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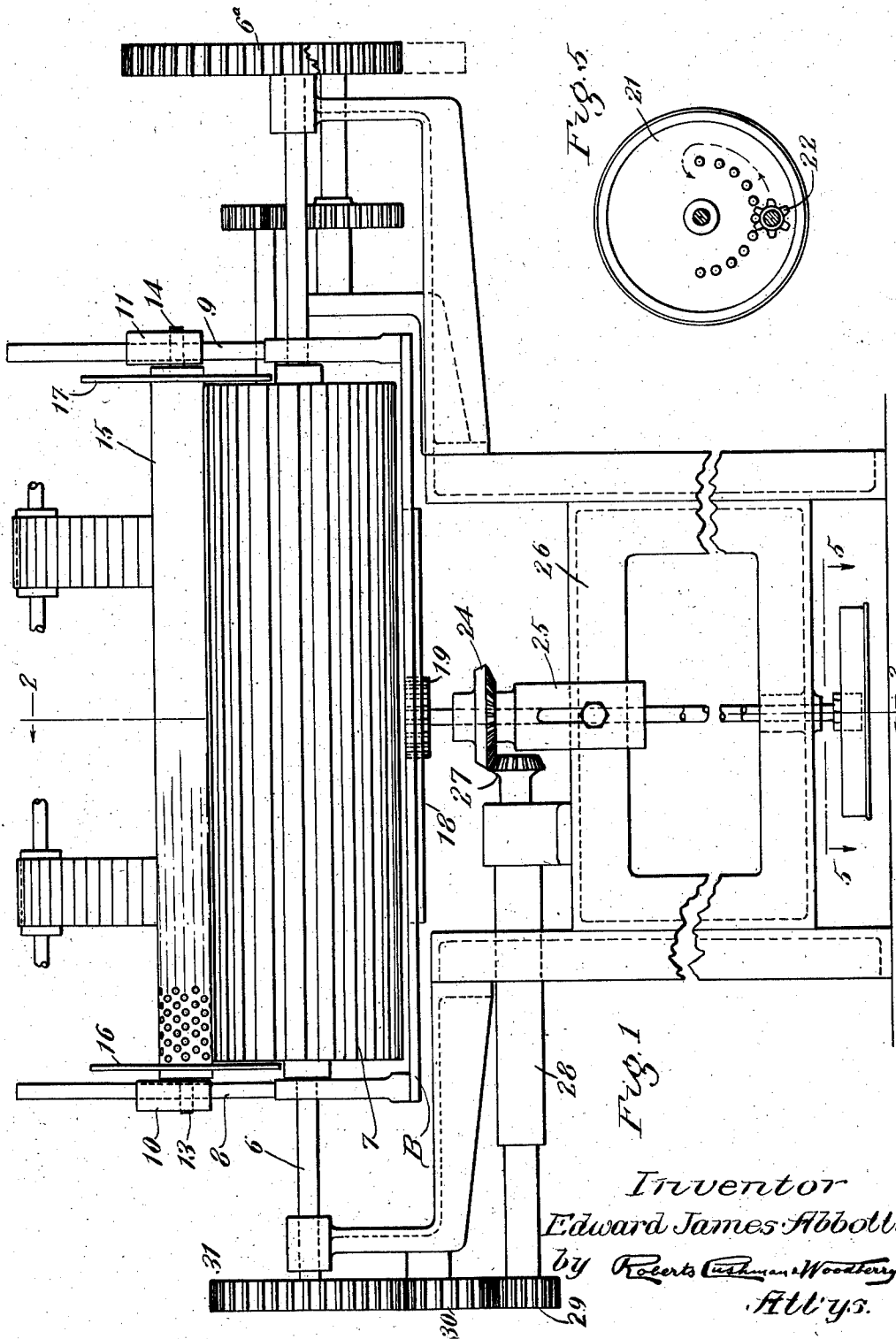
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METHOD OF TREATING AND PACKAGING SLIVERS AND RESULTING PACKAGES

Filed March 26, 1926

3 Sheets-Sheet 1



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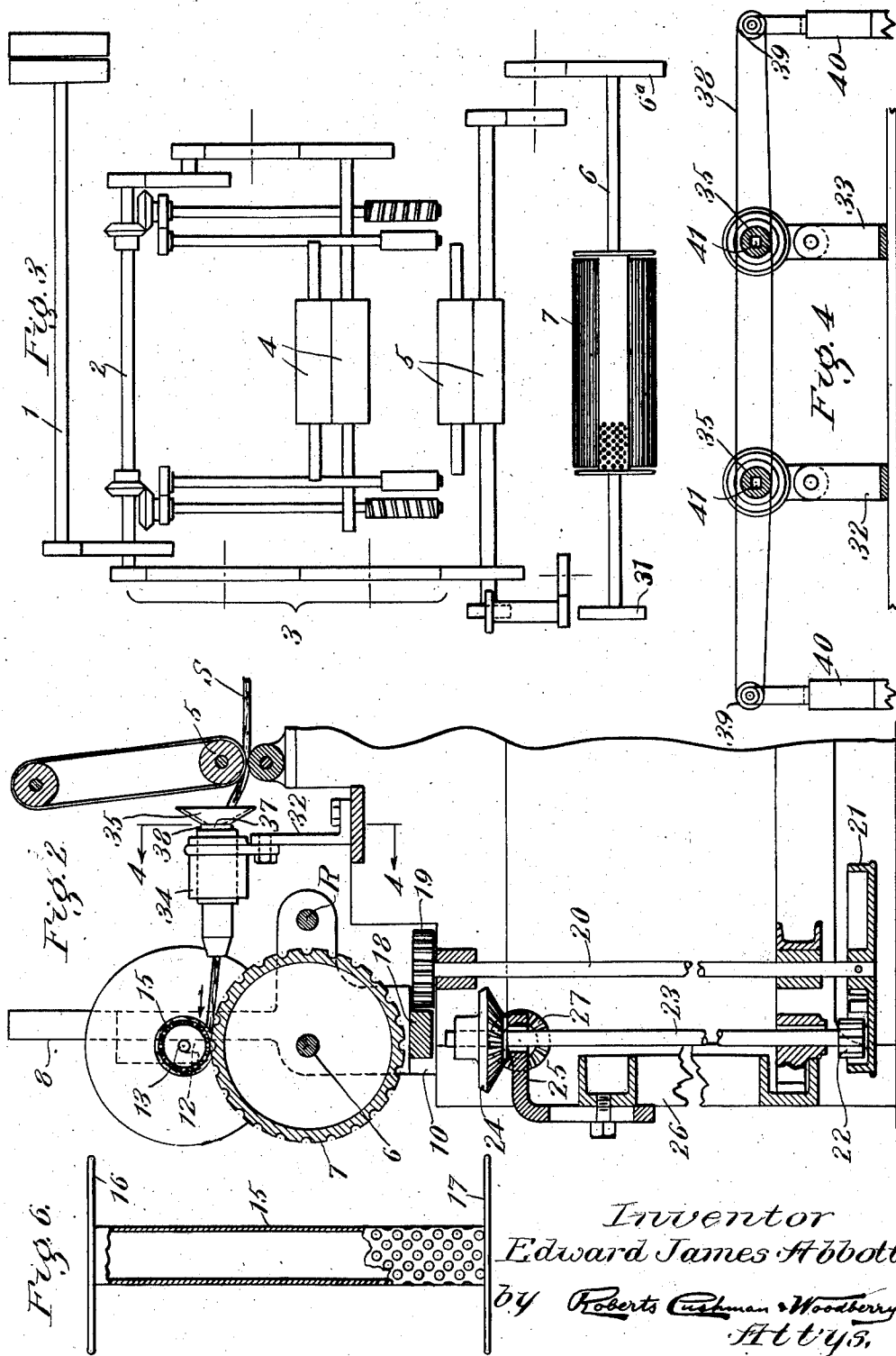
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3 Sheets-Sheet 2



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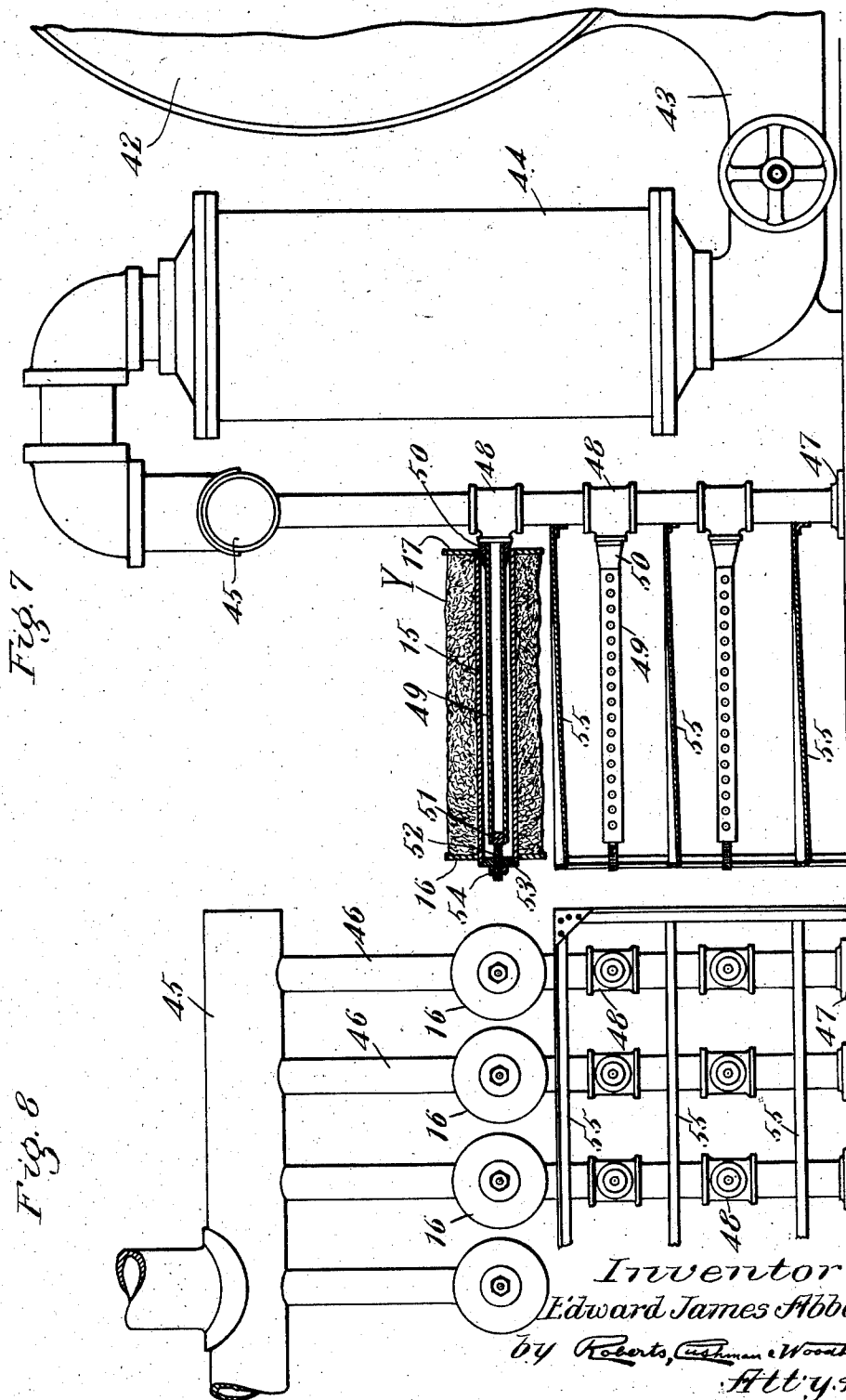
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METHOD OF TREATING AND PACKAGING SLIVERS AND RESULTING PACKAGES

Filed March 26, 1926

3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

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METHOD OF TREATING AND PACKAGING SLIVERS AND RESULTING PACKAGES

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This invention pertains to the manufacture of textiles and more particularly to a method of preparing unspun textile strands hereinafter comprehensively denominated "slivers," together with apparatus useful in practising said method.

The improved method comprises the basic step of winding a sliver, substantially devoid of permanent twist, in such a manner as to produce a package or mass, the sliver being wound under tension and compression and being laid up during winding to form a dense mass of substantially uniform but porous texture, preferably of self-sustaining character. This method also comprises in its more specific aspects the fluid treatment (for example dyeing) and also, if desired, the drying of the yarn mass so produced and preferably a preliminary working or treatment of the sliver for bringing its fibers more or less into parallelism. The mass is preferably wound upon a rigid spool and when the complete process, including either or both fluid treatment and drying, is to be performed, the spool is provided with a perforated barrel for the passage of the fluid and drying media.

While the present invention may be found useful in preparing wool, cotton or other fibrous materials or mixtures of such materials, the invention is herein described by way of specific example as applied to the production and/or treatment of slivers from wool tops whose constituent fibres are normally curly or wavy. Usually this sliver is received at this stage of the operation in the form of a more or less spherical ball about twelve inches in diameter. Commonly this ball is a self-supporting package made by cross winding the sliver upon a tapered stick which is afterward withdrawn. In a ball produced in this manner by an open or repeated cross winding the layers tend to build up unevenly with frequent spots where a large number of slivers cross at the same point. The sliver as thus received is now drawn, usually several times to reduce its diameter, and in drawing it several of the balls are placed in a creel or on spindles and the sliver runs off through gills and drawing boxes where the several slivers are laid more or less

parallel and drawn out, the composite sliver being rewound to form a new yarn mass after each drawing operation.

In some types of machine the sliver is delivered to a conical wooden stick or lap stick resting on a pair of corrugated drive rolls which cause the yarn mass to rotate and thereby to build up a ball similar to the original ball and having similar characteristics. Other types of machines deliver the sliver after drawing to a coiling can, while still other machines wind the sliver upon vertical spindles or small spools by means of a flier which puts a slight twist into the sliver as it is wound upon the spool. Not only does the flier put a permanent twist into the sliver but it also rubs the outer fibers of the sliver so that they tend to curl and this tendency to curl often produces bunches or uneven places in the strand at a later stage in the process.

For the production of the best results in treating the textile fiber in the form of a strand with any fluid reagent, for example an aqueous solution of dyestuff, it is essential to have the strand as free of permanent twist as possible since any crossing of the fibers tends to prevent uniformity in the absorption of the fluid reagent, whereas if the fluid be applied to a sliver having all of its constituent fibers substantially parallel, it is possible to treat the sliver in a very uniform manner.

When as previously referred to the sliver is wound in balls, it is of uneven density and contains spots where many strands cross at the same point and in dyeing such a ball either by the open vat or by the pressure method, the inequalities in density of the ball result in uneven absorption of the dye stuff which greatly detracts from the value of the product.

Obviously when slivers are coiled in a can they can not as a practical matter be dyed in this form since sliver having its fibers substantially parallel to each other is too weak and tender to sustain handling in the dye liquor in the manner in which twisted or spun yarns are handled. Further, as above noted, sliver wound by means of a flier upon the usual type of spool acquires a very considerable permanent twist during the several op-

erations and is thus unfitted for uniform dyeing.

In accordance with my present invention I avoid the introduction of permanent twist into the sliver throughout the entire operation, laying the fibers as nearly parallel as possible and winding the sliver under tension to form a package of substantially uniform density such as to facilitate dyeing by the pressure process as well as rapid and uniform drying, the sliver being tensioned while winding sufficiently to straighten its constituent fibres and being kept under sufficient tension throughout the dyeing and drying steps to give it a permanent set tending to prevent snarling or bunching of the fibers in subsequent operations.

One of the more important features of my present method consists in winding the sliver under compression directly onto a rigid spool, employing a loose type of wind and keeping the sliver under tension but avoiding introduction of permanent twist in laying up the coils upon the spool. Preferably as a step preliminary to winding, I bring the fibers comprising the sliver into more or less parallel relation by drawing, or a combination of gilling and drawing. If several stages of drawing are employed, the sliver may be wound directly upon a spool of ordinary type at the completion of each drawing, but at the end of the last drawing the sliver is preferably wound upon a spool having a perforated barrel to facilitate later operations.

Preferably, though not necessarily, the spool upon which the sliver is wound has its axis substantially horizontal and rests upon a power driven driving roll by which it is frictionally rotated, the spool being reciprocated uniformly in an axial direction to lay the yarn upon the spool in any desired type of wind. The sliver is delivered into the bite between the spool barrel and drive roll and the weight of the spool compresses the sliver as it is wound. To facilitate dyeing, an open or Fiji wind is preferred. Preferably to avoid undue traverse movement of the spool and to keep the mechanism within practical dimensions and to reduce the time of winding to a minimum, a plurality of slivers may simultaneously be wound upon the same spool.

Preferably the yarn is so wound as to form a package of self-sustaining type regardless of whether the spool is provided with heads or not and as above stated I prefer to employ an open wind to facilitate penetration of the dye liquor, although the winding should be of a character to produce a substantially uniform texture throughout the entire length of the yarn mass. The sliver being wound in a self-sustaining type of package upon a rigid core is capable of withstanding the pressure necessary to force the dye liquor through it without slumping down along the barrel of

the spool, or other substantial distortion or relative displacement of its coils or layers and is superior in uniformity to material dyed upon supports of resilient and collapsible character such as are sometimes employed and wherein the yarn mass is placed under a compressive stress that shifts the coils from the position in which they were originally laid in a manner which can not well be predetermined.

After winding and before dyeing the sliver upon the spool may be covered with a pervious textile fabric to protect it during the subsequent steps. The spools with the sliver wound thereon are now set vertically in a dye kettle or tank and clamped in position and the dye liquor is forced through the layers of sliver either from the interior outwardly or vice versa or by alternation of the two methods. During this operation the sliver is supported internally by the spool as well as by the self-sustaining wind employed so that there is little chance of abrasion of the outer layers, while this self-sustaining wind prevents the wet and heavy sliver from slumping down from the upper part of the spool barrel and uncovering the perforations in the latter which would permit the dye liquor to rush out at abnormal velocity thereby snarling or injuring the sliver. Thus the fibers all remain substantially straight, untwisted, and under the original tension with which they were wound.

When the dyeing operation is complete the spools are removed from the dye kettle and the sliver is dried upon the spool, preferably by forcing air, heated or not, as desired, through the layers of sliver.

While it has heretofore been attempted to dry yarn upon perforated spools by forcing air through the yarn upon the spool, the compressed air for this purpose has usually been provided by the use of a constant volume pump or blower. Since a very high pressure is necessary at the beginning to force the air through the wet stock, the apparatus is usually designed with particular reference to the production of such high pressure and when most of the water had been expelled and the resistance decreases, there is no way to increase the volume of air, so that the drying is unduly delayed. In accordance with the present invention the pressure of the air is gradually diminished while the volume of air is increased as the drying process progresses. This results in rapid and uniform drying with less expenditure of power and no damage whatever to the material. The sliver, having thus been dried without twist or bias in any particular direction, may be delivered directly from the spool to the next machine employed in making the yarn and since the fibers have been straightened, and set during the drying process the sliver is in the best

possible condition for the production of high grade yarn.

In the accompanying drawings certain steps in the improved process have been illustrated with reference to a proposed employment of mechanism suitable for practising them, it being understood that so far as the broader aspects of the invention are concerned other and equivalent mechanism may be substituted for that illustrated.

In the drawings,—

Fig. 1 is a fragmentary front elevation of a gill box structure equipped with winding mechanism useful in practising the present process;

Fig. 2 is a section substantially on the line 2—2 of Fig. 1;

Fig. 3 is a diagrammatic plan view illustrating the drawing gear, the driving connections for the gill box, and the position of the winding mechanism relatively thereto;

Fig. 4 is a fragmentary vertical section substantially on the line 4—4 of Fig. 2 but to larger scale;

Fig. 5 is a horizontal section on the line 5—5 of Fig. 1;

Fig. 6 is an elevation, partly in longitudinal section, of a perforated spool useful in performing the process;

Fig. 7 is an elevation partly in vertical section illustrating apparatus useful in performing the drying step of the process; and

Fig. 8 is a view in elevation showing the parts illustrated in Fig. 7, viewed from the left hand side of the latter.

Referring to the drawings Fig. 3 illustrates diagrammatically a gill box of well known type but having the usual balling device replaced by winding mechanism constructed in accordance with the present invention. In this figure the numeral 1 designates the driving shaft, the numeral 2 the back shaft, and 3 the shaft change gears. The back drawing rolls are shown at 4 and the front drawing rolls at 5 but most of the other features of the gill box structure are omitted since the present invention does not in any way relate to the specific details of the gill box structure.

At the front of the machine I arrange a driving shaft 6 carrying a friction driving drum 7 (Figs. 1, 2 and 3) preferably provided with a corrugated surface. To the rear of the shaft 6 and parallel thereto is a fixed guide rod R (see Fig. 2) and the shaft 6 and the rod R constitute guides for a sliding traverse frame comprising the spaced vertical end members 8 and 9 (Fig. 1) and the transverse connecting bar B.

The end members 8 and 9 of the traverse frame constitute guides for vertical sliding weights 10 and 11 respectively. These weights are furnished with downwardly directed bills providing retaining slots 12 (Fig. 2) which are adapted to take over the opposite ends 13 and 14 respectively of a spool

supporting spindle and to hold said spindle in engagement with the vertical front surfaces of the members 8 and 9 of the traverse frame.

The spool spindle is provided with suitable means, not shown, for centering the hollow, rigid, and preferably perforated barrel 15 of a spool provided with heads 16 and 17 at its opposite ends. While I prefer to use a spool having heads I contemplate that in its broader aspects the invention is not limited to a spool having heads, or even to one having a perforated barrel, although I prefer to employ this type of spool. I regard it as quite important that the barrel of the spool be inextensible in length or in other words rigid so that after material has been wound thereon it can not readily be displaced by axial compression of the spool.

The transverse member B of the traverse frame is provided with a rack 18 (Figs. 1 and 2) which meshes with a driving pinion 19 carried by a vertical shaft 20 suitably journaled in the machine frame. The shaft 20 is furnished with a mangle-gear 21 of well known type provided with pins which are engaged by a pinion 22 carried by a driving shaft 23. This driving shaft is journaled in bearings which permit it to move bodily to the extent necessary to allow the pinion 22 constantly to mesh with the pins of the mangle-gear 21. The upper bearing for the shaft 23 is formed in a bracket 25 which is adjustably mounted upon the forward part 26 of the machine frame.

A pinion 24 is secured to the upper end of the shaft 23 and meshes with a pinion 27 on a transverse shaft journaled in a bearing 28 carried by the frame. This shaft is furnished with a pinion 29 meshing with a gear 30 which in turn meshes with a gear 31 carried by the shaft 6. The opposite end of the shaft 6 is furnished with a gear 6^a (Fig. 1) which receives its motion through a suitable train of mechanism (see Fig. 3) from the front drawing rolls.

At a point intermediate the front drawing rolls 5 and the winding drum 7, the frame is provided with a pair of upstanding brackets 32 and 33 (Fig. 4) respectively providing journals 34 for rotary trumpet guides 35. Each of these trumpet guides is provided with a pulley 37 (Fig. 2) for engagement with a belt 38. The belt 38 passes around guide rolls 39 at its opposite ends, such rolls being supported in fixed brackets 40 mounted on the machine frame. Preferably the belt 38 makes a complete turn around each of the pulleys 37 so as to obtain a firm frictional engagement therewith. With the parts thus arranged lateral reciprocation of the traverse frame causes the trumpet guides to oscillate first in one direction and then in the other. The trumpet guides are furnished with axial openings 41 preferably of angular transverse

sections so that they obtain a partial grip upon the sliver S passing therethrough.

The machine thus far described is arranged to wind two slivers simultaneously upon the same spool with a rapid traverse or cross winding so as to build a self-sustaining yarn package of more or less open wind but of uniform texture throughout. While as here shown the apparatus is intended for winding two slivers simultaneously it is contemplated that so far as the broader aspects of the invention are concerned the machine may be designed to wind but a single sliver on the spool or on the other hand to wind a greater number than two. One advantage in winding more than one sliver upon the same spool is that the traverse frame is not required to make so long a reciprocation as it would be were a single sliver to be wound on the long spool which it is desired to employ for the purpose, while the time required for filling a spool is correspondingly reduced.

The operation is briefly as follows, it being assumed that as a preliminary step the sliver is drawn, or drawn and gilled, although it is to be understood that this preliminary step may be omitted, and that the sliver may be presented to the winding means from any suitable source.

The sliver being treated passes from the back rolls 4 to the front rolls 5 which are suitably geared to give the desired draft to the sliver, thus drawing it out and tending to bring the fibers into parallel relation. This drawing of the fibers and laying them in parallel relation may be assisted by the other and usual elements of a gill box which tend to lay the fibers composing the sliver in more or less parallel relation.

Whether or not the drawing and gilling step, or either of them is employed, the sliver or slivers emerge from between the front rolls 5 or equivalent means for providing tension, pass through the trumpet guides 35, and thence pass between the driving drum 7 and the barrel 15 of the spool. The weights 10 and 11 press the spool downwardly against the driving drum and as the driving drum turns the slivers are wound under compression upon the spool, the speed of the drum being such relative to the rate of delivery of the rolls 5 as to place the sliver under a constant tension during the winding sufficient to straighten normally curly or wavy fibers. If the drawing or gilling steps are omitted, the rolls 5 or their equivalent may be regarded as representative of the delivery of any other sliver handling machine.

The mangle wheel 21 causes the traverse frame to reciprocate and this reciprocation is properly timed with reference to the rotation of the spool driving drums to produce the desired wind of the slivers upon the spool whereby to form a self-sustaining package. As the frame reciprocates the trumpet guides

45 oscillate and thus prevent the sliver from receiving any permanent twist as it approaches either end of its traverse. The sliver is thus wound upon the spool under constant tension, and with substantially no permanent twist, in the form of an open and pervious package of uniform density and texture.

In accordance with the present invention the spool, filled during the last winding operation, (if a series of successive windings and rewindings are involved) is withdrawn from the winding apparatus, which may readily be done by lifting the weights 10 and 11 to release the spool spindle, and the spool may then be placed in a suitable dyeing apparatus (not shown) for dyeing the sliver upon the spool. Preferably such apparatus may comprise the usual dye kettle used in pressure dyeing having means for clamping the spool in proper position and for forcing the dye liquor through the material upon the spool.

The dye liquor may traverse the material on the spool from the outside inwardly or from the inside outwardly in accordance with the form of apparatus employed, the particular method of dyeing being immaterial. By reason of the loose and open wind of the yarn mass upon the spool the dye liquor is able to traverse the mass in a uniform manner so that the sliver when removed from the spool is of uniform color while there is substantially no loss of material through abrasion or snarling during the entire process.

When the material upon the spool has been properly dyed the spool is removed from the dye apparatus and may be dried by the use of the apparatus shown in Figs. 7 and 8.

Referring to these figures the numeral 42 indicates a centrifugal blower of a type such that the volume of air delivered increases as the back pressure decreases. This blower has a delivery pipe 43 which delivers air under pressure into the tank or drum 44. This tank or drum is connected with a horizontal header 45 from which extends a series of substantially vertical pipes 46. These pipes are closed at their lower ends and preferably provided with feet 47 adapted to rest upon the floor or other suitable support. The vertical pipes 46 are furnished at intervals with T-connections 48 which carry the horizontally extending perforated tubular supports 49. These supports 49 are sufficiently rigid to support the weight of a spool filled with the wet sliver.

Each of the supports 49 is preferably provided with a conical spool centering member 50 at its rear and with a closure member or plug 51 at its front end. The closure member 51 supports a screw-threaded rod 52.

The spool from the dye kettle is slipped over the support 49 as indicated at the upper part of Fig. 7, the rear end of the barrel of the spool fitting snug against the centering

member 50 to make a tight joint therewith, such centering member being of resilient material if desired. The forward end of the barrel 15 of the spool is now closed by means of a centering cap 53 through which the threaded rod 52 projects and the spool is clamped in position by means of a nut 54 engaging the end of the rod.

I preferably provide drip pans 55 extending between each horizontal tier of spools and such drip pans may if desired be connected to suitable drain pipes not shown.

After the spools have been mounted upon the supports 49 the blower is started and the air under pressure passes down through the pipes 46 and out through the perforations in the supports 49. The pressure at the start of the operation is sufficient to blow the air through the wet mass Y of material upon the spool, but as the water is forced out of the wet material the pressure necessary to force the air therethrough becomes less and for this reason the blower 42 is so chosen that as the resistance decreases the volume of air increases. This results in rapid drying of the material and without danger of damage thereto through the use of excessive pressure after the material has become partly or wholly dry.

After the material upon the spool has been thoroughly dried it may be drawn off directly from the spool for delivery to the next machine or apparatus employed in the process of making yarn. Since the sliver was originally laid upon the spool under constant tension but without twist and since it has been dyed and dried without disturbance it leaves the spool with its fibers substantially parallel, untwisted, and with a distinct set which is of great assistance in preventing snarling or bunching in subsequent operations.

While certain apparatus has herein been illustrated as desirable for performing the improved process it is to be understood that the process is not necessarily dependent on the employment of this specific apparatus but that other and equivalent means may be found useful in obtaining the desired results. It is also to be understood that certain of the steps of the process as above described may be omitted or used in a different order or that other and equivalent steps or reagents may be substituted therefor without departing from the broad invention involved.

Having thus described the invention together with a preferred mode of practicing the same, I claim:

1. That method of preparing untwisted textile sliver having its constituent fibers predominately straight and parallel which comprises winding the sliver without substantially deranging its fibers to form hollow package of dense but substantially uniform and porous texture and of self-sustaining character.

2. That method of preparing textile sliver substantially devoid of permanent twist and having its fibers predominately straight and parallel which comprises winding the sliver under tension and compression and without twist to form an open wind upon a perforated spool of fixed length.

3. That method of preparing untwisted strands which comprises as steps bringing the fibers composing the strand into substantial parallelism, and subjecting the strand while under tension to the action of a boiling fluid while substantially maintaining the parallel relation of the fibers.

4. That method of preparing textile strands substantially devoid of permanent twist which comprises as steps winding the strand without twist upon a perforated hollow rigid core to form an elongate mass and impregnating the mass with a fluid reagent while maintaining its length substantially unchanged.

5. That method of preparing untwisted textile strands which comprises as steps winding the strand without twist to form an elongate hollow package of self-supporting type, and moistening the package with a hot fluid and drying the package while maintaining its length substantially unchanged.

6. That method of preparing untwisted textile strands which comprises as steps winding the strand with a cross wind and without substantial twist upon a perforated rigid spool, covering the material upon the spool with a layer of pervious textile fabric, forcing a fluid medium radially through the mass on the spool, and drying the material upon the spool.

7. That method of preparing textile sliver which comprises as steps bringing the fibers composing the sliver into substantially parallel relation, winding the sliver without substantial twist directly upon a perforated spool of fixed length, and forcing a liquor reagent through the sliver upon the spool.

8. That method of preparing textile sliver which comprises gilling the sliver to lay its fibers substantially parallel, winding the sliver without permanent twist directly upon a perforated spool of fixed length, moistening the sliver upon the spool with a boiling liquid, and subsequently drying the sliver upon the spool.

9. That method of preparing textile slivers substantially devoid of permanent twist which comprises as steps simultaneously winding a plurality of untwisted slivers under tension upon a hollow perforated core with an open wind to form an elongate package of substantially uniform density, and moistening and drying said package.

10. That method of preparing textile slivers substantially devoid of permanent twist which comprises as steps simultaneously winding a plurality of said untwisted slivers

upon a hollow perforated spool under tension and compression while relatively traversing the slivers and the spool axially to lay the strands with substantial uniformity, and treating the material thus wound upon the spool with a fluid reagent.

11. That method of preparing textile slivers which comprises as steps winding the sliver under tension to form a hollow package, moistening the material forming the package, and drying the package by forcing air radially through it, the pressure of the air being gradually decreased and its volume being gradually increased as the drying operation progresses.

12. That method of preparing textile slivers which comprises as steps winding the sliver under tension to form a hollow package, forcing a liquid reagent radially through the package, and drying the package by forcing air through it, the pressure of the air being gradually decreased as the package dries.

13. That method of preparing textile slivers which comprises as steps winding the sliver under tension to form a hollow package, impregnating the package with boiling aqueous fluid, and drying the package by forcing air through it from its interior outwardly, the pressure of the air being diminished as the package dries.

14. That method of preparing textile slivers which comprises as steps boiling the sliver under substantially constant tension in an aqueous fluid, and subsequently drying the untwisted sliver under tension.

15. That method of preparing untwisted textile slivers which comprises as steps winding the sliver under tension and without twist to form a self-sustaining package consisting of helical coils, and subjecting the package to the action of a boiling aqueous fluid while maintaining the several coils in substantially the position in which they were wound.

16. That method of preparing untwisted textile strands which comprises as steps winding the strand under tension without imparting permanent twist to the sliver to form an elongate hollow package of self-supporting type, moistening the material by forcing liquid from the interior of the package outwardly through the mass, and drying the material by forcing air outwardly from the interior of the package.

17. That method of preparing untwisted textile strands which comprises as steps simultaneously gilling a plurality of strands, winding said strands under tension and without twist upon a hollow support, and wetting and drying the strands upon the support.

18. That method of preparing textile sliver which comprises as steps working the sliver to lay its fibers substantially parallel, winding the sliver under tension and without substantially deranging its fibers to form an

elongate hollow package, and treating the sliver composing the package with a hot fluid while maintaining unchanged the relative position of the layers of sliver comprising the package.

19. That method of preparing textile sliver substantially devoid of permanent twist which comprises as steps winding the sliver with a cross wind to form an elongate package while maintaining the sliver in its untwisted condition and without substantially deranging its fibers, and maintaining the length of the package substantially unchanged while moistening and drying the package.

20. That method of preparing textile sliver substantially devoid of permanent twist which comprises as steps winding the sliver without twist upon a hollow perforated spool of fixed length, and subjecting the sliver upon the spool to the action of a fluid reagent.

21. That method of preparing textile sliver substantially devoid of permanent twist which comprises as steps winding the sliver under tension and without twist upon a hollow perforated spool of fixed length, moistening the sliver, and drying the sliver upon the spool.

22. That method of preparing textile sliver which comprises as steps laying the fibres composing the sliver in substantially parallel relation, winding the sliver without twist and under tension upon a spool having heads at its ends and a perforated barrel, and subjecting the sliver upon the spool to the action of a hot fluid medium.

23. A textile package comprising untwisted sliver in the form of an open wound pervious mass upon a hollow, perforated rigid core, the fibers comprising the sliver being substantially straight, parallel and under tension.

24. A textile package comprising untwisted dyed and dried sliver consisting of fibers which in their normal state are wavy, said sliver being wound upon a rigid core to form a pervious mass, the fibers comprising the sliver forming said package having a permanent set and being substantially straight.

25. A textile sliver comprising untwisted fiber, the individual fibers composing the sliver having a permanent set and being substantially parallel, said sliver being dry and dyed to a substantially uniform shade throughout its length.

26. A textile package comprising untwisted sliver wound under tension to form an elongate substantially cylindrical mass wherein each convolution of the sliver occupies substantially the position in which it was originally laid, the mass being capable of retaining its shape when wet and placed on end.

27. A textile package comprising an un-

twisted fibrous strand wound under tension to form an elongate substantially cylindrical mass wherein each convolution occupies substantially the position in which it was originally placed, the winding being of such character as to prevent the mass from slumping down when placed on end and subjected to a pressure dyeing operation.

28. A textile package comprising an elongate substantially cylindrical hollow mass consisting of a cross wound fibrous strand and wherein each convolution occupies substantially the position in which it originally laid, said package being capable of maintaining its shape without substantial deformation when placed on end and subjected to pressure dyeing and drying.

29. That method of preparing untwisted textile sliver having its constituent fibers predominantly parallel which comprises as steps winding the sliver without twisting to form an open wound package of self-sustaining structure and substantially uniform texture, tensioning the strand while winding it, and boiling the package in an aqueous fluid while maintaining the relative position of its constituent windings substantially unchanged.

30. That method of preparing untwisted textile sliver having its constituent fibers predominantly parallel and untwisted which comprises placing such sliver under tension, winding it under compression upon a perforated hollow core while maintaining it in its untwisted condition, thereby forming an elongate mass, and boiling the mass upon the core in an aqueous fluid while maintaining its length substantially unchanged.

31. That method of preparing untwisted textile sliver having its constituent fibers predominantly parallel which comprises winding the sliver without substantially deranging its fibers upon a rigid core to form a substantially cylindrical package while maintaining the sliver in its untwisted condition, and boiling and drying the package while keeping its length substantially unchanged.

32. That method of preparing untwisted textile sliver having its constituent fibers substantially straight and set in predominantly parallel relation which comprises winding the sliver without substantially deranging its fibers to form a hollow package of dense but substantially uniform and porous texture, and of self-sustaining character, dyeing the package by forcing dye stuff radially through the package, and drying the package, by forcing air radially through it.

33. That method of treating wool sliver whose constituent fibers have a normal tendency to curl which comprises as steps tensioning the sliver whereby substantially to straighten its constituent fibers, subjecting the sliver while still under tension to the action of a boiling fluid, and drying the sliver while keeping it under tension.

34. That method of treating sliver prepared from normally wavy wool tops which comprise as steps tensioning the sliver sufficiently substantially to remove the waviness from its constituent fibers, winding the sliver without twisting it to form a package, impregnating the package with a boiling fluid, and drying the package thereby to impart a permanent set to the straightened fibers constituting the sliver.

35. That method of treating untwisted sliver prepared from normally wavy wool tops which comprise as steps tensioning the untwisted sliver sufficiently substantially to remove the waviness from its constituent fibers, winding the sliver without twisting it to form a pervious package of self-sustaining character, circulating a boiling liquid through the package, and drying the package thereby imparting a permanent set to the straightened fibers constituting the sliver.

36. That method of preparing wool sliver, whose constituent fibers are normally wavy, for spinning which comprises as steps winding the sliver under such tension upon a spool as substantially to straighten it and remove the natural waviness of the constituent fibers, treating the mass of material on the spool with a boiling aqueous fluid, subjecting the material on the spool to the action of dry air whereby to dry and set the straightened fibers, and unwinding the dry sliver from the spool.

37. That method of treating an unspun textile strand prepared from normally wavy wool tops which comprise as steps tensioning the strand sufficiently substantially to remove the waviness from its constituent fibers, winding the strand to form a cylindrical pervious self-sustaining package, circulating hot fluid through the package while keeping the length of the package substantially unchanged, and drying the package whereby to impart a permanent set to the straightened fibers constituting the strand.

38. That method of treating wool fiber having a normal tendency to curl which comprises as steps disposing the fiber in predominantly parallel relation without twisting, straightening the fibers whereby substantially to remove their curl, treating the fibers with a hot fluid while restraining them to prevent resumption of their natural curl, and drying the fibers while still under restraint whereby to give them a permanent set.

39. That method of preparing normally wavy wool fiber for spinning which comprises as steps arranging the fiber to form a sliver substantially devoid of twist, winding the sliver under tension and without twisting it upon a spool thereby straightening out the natural waviness of the constituent fibers of the sliver, moistening the material upon the spool, and drying the material on the spool thereby giving the straightened fiber a per-

manent set, and unwinding the sliver from the spool.

40. That method of treating wool sliver whose constituent fibers are normally wavy, which comprises as steps winding the sliver under tension and without substantially twisting it upon a spool, thereby straightening out the natural waviness of the constituent fibers of the sliver, and treating the sliver upon the spool to the action of agents which substantially neutralize the normal tendency of the fiber to resume its original waviness when the sliver is subsequently unwound from the spool.

41. That method of treating wool sliver consisting of normally curly fibers to produce a sliver whose constituent fibers are permanently and predominately substantially straight, said method comprising as steps placing the sliver under such tension as substantially to straighten the normally curly fiber while winding the sliver to form a self-sustaining package of fixed length, subjecting the package to the action of a reagent which temporarily at least neutralizes the tendency of the fiber to curl, and subjecting the package to a treatment which causes the fibers to take a permanent set in their straightened condition.

42. That method of treating unspun wool sliver which comprises as steps keeping the sliver under tension sufficient to make its constituent fibers substantially straight while treating the sliver with a hot fluid, and expelling the fluid from the sliver while still keeping the latter under tension whereby to cause its constituent fibers to take a permanent set in their straightened condition.

Signed by me at Wilton, New Hampshire, this 20th day of March, 1926.

EDWARD JAMES ABBOTT.

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