

Sept. 5, 1967

K. MIKULECKY ETAL
RINGLESS SPINNING APPARATUS WITH EASILY
CLEANABLE SPINNING CHAMBER

3,339,360

Filed March 21, 1967

5 Sheets-Sheet 1

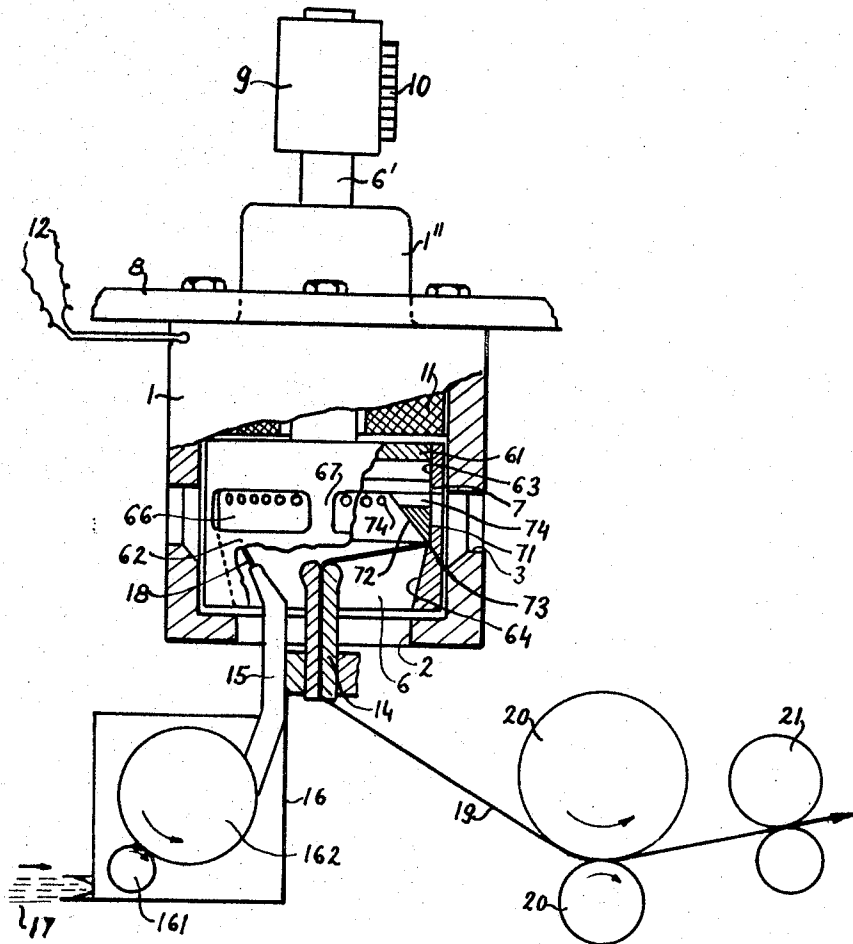


Fig. 1

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5 Sheets-Sheet 2

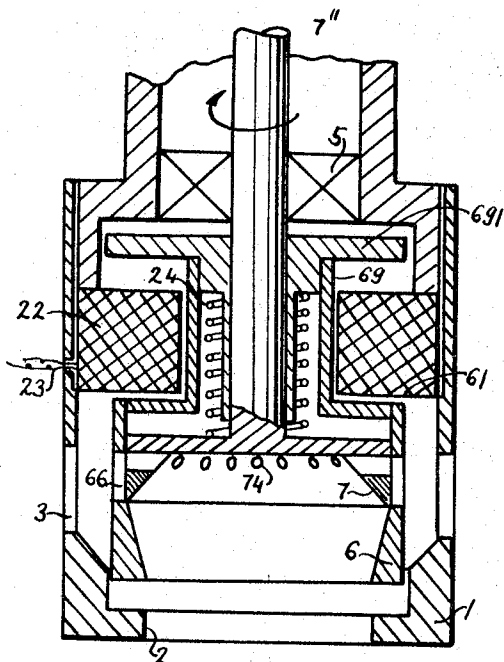


Fig. 5

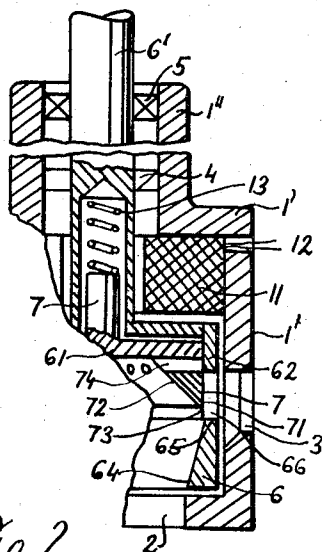


Fig. 2

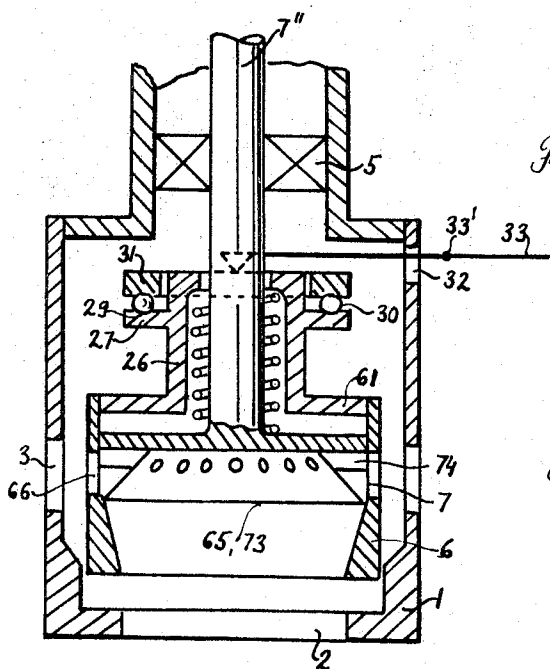


Fig. 8

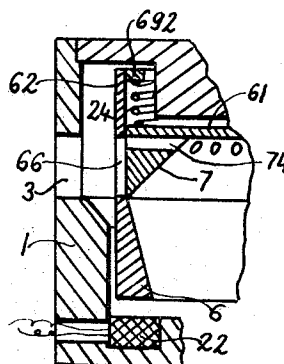


Fig. 6

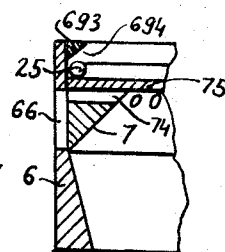


Fig. 7

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Fig. 3

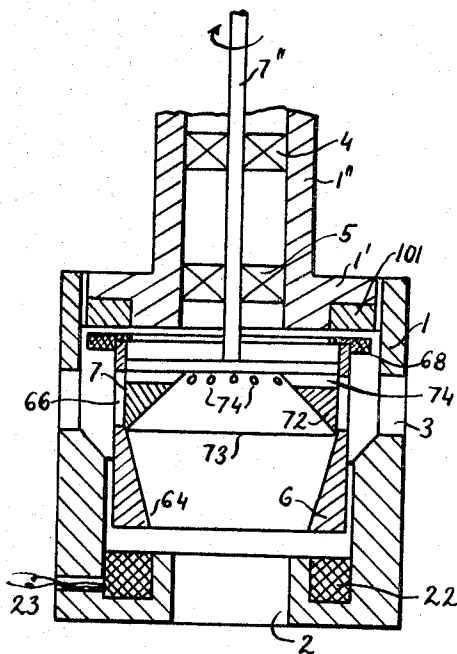
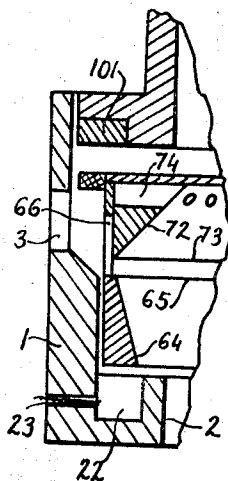


Fig. 4



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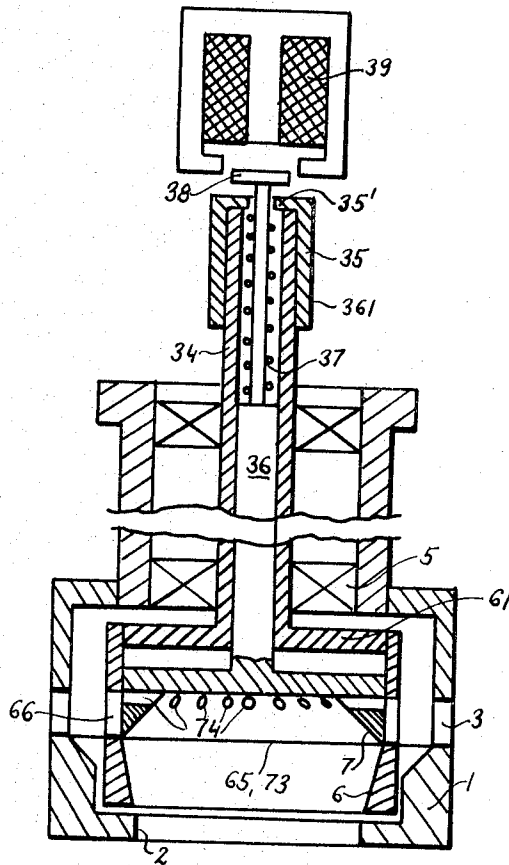


Fig. 9

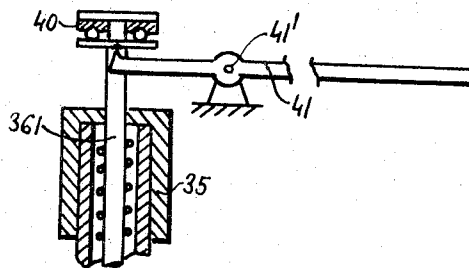


Fig. 10

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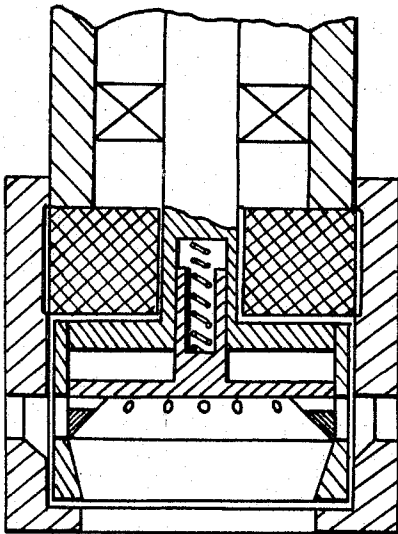


Fig. 11

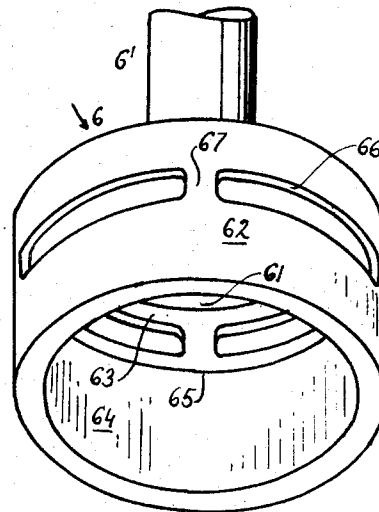


Fig. 14

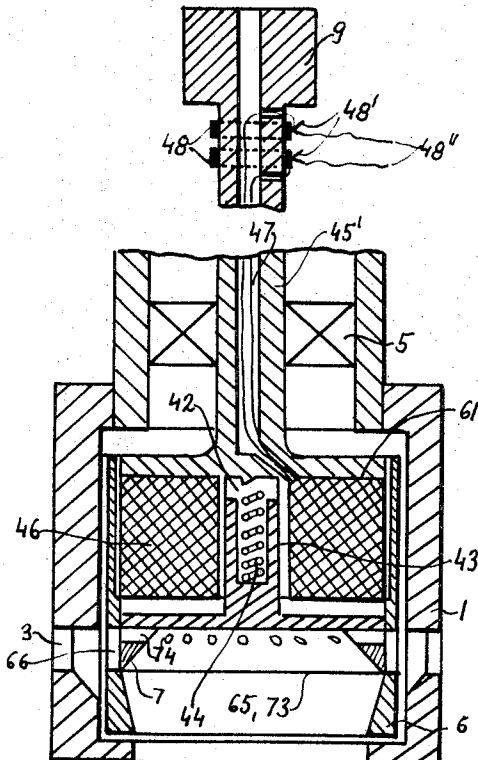


Fig. 12

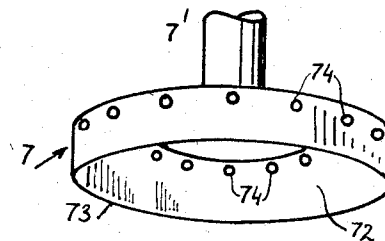


Fig. 13

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RINGLESS SPINNING APPARATUS WITH EASILY CLEANABLE SPINNING CHAMBER

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Filed Mar. 21, 1967, Ser. No. 624,954

Claims priority, application Czechoslovakia,

Mar. 23, 1966, 1,920/66

25 Claims. (Cl. 57—58.89)

ABSTRACT OF THE DISCLOSURE

A ringless spinning apparatus for textile fibers including spinning chamber means comprising two coaxial hollow rotary bodies having inner frusto-conical surfaces and being movable in axial direction relative to each other between a spinning position in which the frusto-conical surfaces meet each other along the large diameter edges of said surfaces to form along the edges a collecting surface for fibers fed into the spinning chamber means, and a cleaning position in which said edges are axially spaced from each other to form an annular gap therebetween permitting escape of impurities collecting on the collecting surface during the spinning process to the outer atmosphere, and means cooperating with the spinning chamber means for creating subatmospheric pressure therein during its rotation about its axis.

Background of the invention

The present invention relates to a ringless spinning apparatus for spinning of textile fibers in a rotary spinning chamber in which during rotation thereof subatmospheric pressure is maintained.

In spinning chambers of this type there occurs after the spinning process has proceeded for a certain time an undesired accumulation of impurities which is a source of yarn breakage and malfunction of the spinning chamber. These impurities have therefore to be removed from time to time, and for this purpose it was necessary up to now to stop rotation of the spinning chamber and to manually remove the impurities therefrom. This operation is cumbersome and time-consuming.

It is an object of the present invention to provide for a spinning chamber which is constructed to facilitate removal of impurities from the interior thereof.

It is an additional object of the present invention to provide for a spinning chamber of the aforementioned kind which is composed of relatively few and simple parts the position of which can be easily changed between a spinning position and a cleaning position, permitting in the latter position automatic discharge of impurities from the interior of the spinning chamber.

Summary of the invention

With these objects in view, the ringless spinning apparatus according to the present invention mainly comprises spinning chamber means including two coaxial rotary hollow bodies having inner frusto-conical surfaces and being movable in axial direction relative to each other between a spinning position in which the frusto-conical surfaces meet each other along the large diameter edges of these surfaces to form along these edges a collecting surface for fibers fed into the spinning chamber means, and a cleaning position in which the aforementioned edges are axially spaced from each other to form an annular gap therebetween permitting escape of impurities collecting on the collecting surface during the spinning process to the outer atmosphere. The apparatus includes further means cooperating with the spinning chamber means for creating subatmospheric pressure therein dur-

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ing its rotation about its axis, mounting means mounting one of said hollow bodies turnable about its axis but immovable in axial direction, moving means cooperating with the other of the bodies for moving the same in axial direction relative to the one body between the spinning and the cleaning position, and rotating means cooperating with the spinning chamber means for rotating the same about its axis.

The means for creating the subatmospheric pressure in the interior of the spinning chamber means may comprise a plurality of air escape openings extending spaced from each other in substantially radial direction from the inner surface of one of the hollow bodies to the outer surface thereof.

The moving means may comprise biasing means cooperating with the other of the aforementioned hollow bodies for yieldably maintaining the same in one of the aforementioned positions, and operating means cooperating with the other body for moving the same, whenever desired, against the biasing means to the other of the positions.

The biasing means may be constituted by spring means or by magnetic means. The operating means for moving the body whenever desired against the force of the biasing means to the other of the positions thereof may be constituted by mechanical means or by electromagnetic means.

The aforementioned two hollow rotary bodies may be constituted by an inner body having an inner surface forming one of the aforementioned frusto-conical surfaces and being formed with air escape openings through which air is discharged from the interior of the spinning chamber means during fast rotation thereof to create a subatmospheric pressure in the interior, and an outer hollow body having a first portion surrounding the inner body and a second portion integral with the first portion and having an inner surface forming the other of the frusto-conical surfaces, the inner body has an outer surface slidably engaging the inner surface of the first portion of the outer body so that the bodies are axially movable with respect to each other, the first portion of the outer body is formed with a plurality of closely adjacent circumferentially extending cleaning openings arranged so that in the spinning position air may escape from the interior of the spinning chamber means through the aforementioned air escape openings and the cleaning openings to the outer atmosphere and so that in the cleaning position the large diameter edge of the frusto-conical surface of the inner body clears the cleaning openings so as to permit escape of impurities through the cleaning openings to the outer atmosphere.

The apparatus may further include stationary housing means surrounding the outer body and the housing means may have a peripheral wall formed with a plurality of closely adjacent circumferentially extending discharge openings therethrough communicating in any position of the bodies with the cleaning openings of the outer body. The apparatus may include further bearing means carried by the stationary housing means and the rotating means may include shaft means coaxially fixed to one of the aforementioned bodies and mounted in the bearing means turnably about its axis but immovable in axial direction. The shaft means may be fixedly connected to the outer body, or to the inner body.

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 schematic partially sectioned side view of one embodiment of a ringless spinning apparatus according to the present invention in which the inner rotary body is axially displaceable with respect to the outer body, FIG. 1 shows the apparatus in the spinning position;

FIG. 2 is a partial sectional view of the apparatus shown in FIG. 1 and illustrating the apparatus in the cleaning position;

FIG. 3 is an axial cross-section through the spinning chamber means of a further embodiment in which the outer rotary body is axially displaceable with respect to the inner rotary body and in which the outer rotary body is yieldably held in its spinning position by means of a permanent magnet and may be moved to the cleaning position by means of an electromagnet, FIG. 3 shows the apparatus in the spinning position;

FIG. 4 is a partial axial cross-section through the embodiment shown in FIG. 3 and showing the apparatus in the cleaning position;

FIG. 5 is an axial cross-section through a further embodiment in which the outer rotary body is axially displaceable with respect to the inner rotary body and in which the outer rotary body is yieldably held in the spinning position by spring means and in which electromagnetic means are provided for moving the outer rotary body from the spinning to the cleaning position;

FIG. 6 is a partial cross-sectional view of an embodiment as shown in FIG. 5 and which differs therefrom only by a slightly different arrangement of the spring and the electromagnetic means;

FIG. 7 is a partial view in axial cross-section of a further embodiment in which the outer rotary body, which is displaceable in axial direction with regard to the inner rotary body, is held in its spinning position during fast rotation of the spinning chamber means by means of centrifugal forces acting on a plurality of balls cooperating with the outer rotary body and in which the latter, during slow rotation of the spinning chamber means will move to its cleaning position by gravitational force;

FIG. 8 is an axial cross-section through a further embodiment in which the outer rotary body is held in the spinning position by spring means and may be moved from the spinning position against the force of the spring means by mechanical means in the form of a lever;

FIG. 9 is an axial cross-section through a further embodiment in which the inner rotary body is axially displaceable with regard to the outer rotary body and in which the inner rotary body is held in the spinning position by spring means and is moved from the spinning to the cleaning position by electromagnetic means;

FIG. 10 is a partial sectional view showing an embodiment similar to that illustrated in FIG. 9, but differing therefrom only in that the means for moving the inner rotary body from the spinning to the cleaning position are constituted by a lever mechanism;

FIG. 11 is an axial cross-section through a further embodiment in which the inner rotary body is movable with respect to the outer rotary body and in which the inner rotary body is held in the spinning position by spring means and moved from the spinning to the cleaning position by electromagnetic means stationarily mounted in the housing means;

FIG. 12 is an axial cross-section through a further embodiment which is similar to that shown in FIG. 11 and differs therefrom only in that the electromagnetic means are mounted in the outer rotary body;

FIG. 13 is a perspective view of the inner rotary body; and

FIG. 14 is a perspective view of the outer rotary body.

Description of the preferred embodiments

Referring now to the drawings, and more specifically to FIGS. 1 and 2 of the same, it will be seen that the ringless spinning apparatus according to the present in-

vention may include a substantially cup-shaped housing 1 having an upper open end and being mounted in the region of the upper open end in any convenient manner, for instance by a plurality of screws, to the machine frame 8, only partially shown in FIG. 1. The bottom wall of the housing 1 is formed with a large central opening 2 therethrough, whereas the peripheral wall of the housing is formed with a plurality of discharge openings 3 which respectively extend in circumferential direction in such a manner that adjacent ends of discharge openings 3 are close together. The upper open end of the housing 1 is closed, as best shown in FIG. 2, by a cover 1' which may be held to the housing by the same screws which fasten the latter to the machine frame 8 and the cover 1' has a central tubular projection 1'' which projects upwardly through an appropriate opening in the machine frame 8. Two bearings 4 and 5, for instance roller bearings of known construction, are mounted in the tubular portion 1'' of the cover 1', and the bearings 4 and 5 turnably support the spinning chamber means which are constituted by an outer rotary hollow body 6 and an inner rotary hollow body 7 which are axially displaceable with respect to each other, as will be explained in further detail later on.

The outer rotary body 6 (see also FIG. 14) has a substantially cylindrical wall 62 of an outer diameter slightly smaller than the inner diameter of the housing 1. The outer rotary body 6 is closed at the upper end by a cover 61 connected to the wall 62 in any convenient manner. A shaft 6' fixedly connected to the cover 61 projects from a central portion of the latter upwardly and is mounted turnably about its axis but immovably in axial direction in the aforementioned bearings 4 and 5. The inner surface of the wall 62 has an upper cylindrical portion 63 and a lower frusto-conical surface portion 64 meeting the cylindrical surface portion 63 along a line 65 and the frusto-conical surface portion 64 has a smaller diameter end substantially equal to the diameter of the opening 2 in the bottom wall of the housing and adjacent the latter. The wall 62 of the outer rotary body 6 is formed in the region of the discharge openings 3 with a plurality of cleaning openings 66 which extend upwardly from the aforementioned line 65 and circumferentially to be separated only by small webs 67, and which communicate with the discharge openings 3. A pulley 9 is fixedly mounted on the upper end of the shaft 6', which pulley is driven by a belt 10 from a drive motor, not shown in the drawing.

The inner rotary body 7 is formed from magnetizable material and has an outer surface 71 slidably guided in the upper inner cylindrical surface portion 63 of the outer body 6. The inner frusto-conical surface 72 (see also FIG. 13) of the inner rotary body has a large diameter bottom edge 73 of a diameter substantially equal to the diameter of the circular line 65 along which the cylindrical inner surface portion 63 and the inner frusto-conical surface portion 64 of the outer rotary body 6 meet. The peripheral wall of the inner rotary body 7 is formed in the region of its upper end with a plurality of closely adjacent substantially radially extending air escape openings 74 therethrough, which communicate at the outer ends thereof, in the position of the inner rotary body as shown in FIG. 1, with the cleaning openings 66 of the outer rotary body and through discharge openings 3 in the housing 1 with the outer atmosphere so that during fast rotation of the spinning chamber constituted by the inner and outer rotary bodies an underpressure will be created in the interior of the spinning chamber.

A stud shaft 7' extends upwardly from a central portion of the inner rotary body 7 into a corresponding bore formed in the lower portion of the shaft 6' and a coil compression spring 13 located in the bore of the shaft 6' and engaging the free end of the stud shaft 7' exerts downward pressure on the inner rotary body 7 to yieldably maintain the latter in a spinning position, as shown

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in FIG. 1, in which the bottom edge 73 of the inner rotary body engages the inner surface of the outer rotary body substantially along the line 65. In the spinning position, as shown in FIG. 1, the inner surface of the spinning chamber has therefore the shape of a double cone with a common base 73, 65 which constitute a so-called collecting surface along which fibers fed into the interior of the spinning chamber will collect during fast rotation of the latter due to centrifugal forces.

As can be seen from FIG. 1, the upper surface of the inner rotary body 7 is, in the spinning position as shown in FIG. 1, downwardly spaced from the bottom face of the cover 61 of the outer rotary body 6, so that the inner rotary body may be upwardly displaced in axial direction relative to the outer rotary body from the spinning position, shown in FIG. 1, to the cleaning position, as shown in FIG. 2.

The moving means which cooperate with the inner rotary body 7 for moving the same from the spinning position, as shown in FIG. 1, to the cleaning position, as shown in FIG. 2, are constituted in the embodiment shown in these two figures by an annular electromagnet 11 extending with clearance about the shaft 6' and being fixedly mounted in the housing between the bottom face of the cover 1' and the top face of the member 61. Conductors 12 connect over a switch not shown in the drawing the electromagnet 11 to a source of electrical energy, likewise not illustrated. By excitation of the electromagnet 11 the inner rotary body 7 which is formed from magnetizable material is displaced against the pressure spring 13 from the spinning position shown in FIG. 1 to the cleaning position illustrated in FIG. 2.

The spinning apparatus includes further means for feeding fibers to be spun into the interior of the spinning chamber and means for withdrawing a spun yarn therefrom. As shown in FIG. 1, the means for feeding fibers to be spun into the interior of the spinning chamber may include a feeding tube 15 extending through the opening 2 in the bottom wall of the housing 1 into the interior of the spinning chamber and connected at its outer end to a separator 16 of known construction which includes a feeding roller 161 and a combing out roller 162 for separating a fibrous body or sliver 17 into individual fibers which are then fed through the feeding tube 15 into the interior of the spinning chamber. The bent inner end of the feeding tube 15 extends toward the collecting surface of the spinning chamber where the separated fibers 18 are collected on the collecting surface in the form of a ribbon, and the yarn 19 formed during fast rotation of the spinning chamber is withdrawn through the withdrawing tube 14 by withdrawing rollers 20. The yarn 19 is then in a known manner wound onto a bobbin 21.

When, during the spinning process, impurities are accumulated on the collecting surface of the spinning chamber, the electromagnet 11 is energized so that the inner rotary body 7 is moved against the action of the compression spring 13 from the spinning position as shown in FIG. 1 to the cleaning position as shown in FIG. 2, so that during continued rotation of the spinning chamber the impurities are ejected through the thus formed gap between the bottom edge 73 and the line 65, the cleaning openings 66 in the outer rotary body, and through the discharge openings 3 in the housing by the action of centrifugal force.

In the embodiments illustrated in FIGS. 3-12, the elements having the same functions as described above in connection with the embodiment illustrated in FIGS. 1 and 2 are designated with the same reference numerals and the means for feeding fibers to be spun into the spinning chamber and the means for withdrawing the spun fibers therefrom are omitted for reasons of simplification from FIGS. 3-12.

In the embodiment shown in FIGS. 3 and 4, a shaft 7'' fixed to a central portion of the inner rotary body 7

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projects upwardly through the tubular extension 1'' of the cover 1' of the housing 1 and is mounted for rotation about its axis on the bearings 4 and 5, but immovable in axial direction. The shaft 7'' is driven in the same manner as the shaft 6' of the embodiment shown in FIG. 1. In the embodiment illustrated in FIGS. 3 and 4, the outer rotary body 6 is movable in axial direction in the housing 1 relative to the inner rotary body 7 between the spinning position as shown in FIG. 3 and the cleaning position as shown in FIG. 4. An annular flange 68 of magnetizable material is fixed in any convenient manner to the upper end of the outer rotary body, which upper end is in this case not closed by a cover member, and a permanent magnet 101 of annular shape is located in an appropriate annular cutout of the housing cover 1' opposite the annular flange 68 to attract the latter and to normally hold the outer rotary body 6 in the spinning position as shown in FIG. 3. A ring-shaped electromagnet 22 is fixedly mounted in a groove of the bottom wall of the housing around the opening 2 and the electromagnet 22 may be supplied with electric current through the conductors 23 from a source not shown in the drawing. When it is desired to move the spinning chamber, constituted by the rotary bodies 6 and 7, from the spinning position as shown in FIG. 3 to the cleaning position as shown in FIG. 4, the electromagnet 22 is excited to attract thereby the outer rotary body 6 which is formed of magnetizable material and to move the latter from the position shown in FIG. 3 against the attracting force of the permanent magnet 101 to the cleaning position as shown in FIG. 4. Obviously, the attracting force developed by the electromagnet 22 during excitation thereof has to be greater than the attracting force of the permanent magnet 101.

In the embodiment shown in FIG. 5, the shaft 7'' fixed to and projecting upwardly from the central portion of the inner rotary body 7 is mounted on the bearings 4 and 5, only the latter one is shown in the drawing, for rotation about its axis, but immovable in axial direction, whereas the outer rotary body 6 is movable in axial direction relative to the inner rotary body between the spinning and cleaning positions. A cover 61 of non-magnetic material is fixedly connected in any convenient manner to the upper end of the outer rotary body 6 and the cover has a central tubular extension 69 projecting upwardly from the cover and surrounding the shaft 7'' with ample clearance. An annular outwardly projecting flange 691 of magnetizable material is fixed to the upper end of the tubular extension 69 and a coil compression spring 24 located about the shaft 7'' engages with its bottom end the upper surface of the inner rotary body 7 and with its upper end the hub portion of the flange 691 so as to yieldably maintain the outer rotary body 6 in the spinning position as shown in FIG. 5. An annular electromagnet 22 is fixedly mounted in the housing 1 surrounding the tubular extension 69, and in the spinning position, as shown in FIG. 5, the top face of the electromagnet is axially spaced from the bottom face of the flange 691. When the electromagnet is excited through the conductors 23 which connect the electromagnet to a source of electric energy not shown in the drawing, the flange 691 is attracted and the outer rotary body 6 is moved downwardly from the spinning position shown in FIG. 5 to a cleaning position to form thereby a gap between the bottom edge 73 of the inner rotary body and the upper end of the frusto-conical inner surface of the outer rotary body 6 so that impurities may escape through the gap thus formed, the cleaning openings 66 in the outer rotary body, and the discharge openings 3 in the housing to the outer atmosphere.

The embodiment only partly illustrated in FIG. 6 differs from the above-described embodiment shown in FIG. 5 only by a slightly different arrangement of the compression spring 24 which cooperates with the outer rotary body 6 to maintain the latter in the spinning position as

shown in FIG. 6 and by a different arrangement of the electromagnet 22 which when energized moves the outer rotary body against the force of the compression spring 24 from the spinning position to the cleaning position. In the embodiment shown in FIG. 6, an inwardly extending annular flange 692 is fixed to the upper end of the outer rotary body 6 and the compression spring 24 engages with opposite ends thereof the top face of the inner rotary body 7 and the bottom face of the flange 692 so as to yieldably hold the outer rotary body 6 in the spinning position as shown in FIG. 6. The annular electromagnet 22 is arranged in an appropriate groove in the bottom wall of the housing 1 normally downwardly spaced from the bottom end of the outer rotary body 6, which in this case is formed from magnetizable material, so that upon energization of the electromagnet 22 the outer rotary body 6 is moved against the resilient force of the compression spring 24 from the spinning position as shown in FIG. 6 in downward direction to the cleaning position thereof.

In the embodiment only partially shown in FIG. 7, an inwardly extending tapered flange 693 with a downwardly facing inner conical surface 694 is fixed in any convenient manner to the upper end of the outer rotary body 6 so as to be spaced in the spinning position of the arrangement, as shown in FIG. 7, a small distance upwardly from the top face 75 of the inner rotary body 7, and a plurality of small balls 25 of a diameter slightly smaller than the radial extension of the flange 693 are located on the upper face 75 of the inner rotary body 7. When the spinning chamber constituted by the bodies 6, 7 is rotated at full speed about its axis, the balls 25 will take up the position shown in FIG. 7, due to centrifugal forces imparted thereto, holding thereby the outer rotary body in the spinning position as shown in FIG. 7. When it is desired to move the outer rotary body 6 from the spinning position to the cleaning position, the revolutions of the spinning chamber are reduced to a value at which the weight of the outer rotary body 6 overcomes the centrifugal force of the balls 25 so that the outer rotary body 6 may move by gravity in downward direction to the cleaning position in which the rotation of the spinning chamber is sufficient to expel the impurities. It is to be understood that in the embodiment only partially shown in FIG. 7, the inner rotary body is provided with a shaft as shown at 7" for instance in FIG. 5 which is mounted in bearings turnable about its axis but immovable in axial direction. It is to be further understood that this embodiment likewise includes a housing as for instance shown at 1 in FIG. 5 which limits the downward movement of the outer rotary body 6.

In the embodiment shown in FIG. 8, mechanical means are used for moving the outer rotary body 6 from the spinning position as shown in FIG. 8 to a downwardly displaced cleaning position. The inner rotary body 7 is again mounted by means of the shaft 7" and the bearings cooperating therewith for rotation about its axis, but immovable in axial direction, and the outer rotary body 6 has at its upper end a cover 61 connected thereto with a central tubular extension 26 provided in the region of its upper end with a double flange 27 having a lower radially outwardly extending portion and an upper radially inwardly extending portion. The lower radially extending portion of the double flange 27 is provided with an annular groove 29 in which a plurality of balls 30 are located, and a ring 31 surrounding the upper end of the tubular extension 26 with clearance is placed on the balls 30 to form with the latter and the radially outwardly extending portion of the double flange 27 an axial thrust bearing. A coil compression spring 28 is arranged in the tubular extension 26 about the shaft 7" engaging with its bottom end the top surface of the inner rotary body 7 and with its top end the bottom surface of the radially inwardly extending portion of the double flange 27 to thereby yieldably maintain the outer rotary body 6 in the

spinning position as shown in FIG. 8, in which the bottom edge 73 of the inner rotary body 7 engages the upper end of the inner conical surface of the outer rotary body 6 and stops thereby the further upward movement of the latter under the influence of the compression spring 28.

The moving means for moving the outer rotary body 6 from the spinning position, as shown in FIG. 8, to a downwardly displaced cleaning position are in this case constituted by a double-armed lever 33 tiltably mounted about a fixed tilting axis 33' and extending through an opening 32 in the housing 1 into the interior of the latter to engage with its inner end, which may have a triangular configuration as shown in FIG. 8, the top surface of the ring 31. If the lever 33 is tilted in counterclockwise direction about its tilting axis 33', the outer rotary body 6 will be displaced in downward direction against the force of the compression spring 28 and be moved to its cleaning position.

In the embodiment shown in FIG. 9, a hollow shaft 34 projects upwardly from a central portion of the cover 61 fixed to the upper end of the outer rotary body 6, and the hollow shaft 34 which is fixed to the cover 61, by being for instance integrally formed therewith, is mounted in the bearings 4 and 5 in a known manner rotatable about its axis but axially non-shiftable. A pulley 35 is coaxially fixed to the upper end of the hollow shaft 34 and the pulley has at its upper end an annular flange 35' projecting inwardly beyond the inner surface of the hollow shaft. A rod 36 fixedly connected to the top wall of the inner rotary body 7 projects from a central portion of the latter upwardly through the interior of the hollow shaft 34 and is guided therein for movement in axial direction. The rod 36 has an upper portion 361 of reduced diameter and a coil compression spring 37 located about this reduced diameter portion 361 abuts with its upper end against the flange 35' of the pulley 35 and with its lower end against the upper surface of the large diameter portion about its axis, but immovable in axial direction, on the latter to thereby yieldably maintain the inner rotary body 7 in the spinning position as shown in FIG. 9 in which the bottom edge 73 of the inner rotary body 7 engages the upper end 65 of the inner frusto-conical surface of the outer rotary body 6.

The moving means for moving the inner rotary body 7 from the spinning position as shown in FIG. 9 to an upwardly displaced cleaning position are in this case constituted by an armature 38 of magnetizable material fixed to the upper end of the reduced diameter portion 361 of the rod 36 projecting beyond the flange 35' of the pulley and cooperating with an electromagnet 39 held in the position shown in FIG. 9 on a machine frame, not illustrated in FIG. 9. When the electromagnet 39 is energized, the armature 38 will be attracted and moved upwardly so that the inner rotary body 7 connected to the armature 38 by the rod 36, 361 will likewise be moved relative to the outer rotary body 6 in upward direction to the cleaning position against the force of the compression spring 37.

The embodiment only partly shown in FIG. 10 differs from the embodiment described in connection with FIG. 9 only by the moving means for moving the inner rotary body 7 from the spinning to the cleaning position. The moving means in this case are constituted by a double-armed lever 41 tiltably about a fixed tilting axis 41 located intermediate its ends and engaging with its inner end an axial thrust bearing 40 fixed to the upper end of the rod portion 361, instead of the armature 38 shown in FIG. 9. By tilting the lever 41 in clockwise direction about its tilting axis the inner rotary body 7 will be moved in upward direction against the force of the compression spring 37. It is to be understood that the embodiment only partially shown in FIG. 10 includes otherwise all elements as shown in FIG. 9.

In the arrangement shown in FIG. 11, the shaft 45 fixed to and projecting upwardly from a central portion of

the cover 61 formed from non-magnetizable material and fixed to the upper end of the outer rotary body 6, is again mounted in bearings 4 and 5, only the latter one is shown in FIG. 11, for rotation about its axis, but non-shiftable in axial direction. The lower end of the shaft 45 is formed with a central bore 42 extending also through the cover 61 and a short hollow shaft 43 fixedly connected to a central portion of the top wall of the inner rotary body 7 is slidably guided in the bore 42 of the shaft 45. The rotary body 7 and the shaft 43 thereof are made in this case of magnetizable material. A coil compression spring 44 arranged partly in the bore 42 and partly in the hollow shaft 43 exerts a downwardly directed pressure on the inner rotary body 7 to yieldably maintain the latter in the spinning position as shown in FIG. 11 in which the bottom edge 73 of the inner rotary body engages with the top edge 65 of the inner frusto-conical surface at the lower part of the outer rotary body 6.

The moving means for moving the inner rotary body in axial upward direction relative to the outer rotary body 6 from the spinning position as shown in FIG. 11 to an upwardly displaced cleaning position are in this case constituted by an electromagnet 46 fixedly mounted in the outer housing 1 above the cover 61 of the outer rotary body 6. Upon energizing of the electromagnet 46, the inner rotary body of magnetizable material will be attracted and moved in upward direction against the force of the compression spring 44 from the spinning position as shown in FIG. 11 to an upwardly displaced cleaning position.

The embodiment illustrated in FIG. 12 differs from the embodiment shown in FIG. 11 in that the electromagnet 46 is mounted directly in the outer rotary body 6 for rotation therewith between the cover 61 and the top wall of the inner rotary body 7, whereby in the spinning position, as shown in FIG. 12, the top surface of the top wall of the inner rotary body 7 is downwardly spaced from the bottom surface of the electromagnet 46. The electromagnet 46 may be energized through the conductors 47 extending through the central bore in the shaft 45' and being connected at the upper ends thereof to slip rings 48 fixedly spaced from each other to an upper portion of the shaft 45' and insulated therefrom and cooperating with brushes 48' of known construction, which are respectively connected to a source of electric energy, not shown in the drawing, by the conductors 48''.

When the electromagnet 46 is energized, the inner rotary body 7 will be attracted and moved in upward direction against the force of the compression spring 44 to its cleaning position upwardly displaced from the position shown in FIG. 12.

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 ringless spinning apparatus differing from the types described above.

While the invention has been illustrated and described as embodied in a ringless spinning apparatus with easily cleanable spinning chamber, 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.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can be applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. In a ringless spinning apparatus for textile fibers, in combination, spinning chamber means comprising two co-axial rotary hollow bodies having inner frusto-conical

surfaces, said hollow bodies being movable in axial direction relative to each other between a spinning position in which the frusto-conical surfaces meet each other along the large diameter edges of said surfaces to form along said edges a collecting surface for fibers fed into the spinning chamber means, and a cleaning position in which said edges are axially spaced from each other to form an annular gap therebetween permitting escape of impurities collecting on said collecting surface during the spinning process to the outer atmosphere; means cooperating with said spinning chamber means for creating subatmospheric pressure therein during its rotation about its axis; mounting means mounting one of said hollow bodies turnable about its axis but immovable in axial direction; moving means cooperating with the other of said bodies for moving the same in axial direction relative to said one body between said spinning and said cleaning positions; and rotating means cooperating with said spinning chamber means for rotating the same about its axis.

2. In a ringless spinning apparatus as defined in claim 1, wherein said means for creating said subatmospheric pressure in the interior of said spinning chamber means comprise a plurality of air escape opening extending spaced from each other in substantially radial direction from the inner surface of one of said hollow bodies to the outer surface thereof.

3. In a ringless spinning apparatus as defined in claim 2, wherein said two hollow rotary bodies comprise an inner rotary body having an inner surface forming one of said frusto-conical surfaces and being formed with said air escape openings, and an outer body having a first portion surrounding said inner body and having an inner surface integral with said first portion and having an inner surface forming the other of said frusto-conical surfaces, said inner body having an outer surface slidably engaging the inner surface of said first portion so that said bodies are axially movable with respect to each other, said first portion of said outer body being formed with a plurality of closely adjacent circumferentially extending cleaning openings arranged so that in said spinning position air may escape from the interior of said spinning chamber through said air escape openings and said cleaning openings to the outer atmosphere and so that in said cleaning position the large diameter edge of said frusto-conical surface of said inner body clears said cleaning openings so as to permit escape of impurities through said cleaning openings to the outer atmosphere.

4. In a ringless spinning apparatus as defined in claim 3, and including stationary housing means surrounding said outer body, said housing means having a peripheral wall formed with a plurality of closely adjacent circumferentially extending discharge openings therethrough communicating in any position of said bodies with said cleaning openings of said outer body.

5. In a ringless spinning apparatus as defined in claim 4, and including bearing means mounted on said stationary housing means, said rotating means including shaft means coaxially fixed to one of said bodies and mounted in said bearing means turnable about its axis but immovable in axial direction.

6. In a ringless spinning apparatus as defined in claim 5, wherein said shaft means are fixedly connected to said outer body.

7. In a ringless spinning apparatus as defined in claim 6, wherein said inner body is at least in part formed from magnetizable material, and wherein said moving means include spring means engaging said inner body and being biased to yieldably maintain the latter in said spinning position, and electromagnetic means cooperating with said part of said inner body to move, when energized, said inner body against the force of said spring means to said cleaning position.

8. In a ringless spinning apparatus as defined in claim 7, wherein said spring means are in the form of a compression spring located in a bore of said shaft means, and

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wherein said electromagnetic means are annular, surrounding a portion of said shaft means and fixedly mounted in said housing means.

9. In a ringless spinning apparatus as defined in claim 7, wherein said shaft means is formed with an axial bore therethrough and wherein said inner body includes a rod-shaped member extending through and beyond said bore and carrying at the free end thereof said part of magnetizable material, said spring means comprising a compression spring connected to said rod-shaped member and biased to yieldably maintain said inner rotary body in said spinning position, and said electromagnetic means being stationarily mounted to cooperate with said part at said free end of said rod-shaped member to move, when energized, the latter and the inner rotary body connected thereto against the biasing force of said spring means to said cleaning position.

10. In a ringless spinning apparatus as defined in claim 7, wherein said shaft means are formed with a blind axial bore, said inner rotary body including a part of magnetizable material slidably guided in said bore, said spring means comprising a compression spring in said blind bore and engaging with one end thereof the closed end of the latter and with the other end thereof said part of said inner body, and wherein said electromagnetic means are annular surrounding a portion of said shaft means in the region of said bore and being fixedly mounted in said stationary housing arranged to cooperate with said part of said inner body to move, when energized, the latter against the force of said spring means from said spinning to said cleaning position.

11. In a ringless spinning apparatus as defined in claim 7, wherein said electromagnetic means are annular and fixedly mounted in said first portion of said outer body, and wherein said portion of magnetizable material of said inner body projects into said annular electromagnetic means, said spring means including a compression spring engaging with opposite ends an end wall of said outer body and said portion of said inner body.

12. In a ringless spinning apparatus as defined in claim 5, wherein said shaft means are fixedly connected to said inner body.

13. A ringless spinning apparatus as defined in claim 12, wherein said outer body has a pair of axially displaced portions formed from magnetizable material, and wherein said moving means comprise biasing means including a permanent magnet fixedly mounted in said housing means and cooperating with one of said portions of magnetizable material for yieldably maintaining said outer body in said spinning position, and an electromagnet mounted in said housing means and cooperating, when energized, with the other part of magnetizable material to move said outer body against the force of said biasing means to said cleaning position.

14. In a ringless spinning apparatus as defined in claim 12, wherein said outer body includes a tubular member surrounding part of said shaft means and having a flange of magnetizable material extending transverse to the shaft axis, and wherein said moving means comprise biasing means in the form of a compression coil spring in said tubular member and engaging with opposite ends said inner body and a portion of said tubular member, said spring being biased to yieldably maintain said outer body in said spinning position, an annular electromagnetic means fixedly mounted in said housing means and cooperating with said flange to move, when energized, said outer body against the force of said compression coil spring to said cleaning position.

15. In a ringless spinning apparatus as defined in claim 12, wherein at least said second portion of said outer body is formed from magnetizable material and including an inwardly projecting annular flange fixed to the free end of said first portion of said outer body, said moving means including biasing means in the form of a compression spring engaging with opposite ends said

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flange and said inner body and being biased to yieldably maintain said outer body in said spinning position, and electromagnetic means fixedly mounted in said housing and arranged to cooperate, when energized, with said second portion of said outer body to move the latter against said biasing means to said cleaning position.

16. In a ringless spinning apparatus as defined in claim 12, wherein said outer body comprises a tubular portion surrounding a portion of said shaft means with ample clearance and having at the free end thereof radially inwardly and outwardly projecting annular flange portions, and wherein said moving means comprises a compression coil spring in said tubular portion and engaging with opposite ends said radially inwardly projecting annular flange portion and said inner body and being biased to yieldably maintain said outer body in said spinning position, a ring member coaxial with and axially spaced from said radially outwardly projecting flange portion, a plurality of rolling elements located between said ring member and said outwardly projecting annular flange portion, and a lever mounted between its ends tiltable about a fixed tilting axis, said lever extending through an opening in said housing means into the latter and engaging with one of its ends said ring member to move, during tilting thereof in one direction about said tilting axis, said ring member and therewith said outer body against said biasing means to said cleaning position.

17. In a ringless spinning apparatus as defined in claim 5, wherein said shaft means is formed with an axial bore therethrough, and wherein said inner body includes a rod-shaped member extending with ample clearance through and beyond said bore and carries at the free end thereof a plate extending transversely thereto, said moving means including a coil compression spring in said bore about said rod-shaped member and cooperating with said inner body for yieldably maintaining the same in said spinning position, a ring member about said rod-shaped member adjacent said plate, a plurality of rolling elements between said plate and said ring member, and a lever tiltable intermediate its ends about a fixed tilting axis and engaging with one of its ends said ring member to move, during tilting thereof about said tilting axis, said ring member and therewith said inner body against the force of said compression spring to said cleaning position.

18. In a ringless spinning apparatus as defined in claim 1, wherein said moving means comprise biasing means cooperating with said other of said bodies for yieldably maintaining the same in one of said positions thereof, and operating means cooperating with said other body for moving the same, whenever desired, against said biasing means to the other of said positions.

19. In a ringless spinning apparatus as defined in claim 18, wherein said biasing means are constituted by spring means.

20. In a ringless spinning apparatus as defined in claim 19, wherein said other of said bodies is formed at least in part of magnetizable material, and wherein said moving means are constituted by electromagnetic means cooperating with said part of said other body.

21. In a ringless spinning apparatus as defined in claim 19, wherein said moving means are constituted by mechanical means.

22. In a ringless spinning apparatus as defined in claim 21, wherein said moving means comprise a lever engaging at one end thereof said other of said bodies.

23. In a ringless spinning apparatus as defined in claim 18, wherein said other of said bodies is formed at least in part from magnetizable material, and wherein said biasing means are constituted by magnet means cooperating with said part of said other body.

24. In a ringless spinning apparatus as defined in claim 18, wherein said other of said bodies comprises at least two axially spaced parts of magnetizable material, and wherein said biasing means comprises a permanent mag-

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net cooperating with one of said parts and said moving means comprise electromagnetic means cooperating with the other of said parts.

25. In a ringless spinning apparatus as defined in claim 1, wherein said spinning chamber means is rotatable about a substantially vertical axis, wherein said moving means include a pair of surfaces namely a first surface extending substantially normal to said vertical axis, a second frusto-conical surface coaxial with said axis and tapering away from said first surface, one of said pair of surfaces forming part of said one body and the other of said pair of surfaces forming part of said other body, and a plurality of balls sandwiched between said pair of surfaces, said balls moving during fast rotation of said spinning chamber means in radially outward direction to move thereby

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said other body to said spinning position, while during slow rotation of said spinning chamber means said other of said bodies will move by gravity to said cleaning position while said balls will be moved in radially inward direction.

References Cited

UNITED STATES PATENTS

2,808,697	10/1957	Williams	57—58.95
3,119,223	1/1964	Meimberg	57—50
3,121,306	2/1964	Cizek et al.	57—58.89

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