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STRAND TWISTING APPARATUS

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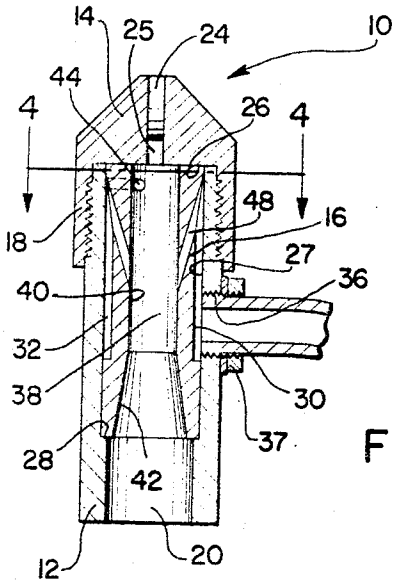

FIG. 2

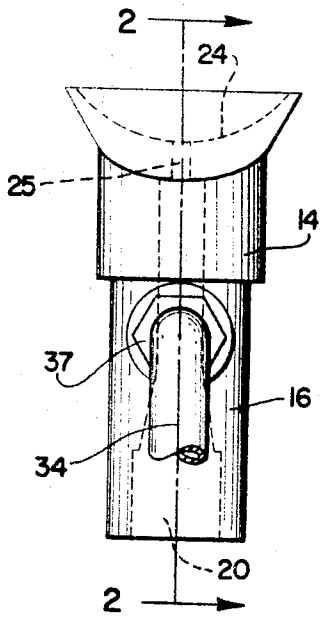

FIG. 1

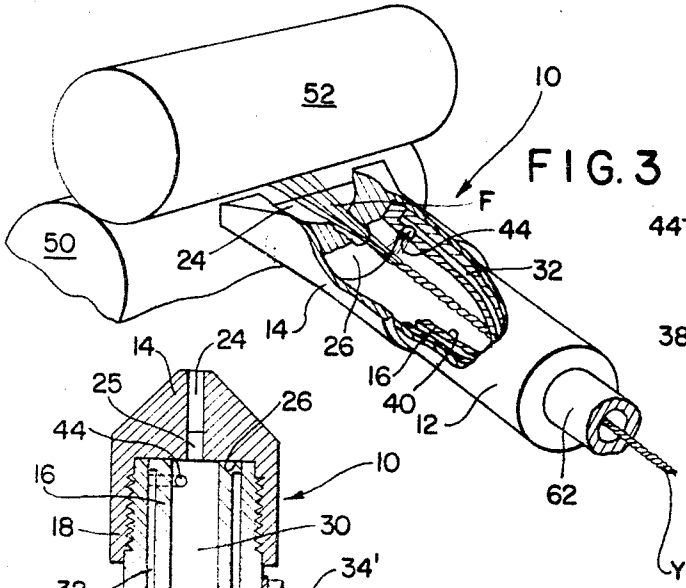

FIG. 3

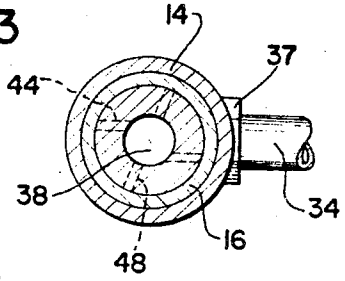

FIG. 4

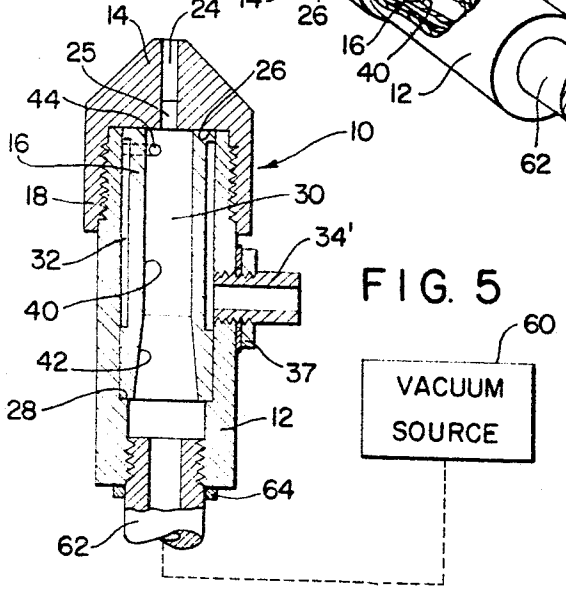

FIG. 5

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STRAND TWISTING APPARATUS

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10 Claims

ABSTRACT OF THE DISCLOSURE

The instant invention is directed to an improved aspirator for twisting and manipulating fibrous yarn. A novel construction is disclosed which includes a chamber arranged to receive therethrough a strand of drafted fibers, a first aperture to direct pressurized fluid into the bore to twist the fibers into yarn, and a second aperture to direct pressurized fluid into the bore to draw the newly formed yarn therethrough. In an alternate embodiment the aspirator is connected to a suction system operable to draw fibers into the aspirator and simultaneously twist the fibers into yarn.

This invention relates generally to strand twisting apparatus and more particularly to a unique aspirating system for manipulating fibrous yarn.

In the conventional spinning process, roving, which is a loose asemblage of subtantially parallel fibers formed into a single strand with very little twist, is drawn through a series of drafting rolls and thereupon mechanically twisted and wound onto a bobbin. The twisting and winding operations are performed simultaneously by means of a traveller which rides around the upper flange of a ring encircling the bobbin. The traveller engages the yarn to hold it clear of the periphery of the bobbin and distributes the yarn along the length of the take-up bobbin as a suitable mechanism operates to reciprocate the ring along substantially the length of the take-up bobbin.

Twist is imparted to the roving by the action of the traveller immediately as it issues forth from the last pair of drafting rolls and becomes yarn. Until the fibers are twisted into yarn, the roving is extremely flimsy and lacks any appreciable tensile strength requiring that it be handled carefully and adroitly. Occasionally it happens that the yarn parts downstream of the delivery pair of drafting rolls, thereupon necessitating the threading up of the fibers issuing from the drafting rolls with the yarn on the bobbin. In the past when initially threading up a spindle, or when piecing up a spindle subsequent to a yarn break downstream of the drafting rolls, it was usual for the operator to seize the fibers issuing from the drafting rolls with her fingers and join them to yarn from the take-up bobbin. She may impart some twist by rolling the fibers in her fingers simply to lend some strength to the strand joint or splice. This manual operation was laborious and required highly skilled operators. A feature of the present invention is means according to which the drafted but untwisted fibers are engaged or snared at the nip of the delivery pair of drafting rolls for removal from the influence of the spinning frame waste disposal system and conveyance into proximity with the spindle for threading thereon while twisting the fibers into yarn and without disturbing the delicate structure of the strand, thereby obviating the need for highly skilled operators.

In general, the above result is accomplished in the present invention by an aspirator system including a vortex nozzle which is advanced until its suction orifice is in close proximity to the nip of the delivery pair of drafting rolls to attract the strand into the suction orifice.

The vortical flow of air within the nozzle imparts to the strand a twist to sufficiently enhance the tensile strength as will permit its manipulation while assuring its continued integrity. The nozzle is thereafter retracted from the drafting rolls preferably at a rate which is substantially the same as the rate of fiber strand delivery from the rolls, drawing the free end of yarn therewith to a position whereat it can be conveniently engaged by the traveller and threaded to a bare take-up bobbin or joined to the free end of yarn extending from a partially wound take-up bobbin. As the nozzle is retracted, it continuously imparts twist to the strand to produce yarn. By selection of an aspirator adapted to impart either S or Z twist to the fibers the twist imparted by the vortex nozzle can be in the direction in which the yarn is twisted in the normal operation of the machine. Hence, the length of yarn which is pieced-up to the supply from the drafting rolls is of acceptable quality for further processing along with the remainder of the yarn on the take-up bobbin.

Accordingly, it is an object of the invention to provide a novel device for attracting a strand of untwisted roving and manipulating it in a desired fashion without disturbing its integrity.

Another object of the invention is to provide an aspirator operable to withdrawn a fibrous strand from the nip of a pair of opposed rolls.

A further object of the invention is to provide a twisting device operable to withdraw a strand of fibers longitudinally therethrough, twisting the fibers as they advance.

Yet another object of the invention is the provision of a device having a source of pressurized fluid, a strand receiving passageway extending therethrough and first and second series of apertures, said first and second series of apertures connecting said source to said passageway.

Another object of the present invention is to provide an aspirator operable via a suction system for simutaneously twisting and withdrawing fibers issuing from the drafting system of a spinning machine.

Other and further objects and advantages flowing therefrom will be obvious or will appear hereinafter in the description and in the drawings wherein like numerals refer to like parts throughout.

In the drawings:

FIG. 1 is an elevational view of the invention;

FIG. 2 is a view taken along lines 2—2 of FIG. 1;

FIG. 3 is a perspective view illustrated in operation with the drafting system of a spinning frame, certain parts of the nozzle being broken away for clarity;

FIG. 4 is a section taken along lines 4—4 of FIG. 2, and

FIG. 5 is an elevational view of a modified form of the invention.

With particular reference to the drawings, the aspirator is generally indicated at **10** and is seen to include basically a housing **12**, a nozzle cap **14**, and an internal tubular element **16**. Housing **12** is threaded at one end as indicated by numeral **18** and cap **14** is internally threaded for tight mating engagement therewith. The opposite end of housing **12** is provided with a yarn exhaust opening **20**. The nose portion of cap **14** is flattened and flared outwardly as seen in FIG. 2 to provide an elongated strand receiving slot **24** extending substantially the width thereof. A short hole **25** (see FIG. 2) is also formed in the nozzle cap **14** and serves as a continuation of slot **24** extending through wall **26**.

The tubular element **16** is positioned within a chamber **27** formed in the housing **12** and is supported at one end upon an annular shoulder **28** defining a portion of said chamber which is reduced in diameter from that portion into which said element has been received. Element **16** is prevented from axial movement within

chamber 27 by reason of wall 26 of cap 14 such that with cap 14 snugly engaged with housing 12, element 16 is firmly seated on shoulder 28. The periphery of element 16 is reduced in diameter as at 30 to define an annular manifold 32 between said element and the inner wall of housing 12. A suitable fluid inlet duct 34 communicates with manifold 32 and is threadedly received through a port 36 in the sidewall of housing 12 and securely fastened thereto as by a nut 37. A longitudinal strand receiving chamber or bore 38 extending through element 16 is of substantially constant diameter at 40 but flared outwardly at 42 at the exhaust end of the nozzle 10.

Viewing FIGS. 1 and 4 a first set of apertures 44 pierced through element 16 serve to connect manifold 32 with the longitudinal bore 38 and intersect tangentially with the internal surface of bore 38, the axes of said apertures preferably being in a plane normal to the axis of said bore. Apertures 44 are desirably located proximate to fish tail slot 24. To the end that the invention may function both to twist the fibers F and then withdraw the fibers as an integral yarn strand Y the distance between apertures 44 and the outer terminus of slot 24 should be a distance somewhat less than the length of the individual fibers being twisted, see FIG. 3. Thus, the fibers F issuing from the drafting rolls are able to continually twist on each other in successive fashion so that the roving continues to elongate as an integral yarn strand Y and the individual fibers are not able to separate from each other.

A second set of apertures 48 which project inwardly and rearwardly through element 16 also serve to connect manifold 32 with the longitudinal bore 38. Apertures 48 intersect with bore 38 a considerable distance downstream from apertures 44, as best seen in FIG. 2. One or more of each of the apertures 44, 48 may be employed in each set thereof, the exact number of each of the apertures 44, 48 being a matter of design preference. However, it is desirable if two or more apertures are employed in a set, that they intersect with the internal surface of said bore at substantially equal angularly spaced intervals thereabout for their maximum efficiency.

In FIG. 3, nozzle 10 is seen operatively positioned in the nip of a delivery pair of drafting rolls 50 and 52 for receiving fibers issuing from the drafting rolls. It will be appreciated that the shape and size nozzle cap 14 are used to good advantage whereby the cap has been flattened to permit its closest possible positioning to the nip of the drafting rolls 50 and 52 in order to pick up the fibers as soon as they issue forth. Thus, the fibers are held in an integral bundle. Also, the width of the nozzle cap 14 assures that it will be in the path of the advancing strand without regard to the exact location of the strand as the strand traverses back and forth in a limited zone between the rolls in the known manner.

Inlet tube 34 leads to a source of fluid under pressure such as compressed air (not shown). As the fluid under pressure flows through apertures 44 from the manifold 32, a vortical fluid path causing a rotating or spinning condition is created within the bore proximate to fish-tail slot 24. Simultaneously, the fluid under pressure flowing through apertures 48 sets up a zone of negative pressure in the bore 38 upstream of their intersection with the internal surface thereof. Thus it will be apparent that the strand is attracted to and drawn through the nozzle 10 by reason of apertures 48. Immediately as the strand enters the nozzle and advances into the region influenced by apertures 44, it is twisted to form yarn. To achieve this result, it is desirable that apertures 44 be located as close to fish tail slot 24 to prevent any tendency of the strand to disintegrate as it advances beyond the drafting rolls 50 and 52 but before it reaches the influence of said apertures. In the twisted or yarn condition, the strand now possesses sufficient tensile strength to permit its reasonable manipulation in the course of further operations as it is discharged through exhaust opening 20.

While a preferred embodiment of the unique vortex nozzle has been disclosed herein, said nozzle lends itself to various other constructions which would be considered as being within the metes and bounds of the invention herein. Accordingly, the only limitations to the invention herein are to be found in the appended claims.

A brief summary of the operation of the embodiment shown in FIGS. 1–4 will next be presented. Assuming that fibers issuing from drafting rolls 50, 52 have, say, become separated from their usual wind-up cop or bobbin the aspirator of the present invention is presented to the nip between the drafting rolls. This presentation may be achieved manually or by suitable mechanism therefor. At the time the elongated slot 24 of nozzle cap 14 is aligned with the nip pressurized fluid such as compressed air is entering manifold 32 via tube 34. The compressed air flows through apertures 44 setting up vortical air currents within bore 38 and also flows through apertures 48 discharging air therethrough toward exhaust opening 20. The increased air velocity within bore 38, particularly emanating as the air is forced out through apertures 48, leads to a negative pressure therein forward of the apertures 48. As a result the fibers F are sucked into bore 38 through slot 24. Since the distance between the outer terminus of nozzle cap 14 and the operative zone for the air flowing through apertures 44 is less than the length of at least the majority of fibers flowing from drafting rolls 50, 52 the fibers F are continuously twisted, a portion of one fiber twisting on an adjacent portion of a successive fiber to thereby construct an elongated yarn strand Y. As the yarn Y is formed, i.e., the fibers F are twisted, in the operative zone of apertures 44, the yarn Y flows aft of bore 38 exiting through exhausting opening 20. As the aspirator 10 is moved away from the nip of drafting rolls 50, 52 with the fibers F engaged as just described, the twist generated by the vortex with bore 38 runs back to the nip, thereby continually imparting twist to the fibers F issuing from the drafting system to produce yarn Y. It will be apparent that the direction of twist imparted to the fibers F will be controlled by the positioning of apertures 44. Thus, to impart either S and Z twist to the yarn it is only necessary to insert an element 16 having apertures drilled on the proper tangent to cause the air forced therewith to rotate either clockwise or counterclockwise, as desired. Desirably, the movement of aspirator 10 away from drafting rolls 50, 52 is correlated to be equal to the rate at which the fibers F issue forth, simply to preclude breaking the yarn Y between the drafting system and aspirator, or on the other hand, to prevent developing undersirable length in the yarn Y as it emaates from the exhaust exit 20 while the aspirator is being moved toward the take-up cop or bobbin.

In FIG. 5 there is illustrated a modified embodiment of the invention. This modification utilizes a central suction source 60 which is connected to the exhaust opening 20 of aspirator 10 through a tube 62 and a suitable fitting 64 secured in the exhaust opening. It will be observed that in this embodiment the aspirator per se is substantially identical to that described earlier in connection with FIGS. 1–4 and in keeping therewith like reference numerals have been applied to identify like parts in both embodiments. It will be observed however that in the instant embodiment the rearwardly projecting apertures are absent. Similarly, the inlet tube 34′ of the embodiment of FIG. 5 is not connected to a positive pressure source but, rather, is simply an air intake means by which ambient air is drawn through the aspirator.

Thus, in operation with the embodiment of FIG. 5 the suction source 60 is operated to draw ambient air through inlet tube 34′, the air being pulled through manifold 32, apertures 44 and longitudinal bore 38. By virtue of the negative pressure within bore 38 the fibers issuing

from drafting rolls **50**, **52** are drawn through slot **24**, through bore **38**, and partially into tube **62**. Since the apertures **44** are positioned tangent to bore **38** in exactly the same manner as described for the embodiment of FIGS. 1–4, the air pulled through these apertures set up vortical currents operable to twist the fibers into yarn. As with the earlier embodiment the length of at least the majority of the fibers being twisted should exceed the distance between the nip of the drafting system and apertures **44**.

It will be appreciated that the aspirator of FIG. 5 may be moved away from a drafting system, desirably at a speed correlated with the rate of issuance of fibers from the drafting system, in the same manner as described with the earlier embodiment once the fibers are engaged therewith.

What is claimed is:

1. A device for twisting together a plurality of fibers advancing from a supply source to form a continuous yarn strand comprising, a chamber having openings through first and second ends thereof for the reception of said advancing fibers, operative means, guide means controlling said operative means for inducting the fibers into said chamber through said first end, and further means for presenting said operative means tangentially into said chamber to communicate with and thereby twist the fibers into yarn.

2. A device as set forth in claim **1** wherein said operative means includes a vacuum system connected into said chamber through said second end.

3. A device as set forth in claim **1** wherein said operative means includes a source of pressurized fluid, and said guide means includes aperture means extending into said chamber in a path inclined toward said second end to deliver siad pressurized fluid into said chamber directionally toward the second end of said chamber and thereby induce said fibers into said chamber.

4. A device as set forth in claim **1** wherein said operative means includes a source of pressurized fluid, and said further means includes orifice means disposed tangentially to the interior wall of said chamber for the admittance of said fluid into said chamber.

5. A device as set forth in claim **4** wherein said guide means includes aperture means extending into said chamber in a path inclined toward said second end to deliver said pressurized fluid into said chamber directionally toward the second and end thereof and thereby induce said fibers into said chamber.

6. A device as set forth in claim **5** wherein said aperture means extends into said chamber at a point closer to said second end than said orifice means.

7. A device as set forth in claim **5** including a housing surrounding said aperture means and said orifice means, said housing having a clearance portion adjacent said aperture means and orifice means to provide a manifold connected to both of said means, and a connector joined with said manifold for directing said pressurized fluid into said manifold for passage to the aperture means and orifice means.

8. A device as set forth in claim **5** wherein said aperture means and orifice means each include a plurality of ports intersecting with said chamber at equally spaced intervals therearound.

9. A device as set forth in claim **5** including a nozzle positioned at the first end of said chamber, said nozzle having an elongated slot at the forward end thereof communicating with said chamber.

10. A device as set forth in claim **9** wherein the spacing bewteen the forward end of said slot and said aperture means is less than the length of at least the majority of the fibers being twisted.

References Cited

UNITED STATES PATENTS

3,079,745	3/1963	Breen et al.	57—77.3 XR
3,094,374	6/1963	Smith.	
3,204,396	9/1965	Foster et al.	57—77.3 XR
3,206,922	9/1965	Nagahara et al.	57—77.3
3,303,639	2/1967	Carter et al.	57—77.3
3,340,684	9/1967	Shichman	57—77.3 XR

JOHN PETRAKES, *Primary Examiner.*

U.S. Cl. X.R.

28—1; 57—36, 77.3, 77.33