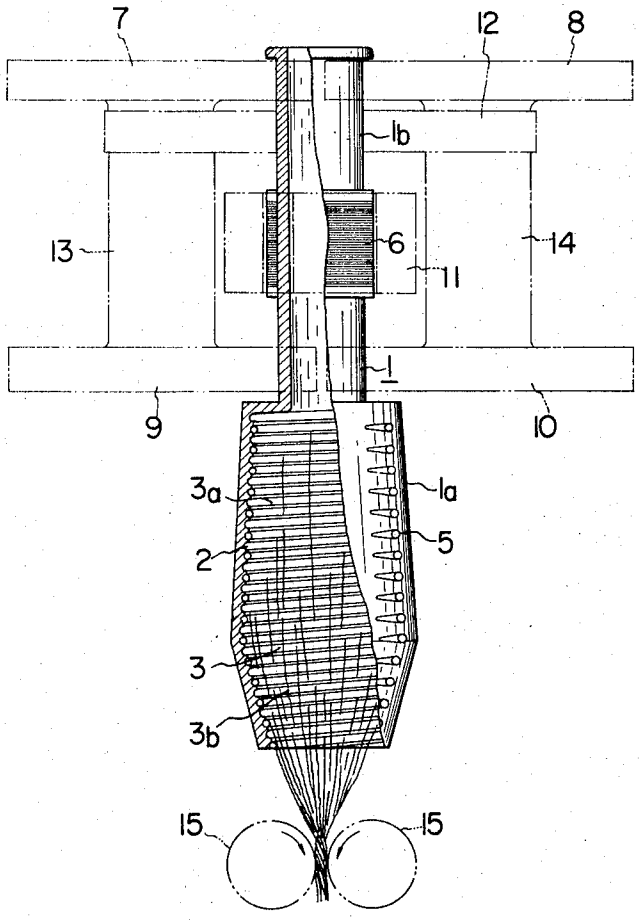
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ROTATING SPINNING TUBE

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FIG. 1

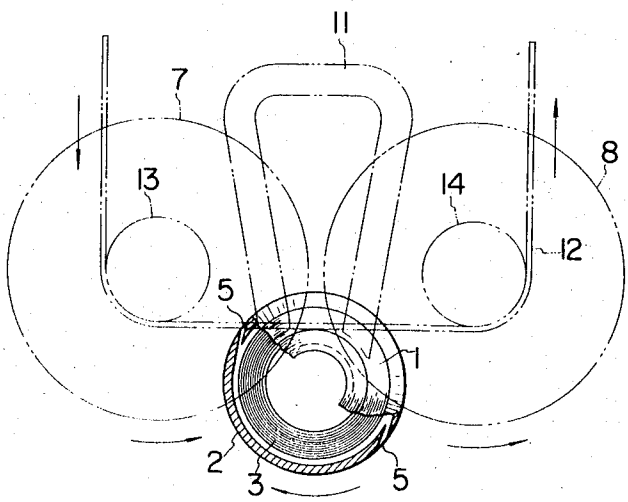


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FIG. 2



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3,368,339

ROTATING SPINNING TUBE

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1 Claim. (Cl. 57—58.89)

ABSTRACT OF THE DISCLOSURE

A rotating spinning tube in which a fiber holding and conveying barrel part is provided with a screw-thread inner wall surface defined by a helical groove and a plurality of air inducting holes through the wall thereof part for introducing air outside of the barrel part to the groove. The wall surface is a double frustrum constituted by two co-axial frustrums joined base-to-base and respectively providing an upper part with a diameter increasing in the direction toward the fiber outlet end of the spinning tube and a lower part with a diameter decreasing in said direction.

This invention relates to rotating spinning tubes and more particularly to a new rotating spinning tube which operates to cause individual fibers drawn from a strand such as a web, sliver, or a rove to spread out along the inner surface of the tube and to revolve as they are circumventedly held, and which, moreover, has a conveying action whereby said fibers are caused to move progressively toward the exit end of the tube as they so revolve.

The art of drawing out individual fibers from a strand of fibers such as a web produced by a carding engine, a sliver produced by a drawing frame, or a rove produced by a flyer frame or an intermediate drawing frame, feeding these fibers into a spinning tube undergoing rotation, and drawing out these fibers collectively through one end of the spinning tube by suitable means has been known. It has been known further that so-called ringless spinning is possible in this operation. In view of this possibility, various inventions relating to spinning apparatuses for ringless spinning have been made in recent years.

These known inventions, however, have not been successful in providing completely satisfactory and practical mechanisms or have had shortcomings such as the coarseness of yarn spun thereby. As a result, none of these inventions have been reduced to useful practice as far as I am aware.

Of these shortcomings, particularly the coarse quality of the spun yarn is considered at present to be an extremely serious disadvantage of spinning apparatuses of the instant type. This disadvantage is thought to be due to the operational action of the spinning tube constituting the principal element of the apparatus, said action merely being that of collectively receiving the fibers and causing them to revolve and lacking a fiber conveying action corresponding to that of a drafting apron, which conveying action is indispensably important in spinning.

More specifically, known spinning tubes lack the conveying action, whereby the individual fibers are caused to move at respectively required speeds progressively toward one end of the spinning tube. For this reason, some of the fibers during spinning remain in a stagnant state within the spinning tube, thereby causing not only unevenness or irregularity of the yarn as an inevitable consequence but also a disarray of the parallelism of the fibers of the yarn, whereby it becomes difficult to spin yarn of the required quality.

In view of the above-mentioned difficulties, it is an object of the present invention to provide a spinning tube capable of causing fibers to spread out along the inner surface of the spinning tube and to revolve as they are

thus circumventedly held and, at the same time, of imparting a conveying action to the fibers whereby they are caused to move progressively toward one end of the tube. By providing a spinning tube of this character, the invention contemplates the reduction of the aforementioned ringless spinning technique to useful practice.

Another object of the present invention is, in providing a spinning tube with the above stated operational action, to utilize principally the centrifugal force and air force produced as a natural result of the rotation of the spinning tube and, by simplifying as much as possible the construction of the tube, to eliminate difficulties in practice.

According to the present invention, briefly stated, there is provided a rotating spinning tube characterized by a fiber holding and conveying barrel part having a screw-thread inner wall surface formed by a helical groove and by a plurality of air inducting holes through the wall of the barrel part for introducing air outside of the barrel part to the helical groove.

According to the present invention there is further provided a rotating spinning tube of the above stated character wherein the screw-thread inner wall surface is in the form of a double frustum consisting of two coaxial frustums joined base-to-base and respectively constituting an upper part with a diameter increasing in the direction toward the fiber outlet end of the spinning tube and a lower part with a diameter decreasing in said direction.

The nature, principle, and details of the invention will be more clearly apparent from the following detailed description with respect to a preferred embodiment of the invention, when read in conjunction with the accompanying drawing in which like parts are designated by like reference numerals, and in which:

FIGURE 1 is a side elevational view, with parts cut away, showing the embodiment of the rotating spinning tube according to the invention; and

FIGURE 2 is a top plan view, with parts cut away, of the spinning tube shown in FIGURE 1.

Referring to the drawing, the spinning tube **1** shown therein has a fiber holding and conveying barrel part **1***a* and a narrow part **1***b* which are coaxially and communicatively joined. A feature of the barrel part **1***a* is that it is provided in its interior with a screw-thread wall surface **3** formed by a groove **2** describing a helical path along the inner surface of the barrel part **1***a*. Another feature of the barrel part **1***a* is that the groove **2** is provided at appropriate intervals with a plurality of air inducting openings **5** having air inducting surfaces for introducing outside air which are in almost tangential directions with respect to the cylindrical inside surface of the barrel part **1***a*.

This spinning tube **1** is rotated at a specific speed by suitable means as for example, means comprising two sets up upper and lower coaxial pairs of mutually neighbouring rotating disks (**7**, **8**) and (**9**, **10**) between which the spinning tube **1** is rotatably contacted so as to be rotated as shown in the direction of the arrow, rotatable shafts **13** and **14** supporting rigidly respectively the disks (**7**, **9**) and (**8**, **10**), an endless tape **12** trained over said shafts **13** and **14** and driven by any conventional driving means not shown in the direction indicated by the arrow, laminated steel ring **6** provided on the spinning tube narrow part **1***b*, and a magnet **11** adapted to attract the rings **6** whereby the narrow part **1***b* is pressed against the rotating disks **7**, **8**, **9** and **10**, thus causing rotation of the spinning tube **1** due to contact friction between the narrow part **1***b* and the outer periphery of the disks.

The spinning tube of the above described construction according to the invention operates in the following manner. When fibers are introduced continuously from above into the spinning tube **1**, they are caused to revolve in the rotating air surrounded by the screw-thread wall surface **3** and, at the same time, are caused by centrifugal

force to spread toward the wall surface 3. At the wall surface 3, the fibers are pressed thereagainst in a manner to traverse over the helical thread of the groove 2.

At the same time, a part of the outside air surrounding the spinning tube 1 is scooped by the air inducting holes 5 and is introduced through the air inducting holes into the groove 2. As a result, the air existing within the groove 2 of the wall surface 3 and following the wall surface in rotation therewith is hindered by air so introduced from the outside, and its rotation is suppressed or braked to some extent, whereby the rotation of the air within the groove 2 is retarded relative to the rotation of the wall surface 3.

Consequently, the revolution of the fibers pressed against the wall surface 3 and having a tendency to revolve together with the wall surface is braked by the resistance of the introduced air, whereby the fibers revolve at a somewhat slower speed than the spinning tube 1. For this reason, the fibers, sliding over the screw-thread wall surface, are caused by the inclination of the groove 2 to move downwardly, whereby the desired conveying action is produced.

More specifically, the revolution of the fibers and the rate of movement or rate of conveyance in the downward direction, which are related to factors such as the pitch of the groove 2 forming the screw-thread wall surface 3 with respect to the rotational speed of the spinning tube 1 and the quantity of air introduced into the spinning tube which depends on the number of air inducting holes 5, should be substantially constant.

For example, the rotational speed N in revolutions per minute of the spinning tube 1 and the revolving speed n in revolutions per minute of the fibers revolving at a slower speed than the spinning tube have the following relationship

$$n=kN$$

where k is the resistance coefficient of the introduced air. The rate of downward movement S per minute of the fibers within the spinning tube can be represented by the following relationship

$$S=P(N-n)$$

where P is the pitch of the helical groove 2.

Accordingly, the fibers which are conveyed downwardly at the speed S per minute through the interior of the spinning tube 1 progressively reach the lower end of the spinning tube, and the leading part of the fiber group appears outside of the spinning tube through its bottom opening. Simultaneously, the forward free end of the fiber group is grasped and drawn out by a conventional means, for example, confronting rollers (15, 15) at a speed equal to the rate of movement S, whereupon the leading part of the fiber group between the point where it is grasped and the lower end of the spinning tube is twisted, whereby a yarn of a degree of twist $T=n/S$ is spun out. This operation is successively repeated with respect to trailing parts of the fiber group following the spun out yarn, the resulting spun yarn being taken up by means (not shown), whereby the spinning is continuously carried out.

When the spinning speed is set at a value which is a multiple D of the rate of movement S of the conveying fibers within the spinning tube, a rubbing slip occurs at the wall surface 3 between the fiber part under drawing-out and the conveying fibers in the spinning tube, whereby a draft corresponding to the multiple D is obtained at this point.

As is apparent from the foregoing description, the present invention provides a rotating spinning tube wherein centrifugal force and air force produced naturally by the rotation of the spinning tube 1 are utilized to reduce some extent the revolving speed n of the fibers within the tube relative to the rotational speed N of the spinning tube, and, at the same time, there is produced a conveying action at a rate of movement S, which conveying action is equivalently similar to the action of aprons in the case of known draft devices and contributes a pronounced effect in spinning yarn of high quality.

While the screw-thread wall surface 3 of the barrel part 1*a* of the spinning tube may be made to have any appropriate shape, the wall surface 3 in the illustrated example has a relatively long upper part 3*a* which diverges slightly, that is, increases in diameter, in the downward direction and a relatively short lower part 3*b* coaxially joined with the upper part 3*a* and converging in the downward direction. A double frustum is thereby formed by two frustum (upper part 3*a* and lower part 3*b*) joined coaxially base-to-base.

The inner wall surface of the above described form of a double frustum has the following advantageous operational features. As soon as the air and fibers to be forced by centrifugal force against the screw-thread wall surface 3*a* are so forced thereagainst, they are caused by a resulting force component to acquire a natural tendency to move in the direction of expanding diameter of the wall surface. This tendency is utilized in the upper part 3*a* to assist the conveying action of the screw-thread wall surface 3 with respect to the fibers whereby the downward travel of the fibers is facilitated.

In the lower part 3*b* adjoining the upper part 3*a*, the converging shape of the wall surface 3 functions to reduce as much as possible the revolving radius of the fibers drawn out through the lower end of the spinning tube 1, thereby reducing the resistance of the air outside of the spinning tube with respect to the fibers and preventing disarray of the fibers within the spinning tube and lowering of the quality of the spun yarn.

That is, the fibers within the spinning tube are respectively conveyed in the upper part 3*a* of the screw-thread wall surface as their circumventing radius is progressively expanded and, successively reaching the region of maximum diameter at the boundary between the upper part 3*a* and the lower part 3*b*, are caused to travel through a bend. Then, in the lower part 3*b*, the fibers are drawn out as they are caused to converge. As the leading part of the fibers is thus being drawn out, the trailing part thereof is subjected to a relatively strong centrifugal force at the above mentioned region of maximum diameter whereby the fibers are forced suitably against the screw-thread wall surface 3 and are spun as they are drawn out in an orderly manner.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention as set forth in the appended claim.

What I claim is:

1. A rotating spinning tube comprising a fiber holding and conveying barrel part having a screw-thread inner wall surface formed by a helical groove and a plurality of air inducting holes through the wall of said barrel part for introducing air outside of said barrel part to said helical groove, said screw-thread inner wall surface being in the form of a double frustum consisting of two co-axial frustums joined base-to-base and respectively constituting an upper part with a diameter increasing in the direction toward the fiber outlet end of the spinning tube and a lower part with a diameter decreasing in said direction.

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JOHN PETRAKES, *Primary Examiner.*