

[54] APPARATUS FOR RINGLESS SPINNING OF FIBRE

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[22] Filed: **Jan. 14, 1974**

[21] Appl. No.: **432,827**

[52] U.S. Cl. **57/58.89**

[51] Int. Cl. **D01h 1/12**

[58] Field of Search **57/58.89, 58.95**

[56] **References Cited**

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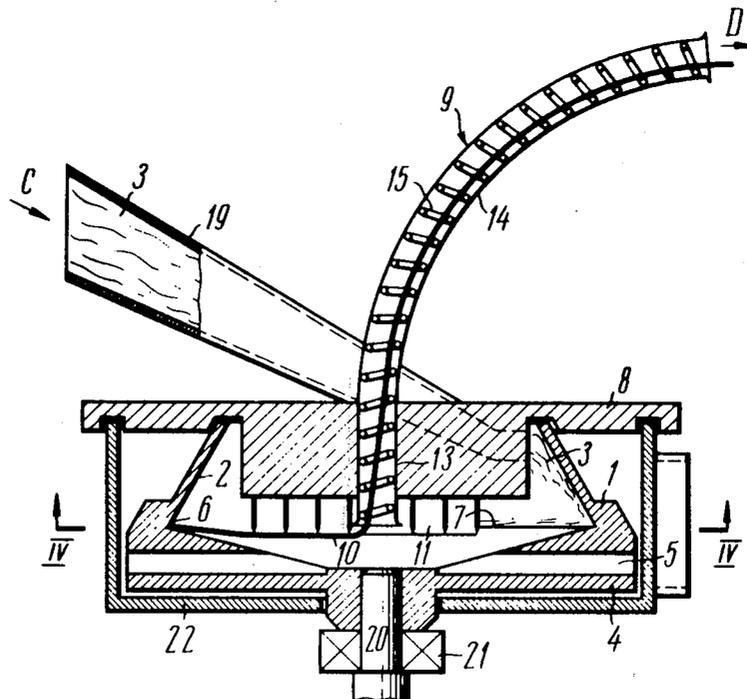
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Attorney, Agent, or Firm—Fleit & Jacobson

[57] **ABSTRACT**

The apparatus includes a driven spinning bowl with an internal frustoconical inclined surface, the bowl having a base with air vents creating suction within the bowl at rotation of this bowl, whereby separate fibres are drawn along the pipe in the lid of the bowl onto the inclined surface of the bowl and into the trough thereof, where these fibres are collected and a sliver is formed therefrom at rotation of the bowl, which sliver is delivered as a ready yarn through a tube having a portion gradually curving in the direction of delivery of this yarn, this portion being provided with projection to impart a twist to the yarn along the straight portion of this tube, of which the value is greater than the desired value of the twist of the yarn, this greater twist being transmitted to the sliver by means of plates having free ends, the plates being secured on the lid and projecting into the bowl to engage the yarn. The disclosed apparatus enables the portion of the yarn between the trough and the delivery tube to acquire a twist which is greater than the desired twist, which reduces the rate of breakage of the yarn inside the bowl at this portion of the yarn.

5 Claims, 4 Drawing Figures



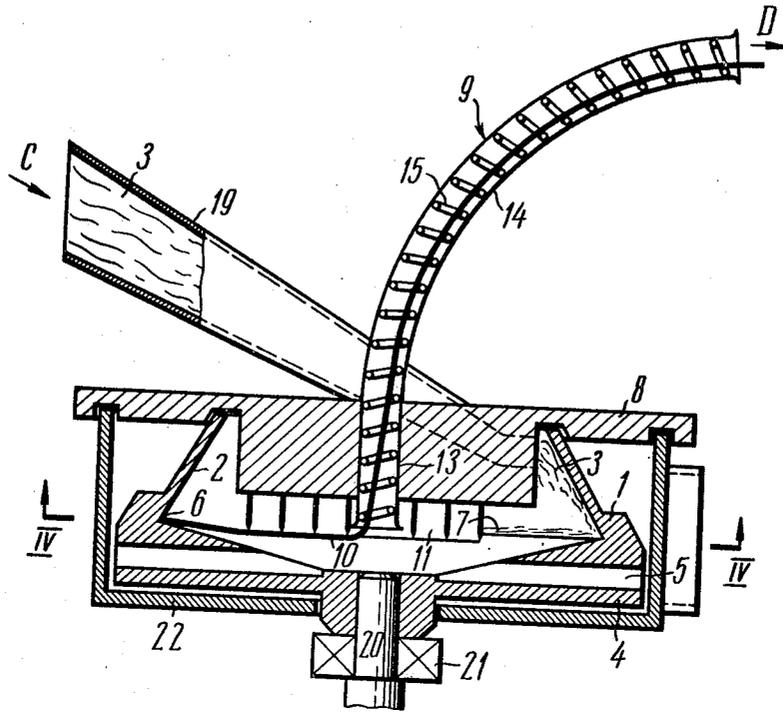


FIG. 1

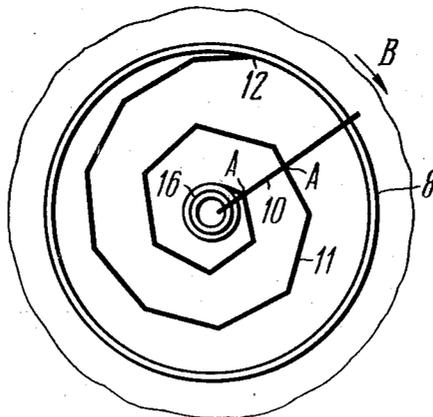


FIG. 2

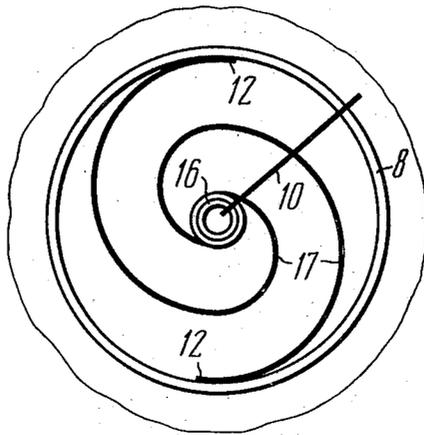


FIG. 3

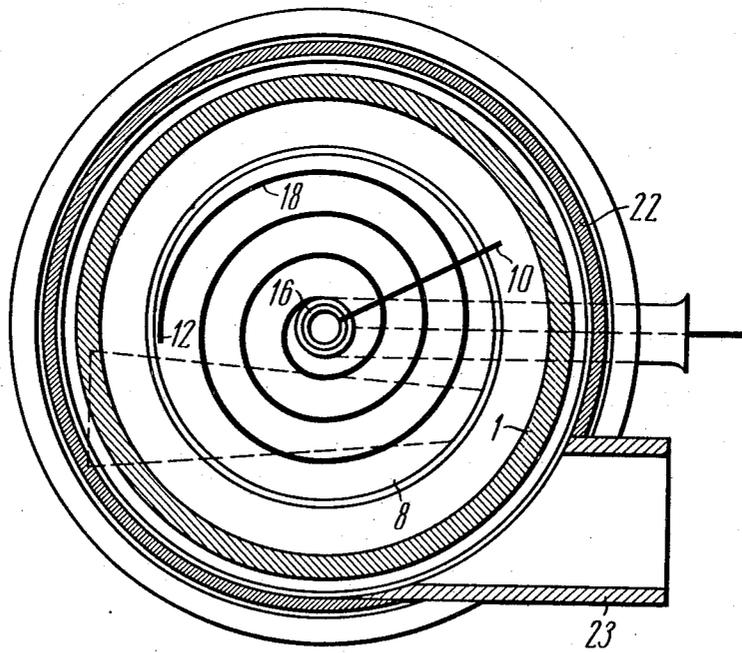


FIG. 4

APPARATUS FOR RINGLESS SPINNING OF FIBRE

The present invention relates to apparatus for pneumatic spinning of yarn, and more particularly, to ringless apparatus for spinning fibre.

The invention may be utilized with utmost effectiveness in obtaining medium and low count yarn from staple chemical fibre, flax fibre, as well as from blends of the above fibre with woollen fibre and with one another.

There is known an apparatus for ringless spinning of fibre, disclosed in French Pat. No. 1,544,444, Int. C1. D 01 h 1/00, comprising a driven spinning bowl with an inclined internal surface of a frustoconical shape and a lid having a suction passage for conveying separated fibres, a delivery passage for delivery of the yarn and a plurality of plates, i.e. intake deflectors, under which there are provided inclined openings, these plates and openings being adapted to create an air cushion under the fibres advancing in the suction passage.

This cushion is necessary to ensure that the fibres moving toward the inclined internal surface of the bowl are not arrested by engaging the wall of the suction passage, which engagement may be caused by a centrifugal force resulting from the fibres gradually varying the direction of their progress.

Both the plates and the openings are inclined in a direction opposite to that of rotation of the bowl and coinciding with the direction of the flow of air through the suction passage, and, consequently, with that of the motion of the yarn, to raise the effectiveness of the air cushion. The provision of the air cushion improves the conditions of conveying the fibres via the suction passage, and, consequently, improves the quality of the yarn produced. However, the known apparatus incorporates no means for reducing the breakage rate of the yarn, which reduction may be attained by increasing the value of the twist of the yarn above the desired twist over the area between the inclined surface of the bowl and the delivery passage, accomplished by engagement of the plates with the yarn. In the known apparatus this cannot be effected, since the plates are inclined in opposition to the direction of the progress of the yarn and are arranged exclusively the suction passage, which results in an increased rate of breakage of the yarn.

There is further known an apparatus for ringless spinning of fibres, disclosed in USSR Inventor's Certificate No. 213,645, C1. 76 c, 24/01, comprising a driven spinning bowl with an internal inclined surface of a frustoconical shape, the bowl being associated with a lid and having a base with air vents, adapted to create suction within the bowl, to draw separate fibres a pipe mounted in the lid along the inclined surface of the bowl into an annular trough adapted to accumulate therein the fibres and to form from these fibres a thin sliver at rotation of the bowl, this sliver being delivered from the bowl through a funnel-shaped tube.

The end face of this funnel, facing the interior of the bowl, is provided with an annular shoulder having cut therein a helical thread matching at a specified angle with a screw thread cut in the internal surface of the funnel, the thread defining a plurality of ribs adapted to engage the yarn. The height of the threads of the helical thread diminishes in the direction of delivery of the yarn, while the height of the screw threads increases in the same direction. In this device twisting is accomplished over the portions of the yarn, extending

axially of the bowl, wherefrom this twisting propagates, owing to the elasticity of the yarn. This propagation of the twist is opposed by the so-called "twist thresholds" in front of which the twist accumulates in the yarn.

The elasticity of the yarn having attained a certain value, the twist in the yarn overcomes the twist threshold and propagates further along the yarn. In the present disclosure the expression a twist threshold is meant to indicate a local point of resistance to the propagation of a twist along the yarn.

As a result of the action upon the yarn of several such twist thresholds the yarn acquires different values of the twist before a twist threshold and after it, which might lead to breakage of the yarn at the portion with a smaller twist. In the foregoing known apparatus such twist thresholds are the point of transition of the yarn from the screw thread upon the helical thread and the annular shoulder, posited intermediate of the twist initiation area and the trough. The first threshold, i.e. the point of transition from one thread to the other, may be overcome by selecting an appropriate structure of the apparatus, whereas the presence of the other threshold, i.e. of the annular shoulder, leads to the yarn having in the portion thereof between the trough and the shoulder a smaller value of the twist than the desired twist, which may lead to the yarn breaking at this portion. This tendency may be counteracted by giving the yarn a twist in excess of the desired value. However, an excessive twist in the yarn rules out its use in the production of a broad range of fabrics (e.g. in production of knitted fabrics and garments, where yarn with an excessive twist cannot be employed). The desired value of the twist is meant here to describe the twist corresponding to that acquired by yarn produced by ring spinning frames. The twist value is the number of twists in the yarn per one linear metre of the yarn of the corresponding count, fibre composition and a range of fabrics that can be produced from this yarn.

It is an object of the present invention to provide an apparatus for ringless of fibre, which would reduce the rate of yarn breakage.

It is an important object of the present invention to provide an apparatus for ringless spinning of fibre, which would ensure production of yarn with a desired twist.

It is a further object of the present invention to provide an apparatus for ringless spinning of fibre, which would be of a simple structure.

These and other objects are attained in an apparatus for ringless spinning of fibre, including a driven spinning bowl having an inclined internal surface of a frustoconical shape, the bowl being associated with a lid and having a base with air vents adapted to create suction within this bowl, to draw separate fibres from a pipe mounted in the lid along the inclined internal surface into the annular trough of the bowl, this trough being adapted to accumulate fibres therein and to form a thin sliver of these fibres at rotation of the bowl, the sliver being delivered as spun yarn through a tube mounted in said lid and having internally directed projections for engagement with the yarn, in which apparatus, in accordance with the present invention, this tube has a portion which is gradually curved in the direction of the delivery of the yarn, this portion having said projections positioned thereon, to effect twisting of the yarn along the straight portion of said tube to a degree that is greater than the desired degree of twisting of this

yarn, this greater twist being transmitted to the sliver in the trough of the bowl by means of plates mounted on the lid, the plates having the free ends thereof directed into the bowl, the plates engaging the yarn.

An apparatus with this structure reduces the rate of breakage of the yarn and produces yarn with a desired twist, including the twist permissible for production of knitted fabrics, owing to the yarn being imparted a twist over the portion thereof between the trough and the free end of the plate, which is in excess of the desired value, with subsequent reduction of this twist to the desired value at the point of exit of the yarn from the tube. This is attained by the projections on the curved portion of the tube forming the first twist threshold. The positioning of the first twist threshold above the point of twist formation in the straight portion of the yarn opposes propagation of the twist in the direction of delivery of the yarn, whereby it becomes possible to impart to the yarn in the area of its formation a twist that is greater than the desired value. The second twist threshold formed by the end face of the tube is easily overcome by this excessive twist, since the plates engage the yarn at the points of contact, moving to the periphery of the bowl, which forwards the twist toward the trough, creating the greatest value of the twist adjacent to this bowl, whereby the twist is effectively transmitted to the sliver laying in the trough.

According to a preferred embodiment of the present invention, it is advisable that said projections should be presented by a cylindrical coiled spring having the ends thereof secured to the end faces of the tube. This feature simplifies manufacture of the tube and offers ready replacement of the spring, as the latter is worn out by the friction of the yarn against the limited number of the points of this spring.

To provide for positive forwarding of the twist to the sliver, owing to permanent engagement of the plates with the yarn, it is advisable that the plates should be arranged on the lid so that the ribs thereof intersect the plane of the trough.

To make for optimum conditions for forwarding the twist to the sliver, it is advisable that the plates should be arranged on the lid so that the point of engagement of each plate with the yarn move from the axis of rotation of the yarn toward the periphery thereof in the direction of rotation of the yarn.

The above conditions may be provided for by the plates being of a spiral shape.

The present invention will be better understood from a detailed description of an embodiment thereof with reference to the accompanying drawings, wherein:

FIG. 1 is a cross-sectional side view of the herein disclosed apparatus for ringless spinning of fibre;

FIG. 2 is a view from below of the lid with the plates;

FIG. 3 is a view from below of a different embodiment of the lid with the plates;

FIG. 4 is a sectional view along line IV—IV in FIG. 1.

Referring now to the appended drawings, the apparatus for ringless spinning of fibre comprises a driven spinning bowl (FIG. 1) having an internal inclined surface 2 of a frustoconical shape for accumulation thereon of separate fibres 3 being supplied, the base 4 of the bowl 1 having made therethrough air vents 5 adapted to create suction within this bowl. The bowl 1 includes a trough 6 for accumulation in this trough of the fibres 3 sliding down the inclined surface 2 of the

bowl, which fibres are formed into a thin sliver 7 by rotation of the bowl. The latter is associated with a lid 8 having mounted thereon a tube 9 for delivery of spun yarn 10.

Spiral-shaped plates 11 have one end thereof secured to the lid 8, while the opposite end 12 (FIG. 2) of each plate is free.

The plates 11 (FIG. 1) are positioned so that their ribs intersect the plane defined by the trough 6 and are held in permanent engagement with the yarn 10 formed from the sliver 7 in the trough 6 and delivered from the bowl 1 via the tube 9 including a straight portion 13 and a smoothly curved portion 14. The portion 14 includes projections 15 imparting a twist to the yarn 10 over the straight portion 13, this twist being in excess of the desired twist of the final yarn. This twist is transmitted by means of the plates 11 to the sliver 7. The projections 15 are arranged with a pitch ensuring that the yarn is so supported by these projections that it would not contact the walls of the tube 9.

The direction of the projections should correspond to the direction of the twisting of the yarn. The projections 15 may be formed by an extended cylindrical coiled spring 16 with a corresponding direction of the coils, tightly fitting into the tube 9. In this case the opposite ends of the spring 16 are secured to the respective end faces of the tube 9.

The plates 11 (FIG. 2) are positioned so that the point "A" of contact of each one of the plates with the yarn 10 moves away from the axis of rotation of the bowl 1 toward the periphery of the bowl in the direction of delivery of the yarn, which corresponds to the direction of rotation of the bowl indicated in the drawing with the arrow B. The plates 11 may alternatively be in the form of a pair of spirals 17, as is shown in FIG. 3, or even in the form of a single spiral, as is shown in FIG. 4.

The lid 8 (FIG. 1) has mounted thereon a pipe 19 through which separate fibres 3 are conveyed in a stream of air into the bowl 1 under the action of suction created in this bowl, onto the inclined surface 2 of the bowl. Separation of the fibres 3 and delivery of the final yarn 10 are effected in any suitable known manner.

The spinning bowl is mounted on a spindle 20 designed for rotation in bearings 21 and receiving rotation from any suitable known drive mechanism not shown in the drawings.

The spinning bowl 1 is enclosed within a casing 22 provided with an exhaust connection 23 sealingly connected in any known suitable manner with a manifold through which air coming into the bowl 1 is withdrawn therefrom. The direction of supply of the fibres into the bowl is indicated in the drawings with the reference arrow C, while the direction of delivery of the yarn is indicated with the arrow D.

The apparatus operates as follows.

The spindle 20 is rotated by the drive mechanism (not shown) jointly with the bowl 1. The air vents 5 create suction within the bowl 1, which results in a stream of air being drawn into the bowl 1 via the pipe 19, the stream carrying separate fibres 3 therealong and placing them onto the inclined surface 2. Upon having engaged this inclined surface 2, the fibres 3 vary the direction of their advance and are pressed in a straightened form to this surface by the centrifugal force. The action of the same centrifugal force makes the fibres 3 slide down the inclined surface 2 of the frustoconical

shape, and, while so sliding from a smaller diameter of the bowl toward a greater one, they are straightened even further and accumulate in the trough 6, in the form of a thin sliver 7.

Simultaneously with the commencing of feeding of the separate fibres 3, an end of the already spun yarn 10 is introduced into the tube 9. The action of suction within the bowl 9 creates a stream of air via the tube 9, directed into the bowl 1. This stream flows along said end of the already spun yarn 10, into the internal space of the bowl 1, where this end is taken by the rotating stream of air, and the rotating end of the yarn 10 engages the sliver 7 in the trough 6. This rotating end of the yarn winds the sliver 7 thereabout, in which way the spinning operation commences. Then the spun yarn 10 is withdrawn from the bowl continuously by any suitable known mechanism (not shown) in the direction indicated with the arrow D.

The portion of the yarn 10 between the trough 6 and the tube 9, which is rotating at an angular speed approximating the angular speed of rotation of the bowl 1, imparts a twist to the portion of the yarn in the straight portion 13 of the tube 9. The curving portion 14 of the tube 9 includes the projections 15 which the yarn 10 engages, owing to the tension thereof caused by the action of the centrifugal force created at the rotating portion of the yarn 10 between the trough 6 and the tube 9.

At each point of engagement of the tensioned yarn 10 with the projection 15 there is created a twist threshold opposing propagation of the twist in the direction of delivery of the yarn. The direction of inclination of the projections 15 coincides with the direction of twisting of the yarn 10, whereby the yarn engaging the projections and sliding therealong is acted upon by forces of friction of which the corresponding components create a torque tending to impart to the yarn a "false" twist in a direction opposite to that of the true twist, which fact makes the action of the twist thresholds still more pronounced.

It is now evident that although the yarn has the desired twist at the outlet of the tube 9, in the direction from this outlet toward the straight portion 13 the yarn has the value of the twist which increases in front of each twist threshold presented by a successive projection 15, which value is in excess of the desired twist. Therefore, by having the twist which is greater than the desired value along the straight portion 13, the yarn easily overcomes the twist threshold in the form of the end face of the tube 9, projecting into the tube 1.

The rotating portion of the yarn 10 between the tube 9 and the trough 6 is pressed by the tension of the yarn to the ribs of the plates 11, these plates intersecting the plane of the trough 6, as it has been already described. As the yarn 10 is being delivered in the direction of the arrow D, with simultaneous rotation of the abovesaid portion along the arrow B, the points A of engagement of the yarn with the plates 11 move from the tube 9 toward the periphery of the bowl, i.e. toward the trough 6, which promotes a motion of the twist toward this

trough, whereby the value of the twist adjacent to this trough is greater than the desired value. It should also be noted that this displacement of the twist by the plates 11 helps to overcome the twist threshold presented by the end face of the tube 9, projecting into the bowl, since the twist has its smallest value adjacent to this tube 9. The propagation of the twist over the area from the tube 9 to the trough 6 is also promoted, although to a smaller degree, by the rolling of the yarn 10 over the ribs of the plates 11.

Therefore, the yarn 10 has a degree of the twist over the portion from the outlet of the tube 9 to the trough 6, which is greater than the desired twist, this value being at its maximum adjacent to the trough, which yields effective transmission of the twist to the sliver 7 and results in an increased strength of the abovementioned portion of the yarn.

What is claimed is:

1. An apparatus for ringless spinning of fibre, comprising: a spinning bowl mounted for rotation; means for imparting rotation to said bowl; an internal inclined surface of said bowl of a frustoconical shape; a lid associated with said bowl and including a pipe adapted for passage of separate fibres therethrough; the base of said bowl having air vents made therein for creating suction within said bowl at rotation thereof, to draw said separate fibres from said pipe onto said inclined surface; an annular trough defined within said bowl, adapted to collect therein said separate fibres coming thereinto along said inclined surface and to form said fibres into a sliver at rotation of said bowl; a tube mounted in said lid and adapted to have final yarn, formed from said sliver, delivered therealong; a straight portion of said tube; a portion of said tube, gradually curving in the direction of the delivery of the yarn; projections provided in said curving portion and adapted to impart a twist to the yarn over said straight portion of said tube, of which the value is greater than the desired twist of the yarn, said twist being transmitted to said sliver; plates having each one end thereof mounted on said lid and having the opposite, free end thereof projecting into said bowl being adapted to engage the yarn, whereby a twist which is greater than the desired twist of the yarn is transmitted to said sliver being formed in said trough.

2. An apparatus as claimed in claim 1, wherein said projections in said tube are formed by a cylindrical coiled spring having the ends thereof secured to the opposite end faces of said tube.

3. An apparatus as claimed in claim 1, wherein said plates are arranged on said lid so that the ends thereof intersect the plane of said trough.

4. An apparatus as claimed in claim 1 wherein said plates are arranged on said lid so that the point of contact of the yarn with each said plate moves from the axis of rotation of said bowl toward the periphery thereof in the direction of rotation of said bowl.

5. An apparatus as claimed in claim 4, wherein said plates are shaped as spirals.

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