May 12, 1970 J. STARY 3,511,044

METHOD OF AND APPARATUS FOR RINGLESS SPINNING OF FIBERS

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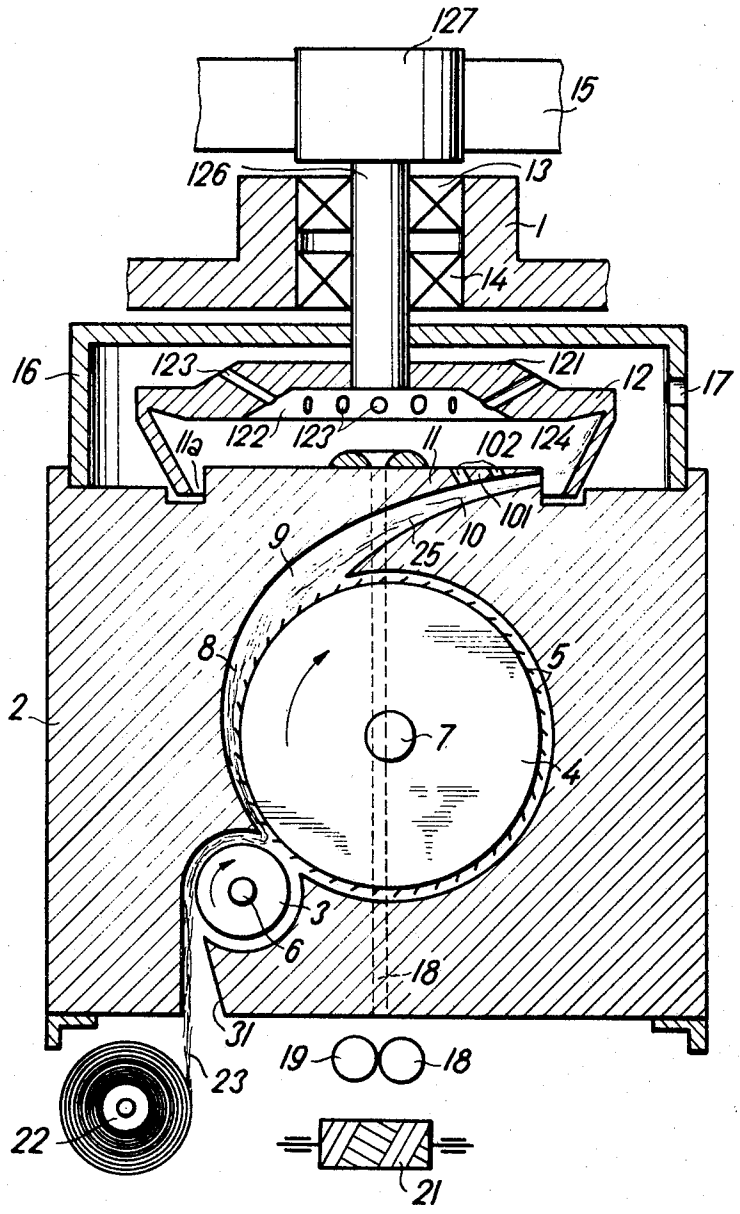

Fig. 1.

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METHOD OF AND APPARATUS FOR RINGLESS SPINNING OF FIBERS

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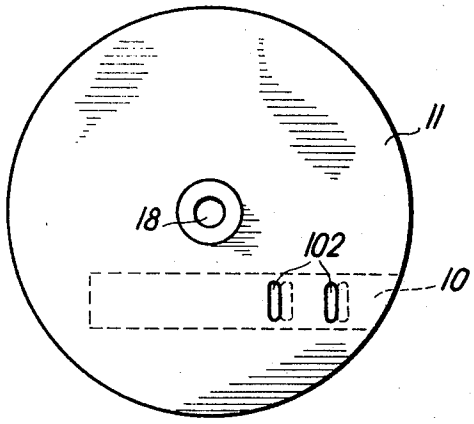

Fig. 2.

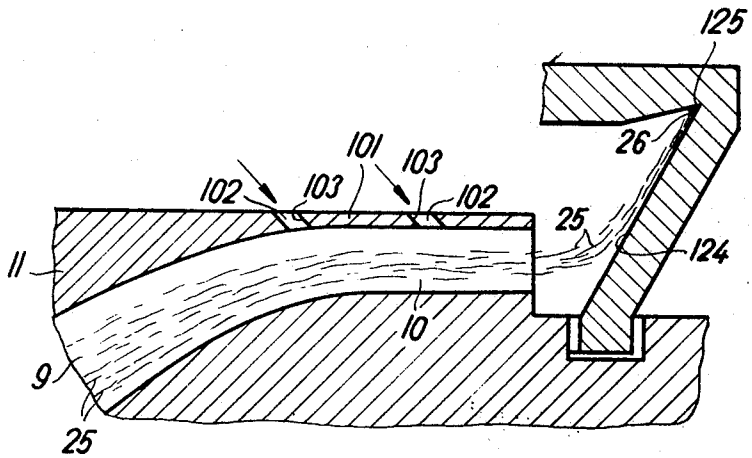

Fig. 3.

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METHOD OF AND APPARATUS FOR RINGLESS SPINNING OF FIBERS

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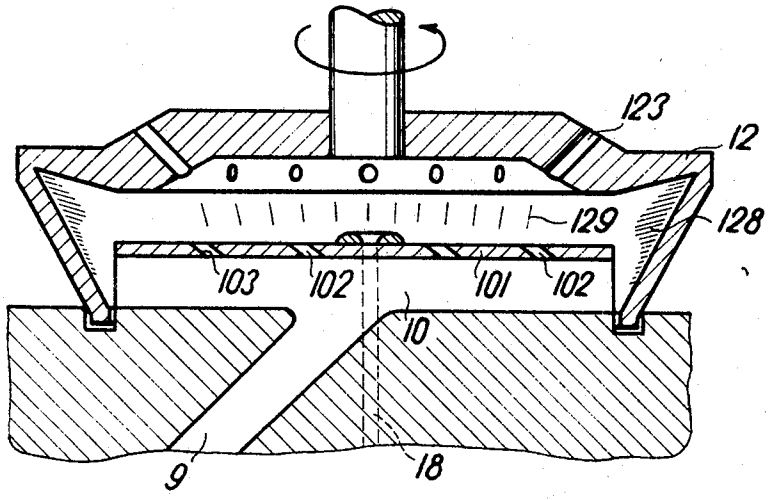

Fig. 4.

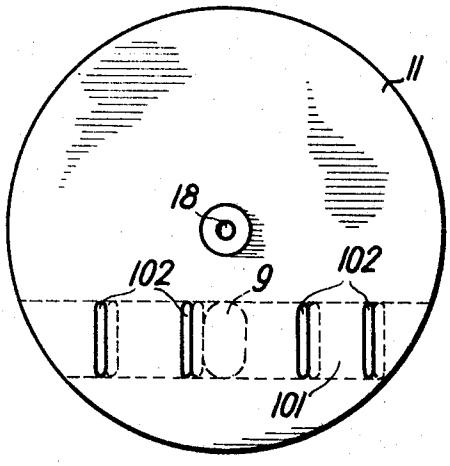

Fig. 5.

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METHOD OF AND APPARATUS FOR RINGLESS SPINNING OF FIBERS

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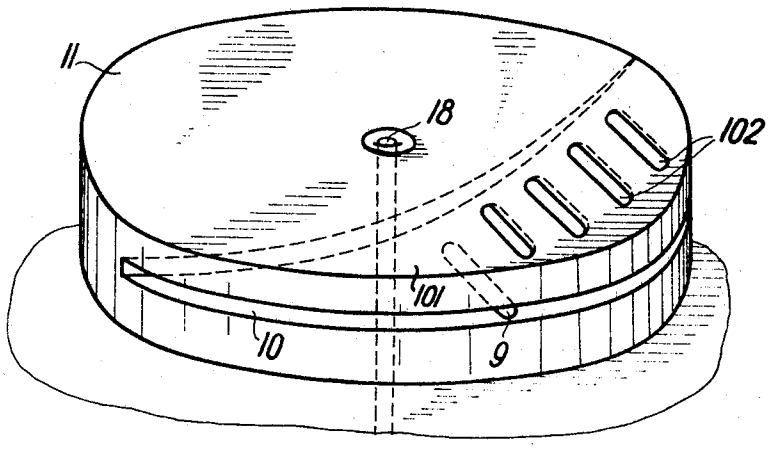

Fig. 6.

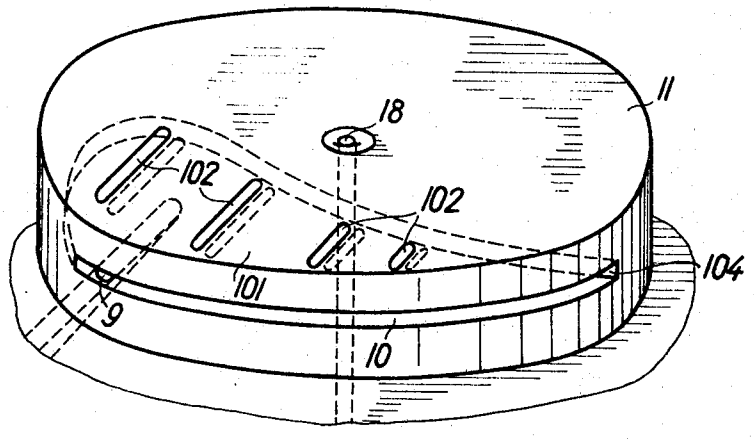

Fig. 7.

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METHOD OF AND APPARATUS FOR RINGLESS SPINNING OF FIBERS

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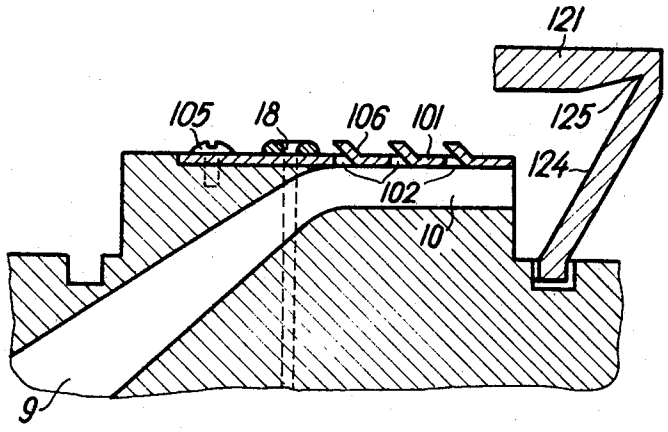

Fig. 8.

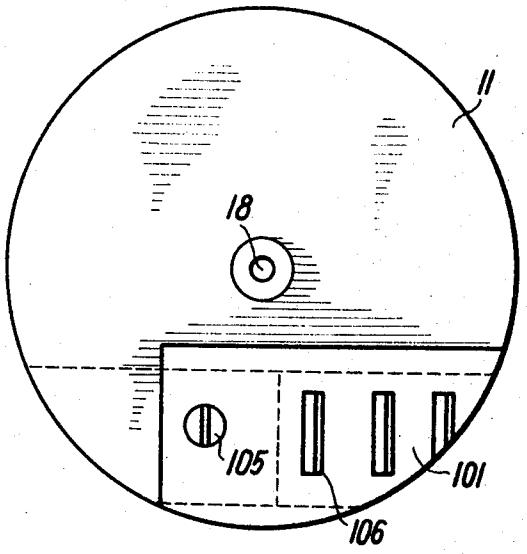

Fig. 9.

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METHOD OF AND APPARATUS FOR RINGLESS SPINNING OF FIBERS

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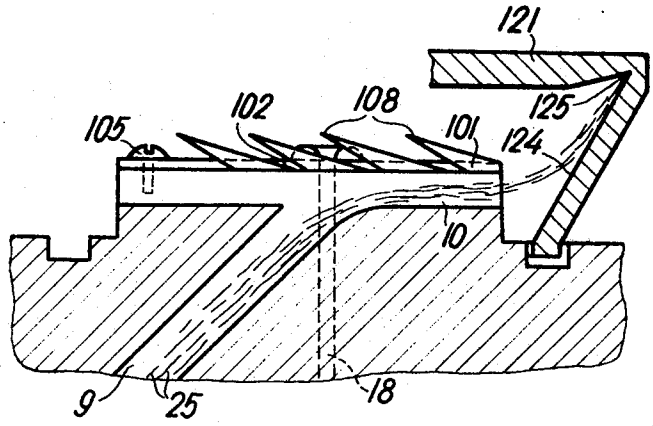

Fig. 10.

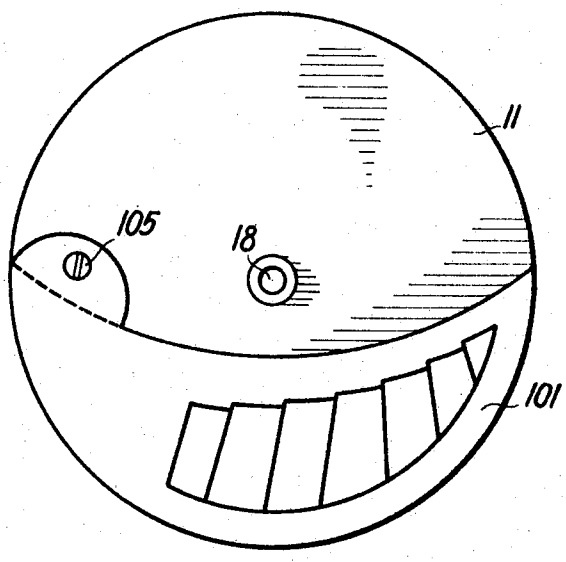

Fig. 11.

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United States Patent Office 3,511,044
Patented May 12, 1970

3,511,044

METHOD OF AND APPARATUS FOR RINGLESS SPINNING OF FIBERS

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Filed Jan. 16, 1969, Ser. No. 791,749
Claims priority, application Czechoslovakia, Jan. 19, 1968, 426/68
Int. Cl. D01h 1/12, 7/00
U.S. Cl. 57—58.91 12 Claims

ABSTRACT OF THE DISCLOSURE

A rotary spinning chamber has an internal circumferential spinning surface and an open axial side. A stationary cover extends into the open side closing the same and is provided with a passage bounded by a wall portion separating it from the interior of the chamber and having an outlet end directed at and adjacent to the spinning surface. Feed means feeds a stream of fibers into the passage for advancement therethrough and issue from the outlet for centrifugal deposition on the spinning surface. The wall portion is provided with one or more apertures through which air from the interior of the spinning chamber may enter the passage inwardly of the outlet end thereof to thereby establish an air cushion between the wall portion and the stream of fibers advancing towards the outlet end.

BACKGROUND OF THE INVENTION

The present invention relates to the continuous spinning of fibers, and more particularly to the continuous ringless spinning of fibers in a rotating spinning chamber. Still more particularly the invention relates to a method and apparatus for effecting such continuous ringless spinning.

It is known to spin separated fibers in a rotary spinning chamber by advancing a stream of such fibers into the interior of the spinning chamber where they are deposited by centrifugal action on the interior circumferential spinning surface from which they are then withdrawn in form of a yarn. In apparatus of this type known from the prior art it is general practice to lead the fibers from the separating mechanism where a sliver of fibers is separated into a stream of individual fibers, into the rotary spinning chamber through a conveying passage which extends roughly tangentially with reference to a combing-out roller of the combing-out mechanism and which discharges into the interior of the rotary spinning chamber in such a manner that the fibers are directed in the shortest possible path onto the circumferential side wall which merges into the so-called collecting surface. The fibers are conveyed in a gaseous carrier medium, such as air, into the interior of the rotary spinning chamber where they first impact upon a conically tapering circumferential internal wall constituting a part of the spinning surface and radially outwardly inclined or tapered towards the plane of largest internal cross section of the spinning chamber where the actual conversion of the fibers into a yarn takes place. The fibers slide over this wall from their point of original contact or impact until they reach the plane of largest internal cross section where they become deposited in form of a ribbon-like structure which latter is continuously twisted into yarn which, in turn, is continuously withdrawn from the rotary spinning chamber.

The problem with this type of construction is that movement over the fibers through the conveying passage into the interior of the spinning chamber and prior to their issuance from the passage takes place in frictional engagement with the wall surfaces bounding the conveying passage. This, in turn, results in breaking of the fibers and

a change in their straight extended condition. Evidently, this has a detrimental effect and the ribbon which forms on the spinning surface in the plane of largest internal cross section of the spinning chamber exhibits inferior parallelism of the fibers. Consequently, the yarn produced from such ribbon is possessed of the same disadvantage and is of inferior quality.

In accordance with another known embodiment a cover is provided closing the open axial side of a cylindrical rotating spinning chamber and extending partly into the interior of this spinning chamber. In this prior-art construction the conveying channel discharges into an annular groove provided in this cover and from there are distributed directly onto the spinning surface of the rotary spinning chamber. The spinning surface is provided with needles and with air-escape openings and the fibers deposited thereof are twisted and delivered in the form of a yarn—against the action of the aforementioned needles—through a coaxial outlet channel from the rotating spinning chamber. In this construction a disadvantage in addition to the one outlined earlier is the fact that fibers frequently are caught on the lowest portion of the annular distribution groove, occasioning the formation of fiber clusters which, when they are suddenly released by breaking free, give rise to breakages in the yarn.

SUMMARY OF THE INVENTION

It is a general object of the present invention to overcome these disadvantages.

A more particular object of the invention is to provide a method of and an apparatus for ringless spinning of fibers into a yarn wherein the aforementioned disadvantages are avoided with the result that the yarn produced is of higher quality than heretofore possible.

In accordance with my novel method the fibers advancing in a stream through the fiber conveying passage are prevented from contact with the wall bounding the passage by the formation of an air cushion which is formed intermediate the stream of fibers and the aforementioned wall inwardly of the outlet of the fiber conveying passage.

My novel apparatus comprises a rotary spinning chamber having an internal circumferential spinning surface and an open axial side. Such spinning chambers are already known from the art. A stationary cover extends into the open side closing the same and is provided with a passage having an inlet and an outlet end directed at and adjacent to the spinning surface. The passage is bounded by a wall portion which separates it from the interior of the chamber. Feed means communicates with the inlet for feeding a stream of fibers into the same so that these fibers advance through the passage and issue from the outlet for centrifugal deposition on the spinning surface. Further I provide means for effecting the establishment and maintenance of a cushion of air between the aforementioned wall portion and the stream of fibers advancing in the passage, and this air cushion is established and maintained in the outlet region of the passage inwardly adjacent the outlet of the passage.

Advantageously the outlet portion of the fiber-conveying channel, which is directed towards the spinning surface onto which the fibers are to impact, extends in a plane normal to the rotational axis of the chamber.

Because the air cushion is formed by providing the wall portion bounding the outlet zone of the fiber-conveying passage and facing the interior of the spinning chamber, with one or more aperture sthrough which turbulent air from the interior of the spinning chamber enters into the outlet zone of the fiber-conveying passage, it is advantageous that the one or more apertures in this wall portion be inclined in direction oppositely the direction of rotation of the spinning chamber. Moreover, the edge portions bounding these apertures and located at that

side of the wall portion which faces the interior of the chamber, are advantageously slightly raised above the general plane of that particular side of the wall portion and inclined oppositely the direction of the spinning chamber so as to in effect peel off the boundary layer sweeping along this side and directed into the one or more apertures.

In accordanue with a further concept of my invention which is advantageous from the point of view of easy production and maintenance, the wall portion in question may be a separate member which is rigidly but removably secured to the remainder of the cover.

The outlet zone or portion of the fiber-conveying channel, that is the zone in which the air cushion is established and maintained, and which extends transversely of the rotational axis of the spinning chamber, is elongated as has already been indicated and in accordance with one embodiment will discharge at two points, that is it will have two outlet or discharge openings.

A particularly advantageous guidance of fibers onto the inner circumferential spinning surface of the spinning chamber is obtained if the elongated outlet portion of the fiber-conveying channel is of drop-shaped form with the tapering end of this configuration facing the direction of rotation of the spinning chamber and with the actual outlet of the outlet zone discharging at a portion of arc over the circumference of the stationary cover. According to a further advantageous embodiment the outlet zone may be shaped as a sector of arc and discharge in the similar manner as just outlined.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a vertical section through an arrangement embodying my invention;

FIG. 2 is a plan view of a detail of FIG. 1;

FIG. 3 is a fragmentary sectional detail view, on an enlarged scale, of a portion of FIG. 1;

FIG. 4 is a fragmentary vertical section through a further embodiment of the invention;

FIG. 5 is a view similar to FIG. 2 but of a corresponding portion of FIG. 4;

FIG. 6 is a perspective view of another embodiment of the outlet portion of the fiber-conveying channel;

FIG. 7 is a view similar to FIG. 6 but of yet a further embodiment of the outlet portion of the fiber-conveying channel;

FIG. 8 is a vertical section through the outlet portion of the fiber-conveying channel illustrating yet another embodiment of the invention;

FIG. 9 is an axial view of FIG. 8;

FIG. 10 is a vertical section through a modification of the embodiment illustrated in FIG. 8; and

FIG. 11 is an axial view of the embodiment shown in FIG. 10.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing firstly the embodiment illustrated in FIGS. 1–3 it will be seen that reference numeral **1** generally identifies a body portion or supporting portion **1** of a machine, such as a frame or the like. Mounting on the portion **1** is a member **2** constituting the housing of a fiber-separating mechanism and it is provided with an upper cylindrical portion **11** projecting upwardly. In a cavity provided in the member **2** there is mounted for rotation about an axis **6** a feed roller **3**, and contiguously thereto in another cavity mounted for rotation about an

axis **7** is located a combing-out roller **4** provided with a plurality of needles or projections **5** extending tangentially to the surface of the roller **4**. The construction of the roller **4** and of the feed roller **3** is well known in the art and requires no further description. Drives for the shafts constituting the axes **6** and **7** are not illustrated; they may be conventional and derived from the main drive of the machine.

The cavity **8** in which the combing-out roller **4** is located merges into a fiber-conveying channel **9** as shown in FIG. 1, and this extends roughly tangentially with respect to the roller **4**. It tapers in cross section in the direction away from the roller **4** and merges—by changing its direction—into an outlet portion **10** provided in the upper cylindrical portion **11** which constitutes a stationary closure or cover for the open side of a rotary spinning chamber **12** of known construction. The portion **11** is surrounded by a circular groove **11***a* into which the lower free edge portion of the rotary spinning chamber **12** extends without, however, contacting the portion **11** or the member **2** in any way.

As pointed out before, the spinning chamber **12** is already well known as to its construction. It suffices to point out that it comprises a transverse wall **121** in which there is formed a recess **122** and that air-escape openings **123** are provided in the wall of the spinning chamber communicating with the recess **122** so that, in response to rotation of the spinning chamber **12**, air will escape through the openings **123** and an underpressure will be created in the interior of the chamber. A side wall **124**, which may also be thought of as a "slide" wall because fibers slide over it subsequent to impacting thereupon, tapers conically in downward direction or, conversely, diverges radially outwardly and upwardly until it merges into the so-called collecting surface **125** in the plane of the greatest inner circumference of the chamber **12**. The entire interior circumferential surface of the wall **124**, including the collecting surface **125**, may be thought of as the spinning surface.

The spinning chamber **12** is fixed in known manner on a shaft **126** which is supported for free rotation in bearings **13** and **14** and which terminates in a belt pulley **127**. The bearings **13** and **14** are mounted again on the machine body or support **1** and a drive belt **15**, shown only partially, engages the belt pulley **127** and is driven by a non-illustrated drive so as to impart rotation of the shaft **126** and thereby to the spinning chamber **12**. A cover **16** surounds the spinning chamber and is mounted on the member **2**, being provided on an aperture **17** which serves as an air outlet.

A withdrawal channel **18** extends through the member **2** and the cylindrical portion **11** in the rotational axis of the spinning chamber **12**, axially spaced from the inner axial end of the roller **4**, that is the end which is not visible in FIG. 1. Driven withdrawing rollers **19** and **20** are located below the lower end of the channel **18** and serve to withdraw yarn from the interior of the spinning chamber and to forward it to a take-up **21**, illustrated only diagrammatically. An inlet **31** is provided in the member **2** communicating with the cavity in which the feed roller **3** is mounted for rotation, and a supply bobbin **22** of sliver **23** is mounted proximal to the inlet **31** for free rotation.

The free space within the spinning chamber **12** may roughly be divided for purposes of better understanding of the invention into an annular deposition zone (compare FIG. 4) which is illustrated by the shaded area **128** and is located in close proximity to the wall **124**, and a twist-and-withdrawal zone **129** located in the central area of the free space of the spinning chamber **12** and identified by the other shaded area in FIG. 4.

As evident from FIG. 3, the arrangement of the outlet portion **10** of the fiber-conveying channel **9** is such that the wall portion **101** bounding the outlet portion at the side facing the interior of the chamber **12** is interposed

between the twist-and-withdrawing zone **129** in this interior and the stream of separated fibers **25** being conveyed through the outlet portion **10**. By provision of at least aperture **102**—a plurality of such apertures being shown in all illustrated embodiments—in the wall **101** the outlet portion or outlet zone **10** of the channel **9** communicates with the interior of the chamber **129**, and more particularly with the twist-and-withdrawing zone **129**. The purpose is to permit entry of air from the interior of the chamber **12** through this one or more apertures **102** into the outlet portion **10** to form a cushion between the wall **101** and the advancing stream of fibers **25**.

Advantageously, the outlet portion **10** of the channel **9** extends in a plane normal to the axis of rotation of the chamber **12** and the surfaces **103** bounding the apertures **102** are inclined oppositely to the direction of rotation of spinning chamber **12** to assure that air is "scooped" or swept into these apertures **102**.

Operation of my novel device wil be evident from what has been described heretofore. The feed roller **3** withdraws sliver **23** from the supply bobbin **22** and feeds it to the combing-out needles **5** of the rapidly rotating combing-out roller **4**. The sliver is thus separated into a stream of fibers **25** which, under the action of the rotating roller and the simultaneous influence of underpressure generated in the spinning chamber **12** by provision of the air-escape openings **23**, advances into and through the fiber-conveying channel **9**. Because the channel tapers in cross section in downstream direction, the carrier medium with the fibers **25**—in this case air—is accelerated and thus serves to straighten the fibers that are being advanced towards the outlet portions **10**.

The transition of the separated fibers **25**, accompanied by the change of direction of their flow as they enter from the main portion of the channel **9** into the outlet portion **10**, imparts to the fibers a tendency to displace themselves and come into contact with the wall **101** with the disadvantages mentioned in the introduction portion of this specification. This is effectively prevented by the air cushion **107**—represented by the shaded area **107** in FIG. 3—formed and maintained by the air stream entering from the interior of the spinning chamber **12** through the openings **102** into the outlet portion **10** of the channel **9**. The air cushion **107** prevents the separated fibers from contacting the wall **101** and thus from being slowed in their advance, from becoming deformed in the sense of becoming tangled or having their straight configuration changed to a different configuration, and from impairing their parallelism in the finished yarn. Thus, the separated fibers **25** glide upon the air cushion **107** and, after leaving the outlet portion **10** of the channel **9** they reach the deposition zone **128** and contact the wall **124** of the rotating spinning chamber **12**. Under the action of the centrifugal force resulting from this rotation they slide on the wall **124** onto the collecting surface **125** where they become deposited in the form a ribbon-like structure **26** as shown in FIG. 3.

When the device is started up, a length of yarn is conveyed from the downstream end of the channel **18** through the channel into the interior of the spinning chamber and under the influence of the centrifugal force becomes deposited with its end against the ribbon **26** formed on the collecting surface **125**. Thereafter, the inserted yarn is withdrawn through the channel **18** under the action of the rollers **19** and **20** and wound onto the take-up **21**. This causes the ribbon **26** to be removed from the collecting surface **125** and to be continuously withdrawn through the channel **18**, and this ribbon is being continuously replenished by deposition of fibers **25** on the surface **125**. The rotation of the spinning chamber **12** effects twisting of the ribbon **26** particularly in the area between the inlet of the channel **18** and the collecting surface **125** which is represented in FIG. 4 by the shaded area designated as the twist-and-withdrawal zone **129**.

By locating the discharge opening of the outlet portion **10** in close proximity with the wall **124** the fibers are prevented from escaping into the twist-and-withdrawing zone **129**; as a consequence they are kept from being partly spun-in into the yarn which is being withdrawn and this is advantageous because they would impair the quality of the yarn. Whirling of air in the space of the spinning chamber and the pneumatic conditions in the channel **9** and the outlet portion **10** are so chosen as to induce streaming of air through the holes **102** into the outlet portion **10** and formation of the air cushion **107**, thereby preventing the separated fibers **125** from contacting the wall **101** or even from passing through the holes **102** into the twist-and-withdrawal zone **129**.

In the embodiments of FIGS. 4 and 5, the outlet portion **10** of the channel **9** extends transversely across the entire potrion **11** so that it has, as viewed in axial direction, an elongated shape and discharges at two discharge openings located at spaced parts of the cylindrical portion **11**. This is clearly illustrated in the drawing.

In the embodiment of FIG. 6 the outlet portion **10** has the form of a sector of an arc and its outlet opening is such as to discharge over a portion of the circumferential edge face of the cylindrical portion **11**. The openings **102** are provided only in that portion of the wall **101** under which the separated fibers **25** pass to the outlet opening.

The embodiment of FIG. 7 is quite similar to that of FIG. 6 except here the outlet portion **10** has a drop-shaped form with the entry of the separated fibers **25** from channel **9** into the outlet portion **10** being located approximately at the point of greatest enlargement of the drop and with the cross section of the drop tapering in the direction of rotation of the spinning chamber **12**. The discharge opening is again configurated in the manner as shown in FIG. 6. The drop-shaped form of the outlet portion **10** corresponds roughly to the shape of flow of the separated fibers which they would assume if the vertical side wall **104** bounding the portion **10** were not a factor limiting this shape.

In the embodiments of FIGS. 8 and 9, the wall **101** is a separate discrete member, which may for instance be made of sheet metal or the like, and which is attached rigidly but removably to the cylindrical portion **11** by a screw **105** or an analogous means. Here the apertures **102** are provided by forming slots in the wall **101** and upwardly deflecting edge portions bounding these slots, that is deflecting them into the interior of the chamber **12** to thereby peel the boundary layer of air sweeping over the upper surface of the wall **101** and guided into the slots **106**.

The embodiment of FIGS. 10 and 11, finally, shows the wall **101** again to be in form of a discrete member which, as in FIGS. 8 and 9, may be an approximately arcuate segment and which is attached by screw **105** to the portion **11**. In FIGS. 10 and 11 the upper edges **108** bounding the apertures **102** are configurated as cutting edges to provide still further peeling of the boundary layer. This is advantageous if particular and a particularly strong air cushion is desired in the interior of the portion **10**.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and dscribed as embodied in an arrangement for ringless spinning of fibers into yarn, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

I claim:

1. Apparatus for ringless spinning of fibers into yarn, comprising a rotary spinning chamber having an internal

circumferential spinning surface and an open axial side; a stationary cover extending into said open side closing the same and being provided with a passage having an inlet and an outlet end directed at and adjacent to said spinning surface, said passage being bounded by a wall portion separating it from the interior of said chamber; feed means communicating with said inlet for feeding a stream of fibers into the same so that such fibers advance through said passage and issue from said outlet for centrifugal deposition on said spinning surface; and means for effecting establishment and maintenance of a cushion of air between said wall portion and the stream of fibers in said passage in the outlet wall region of said passage inwardly adjacent said outlet of said passage.

2. Apparatus as defined in claim **1**, said means comprising at least one aperture provided in said wall portion in said region so as to permit entry of agitated air from the interior of said chamber into said passage.

3. Apparatus as defined in claim **2**, said spinning chamber rotating in a predetermined direction, and said aperture being inclined oppositely said predetermined direction so as to facilitate entry of air from the interior of said spinning chamber through said aperture into said outlet zone of said passage.

4. Apparatus as defined in claim **3**, wall portion is provided with at least one slot constituting said aperture, and wherein an edge portion bounding said slot is deformed into said spinning chamber and inclined opposite said predetermined direction of rotation.

5. Apparatus as defined in claim **3**, wherein said aperture is bounded at the side of said wall portion facing the interior of said chamber by a sharp edge inclined in direction opposite the rotation of said spinning chamber.

6. Apparatus as defined in claim **2**, said means further comprising at least one additional aperture similar to said one aperture.

7. Apparatus as defined in claim **1**, said spinning chamber having an axis of rotation, and said outlet zone of said passage extending in a plane substantially normal to said axis of rotation.

8. Apparatus as defined in claim **1**, said wall portion being constituted by a discrete member; and further comprising connecting means fixedly but removably connecting said discrete member with the remainder of said stationary cover.

9. Apparatus as defined in claim **1**, said outlet zone being elongated in direction transversely of the axis of rotation of said spinning chamber and having opposite ends each provided with an outlet opening discharging onto said spinning surface.

10. Apparatus as defined in claim **1**, at least the part of said cover which extends into said spinning chamber being cylindrical, and said outlet zone being of substantially drop-shaped configuration elongated in direction transversely of the axis of rotation of said spinning chamber and tapering in direction of rotation thereof; and wherein said outlet is provided in a circumferential edge face of said part of said cover extending over a portion of arc.

11. Apparatus as defined in claim **1**, at least the part of said cover which extends into said spinning chamber being cylindrical and provided with a circumferential edge face, said outlet zone being configurated in direction transversely of the axis of said spinning chamber in form of a portion of arc; and wherein said outlet is provided in said circumferential edge face and extends over a portion of arc in said edge face.

12. A method of ringless spinning of fibers into yarn in a rotary underpressure spinning chamber having an internal circumferential spinning surface and an open side closed by a stationary cover, comprising the steps of advancing a confined stream of fibers through a passage in said cover in direction towards said spinning surface; effecting formation of a cushion of air within the end portion of said passage inwardly of the outlet thereof and intermediate said stream of fibers and at least one wall bounding said passage; collecting the fibers issuing from said passage under the influence of centrifugal force on said spinning surface under concomitant conversion of the thus collected fibers into a yarn; and withdrawing said yarn from said rotary spinning chamber.

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JOHN PETRAKES, Primary Examiner

U.S. Cl. X.R.

57—58.95, 156