April 29, 1969 J. STARY ET AL 3,440,812
METHOD AND APPARATUS FOR THE CONTINUOUS RINGLESS
SPINNING OF YARN FROM SEPARATED STAPLE FIBERS
IN A ROTATING SPINNING CHAMBER
Filed Oct. 9, 1967 Sheet 1 of 4

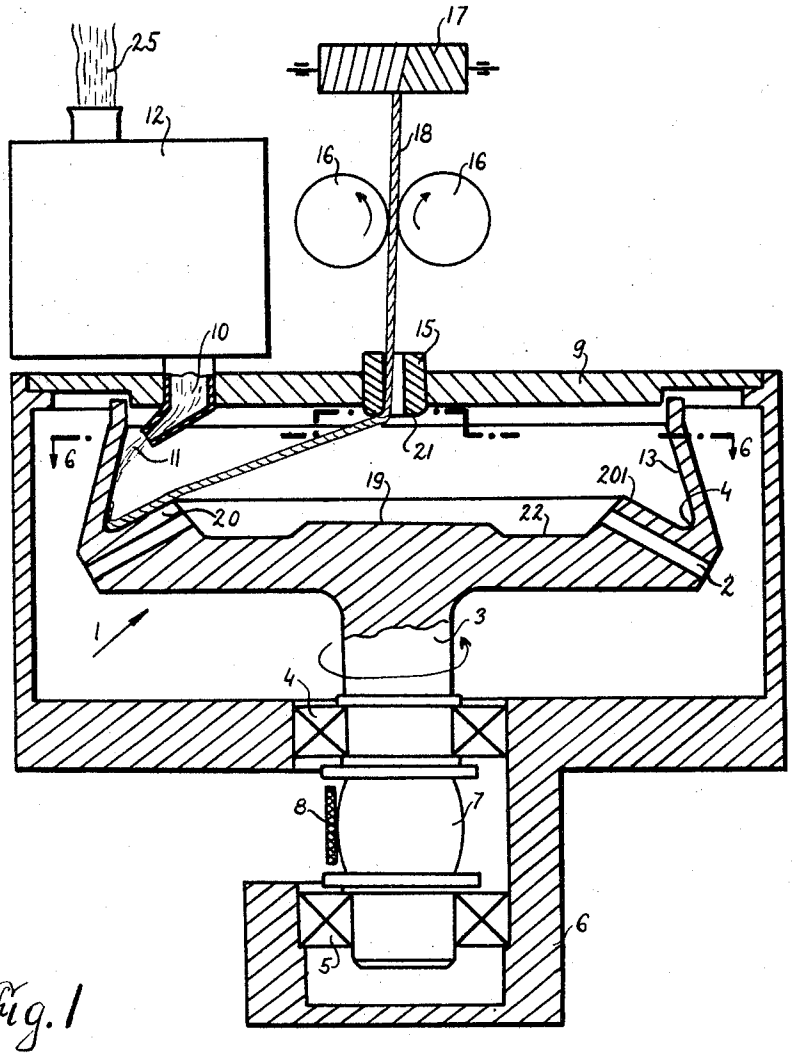


Fig. 1

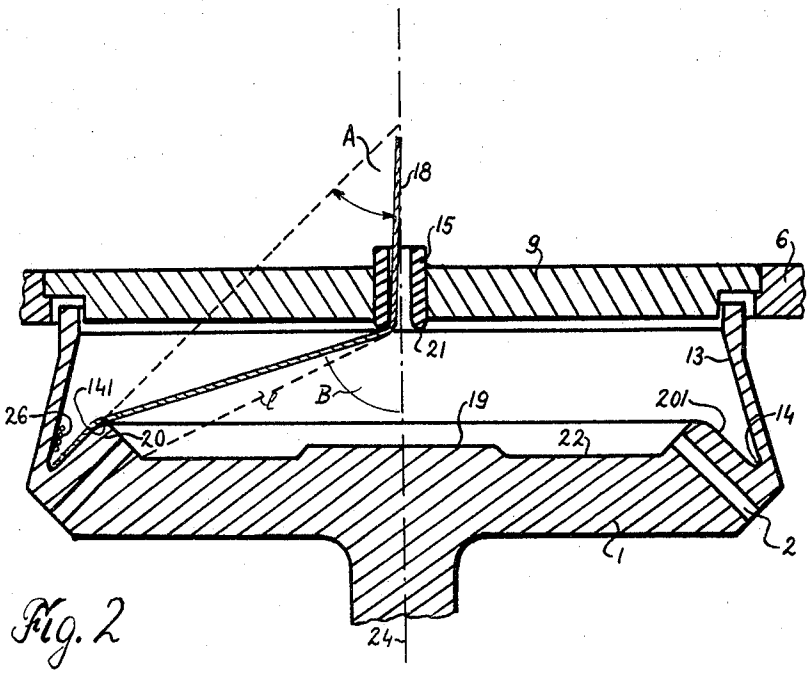

A
18
15
9
6
21
13
141
26
l
B
19
201
14
20
22
1
2
24

Fig. 2

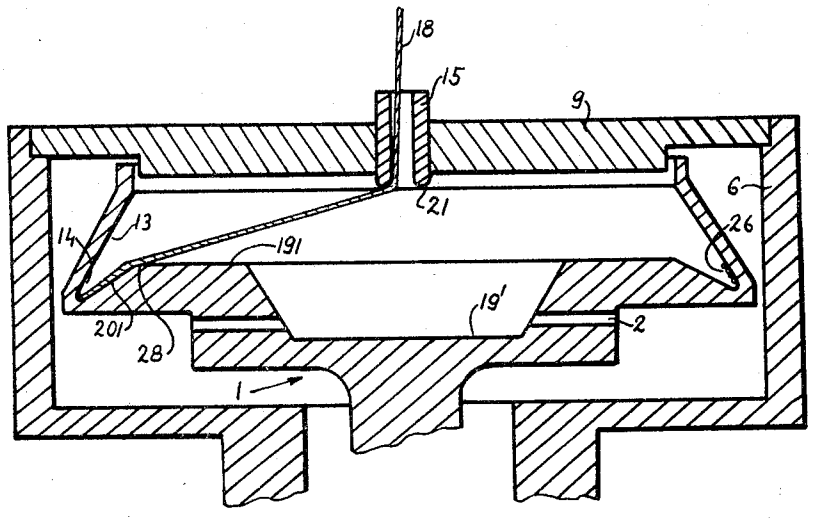

18
15
9
6
21
14
13
191
26
201
28
19'
2
1

Fig. 4

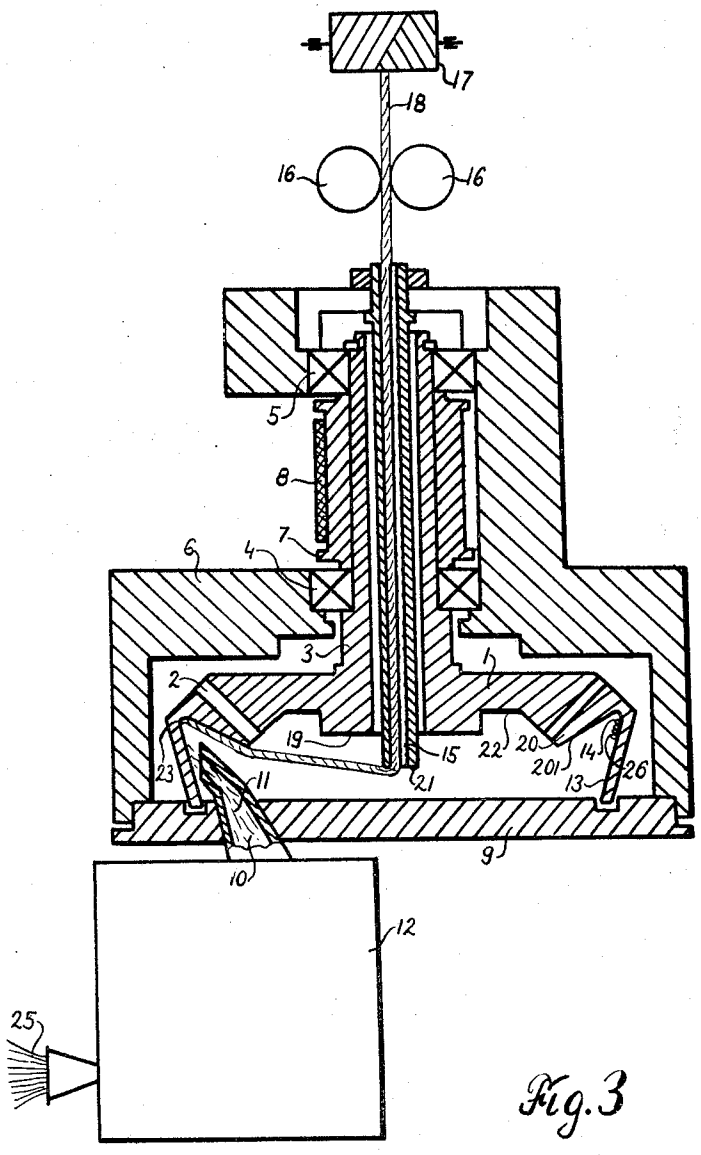
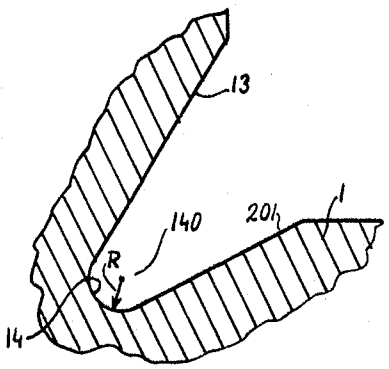


Fig. 3

Fig. 5



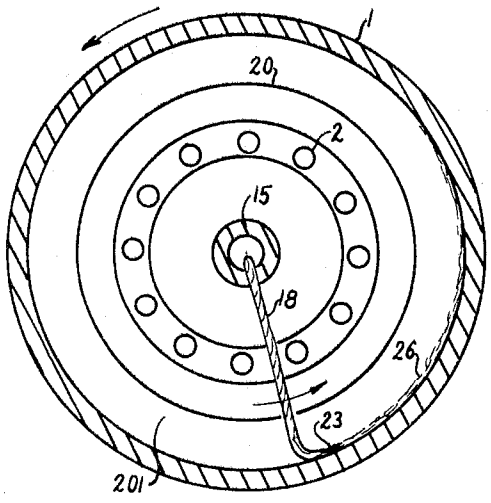


Fig. 6

United States Patent Office 3,440,812 Patented Apr. 29, 1969

3,440,812

METHOD AND APPARATUS FOR THE CONTINUOUS RINGLESS SPINNING OF YARN FROM SEPARATED STAPLE FIBERS IN A ROTATING SPINNING CHAMBER

Josef Stary, Usti nad Orlici, Miloslav Kubovy, Dolni Dobrouc, and Erik Jirasek, Usti nad Orlici, Czechoslovakia, assignors to Vyzkumny Ustav Barlnarsky, Usti nad Orlici, Czechoslovakia

Filed Oct. 9, 1967, Ser. No. 673,741
Claims priority, application Czechoslovakia, Oct. 11, 1966, 6,447/66
Int. Cl. D01h 7/00, 7/76
U.S. Cl. 57—58.89 10 Claims

ABSTRACT OF THE DISCLOSURE

A method of continuous ringless spinning of yarn in which a portion of the yarn adjacent the fiber collecting surface of a rotating spinning chamber and spaced from the inner end of the withdrawing passage of the yarn is frictionally engaged by a surface portion of the rotating spinning chamber and preferably deflected in direction of the axis of rotation of the latter to apply a frictional force to the aforementioned yarn portion, and an apparatus for carrying out the method.

Background of the invention

The present invention relates to a method and apparatus for the continuous ringless spinning of yarn in a rotating spinning chamber in which separated staple fibers are deposited on the so-called collecting surface of the spinning chamber and withdrawn in the form of a yarn through a withdrawing passage of the apparatus.

Spinning chambers are known in which the separated staple fibers are fed by means of air currents into the spinning chamber so that the staple fibers are deposited in form of a ribbon on the so-called collecting surface of the spinning chamber. The yarn end adjacent to the collecting surface collects, while the yarn is withdrawn through the withdrawing passage, fibers from the ribbon while imparting a twist thereto so that the fibers are continuously twisted into a yarn. The yarn is withdrawn through the so-called funnel and wound onto a bobbin. During the aforementioned process, the collecting point, i.e., the point of collecting the fibers from the ribbon by the twisting end of the yarn, moves in a direction corresponding to the rotary motion of the spinning chamber at a speed which equals the sum of the speed of the collecting surface of the spinning chamber and the withdrawal speed of the yarn. The yarn in the spinning chamber has in an axial view a form which is arcuately bent between the collecting point and the withdrawal passage in the direction of the rotary motion of the spinning chamber.

During the spinning of fibers in such a spinning chamber it happens sometimes that shells or other impurities contained in the raw material or fiber agglomerates which have not been properly separated are fed together with the separated fibers into the spinning chamber. When such impurities or shells fall onto the collecting surface of the spinning chamber, a localized portion of greater mass will form in the ribbon and when this greater mass begins to be withdrawn by the yarn, the increased centrifugal force of this greater mass will produce a considerably increased lifting resistance and therewith an increased tension in the yarn. If no breakage takes place in this case, the increased

resistance will cause on the one hand a change in the shape of the yarn section in the spinning chamber in such a manner that the yarn will now curve from the collecting point towards the withdrawal passage in a direction opposite to the direction of rotation of the spinning chamber, and on the other hand a change of the relative speed of the collecting point on the collecting surface, which change of speed will be equal to the difference in the rotary speed of the collecting surface and the withdrawing speed of the yarn.

If the above-mentioned situation occurs, the penetration of twist in the yarn up to the collecting point is much more difficult to obtain due to the mentioned unsuitable configuration of the yarn end in the spinning chamber, and this causes a considerable drop in the strength of the yarn which is spun, which in turn will increase the number of yarn breakages during the spinning process.

The above drawbacks will detrimentally effect the spinning process especially during the spinning of fine yarns, or when the yarn is withdrawn at a high speed, and particularly during spinning of low twisted yarns.

A spinning chamber is known in which the collecting surface is provided with needles for controlling the shape of the yarn curve in the spinning chamber. The action of these needles on the ribbon of fibers which is spun into the yarn is however so intensive that when fine yarns are spun, the holding force exerted by the needles on the fiber ribbon is sometimes greater than the tensile strength of the yarn which is spun so that yarn breakage will frequently occur. This yarn breakage increases when the number of revolutions of the spinning chamber is increased so that this known construction will not be suitable for spinning fine yarns and also not be suitable to a high speed spinning process.

In addition, impurities contained in the fed raw material adhere, as known, to the collecting surface of the spinning chamber and must be removed from time to time. Evidently, when the collecting surface is provided with needles, this cleaning process is rendered much more difficult.

It is an object of the present invention to overcome the aforementioned drawbacks in spinning chambers for the continuous spinning of yarn.

It is a further object of the present invention to provide a method and apparatus for the continuous ringless spinning of yarn in which also fine yarn numbers may be produced with considerable speed without the danger of frequent yarn breakages during the spinning process.

Summary of the invention

With these objects in view, the method according to the present invention of continuous ringless spinning of yarn in a spinning chamber comprises the steps of depositing separated staple fibers on the annular collecting surface of a spinning chamber, spinning the fibers into yarn while rotating the spinning chamber about its axis and withdrawing the yarn from the collecting surface and out of the spinning chamber through an opening coaxial with the aforementioned axis, and frictionally engaging a portion of the yarn adjacent the collecting surface and spaced from the aforementioned opening with a surface portion of the rotating spinning chamber to apply to the yarn portion a frictional force rotating with the spinning chamber. Preferably the aforementioned yarn portion is axially deflected by the surface portion of the spinning chamber to thereby increase the frictional force applied to the yarn portion.

The spinning apparatus according to the present invention for carrying out the aforementioned method may comprise a rotary spinning chamber having an axis of rotation and a coaxial annular collecting surface for fibers to be spun into a yarn, means for depositing fibers onto the collecting surface, a coaxial withdrawing passage having an inner end axially displaced from the collecting surface, means for withdrawing the yarn from the collecting surface through the aforementioned withdrawing passage, and means forming part of and rotating with said spinning chamber and frictionally engaging a yarn portion adjacent to the collecting surface and spaced from the withdrawing passage for applying a frictional force to the aforementioned yarn portion. Preferably, the last mentioned means for applying a frictional force to the aforementioned yarn portion is arranged to deflect the yarn portion in axial direction to thereby increase the frictional force.

The engaging and deflecting means is preferably in the form of an annular deflecting surface coaxially arranged with the axis of rotition of the spinning chamber and extending inwardly from the collecting surface. The annular deflecting surface may be in the form of a substantially frusto-conical surface and preferably the inner edge of said frusto-conical surface projects beyond a straight line extending from the collecting surface to the inner end of the withdrawal passage to thereby deflect the yarn portion adjacent to the collecting surface in direction of the axis of the spinning chamber so as to increase the friction imparted to this yarn portion.

The spinning chamber may have an end wall and a peripheral wall having an inner substantially frusto-conical surface tapering in a direction away from the end wall, and the frusto-conical deflecting surface may be constituted by an annular surface portion of the end wall inclined to the inner frusto-conical surface of the peripheral wall and joined to the latter by an annular groove forming the collecting surface. Advantageously, this annular groove which forms the collecting surface has in a plane including the axis of rotation of the spinning chamber a radius of curvature between 0.28 and 0.32 mm. which permits spinning of the most current yarn numbers.

To achieve good results with the spinning chamber according to the present invention, half of the apex angle of the frusto-conical deflecting surface is smaller than the angle included between the axis of rotation and a straight line in a plane including the aforementioned axis and passing from the inner edge of the frusto-conical deflecting surface to the inner end of the withdrawal passage.

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 descriptions of the drawings

FIG. 1 is a schematic axially cross section of a spinning chamber according to the present invention;

FIG. 2 is a partial axial cross section of an apparatus similar to FIG. 1 and illustrating the angles which the deflected portion of the yarn and the remaining yarn portion respectively include with the axis of rotation of the spinning chamber;

FIG. 3 is an axial cross section of a modified embodiment according to the present invention in which feeding of the fibers into the spinning chamber and withdrawal of the spun yarn from the spinning chamber is made in opposite directions;

FIG. 4 is a partial axial cross section of a spinning chamber according to the present invention and showing

a form of a spinning chamber slightly deviating from that shown in FIG. 1;

FIG. 5 is a partial cross sectional view, drawn to an enlarged scale, of the groove-shaped collecting surface of the spinning chamber; and

FIG. 6 is a cross sectional view taken along the line 6—6 of FIG. 1 and illustrating especially the configuration of the yarn between the collecting point and the withdrawing passage.

Descripton of the Preferred embodiments

Referring now to the drawings and more specifically to FIG. 1 of the same, it will be seen that the spinning chamber **1** according to the present invention may be provided in its bottom wall **19** with a plurality of substantially radially extending ventilating passages **2** which during fast rotation of the spinning chamber about its axis will provide an underpressure in the interior of the spinning chamber. A shaft **3** integral with the bottom wall **19** projects downwardly therefrom and is rotatably mounted in bearings **4** and **5** supported in any suitable manner on the partially illustrated machine frame **6**. The shaft **3** is provided intermediate the bearings **4** and **5** with a pulley portion **7** engaged by a belt **8** for rotating the shaft **3** and therewith the spinning chamber about the axis of the latter. The spinning chamber has an annular peripheral wall which preferably has an inner surface **13** in form of a frusto-conical surface tapering in a direction away from the bottom wall **19** of the spinning chamber. The upper open end of the spinning chamber **1** is substantially closed by a lid **9** mounted on the machine frame **6** and slightly spaced from the upper end of the peripheral wall of the spinning chamber so as to be out of contact with the latter and so that the spinning chamber may rotate freely with respect to the stationary lid **9**. An inlet passage **10** extends from a known separating device **12**, schematically illustrated in FIG. 1, and which separates fibers from a fiber body **25**, through an appropriate opening in the lid **9** into the interior of the spinning chamber for feeding separated fibers **11** into the interior of the spinning chamber. The inner portion of the inlet passage **10** is bent towards the inner surface **13** of the peripheral wall of the spinning chamber. A tube portion **15** constituting a withdrawal passage for the yarn to be spun in the spinning chamber is fixed in the lid coaxially with the axis of rotation of the spinning chamber. A pair of oppositely rotated withdrawing rollers **16** are located above the tube **15** frictionally engaging the yarn **18** on opposite sides for withdrawing the same through the withdrawal passage, and the yarn is subsequently wound on a bobbin **17** located above the withdrawing rollers.

The bottom wall **19** of the spinning chamber is made in such a way to form a deflecting element which in the embodiment as shown in FIG. 1 has the shape of a concentric projection **20** having an outer substantially frusto-conical deflecting surface **201** inclined to the inner frusto-conical surface **13** of the peripheral wall of the spinning chamber and joined to the latter by an annular groove **14** forming a collecting surface on which the separated fibers emanating from the inlet passage **10** will collect. The bottom **19** forms inwardly of the projection **20** a recess **22** from which the aforementioned ventilating passages **2** extend in substantially radial direction to the outer surface of the spinning chamber.

As shown in FIG. 2, the inner edge of the collecting surface **201** projects in axial direction beyond a theoretical line **1** connecting the bottom of the groove-shaped collecting surface **14** with the inner end of the tube **15** constituting the widthdrawing passage. As likewise shown in FIG. 2, the angle A, which is half of the apex angle of the deflecting surface **201** is smaller than the angle B included between the axis of rotation **24** of the spinning chamber and a straight line in a plane including this axis and passing from the inner edge **141** of the deflecting

surface **201** at which the yarn **18** will get out of contact with the deflecting surface to the inner end **21** of the tube or withdrawing passage **15**. The arrangement is made preferably in such a way to establish a ratio between the angle A and B within the range 1:1.01 and 1:9 and preferably within a range 1:1.2.

The apparatus as described above in connection with FIG. 1 will operate as follows:

The fibers **11** separated by the separating device **12** from the fiber body **25** are fed through the inlet passage **10** by the action of the partial vacuum produced in the interior of the spinning chamber during fast rotation of the latter by the ventilating passages **2** into the interior of the spinning chamber **1** and slide downwardly at the inner surface **13** of the peripheral wall of the spinning chamber toward the collecting surface **14** on which the fibers are deposited in form of a ribbon **26**. Yarn **18** is initially fed through the withdrawing channel **15** into the spinning chamber to engage with its end the ribbon **26** which begins to accumulate on the end of the inserted yarn, upon which the direction of movement of the yarn **18** is reversed and the yarn is spun in and continuously withdrawn by the withdrawing rollers **16** and wound onto the bobbin. During spinning, the front end of the yarn thus formed moves along the collecting surface **14** in the same direction as the spinning chamber rotates at a speed equal to the sum of the speed of the collecting surface and the withdrawal speed of yarn **18** and the yarn end gathers at a point **23** (FIG. 6) also called collecting point the fibers from the ribbon **26** simultaneously imparting a twist thereto so as to spin the same into a yarn. In order to avoid a change of the direction of movement of the collecting point due to a sudden increase of the centrifugal forces acting at the collecting point of the ribbon when heavy impurities or fiber agglomerates are fed together with the separated fibers into the spinning chamber, the yarn **18** is subjected at a portion adjacent the collecting surface **14** and spaced from the withdrawing passage **15** to the frictional effect of the deflecting surface **201** which deflects the portion **18** of the yarn engaging the deflecting surface in axial direction and simultaneously entrains it in the direction of rotation of the spinning chamber, preventing thereby a change in the direction of movement of the collecting point **23** and thus the production of a yarn of inferior quality or eventual yarn breakage.

The embodiment shown in FIG. 3 differs from the embodiment as shown in FIG. 1 and above-described mainly in that the feeding of the separated fibers into the spinning chamber **1** is performed from one side, whereas the withdrawal of yarn from the interior of the spinning chamber is performed from the other side of the latter. In this case, the tube **15** forming the withdrawing passage extends through an axial bore of the shaft **3** out of contact with the inner bore surface.

The embodiment shown in FIG. 4 differs slightly from the embodiment shown in FIG. 1 in that the central depression **19'** in the bottom wall of the spinning chamber dose not extend from the inner edge **26** of the deflecting surface **201**, but in this case the top face **191** of the bottom wall of the spinning chamber **1** extends in a plane normal to the axis of rotation of the spinning chamber inwardly from the annular edge **28** of the deflecting surface **201** and the depression **19** extends from this top surface **191** downwardly into the bottom wall of the spinning chamber only into a central portion of the bottom wall.

The groove-shaped collecting surface **14** has in a plane including the axis of rotation of the spinning chamber a radius of curvature R which is preferably in the range of 0.28 to 0.32 mm. Such a dimension will be suitable for the spinning of most current yarn numbers without the necessity of changing the dimension of the collecting surface.

It will be understood that each of the elements described above, or two or more together, may also find a usefull application in other types of apparatus and method for the continuous ringless spinning of yarn in a rotating spinning chamber differing from the types described above.

While the invention has been illustrated and described as embodied in an apparatus for the continuous ringless spinning of yarn in a spinning chamber provided with a spinning chamber has an end wall and a peripheral wall deffecting surface frictionally engaging the yarn at a portion thereof adjacent to the collecting surface of the 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 by 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.

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

We claim:

1. A method of continuous ringless spinning of yarn in a spinning chamber rotatable about an axis and having an annular coaxial collecting surface, comprising the steps of depositing separated staple fibers on said collecting surface; spinning said fibers into a yarn while rotating the spinning chamber about said axis and withdrawing the yarn from said collecting surface and out of said spinning chamber through an opening coaxial with said axis; and frictionally engaging a portion of said yarn adjacent said collecting surface and spaced from said opening with a surface portion of said rotating spinning chamber to apply to said portion of said yarn a frictional force entraining said yarn portion in the direction of rotation of the spinning chamber.

2. A method as defined in claim **1** and including the step of axially deflecting said portion of said yarn by said surface portion to increase the frictional force applied to said yarn portion.

3. A spinning apparatus comprising, in combination, a rotary spinning chamber having an axis of rotation and a coaxial annular collecting surface for fibers to be spun into a yarn; means for depositing fibers onto said collecting surface; a coaxial withdrawing passage having an inner end axially displaced from said collecting surface; means for withdrawing the yarn from the collecting surface through said withdrawing passage; and means forming part of and rotating with the spinning chamber and frictionally engaging a yarn portion adjacent said collecting surface and spaced from said withdrawing passage for applying a frictional force to said yarn portion.

4. A spinning apparatus as defined in claim **3**, wherein said means for applying a frictional force to said yarn portion is arranged to deflect said yarn portion in axial direction.

5. A spinning apparatus as defined in claim **4**, wherein said engaging and deflecting means is in the form of an annular deflecting surface coaxially with said axis and extending inwardly from said collecting surface.

6. An apparatus as defined in claim **5**, wherein said annular deflecting surface is a substantially frusto-conical surface.

7. An apparatus as defined in claim **6**, where half of the apex angle of said frusto-conical deflecting surface is smaller than the angle included between said axis of rotation and a theoretical straight line in a plane including said axis and passing from the inner edge of said frusto-conical deflecting surface to said inner end of said withdrawing passage.

8. An apparatus as defined in claim **6**, wherein the inner edge of said annular deflecting surface projects in direction of said axis beyond a theoretical straight line extending from said collecting surface to said inner end of said withdrawing passage.

9. An apparatus as defined in claim 8, wherein said spinning chamber has an end wall and a peripheral wall having an inner substantially frusto-conical surface tapering in a direction away from said end wall, and wherein said frusto-conical deflecting surface is a surface portion of the end wall inclined to said inner frusto-conical surface and joined to the latter by an annular groove forming said collecting surface.

10. An apparatus as defined in claim 9, wherein said annular groove has in a plane including said axis a radius of curvature between 0.28 and 0.32 mm.

References Cited

UNITED STATES PATENTS

3,163,976	1/1965	Juillard	57—58.89
3,324,642	6/1967	Meimberg et al.	57—58.95

JOHN PETRAKES, *Primary Examiner.*

U.S. Cl. X.R.

57—58.95