Feb. 4, 1969 H. LANDWEHRKAMP ETAL 3,425,205

METHOD AND APPARATUS FOR STRAND QUALITY CONTROL IN ROTARY SPINNING CHAMBERS

Filed Nov. 14, 1967

Sheet 1 of 2

Fig. 1

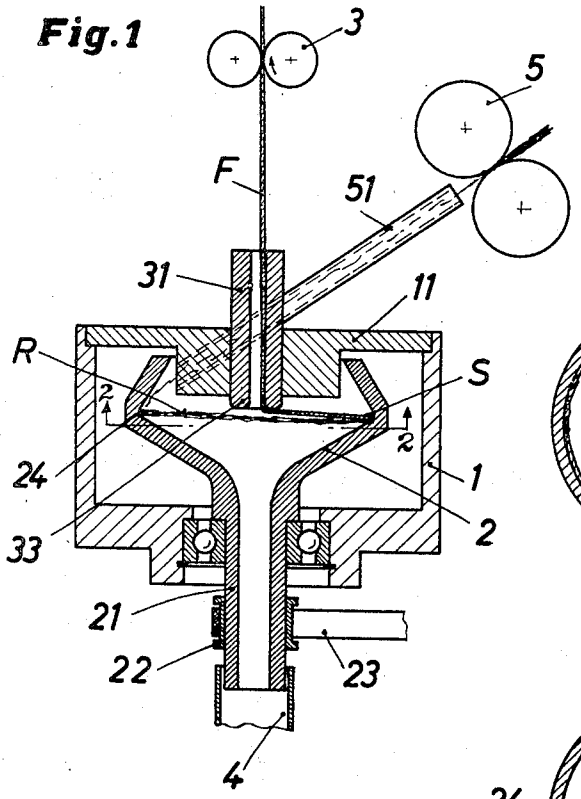


Fig. 2

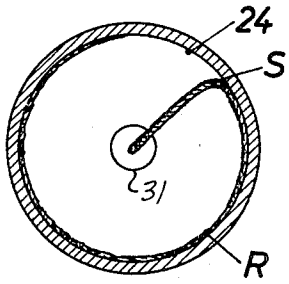


Fig. 3

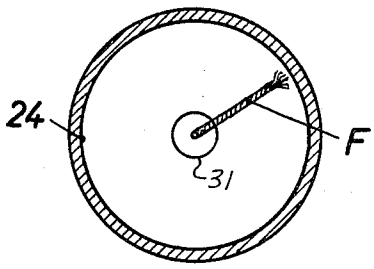


Fig. 4

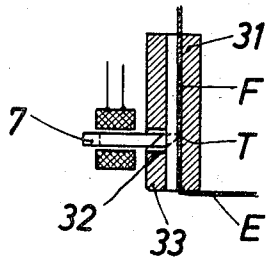
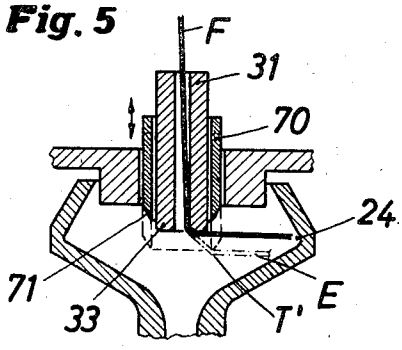


Fig. 5



INVENTORS
HANS LANDWEHRKAMP
FRANZ SCHREYER

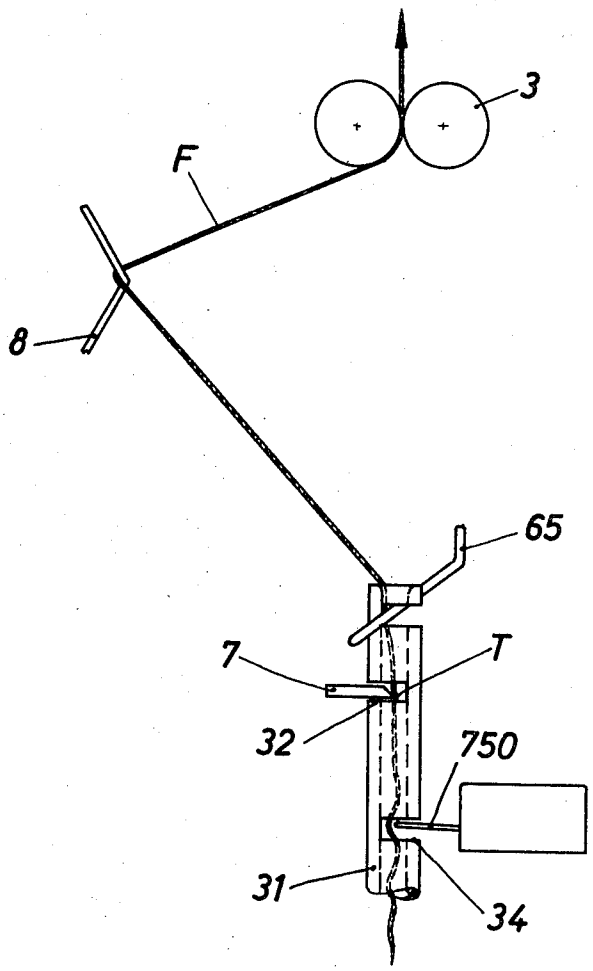
BY

Robert W. Beach

ATTORNEY

Feb. 4, 1969 H. LANDWEHRKAMP ET AL 3,425,205
METHOD AND APPARATUS FOR STRAND QUALITY CONTROL IN ROTARY SPINNING CHAMBERS
Filed Nov. 14, 1967 Sheet 2 of 2

Fig. 6



INVENTORS
HANS LANDWEHRKAMP
FRANZ SCHREYER
BY
Robert W. Beach
ATTORNEY

United States Patent Office 3,425,205
Patented Feb. 4, 1969

3,425,205

METHOD AND APPARATUS FOR STRAND QUALITY CONTROL IN ROTARY SPINNING CHAMBERS

Hans Landwehrkamp and Franz Schreyer, Ingolstadt, Germany, assignors to Schubert & Salzer Maschinenfabrik Aktiengesellschaft, Ingolstadt, Germany, a corporation of Germany

Filed Nov. 14, 1967, Ser. No. 682,944
Claims priority, application Germany, Nov. 19, 1966, Sch 39,841
U.S. Cl. 57—58.89
Int. Cl. D01h 7/00
8 Claims

ABSTRACT OF THE DISCLOSURE

When a spinning operation is discontinued, the strand is severed a predetermined distance from the fiber-collection zone, the inferior trailing severed portion is removed from the spinning apparatus, and the strand end is moved in a direction opposite its normal travel direction such predetermined distance to the collection zone in readiness to resume spinning. A reciprocable knife may extend into the strand-withdrawal tube transversely of the tube length to sever the strand, or an annular knife encircling the withdrawal tube is axially reciprocated longitudinally of the withdrawal tube to a location between the tube and the collection zone to sever the strand moving generally radially into the tube. Alternatively, the strand may be twisted from the fiber at the point of strand tangency to the collection zone by stopping the strand-withdrawal mechanism and continuing rotation of the chamber.

In order to start the spinning operation in rotary spinning chambers, a strand end must be inserted through the strand-withdrawal opening or tube communicating with the spinning chamber until such strand end engages fiber in the fiber collection zone. When the strand end engages such fiber, the fiber is drawn and twisted continually adding to the strand length. A free strand end must be fed to the collection zone after each interruption of the spinning process, whether resulting from intentional machine shutdown, by a break in the continuous strand or by some other disturbance in the operation causing separation of the strand from fiber in the collection zone. Such return can be effected in principle in various ways, either manually or automatically. However, the strand quality in the region of a break or discontinuity is frequently impaired by thick or thin sections, or less uniformly or firmly-bound fibers, or by nonuniform twist or some combination of such flaws. In addition, a definite length of the free strand end must be returned to the collection channel for restarting the spinning operation to minimize the regions of irregularity in the finished yarn caused by discontinuity in the spinning process.

Previous starting methods have not recognized these problems, however. or example, it is customary to stop the drive for the fiber-sliver supply, the yarn- or strand-withdrawing rolls and the spinning chamber simultaneously. Because of its high relative rotational speed the spinning chamber continues to rotate for a time, although decelerating, and continues to spin fiber remaining in the collection zone. The strand end portion is not spun uniformly due to the decreasing chamber speed nor is it drawn from the chamber, so that tension required to impart proper twist to the strand is absent. Therefore, the trailing strand end portion lacks constant thickness and, due to the decreasing fiber supply, the free end becomes progressively thinner and tends to curl into a tight knot. When fiber is again supplied to the collection zone for resuming the spinning operation and the chamber begins

to rotate, the knotted strand end is usually not in a position to insure immediate contact with fiber. In previous practice the drawing mechanism is timed to begin withdrawing the strand a predetermined interval after the fiber supply is started so that the strand is withdrawn regardless of whether contact has been made with the fiber. Consequently, false starts in which the strand end is pulled out of the chamber without a continuing strand being formed are not uncommon and it is necessary to feed the strand end back into the spinning chamber. Even if contact is made with the fiber, a tightly knotted or curled strand end may not pick up sufficient fiber to form a strong bond so that the strand may break easily at the weak location.

If the spinning operation is interrupted by strand breakage, the torn strand end usually includes flaws, such as abraded regions or fiber lumps or pills. Because broken strand ends are not suitable for restarting the spinning operation, an auxiliary thread or strand may be extended into the spinning chamber and then rolled onto a separate spool after starting.

It is a principal object of the present invention to provide a strand end of uniform quality and thickness which can be introduced into the fiber-collection zone for starting a spinning operation and to minimize thereby the effect on strand uniformity of an interruption in the continuous spinning process.

Another important object is to provide a strand end at a predetermined distance from the collection zone prior to resumption of the spinning process and to facilitate thereby such resumption by automatically returning the strand to a precise location relative to the collection zone.

FIGURE 1 is a vertical axial section through representative rotary spinning apparatus to which the present invention is particularly applicable.

FIGURES 2 and 3 are diametral sections on line 2—2 of FIGURE 1 through the spinning chamber illustrating sequentially one method of severing a strand.

FIGURE 4 is an axial section through a strand-withdrawal tube showing strand-cutting mechanism.

FIGURE 5 is a fragmentary axial section through a spinning chamber and withdrawal tube illustrating a different type of strand-cutting mechanism.

FIGURE 6 is a schematic representation of strand withdrawal and clamping mechanism having cutting mechanism of the type shown in FIGURE 4.

Shown in FIGURE 1 is a rotary spinning chamber **2** enclosed in a stationary housing **1** having a cover **11**. Fiber sliver is fed through rolls **5** and feed tube **51** extending through cover **11** into strand-forming chamber **2** to direct the sliver toward the wall of the chamber interior. Fibers separated by a higher rate of velocity of the rolls **5** as of the supply of the sliver S are moved by centrifugal action to the portion of the chamber having the greatest diameter, which portion defines a fiber-collection zone or channel **24**. Fibers in the channel form a ring R which is spun into a strand F and then twisted into yarn and the strand is withdrawn through a stationary tube **31** in cover **11** by drawing rolls **3** and then wound onto a bobbin or spool. The spinning chamber is rotated by belt **23** on sheave **22** encircling hollow shaft **21**, which shaft is integral with the lower portion of the spinning chamber **2**. The pressure in the spinning chamber is predominantly below atmospheric and such low pressure can be created by high speed rotation of the chamber itself, but is preferably created by connecting a suction source **4** to the mouth of hollow shaft **21**.

Conventionally, drives for sliver feed rolls **5**, drawing rolls **3** and the spinning chamber **2** are de-energized simultaneously when the spinning process is to be stopped. Because the spinning chamber rotates at a high speed rela-

tive to rolls 3 and 5, such chamber requires a longer period than such rolls to come to a stop so that, during such period, the relative rotational speed of rolls 3 and 5 and of the spinning chamber differ from their relative speeds during normal spinning. During deceleration of the spinning chamber, the fiber remaining in ring R in the collection channel continues to be bound forming an extension of strand F; however, because of the change in speed relationship of the components as mentioned above, the length and characteristics of the strand are uncontrolled and such nonuniform strand end causes difficulties in restarting the spinning operation.

In accordance with the present invention, a smooth uniform strand end portion is provided by stopping the feed rolls 5 and drawing rolls 3 while maintaining the spinning chamber 2 at its normal rotational speed for an additional interval. As a result of the continued chamber spin, the fiber ring R of loose fiber is spun or bound into a continuation of strand F as illustrated in FIGURE 2. Because rolls 3 have stopped, strand F no longer is pulled longitudinally from the chamber so that the same point S of the strand is maintained in contact with collection channel 24 by centrifugal force and, consequently, continues to be twisted at this location. The centrifugal force on the fiber ring and the pressure of the strand against the collection surface prevents such twist from being transmitted to the strand formed in fiber ring, however, so that the strand twist is localized sufficiently to sever the free portion of strand F from the strand portion in ring R at the point of tangency S of the strand with the collection channel. Since the strand is always twisted off at the same point of tangency location the length of the strand F is of definite predetermined length. Also because the finished free strand is severed from the length of spun fiber in the spinning channel, such free strand is of a quality consistent with the previously spun strand, as illustrated in FIGURE 3. The spinning chamber is stopped after the free strand portion is severed from the strand portion in the collection channel and the imperfect strand portion is removed from the collection channel and chamber through hollow shaft 21 and tube 4, for example, or by other cleaning apparatus such as disclosed in our copending application No. 655,906, filed July 25, 1967.

When the strand F is released by severing from the strand portion in the collection channel, tension due to strand twist tends to snap the strand end out of the withdrawal tube. Consequently, clamping mechanism in or adjacent to the withdrawal tube is preferably provided to supplement the restraining force exerted by the suction from source 4 for holding the strand end in the tube. Suitable clamping mechanism is disclosed in copending application Ser. No. 665,118 of Hans Landwehrkamp et al., filed Sept. 1, 1967, and is represented in FIGURE 6 by clamp 65.

To start the spinning operation, the drive for spinning chamber 2 is energized. Because strand F was severed to a length just sufficient to extend radially of withdrawal tube 31 to collection channel 24 of such chamber, the strand end cannot be held in the channel by centrifugal force created by the rotating chamber without the position of the strand being changed. Consequently, the chamber can rotate indefinitely without affecting such strand end. At any desired time, the sliver feed roll 5 can be actuated to supply a new fiber ring R to channel 24. Simultaneously or subsequently, return mechanism can be actuated to feed the strand back into the chamber a predetermined distance to engage the free strand end with the newly-formed fiber ring for resumption of spinning. The return may be accomplished, for example, by reversing the rotation of drawing rolls 3 a predetermined number of revolutions. Subsequently, the drawing rolls will be energized synchronously to begin withdrawing strand from the chamber.

Instead of separating strand F from an imperfect strand end E by twisting, as described above, the separation can be effected by an appropriate cutting device. In FIGURE 4 a cutting knife 7 is shown which is reciprocable through a slot 32 in the side of withdrawal tube 31. After drawing rolls 3 have been stopped, the knife can be mechanically, pneumatically, hydraulically or electromagnetically projected through the slot and pressed against the diametrically opposite tube wall to sever strand F at point T. Alternatively, an electrically heated filament may be used to cut the strand.

Another type of cutting arrangement is shown in FIGURE 5. In this case a sleeve 70 encircles withdrawal tube 31 extending through cover 11. The lower end of sleeve 7 is beveled to form an annular knife edge 71 and the sleeve is axially slidable from the full-line position in which the cutting edge 71 is above mouth 33 of tube 31 to the broken-line position in which the knife edge extends below the tube mouth into the spinning chamber. When the strand is to be severed, sleeve 70 is slid into the broken-line position so that rotation of the spinning chamber 2 will press the strand against cutting edge 71 to sever it at point T'. The severed portion E of the strand within the spinning chamber 2 will be removed from the chamber through hollow shaft 21 and tube 4 as previously described.

Although the strand-severing point has been shown and described as being within the spinning chamber or in the withdrawal tube, a cutting implement could be provided at other locations, if desired, such as between the upper end of withdrawal tube 31 and drawing rolls 3, or between drawing rolls 3 and a bobbin or spool onto which finished yarn is wound, provided that suitable mechanism is provided for returning the free strand end a sufficient distance into the spinning chamber collection channel. At whatever location the strand is severed, such location should be predetermined and known so that return supply mechanism can be synchronized with feed rolls 5, chamber 2 and drawing rolls 3 to move the strand F back into the spinning chamber the proper distance so that resumption of the spinning operation can be effected consistently and automatically.

The present method of controlling the quality of the yarn product by providing a strand end of uniform quality for use in resuming a spinning process interrupted intentionally may also be employed when the interruption occurs because of unintentional strand breakage or by some other disturbance. Because such disturbance or breakage occurs at random, rather than at predetermined locations, it is even more important to provide means for cutting the strand to a predetermined length in order to assure reliable restarting of the operation. If, for example, a break in the strand is sensed by a sensor 750, such as shown in FIGURE 6, through a slot 34 in the side of withdrawal tube 37, the drawing rolls 3 can be stopped and clamp 65 actuated to retain the strand in the spinning apparatus. If the strand is clamped in a position such that a portion of the strand bridges slot 32, such strand can be severed at location T and returned to the collection channel, as described in connection with FIGURE 4. If the strand is pulled a sufficient distance out of the spinning chamber so that its free end is above the knife, additional mechanism is required to return the strand a sufficient distance into the tube for cutting. Such return mechanism is represented by movable guide 8. Such guide can be moved to the right, as seen in FIGURE 6, into alignment with the nip of rolls 3 and axially of tube 31 to permit the strand to drop into the tube. Sensing, clamping and return mechanism of this and alternative types are described in aforementioned Landwehrkamp et al. application Ser. No. 665,118.

In all of the control methods shown and described, the strand is severed at a predetermined distance from the collection channel so that the trailing portion of inferior quality is removed and so that automatic mechanism can be provided to return a free strand end to the most advantageous position relative to collection channel 24

to assure reliable resumption of the spinning process.

The method and apparatus of the present invention can be applied successfully to all spinning devices having rotating spinning chambers, such as shown in German Patent 1,111,549, for example.

We claim:

1. The method of controlling strand quality during interruption and resumption of spinning a continuous strand drawn from a fiber-collection zone to which fiber is continuously fed, which comprises the steps of severing the continuous strand at a predetermined distance from the fiber-collection zone, removing from the fiber-collection zone the severed strand end portion and fiber clinging thereto, and, in resuming spinning of the continuous strand, moving the continuous strand end a predetermined distance toward the collection zone.

2. The method defined in claim 1, including the step of moving the continuous strand toward the collection zone before severing the strand.

3. The method defined in claim 1, including before severing the strand the steps of interrupting the supply of fiber to the fiber-collection zone, interrupting drawing of the strand from the fiber-collection zone, and severing the strand a predetermined period after the supply of fiber to the fiber-collection zone has been interrupted and drawing of the strand has been interrupted while continuing to twist the strand at normal spinning speed.

4. In apparatus for spinning a strand having a tube through which a continuously spun strand is drawn from a fiber-collection zone, cutting means adjacent to said

tube engageable with the strand for severing it at a predetermined location relative to the tube and fiber-collection zone.

5. In the apparatus defined in claim 4, in which the tube has an aperture through a wall thereof, the cutting means being projectable through such tube aperture into engagement with the strand drawn through such tube.

6. In the appartus defined in claim 5, the cutting means including a knife projectable through the tube aperture.

7. In the apparatus defined in claim 5, the cutting means including a heated filament projectable through the tube aperture.

8. In the apparatus defined in claim 4, the cutting means including a sleeve encircling the tube, having its end adjacent to the fiber-collection zone sharpened and reciprocable relative to the tube between a position in which its sharpened end encircles the tube and a position in which its sharpened end projects beyond the tube end for engagement with the strand portion between the fiber-collection zone and the tube.

References Cited

UNITED STATES PATENTS

3,119,223	1/1964	Meimberg	57—58.95 XR
3,334,479	8/1967	Mikulecky et al.	57—58.89 XR
3,339,359	9/1967	Ripka et al.	57—58.89
3,375,649	4/1968	Burés et al.	57—58.91

DONALD E. WATKINS, *Primary Examiner.*