this pressure being due in part to the weight of the spool and its supports, but particularly to the action of the spring 55. The change gear 27 is so chosen that the surface speed of the drum 66 and thus the surface speed of the spool barrel or the winding mass thereon, bears such relation to the speed of delivery of the strand from the rolls 5 as to place the winding strand under a predetermined and substantial tension. In dealing with wavy or curly fibers such as wool tops, it is preferable to employ such a tension as to straighten the fibers and hold them straight while they are being wound upon the spool. The change gear 47 in the gear box is also selected to provide a rapid reciprocation of the drum with respect to the strand delivery guides such as to produce a cross-wind, usually of approximately 30° angle, although this angle may be varied in accordance with the material being wound.

It will be noted that the strand with its fibers substantially parallel which is delivered by the rolls 5 is by the mechanism above described wound without having any twist im-

parted thereto so as to build up upon the spool a cross-wound package. By reason of the compacting action of the trumpet guides, which by their oscillation smooth, round, and compress the sliver, and by arranging the delivery end of the trumpet guides at a distance from the nip of the winding elements which is less than the normal fiber length, it is possible to wind the untwisted fiber in highly compressed condition so that a very hard and tight wound package results. By using a plurality of delivery trumpets it is unnecessary to use an excessive length of traverse such as would be the case in order to build up the long cylindrical package desired, for by the use of a plurality of trumpets the package is built up as a plurality of individually wound masses abutting at their ends, the traverse being of proper length to build a single one of these individual masses. By providing trumpet guides arranged as described, the constituent fibers of the sliver can not spread or separate as before winding, so that they reinforce one another as they do in a twisted strand, and thus it is possible to wind them under high tension. By winding under high tension and by applying the proper force for pressing the winding mass against the driving drum, it is possible to build up upon the hollow core or dresser spool barrel a cylindrical package of very substantial length, for example forty inches, and of a hard, dense but porous and uniform structure whose constituent convolutions are laid up under such tension and under such compression that each convolution tends to maintain the position in which it was first laid and thus when the package is removed and placed on end, for example to facilitate pressure dyeing, bleaching or the like, the wet material sustains itself upon the spool barrel and does not slump down so as to leave a part of the barrel exposed.

Although this package is of very dense, hard character due to the tension and compression under which it is wound, it may nevertheless be wound at high speed, and by the provision of the trunnion devices above described the completed package may readily be removed from the machine and a fresh spool substituted with a minimum amount of delay and trouble.

While I have described certain desirable features embodying a preferred construction, I wish it to be understood that changes in proportion, relative arrangement and size of parts, as well as the substitution of equivalents may be made without departing from the spirit of the invention.

I claim:

1. Apparatus of the class described comprising means for gilling textile sliver, means for supporting a spool having a rigid barrel and fixed heads, and means for rotating the spool whereby to wind the sliver delivered from the gilling means directly upon the spool without twist.

2. Apparatus of the class described comprising means for gilling sliver to bring its constituent fibers into substantially parallel relation, and means for cross-winding the gilled sliver directly upon a spool under such tension and compression as to form a hard, dense, self-sustaining package.

3. Apparatus of the class described comprising in combination with means for gilling a fibrous strand, means for compacting the strand delivered from the gilling means, and means for winding the strand with a cross-wind upon a rigid core, while still compacted, under such tension as to form a dense self-sustaining package.

4. Apparatus of the class described comprising in combination means for gilling sliver, means for supporting and rotating a dresser spool having a rigid barrel and fixed heads, and means for delivering the sliver from the gilling means under tension and without twist to be wound upon the spool.

5. Apparatus of the class described comprising in combination with means for gilling a fibrous strand, means for supporting and rotating a spool upon which to wind the strand, and traverse guide means adapted to compact the untwisted sliver received from the gill and to deliver it to the spool in compact form.

6. Apparatus of the class described comprising means for supporting a spool, a drive roll, means for delivering untwisted textile strand at a predetermined linear speed, means for traversing the strand to produce a cross-wind, means for turning the drive roll at such a speed relative to the rate of strand delivery as to keep the strand under a predetermined tension while winding it upon the spool, and means for maintaining a substantially uniform pressure between the building yarn mass on the spool and the drive roll throughout the formation of the package, the parts being so constructed and arranged as to build upon the spool a substantially cylindrical, dense but porous, package of substantially uniform texture and of self-sustaining character.

7. Apparatus for use in winding untwisted textile strand to form an elongate cross-wound self-sustaining package comprising a strand delivery guide, a frame reciprocable relatively to the guide, means for reciprocating the frame, a drive roll movable bodily with the frame, means for rotating the drive roll, and means carried by the frame for supporting a spool in driving relation to the drive roll.

8. Apparatus of the class described for use in winding untwisted textile strand to form an elongate, cross-wound self-sustaining package comprising a strand delivery guide, a frame reciprocable relatively to the guide,

means for reciprocating the frame, a drive roll associated with the frame to move axially with the latter, means for rotating the drive roll, and trunnion devices carried by the frame for supporting a spool in driving relation to the drive roll, said trunnions being relatively movable to permit a spool to be inserted between them.

9. Apparatus for use in winding textile strand to form an elongate, cross-wound, self-sustaining package, said apparatus comprising a strand delivery guide, a frame reciprocable relatively to the guide, means for reciprocating the frame, a drive roll associated with the frame to move axially with the frame, and trunnions carried by the frame for supporting a core in driving relation to the drive roll, one at least of said trunnions comprising an axially movable support, and means for moving said support to permit a core to be introduced between the trunnions or to be withdrawn therefrom.

10. Apparatus for use in winding textile strand to form an elongate cross-wound self-sustaining package comprising a strand delivery guide, a drive roll, a reciprocating frame, and trunnions carried by the frame for supporting a spool in driving relation to the drive roll, each trunnion comprising a normally fixed part, and a freely rotatable part engageable with the spool.

11. Apparatus for use in winding textile strand to form an elongate, cross-wound package, said apparatus comprising a strand delivery guide, a drive roll, means for rotating the roll, a reciprocating frame, means for relatively reciprocating the frame and guide, and trunnions carried by the frame for supporting a spool in driving relation to the drive roll, each of said trunnions comprising a normally fixed support and a freely rotating head carried by the support, the head having an annular flange adapted to fit against an inner surface of the spool barrel, and a face engageable with an end surface of the spool.

12. Apparatus for use in winding textile strand upon a rigid core to form a cross-wound, self-sustaining package, said apparatus comprising a drive roll, means for turning the roll, and means for supporting a core in driving relation to the roll and for maintaining a substantially uniform pressure between the winding mass on the core and the surface of the roll irrespective of the diameter of the winding mass.

13. Apparatus for use in winding textile strand upon a rigid core to form a cross-wound, self-sustaining package, said apparatus comprising a drive roll, movable means for supporting a spool in driving relation to the drive roll, and means for exerting force on said supporting means such as to maintain a substantially uniform pressure between the winding mass on the spool and the surface of the drive roll from the beginning to the completion of the package.

14. Apparatus for use in winding textile strand upon a rigid spool to form a cross-wound, self-sustaining package, said apparatus comprising a drive roll, means for turning the roll, a pair of supporting arms provided with means for rotatably supporting a spool in driving relation to the drive roll, and means for exerting force tending to swing said arms in such a way as to cause the spool to press against the surface of the roll, said force exerting means acting with a progressively varying effective effort whereby to maintain a substantially constant pressure between the winding mass on the spool and the surface of the drive roll regardless of the size or weight of the package.

15. Apparatus for use in winding textile strand upon a rigid core to form a cross-wound, self-sustaining package, said apparatus comprising a drive roll, means for turning the roll, a pair of supporting arms provided with means for rotatably supporting a core in driving relation to the package, said arms being so arranged as to rise as the diameter of the winding mass on the core increases, and force applying means tending to move the arms downwardly, said force applying means acting through a progressively decreasing lever arm as the supporting arms rise whereby to maintain a substantially constant pressure between the winding mass on the core and the drive roll throughout the building of the package.

16. Apparatus for use in winding textile strand upon a rigid core to form a cross-wound, self-sustaining package, said apparatus comprising a drive roll, means for turning the drive roll, a pair of supporting arms arranged to swing about a common axis, each arm being provided with a trunnion for engagement with an end of a core for holding the core in driving relation to the drive roll, and spring means connected to each arm at a point such that as the arm moves in response to increase the diameter of the winding mass on the core, the effective leverage through which the spring means acts upon the supporting arm correspondingly decreases.

17. Apparatus for winding untwisted textile strand to form an elongate, self-sustaining, cross-wound package comprising a rotating drive roll, means for supporting a core in driving relation to the drive roll, a tubular strand delivery guide having a strand passage of such diameter as to compress the strand passing through it, means for producing a relative traverse motion between the guide and core, and means for oscillating the guide about its own axis to smooth and round the strand, said delivery guide extending to a point closely adjacent to the nip of the

drive roll whereby to permit winding the strand under high tension.

18. Apparatus for winding untwisted textile strand to form an elongate, self-sustaining mass comprising a rotating drive roll, means for supporting a spool barrel in driving relation to the drive roll, a tubular strand delivery guide having a strand passage of such size and contour as to compress the strand passing through it, means for producing a relative traverse of the core and guide, and means for oscillating the guide about its own axis in timed relation to the traverse motion, said guide terminating at a distance from the nip of the drive roll substantially less than the normal length of the fiber composing the strand.

19. Apparatus for winding textile strand to form an elongate, self-sustaining, cross-wound package, said apparatus comprising a rotating drive roll, means for supporting a spool barrel in driving relation to the drive roll, a plurality of tubular strand delivery guides, each adapted to turn on its own axis, means for producing a traverse movement between the spool barrel and guide whereby simultaneously to wind strands delivered by the several guides, each with a cross-wind upon adjacent portions of the barrel, and means for oscillating each guide about its own axis, each guide terminating close to the nip of the drive roll whereby to maintain its control of the strand substantially to the instant of winding.

20. Apparatus for winding untwisted textile strand to form an elongate, self-sustaining, cross-wound package, said apparatus comprising a rotating drive roll, means for supporting a spool barrel in driving relation to the drive roll, a plurality of strand delivery guides spaced longitudinally of the core, means for supplying a strand to each guide, and means for producing a relative traverse of the core and guides whereby to wind the several strands with a cross-wind upon adjacent parts of the core, each guide having a passage of a size and shape such as to compress the strand.

21. Apparatus for use in preparing unspun textile strand, comprising means for laying the constituent fibers of the strand in substantially parallel relation, and means for winding the strand under tension upon a rigid spool without imparting twist to the strand whereby to form a dense, self-sustaining, elongate cross-wound package.

22. Apparatus for use in preparing unspun textile strand, said apparatus comprising means for disposing the constituent fibers of the strand in substantially parallel relation, and means for compacting the strand and for winding the strand under tension, without substantially deranging its constituent fibers, upon a rigid spool to form a hollow package of dense but substantially uniform and porous texture and self-sustaining character.

23. Apparatus for use in preparing unspun textile strand, said apparatus comprising means for bringing the constituent fibers of the strand into substantially parallel relation, means for winding the strand under tension and without twist or substantial derangement of its parallel fibers upon a perforated spool of fixed length, and means for compressing the winding mass during winding, whereby to form a self-sustaining package which will not slump longitudinally when the package is placed on end and wet.

24. Apparatus for preparing unspun textile strand comprising means for winding the strand upon a spool to form a porous, substantially uniform, elongate package of self-sustaining character, and means for compacting the strand and for tensioning the strand during winding to such a degree as to remove any normal waviness of its constituent fibers.

25. Apparatus for preparing unspun textile strand comprising means for delivering the strand at a predetermined rate, means for drawing the strand, means for bringing the constituent fibers of the strand into substantially parallel relation, means for winding the strand without substantial derangement of its parallel fibers upon a perforated spool of fixed length to form an elongate, self-sustaining package, and means for tensioning the strand and for compressing the package during winding.

26. Apparatus for use in the preparation of unspun wool tops comprising fiber having a normal tendency to curl, said apparatus comprising means for tensioning the fiber sufficiently substantially to straighten it, and means for winding it upon a rigid spool, while still under such tension and without imparting substantial twist thereto, so as to form an elongate, self-sustaining, substantially cylindrical package capable of standing on end in wet condition without slumping endwise.

27. Apparatus for use in the preparation of unspun wool tops comprising fiber having a normal tendency to curl, said apparatus comprising means for delivering the fiber in the form of an untwisted sliver at a predetermined linear speed, means for supporting a spool, means for turning the core at such a surface speed as to wind the sliver thereon with a uniform predetermined tension such as to straighten the fiber but without imparting twist thereto, and means for causing the sliver to be laid on the spool with a cross-wind to form a self-sustaining porous package of substantially uniform density.

28. Apparatus for preparing textile strand comprising means for gilling the strand to lay its constituent fibers substantially parallel, means for supporting a hollow, cylindrical core of large diameter, means for com-

pacting the strand, means for rotating the core to wind the strand thereon under a predetermined tension, and means for subjecting the winding mass to radial compression of substantially uniform amount throughout the winding operation.

29. Apparatus for use in winding textile strand comprising a relatively stationary strand guide, a reciprocating frame, a drive roll and spool supporting means moving with the frame, and means including a mangle-gear and pinion for reciprocating the frame.

30. Apparatus for use in winding textile strand comprising a relatively stationary strand guide, a reciprocating frame, a drive roll and core supporting means moving with the frame relatively to the guide, means for delivering strand at a predetermined linear speed to the guide, and means driven in timed relation to the strand delivery means for reciprocating the frame, said reciprocating means comprising a mangle-gear and pinion.

31. Apparatus for winding textile strand comprising a strand delivery guide, a horizontally reciprocating frame, a rack on the frame, a pinion engaging the rack, a substantially vertical shaft carrying the pinion, a mangle-gear engaging a pinion at the lower part of the shaft for turning the shaft alternately in opposite directions whereby to reciprocate the frame, and means carried by the frame for supporting a rotary core upon which the strand from the guide is wound to form a package.

32. Apparatus for winding textile strand comprising a rotary drive shaft, a drive roll splined on the shaft, a reciprocating frame provided with abutments engaging the opposite ends of the drive roll, means carried by the frame for supporting a spool, means for reciprocating the frame, a strand delivery guide fixed relatively to the reciprocating movement of the frame but rotatable on its own axis, a flexible actuating element connected at opposite ends to the frame and embracing the guide whereby, as the frame reciprocates, to rotate the guide, and means for rotating the spool carried by the frame whereby to wind the strand upon the spool to form a package.

33. Apparatus for preparing unspun textile strand comprising spaced pairs of drawing rolls, means for driving the two sets of rolls at different surface speeds whereby to draw the strand passing from one to the other, gilling means interposed between the sets of rolls, said gilling means being arranged to lay the constituent fibers of the strand in substantially parallel relation, means for supporting a rotating core upon which to wind the unspun strand without derangement of its parallel fibers, a driving roll for rotating the core and the package thereon at such a speed as to maintain a predetermined substantially uniform tension upon the strand during winding, guide means for the strand, and means for relatively reciprocating the guide means and the core in such a manner as to lay the strand in the form of a cross-wound, dense but porous self-sustaining package upon the core.

34. Apparatus of the class described comprising means for gilling textile sliver to bring its fibers into substantially parallel relation, and means for winding the sliver upon a spool to form a dense self-sustaining package capable of standing on end in wet condition without slumping endwise of the spool.

35. Apparatus of the class described comprising means for disposing the constituent fibers of a textile sliver in substantially parallel relation, and means for winding the sliver upon a rigid core under tension to form a dense package of fixed length capable of standing on end in wet condition without slumping endwise of the core.

36. Apparatus of the class described comprising means for delivering unspun textile sliver at a predetermined linear speed, and means for winding the sliver under tension with a cross-wind upon a spool having a barrel and fixed heads to form a self-sustaining package of fixed length capable of standing on end when in wet condition without slumping endwise of the spool.

Signed by me at Boston, Massachusetts, this 6th day of February, 1930.

EDWARD J. ABBOTT.