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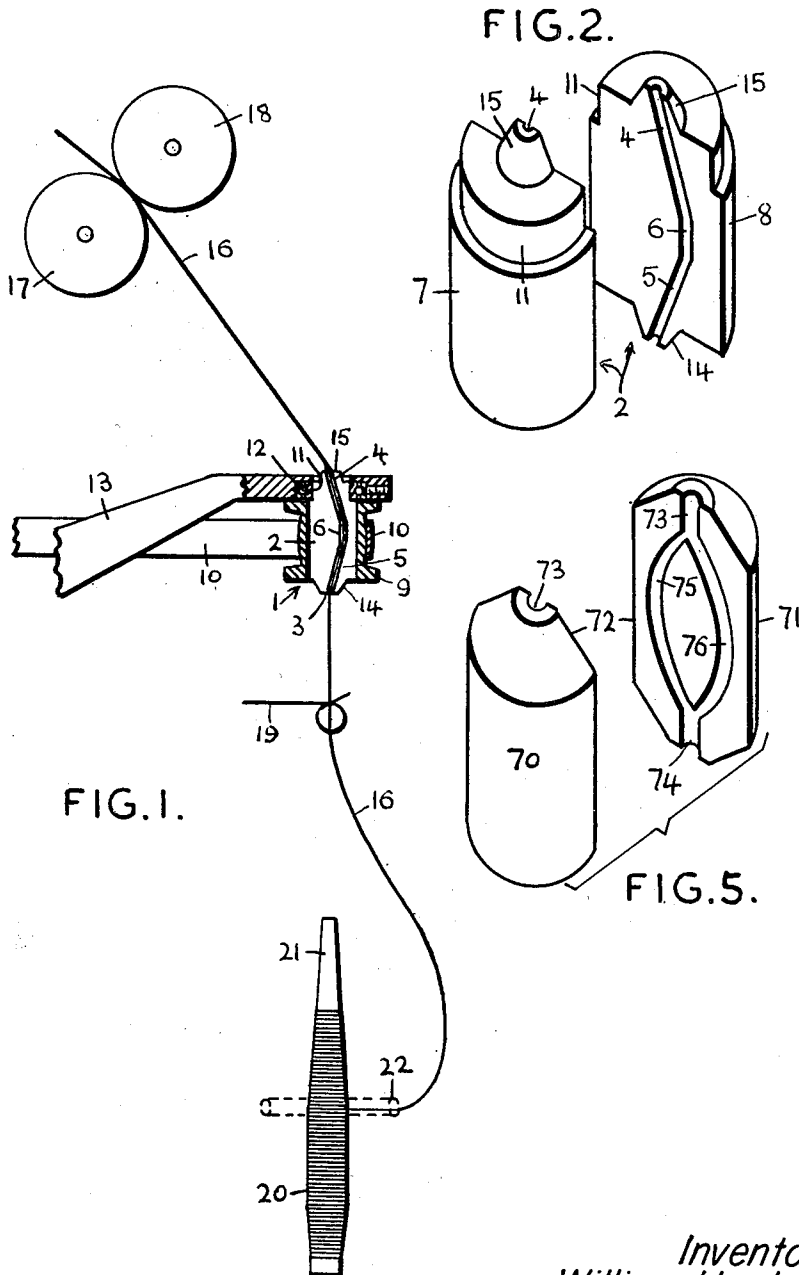
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2,556,919

DRAWING, TWISTING, DOUBLING, AND SPINNING MACHINERY

Filed Sept. 7, 1949

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

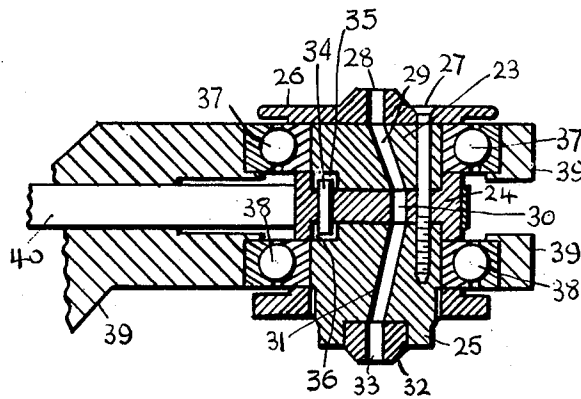


FIG. 3.

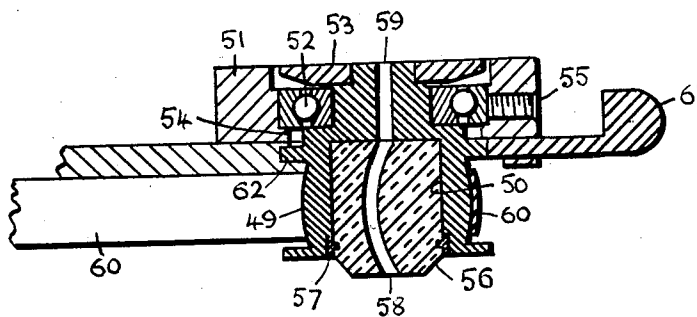


FIG. 4.

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## UNITED STATES PATENT OFFICE

2,556,919

DRAWING, TWISTING, DOUBLING, AND  
SPINNING MACHINERY

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This invention relates to drawing, twisting, doubling and spinning machinery used for processing natural fibres such as cotton, worsted, wool, flax or hemp or synthetic fibres such as viscose rayon fibres, in the form of a thread, yarn, roving or sliver, hereinafter referred to generally as a "thread."

In the drafting of textile rovings (or slivers), it is known to pass the roving as it travels to the collecting can through a false twisting tube so that the roving is first twisted in one direction and is then untwisted in the opposite direction so that the collected roving is free from twist. In the twisting of thread by the cap, the ring or the flyer systems, it has been proposed to pass the yarn from the last pair of drafting rollers through a pretwisting tube from which the pretwisted yarn passes to a collecting bobbin on which it is laid by the cap, ring or flyer. Thus British specification No. 4,579/1912 describes the use of a twist tube comprising a rotating spindle having two axially disposed passages, the upper passage passing in at the centre of the spindle and out at one side and the lower passage passing in at the side of the spindle and out through the centre of the spindle. British specification No. 10,327/1913 describes the use of a twist tube having at one end a deep groove extending spirally round the outside of the tube, and a hole through which the yarn is passed from the spiral into the twist tube and thence to the cap or other spinning device.

The pretwisting of the thread by the twisting tube takes place before any winding strains are exerted on the thread and not only permits the use of higher delivery and collection speeds but also ensures that the thread is maintained under an even tension during the actual twisting operation. However, the twisting tubes as hitherto employed have been of complicated structure, have been expensive to produce and moreover when a thread breaks, the rethreading of the tube, usually referred to as "piecing up," has been a troublesome operation.

The object of the present invention is to provide an improved form of twisting tube which is cheap and simple in construction.

In accordance with the present invention, a twisting tube for use in drawing, twisting, doubling and spinning frames comprises a rotatable member having a continuous, smooth, wholly internal channel so constructed that both the entrance and exit holes are concentric with the axis of rotation of the member, and a thread cannot pass through the channel without being

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deflected by the walls of the channel from the axis of rotation of the member.

The channel in the twisting tube according to the invention may be formed simply by two oblique passages both of which emerge concentrically with the axis of rotation of the member and which converge and meet within the tube to form a continuous channel; the angle between the two passages is preferably within the range of 120°-150°. In a further construction the channel is formed by two oblique passages which both emerge concentrically with the axis of rotation of the member and are joined together within the member by a passage which is substantially parallel to the axis of rotation; with this form of tube, the oblique passages are preferably arranged at an angle of 15° to 30° to the vertical. In other forms of tube, a sinuous or otherwise curved channel may be employed.

In general it is preferred to construct the channelled members for example of chromium plated metal in two or more channelled parts which are assembled to provide a unitary twisting member. The channel should be smooth so that no abrasion of the thread takes place within the member.

In all tubes according to the invention the essential features are that the entrance and exit holes for the thread are concentric with the axis of rotation of the member and that within the member the thread is deflected away from the axis of rotation. Thus when using a twisting tube according to the invention, the thread passes from drafting rollers along the plane of the axis of rotation of the tube until it reaches the rotating channelled member; the thread then passes through the channelled member where it is first deflected away from and then brought back to the axis of rotation at which point it leaves the channelled member for example as a balloon and passes to a normal twisting device such as a cap, ring or flyer; if desired, a further thread guide may be placed between the twisting tube and the twisting spindle so that the thread after leaving the twisting tube passes along the axis of rotation of the tube until it reaches the guide and then passes as a balloon from the guide to the collecting bobbin. In this manner, the thread is twisted as it leaves the nip of the drafting rollers and twist is maintained in the thread by the twisting device used to collect the thread. The degree of twist inserted in the thread is dependent solely on the angular speed of the twisting spindle, the tube having no effect on the final degree of twist. The effect

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of the twisting tube is to cause the thread to twist as it passes from the nip of the drafting rollers to the tube. As a result the thread leaving the twisting tube will have a degree of twist depending on the speed of the tube. If the twisting spindle is rotated at the same angular speed as the tube then the twist in the thread as it leaves the tube is unaltered as it passes to the twisting spindle. In other words the degree of twist in the yarn throughout its passage from the exit of the tube to the collecting device is the same. If the spindle is rotating at a higher speed than the speed of the tube, the degree of twist in the yarn leaving the tube is lower than the degree of twist as determined by the spindle so that the thread will be twisted further as it passes from the tube to the spindle. In the same way, if the tube rotates faster than the spindle, the degree of twist at the tube is higher than the predetermined twist so that some of the twist will be taken out between the tube and the spindle.

The advantages of the present invention compared with the standard drawing, twisting, doubling and spinning machines used for example for cotton, flax, wool and worsted, are that larger yarn packages may be collected, finer counts of yarn may be spun and strain on the thread during twisting is reduced to a minimum. By adding twisting tubes according to the invention to existing cap, ring and flyer frames it is possible to build larger packages and to spin finer yarns than were hitherto possible. The tubes according to the invention also have the advantages over previously proposed twisting tubes, in that they are simple in construction and cheap to produce for example by metal die-casting, the yarn is uniformly and smoothly twisted, and particularly, they are more easily rethreaded for piecing-up purposes since the thread is not taken outside the tube during the pretwisting as in prior proposals. The twisting tubes according to the invention may be rethreaded by means of a flexible wire which can be pushed very easily through the channel. In some circumstances it is not necessary to stop the tube in order to rethread, since the wire may be passed through the channel while the tube is still rotating; however, stop mechanism for stopping the rotation of the tube may be provided if desired.

The present invention is illustrated by way of examples in the accompanying diagrammatic drawings in which

Figure 1 is a view of a ring spinning machine including a twisting tube according to the invention, this tube being shown in section.

Figure 2 is a perspective view showing the two half-cylindrical parts forming the twisting tube shown in Figure 1.

Figures 3 and 4 show other forms of twisting tubes according to the invention, and

Figure 5 shows the two half-cylindrical parts forming a further form of twisting tube according to the invention.

The ring spinning machine shown in Figure 1 includes a twisting tube 1 having a channelled member 2. The channelled member 2 is in the form of a cylinder, one inch in diameter and two inches long provided with a channel 3 formed by oblique passages 4 and 5,  $\frac{1}{8}$  inch diameter in the top and bottom of the member 2 starting from the axis of the member 2, at an angle of  $15^\circ$  to the vertical for a vertical distance of  $\frac{3}{4}$  inch and joined by a straight passage 6,  $\frac{1}{2}$  inch long parallel to the axis of the cylinder. The

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member 2 may be made by die-casting two grooved parts 7 and 8 (Figure 2) which are mirror images of each other and are joined together to form the channelled member 2 by shrinking an outer collar 9 of mild steel on to the two parts, the collar being shaped as a wharf for driving the member 2 through a tape 10. The top of the member 2 is machined to provide a shoulder 11 and a force-fit for the inner race of a ball bearing journal 12. The outer race of the ball bearing fits into a fixed bracket 13 on the machine frame. At the top and bottom of the channel 3 two small caps 14, 15 are provided to reduce disturbing air currents which tend to hinder threading of the tube.

The tube 1 was used on a ring spinning frame as shown in Figure 1, in which a roving 16 was passed between drafting rollers 17, 18, through the twisting tube 1, through a fixed guide 19 and was then collected on a package 20 on a spindle 21 by means of a ring 22. Details of the ring frame were as follows: pitch spindle  $3\frac{1}{2}$ ", front roller 4", ring diameter  $2\frac{1}{2}$ ", lift  $9\frac{1}{2}$ " and spindle speed 10,000 revolution per minute. A yarn 1/100's worsted counts, 22 turns per inch Z was spun from a roving of 1.5 denier 4" rayon staple weighing 3 drams per 40 yards, giving a total denier of approximately 1300; without the use of the twisting tube 1 this roving could only be spun to 1/60's worsted counts on the same frame at 7,000 revolutions per minute with a  $9\frac{1}{2}$ " lift. Further examples of yarns obtained with the tube 1 on the same frame are as follows:

A 4.5 denier 6" rayon staple roving weighing 25 drams per 40 yards was spun to 1/12's worsted counts, 6 turns per inch Z using a spindle speed of 9,000 revolutions per minute.

A 4.5 denier 6" rayon staple roving weighing 6 drams per 40 yards was spun to 1/36's worsted counts, 14 turns per inch Z, using a spindle speed of 10,000 revolutions per minute.

A 1.5 denier 4" rayon staple roving weighing 3 drams per 40 yards was spun to 1/120's worsted counts, 24 turns per inch Z using a spindle speed of 9,000 revolutions per minute.

The twisting tube shown in Figure 3 comprises three channelled components 23, 24, 25 and a top cap 26, held together by means of two or more bolts, only one bolt 27 being shown. A channel 28 in the cap 26, concentric with the vertical axis of the twisting tube coincides exactly with the entrance of a second channel 29 in the top component 23. The channel 29 passes through the top component 23 at an angle (conveniently from  $15^\circ$  to  $30^\circ$ ) to the vertical axis of the twisting tube and at its lower end coincides exactly with the entrance of a third channel 30 in the centre component 24, the channel 30 being parallel to but offset from the vertical axis of the twisting tube. The lower end of channel 30 coincides with the entrance of a fourth channel 31 in the lower component 25; at the bottom end of the lower component 25, the channel 31 is concentric with the vertical axis of the twisting tube and is arranged at such an angle that its upper end coincides exactly with the lower end of channel 30 in the central component 24. A cap 32 fits concentrically into the base of the lower component 25 and has a central channel 33 concentric with the vertical axis of the twisting tube and coinciding with the lower end of the fourth channel 31 in the lower component 25. To locate the three components 23, 24 and 25 in a correct alignment in which the

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channels 29, 30 and 31 are coincident with each other, a locating pin 34 passing through the centre component 24, fits into a recess 35 in the top component 23 and a second recess 36 in the lower component 25.

The twisting tube assembly comprising the three components 23, 24 and 25 and the two caps 26 and 32 is rotatable in two ball bearing races, 37 and 38 mounted in the machine frame 39. The upper ball bearing race 37 is located on the top component 23 and the lower ball bearing race 38 is located on the lower component 25. The centre component 24 acts as a wharfl for the twisting tube assembly and a distance piece for bearings 37 and 38. The wharfl is rotated by a driving tape 40.

The twisting tube shown in Figure 4 comprises a hollow wharfl 49 open at its lower end but closed at its upper end to form a chamber 50; the wharfl 49 is supported in a bearing housing 51 by a ball bearing race 52 bearing on shoulders of the upper end of the wharfl 49, and is retained in position by a cap 53. The cap 53, mounted on the upper end of the wharfl 49 overlaps the upper edge of the ball bearing 52 which itself is retained by a step 54 in the bearing housing 51, and is held in position by a grub screw 55.

The chamber 50 is plugged with a close fitting porcelain cylinder 56 keyed in position with a ring 57 of sulphur, mastic or other suitable bonding material. A curved channel 58 passes through the porcelain cylinder 56, being concentric with vertical axis of the cylinder 56 and the wharfl 49 at the upper and lower ends of the cylinder 56; between the ends of the cylinder 56 the channel 58 describes a curved path such that its maximum displacement away from the vertical axis of the cylinder 56 occurs half-way along its path. A second channel 59 passes through the upper end of the hollow wharfl 49, concentric with its vertical axis, and coincident with the upper end of the channel 58. The wharfl 49 is capable of rotation within the ball bearing race 52, and is driven by a driving tape 60. The wharfl 49 may be braked by the operation of a brake lever 61, which has a cam surface capable of bearing upon a flange 62 of the wharfl.

The twisting tube shown as a split tube in Figure 5 is formed by two identical half-cylinders 70 and 71 having a double groove cut in their longitudinal flat faces 72. The double groove is formed by an entrant groove 73 and an exit groove 74 which are both concentric with the vertical axis of the tube and which are joined by two curved grooves 75 and 76, one of which is a mirror image of the other about the vertical axis of the tube. The two half-cylinders 70 and 71 are secured together in the same way as are

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the parts 7 and 8 shown in Figure 2 to form a twisting tube having two wholly-internal channels either of which can be used for the purpose of pretwisting yarn. This form of tube is preferred when the two half-cylinders are made by casting since then the two half-cylinders are identical instead of being mirror images and only one mould is required.

What we claim is:

1. A twisting tube for use in the drawing, twisting, doubling and spinning of textile threads comprising a rotatable member formed by at least two parts which are constructed so that when the parts are assembled together, the said member has a continuous, smooth, wholly internal channel the entrance and exit holes of which are concentric with the axis of rotation of the member and part of the channel within the member is eccentric to the axis of rotation of the member whereby a thread cannot pass through the channel without its being deflected solely by the walls of the channel from the axis of rotation of the member, and means for joining and holding said parts together to form the said rotatable member.

2. A twisting tube as claimed in claim 1 wherein the internal channel is formed by two oblique passages both of which emerge concentrically with the axis of rotation of the member and which converge and meet within the tube to form a continuous channel.

3. A twisting tube as claimed in claim 2 wherein the angle between the passages is within the range of 120° to 150°.

4. A twisting tube as claimed in claim 1 wherein the internal channel is formed by two oblique passages which both emerge concentrically with the axis of rotation of the member and are joined together within the member by a passage which is substantially parallel to the axis of rotation.

5. A twisting tube as claimed in claim 4 wherein the oblique passages are arranged at an angle of 15° to 30° to the vertical.

6. A twisting tube as claimed in claim 1 wherein the internal channel is curved.

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