June 3, 1969 J. C. COLLINS 3,447,298

TURBINE SPINNING APPARATUS

Filed Jan. 31, 1967 Sheet 1 of 2

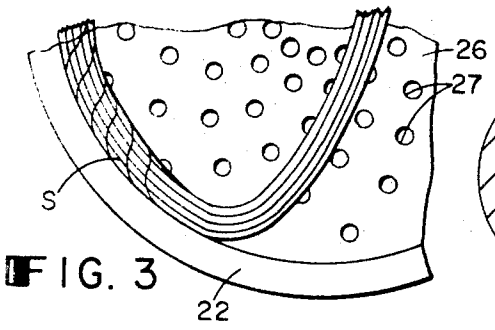

FIG. 3

FIG. 1

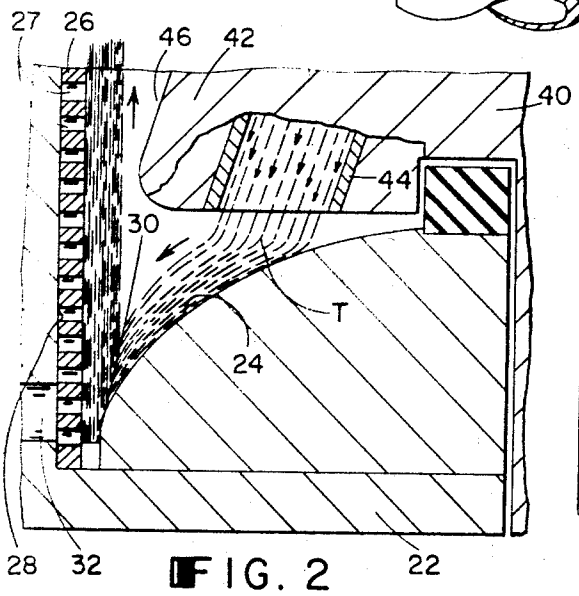

FIG. 2

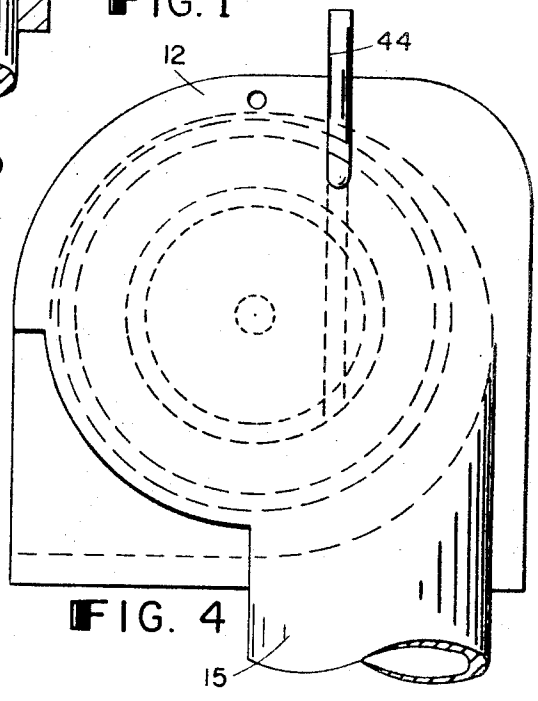

FIG. 4

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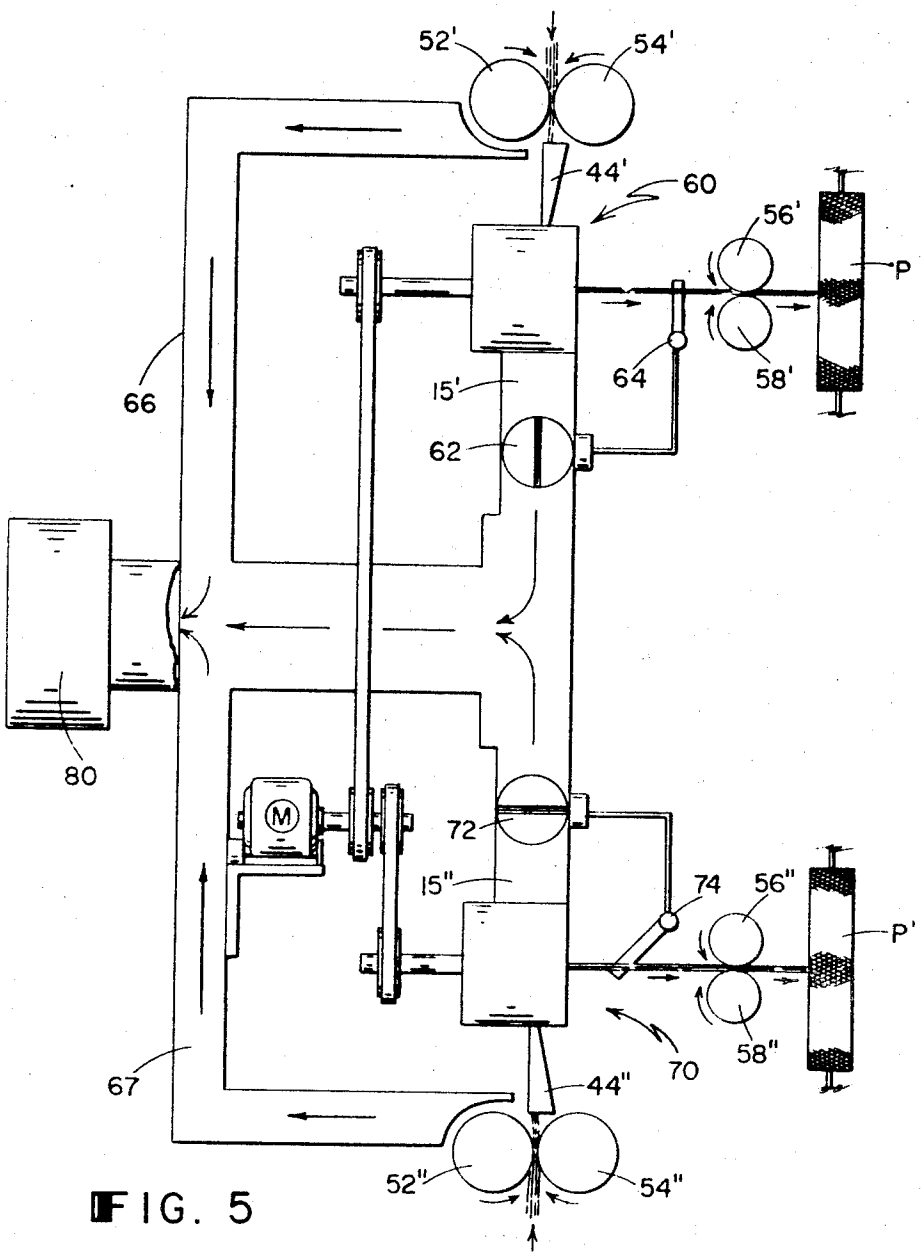

FIG. 5

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TURBINE SPINNING APPARATUS

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U.S. Cl. 57—58.89 9 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to textile machinery utilizing a plurality of spinning units each having a rotor providing a centrifugal spinning cavity having a peripheral wall free from apertures defining a smooth trumpet-shaped, fiber drafting surface and a transverse end wall having air exit apertures. The end and peripheral walls are joined at the larger diameter end of the peripheral wall providing a V-shaped fiber accreting groove. The fiber feeding means introduces fibers into the spinning cavity at a point spaced from the fiber drafting surface and axially spaced from the fiber accreting groove by at least about one-half of fiber length. A yarn exit passageway is positioned coaxially with respect to the rotor.

The control means of the disclosure consists of an enclosure for each of the rotors in communication with the air exit apertures therein, air suction means communicating with each of the air enclosures and a valve for each of the enclosures effective to cut off air flow upon absence of a yarn in order to prevent continuation of fiber feeding into a spinning unit.

This invention relates to textile machinery and more particularly to such machinery of the type utilizing a plurality of spinning units each having a rotor providing a centrifugal rotary spinning cavity into which fibers are continuously introduced to spin them into yarn which is continuously removed from the cavity.

Centrifugal spinning has long been known to the art but has been slow in reaching commercial acceptance because of the difficulty of producing commercially useful yarn especially from the standpoints of yarn uniformity as well as control of the spinning units themselves.

Accordingly, it is a major object of the invention to provide a novel centrifugal spinning unit capable of providing improved yarn uniformity.

It is another major object of the invention to provide novel control means for the spinning units themselves in a spinning frame utilizing a plurality of such units having a common drive means.

The present invention accomplishes the above objects in a spinning frame of the type having one or more such units, each having a rotor with air exit apertures therein providing a rotary centrifugal spinning cavity, fiber feeding means for introducing fibers into said cavity to spin them and yarn removal means for removing the spun yarn from the cavity.

The novel centrifugal spinning device of the invention is concerned principally with a novel rotor element providing a spinning cavity of unique configuration, together with the introduction of fibers to said cavity and the removal of spun yarn therefrom. Such cavity configuration provides a generally peripheral cavity wall free from apertures defining a smooth, preferably convexly-curved, flared, trumpet-shaped, peripheral fiber drafting surface of revolution about the axis of rotation of said rotor and a transverse end wall having air exit apertures therethrough defining a plane surface extending generally perpendicular to said axis. The end and peripheral walls are joined at the larger diameter end of the

peripheral surface of revolution providing a peripheral generally V-shaped narrow-bottomed fiber accreting groove having air exit apertures preventing fiber passage therethrough in its generally perpendicular side defined by said plane surface and being free of apertures in its sloping side defined by said peripheral surface.

The fiber feeding means introduces fibers into the spinning cavity at a point adjacent to the fiber drafting surface, axially spaced from the fiber accreting groove by a substantial distance preferably at least about one-half of the staple fiber length, preferably through a stationary input passageway. A restricted yarn removal means is also provided, preferably including a yarn exit passageway positioned coaxially with respect to the rotor, for removing spun yarn from the spinning cavity. Power means are provided for rotating the rotor at high speed and providing air flow outwardly from the spinning cavity through its air apertures and inwardly to said cavity through the fiber input passageway and the yarn exit passageway for deposit of fibers on said fiber drafting surface for drafting thereof during movement thereacross followed by accretion thereof in said V-shaped narrow-bottomed groove to form a yarn twisted upon its removal to said exit passageway.

The novel control means of the invention is utilized in a spinning frame of the type wherein power means are provided common to all of the rotors. It consists of enclosure means for each of the rotors in communication with the air exit apertures therein, air suction means communicating with each of the air enclosure means, valve means for each of the enclosure means effective to cut off air flow therefrom to said air suction means and control means, responsive to a yarn at each of the yarn removal means, constructed and arranged to operate its said valve means to cut off air flow upon the absence of a yarn in order to prevent continuation of fiber feeding into a spinning unit which would fill it full of fibers and clog it.

Still further objects and features of the invention will be apparent from the following detailed description of a preferred embodiment thereof, taken with the accompanying drawings, wherein:

FIG. 1 is a cross-sectional elevational view of the novel centrifugal spinning unit of the preferred embodiment of the invention;

FIG. 2 is a partial cross-sectional elevational view enlarged with respect to that of FIG. 1;

FIG. 3 is an end view of the unit of FIG. 1;

FIG. 4 is a partial cross-sectional end view enlarged with respect to that of FIG. 3, and

FIG. 5 is a somewhat diagrammatic view of the control system of the invention utilized with a plurality of the units of FIGS. 1 through 4.

Referring to the drawings, in FIGS. 1 through 4 is shown the novel centrifugal spinning device of the invention. It includes an enclosure **12** having an involute chamber **14** therein, in which chamber suitable bearings **16** mount a rotor **20** for rotation by a driving motor **18**. Rotor **20** has a cavity including a generally peripheral wall **22** free from apertures defining a smooth, convexly-curved, flared, trumpet-shaped, peripheral fiber drafting surface of revolution **24** about the axis of rotation of rotor **20** and a transverse end wall **26** having air exit apertures **27** therethrough defining a plane surface **28** extending generally perpendicularly to said axis. Walls **22** and **26** are joined at the larger diameter end of peripheral surface of revolution **24** providing a peripheral generally V-shaped fiber accreting groove **30** having a narrow bottom surface which may preferably be about 0.02 inch in width. Air exit apertures **27** preventing fiber passage therethrough are provided in the generally

perpendicular side of groove **30** defined by plane surface **28**, said groove being free of apertures in its sloping side defined by peripheral surface **24**. The angle of said sloping side may be up to about 45 degrees with respect to its perpendicular side. Apertures **27** preferably provide at least about 30 percent open area and are preferably of less than about 0.03 inch dimension, both as a diameter and length, and need not be round but are preferably of equivalent dimension if of some other shape. The spinning cavity is connected to involute chamber **14** by a peripheral air passage **32** communicating with the downstream ends of apertures **27** in the wall of groove **30** which in turn provide for air flow from the spinning cavity into said air passage **32**. Involute chamber **14** is provided with an air exit pipe **15**.

Enclosure cover **40** for the end of the involute chamber is provided with a plug element **42** fitting within the spinning cavity and extending from its smaller toward its larger diameter end. Plug **42** is provided with a fiber input passageway in the form of a hollow tube **44** for introducing fibers into the spinning cavity from the exit end of the passageway positioned adjacent to but spaced from the fiber drafting surface **24** at a point T thereon and axially spaced from the fiber accreting groove **30** by a substantial distance of at least about one-half of fiber length, about one-half inch in the case of cotton. The angle of surface **24** at point T is preferably between about 10 to 45 degrees with respect to the axes of plug **42** and rotor **20**. The free end of plug **42** is axially spaced from transverse wall **26** and includes a restricted yarn removal passageway **50** positioned coaxially with respect to the axes of rotor **20** and plug **42** for removing yarn from the spinning cavity, a concave conical transition surface **46** preferably being provided in the free end of plug **42**.

Sliver input rolls **52**, **54** are provided for feeding sliver into tube **44** and yarn output rolls **56**, **58** for removing spun yarn from yarn removal passageway **50**.

In operation, motor **18** rotates rotor **20** at high speed and provides air flow outwardly from the spinning cavity through air apertures **27**, air passage **32**, involute chamber **14**, and air exit pipe **15** and inwardly to said cavity through fiber input tube **44**. This results in the deposit of fibers on fiber drafting surface **24** for drafting thereof during movement thereacross followed by accretion thereof in groove **30** to form a yarn twisted upon its removal to said exit passageway. For starting, with output rolls **56**, **58** stopped, air flow inwardly through yarn exit passageway **50** makes it possible to feed a seed yarn into the removal passageway for picking up infed fibers accreted in groove **30** by the rotation of rotor **20**, after which yarn output rolls **56**, **58** are started for continuous operation of the centrifugal spinning unit.

In FIG. 5 is shown the control system of the invention as used with two continuous centrifugal spinning units preferably of the type above described. It will be understood that although, for simplicity, only two such units are shown, a large number of such units, driven by a single rotor drive, are commonly used in a unitary machine.

With such arrangement, air exit pipes **15'** and **15''** from each of the spinning units, generally designated at **60**, **70**, are connected to a suitable source of suction such as a condenser **80** including an air suction pump. Each of the air exit pipes **15'** and **15''** is provided with a suitable electrically actuated cut-off valve **62**, **72**, respectively, controlled by yarn sensing switches **64**, **74**, respectively. Thus, in operation, if the spun yarn issuing from a spinning unit is broken, its yarn sensing switch **64** or **74** positioned adjacent to and between its yarn removal passageway and its yarn removal rolls will be operated to close its valve **62** or **72**. This will prevent further feed of sliver into the yarn feed tube **44** of the spinning unit and so prevent its clogging before it can be started up again by the operation. For removing the fiber that would otherwise be accumulated at tube **44** when its suction is cut off by valve **62** or **72**, branch suction lines **66** and **76** may be provided connected to condenser **80**.

What is claimed is:

1. A device for spinning yarn comprising:

an enclosure having an involute chamber therein with an external air passage therefrom,

a rotor rotatably mounted in said chamber, said rotor providing an open ended cavity having

a generally peripheral wall free from apertures defining a smooth, flared peripheral fiber drafting surface of revolution about the axis of rotation of said rotor and

a transverse end wall having air exit apertures therethrough defining a plane surface extending generally perpendicularly to said axis,

said walls being joined at the larger diameter end of said peripheral surface of revolution providing a peripheral generally V-shaped fiber accreting groove having air exit apertures preventing fiber passage therethrough in its generally perpendicular side defined by said plane surface and being free of apertures in its sloping side defined by said peripheral surface,

a stationary plug extending from said enclosure into said rotor cavity coaxially therewith, said plug having a peripheral surface of revolution spaced from said drafting surface, a smoothly backwardly-curved free end surface spaced from said rotor transverse end wall.

fiber feeding means including fiber input passageway through said stationary plug for introducing fibers into said cavity through the peripheral wall of said plug at a point adjacent to said fiber drafting surface and axially spaced from said fiber accreting groove by a substantial distance of at least about one-half of fiber length,

yarn removal means including a restricted yarn exit passageway through said plug positioned coaxially with respect to said plug and rotor for removing yarn from said cavity, and

power means for rotating said rotor at high speed and providing air flow outwardly from said cavity through said air apertures and said external air passage and inwardly to said cavity through said fiber input passageway and said yarn exit passageway for deposit of fibers on said fiber drafting surface for drafting thereof during movement thereacross followed by accretion thereof in said V-shaped groove to form a yarn twisted upon its removal to said exit passageway.

2. A device as claimed in claim **1** wherein said fiber drafting surface is of convexly-curved, flared, trumpet-shaped configuration.

3. A device as claimed in claim **1** wherein said air apertures provide at least about 30 percent open area along said groove and are of less than about 0.03 inch in dimension.

4. In a spinning frame of the type having:

a plurality of spinning units each having a rotor with air exit apertures therein providing a rotary spinning cavity, fiber feeding means for introducing fibers into said cavity and yarn removal means for removing yarn from said cavity and

power means for rotating said rotors to spin yarn therein,

that improvement which consists of:

enclosure means for each of said rotors in communication with said air exit apertures therein,

air outlet means for each of said air enclosure means,

valve means for each of said air outlet means effective to cut off air flow therefrom and

control means for each of said spinning units responsive to a yarn at each of said yarn removal means constructed and arranged to operate its associated

said valve means to cut off said air flow upon absence of a yarn at said yarn removal means.

5. A device for spinning yarn comprising:

an enclosure having a chamber therein with an external air passage therefrom,

a rotor rotably mounted in said chamber, said rotor providing an open ended cavity having

a generally peripheral wall free from apertures defining a smooth flared peripheral fiber drafting surface of revolution about the axis of rotation of said rotor, and

a transverse end wall having air exit apertures therethrough defining a plane surface extending generally perpendicularly to said axis,

said walls being joined at the larger diameter end of said peripheral surface of revolution providing a peripheral generally V-shaped fiber accreting groove having air exit apertures preventing fiber passage therethrough in its generally perpendicular side defined by said plane surface and being free of apertures in its sloping side defined by said peripheral surface,

a stationary plug extending into said rotor cavity coaxially therewith, said plug having a peripheral surface of revolution spaced radially inwardly from said drafting surface in confronting relation thereto, and having a free end surface spaced from said rotor transverse end wall,

fiber feeding means for introducing fibers into said cavity at a point adjacent to said fiber drafting surface and axially spaced from said fiber accreting groove, said feeding means including a fiber input passageway extending through said stationary plug for introducing the fibers through said peripheral surface thereof,

yarn removal means including a restricted yarn exit passageway for removing yarn from said cavity, and

power means for rotating said rotor at high speed and providing air flow outwardly from said cavity through said air apertures and said external air passage and inwardly to said cavity through said fiber input passageway and said yarn exit passageway for deposit of fibers on said fiber drafting surface for drafting thereof during movement thereacross followed by accretion thereof in said V-shaped groove to form a yarn twisted upon its removal to said exit passageway.

6. A device for spinning yarn comprising:

an enclosure having a chamber therein with an external air passage therefrom,

a rotor rotatably mounted in said chamber, said rotor providing an open ended cavity having

a generally peripheral wall free from apertures defining a smooth flared peripheral fiber drafting surface of revolution about the axis of rotation of said rotor, and

a transverse end wall having air exit apertures therethrough defining a plane surface extending generally perpendicularly to said axis,

said walls being joined at the larger diameter end of said peripheral surface of revolution providing a peripheral generally V-shaped fiber accreting groove having air exit apertures preventing fiber passage therethrough in its generally perpendicular side defined by said plane surface and being free of apertures in its sloping side defined by said peripheral surface,

fiber feeding means including fiber input passageway for introducing fibers into said cavity at a point adjacent to said fiber drafting surface and axially spaced from said fiber accreting groove by a substantial distance,

yarn removal means including a restricted yarn exit passageway for removing yarn from said cavity,

power means for rotating said rotor at high speed and providing air flow outwardly from said cavity through said air apertures and said external air passage and inwardly to said cavity through said fiber input passageway and said yarn exit passageway for deposit of fibers on said fiber drafting surface for drafting thereof during movement thereacross followed by accretion thereof in said V-shaped groove to form a yarn twisted upon its removal to said exit passageway,

valve means for said external air passage of said enclosure, effective to cut off air flow therefrom, and

control means responsive to a yarn at said yarn removal means constructed and arranged to operate said valve means to cut off said air flow upon absence of a yarn at said yarn removal means.

7. In a rotary spinning unit of the type including a rotor having a varying diameter cavity extending therein about its axis of rotation and air exit apertures therethrough for exhausting air from said cavity, fiber feeding means communicating with said cavity for introducing fibers therein, and yarn removal means for removing yarn from said cavity, the improvement comprising:

the wall of said cavity having an annular surface of revolution extending arcuately in a smooth convex curve longitudinally and radially of said cavity from its major diameter portion to a lesser diameter portion thereof, and having another surface confronting said arcuate surface at said major diameter portion of the cavity and defining therewith an annular generally V-shaped fiber accreting slot;

said air apertures communicating with said cavity through said other surface of the cavity wall;

said fiber feeding means including a fiber input passageway introducing the fibers into said cavity at said lesser diameter portion thereof and directly onto said arcuate surface thereat, the exit end of said fiber input passageway being spaced closely adjacent and radially inwardly of said arcuate surface at said lesser diameter portion of the cavity and being spaced relatively distal from said fiber accreting slot; and

the fibers introduced upon said arcuate surface being drafted thereby in the direction of rotation thereof and being moved thereacross longitudinally and radially outwardly of the cavity to said fiber accreting slot.

8. A spinning unit as in claim 7, wherein said fiber accreting slot encloses an angle of no more than approximately 45°.

9. A spinning unit as in claim 7, wherein said other surface of said cavity wall extends generally perpendicular to the axis of rotation of said rotor.

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