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Stahlecker et al.

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[54] **APPARATUS FOR PIECING A THREAD IN AN OPEN-END SPINNING UNIT**

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[52] **U.S. Cl.** ..... **57/34 R;** 57/58.89

[51] **Int. Cl.². D01H 7/00;** D01H 1/12; D01H 15/00

[58] **Field of Search** ..... 57/22, 34 R, 34 TT, 58.89, 57/58.95, 81, 83, 159

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Primary Examiner—Donald E. Watkins
Attorney, Agent, or Firm—Craig & Antonelli

[57] **ABSTRACT**

Apparatus for piecing a thread end in an open-end spinning unit having a spinning rotor with a ring of open-up fibers including opening means having friction tool means for fraying the thread end at a predetermined location and a device for returning the thread end into the spinning rotor after fraying thereof by the friction tool means. Preferred embodiments of the friction tool means include rotatably mounted friction tool members as well as non-rotatably mounted friction tool means. The friction tool means have roughened surfaces in the form of a file in some embodiments, while having brush like surfaces in other embodiments. Various means are provided for adjusting the position of the friction tools and for operating same to effect roughening or fraying of the thread, including surfaces designed to effect a severing of the thread after a preliminary roughening. Clamping devices are also provided for clamping the thread at opposite sides of the friction tool, which clamping devices are movable with respect to one another to effect severing of the thread after being frayed.

29 Claims, 11 Drawing Figures

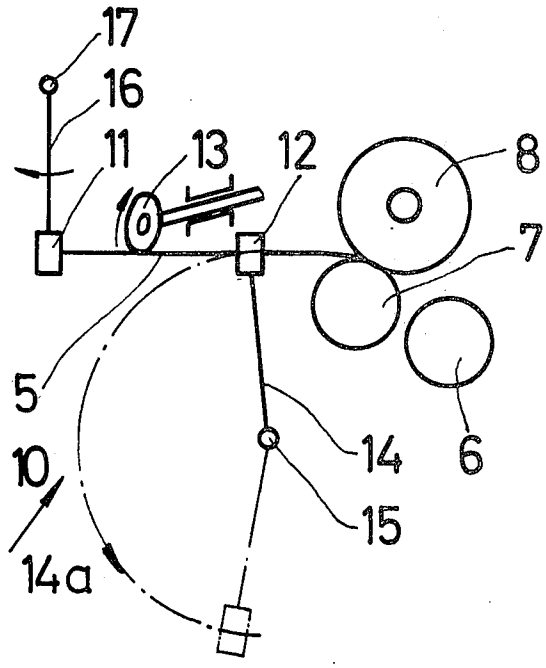


Fig.1

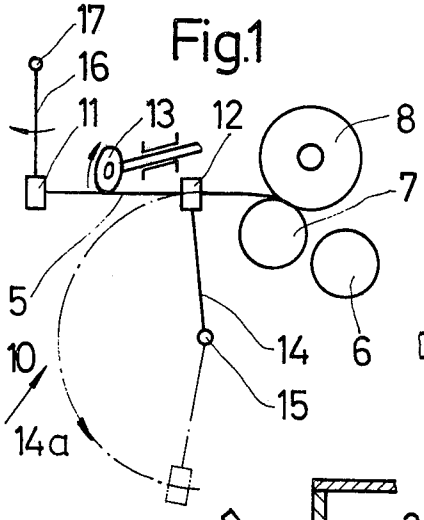


Fig.2

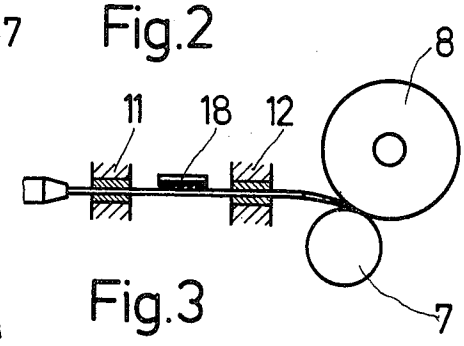


Fig.3

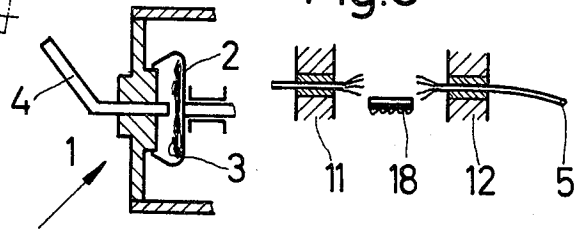


Fig.5

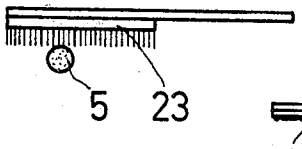


Fig.4

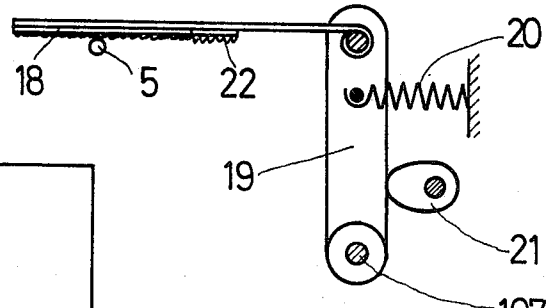


Fig.6

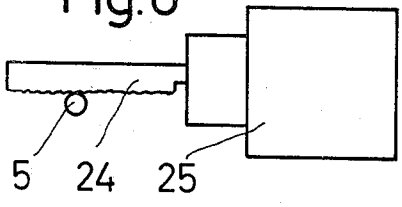


Fig.7

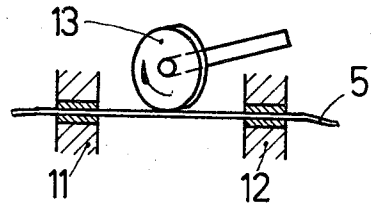


Fig.8

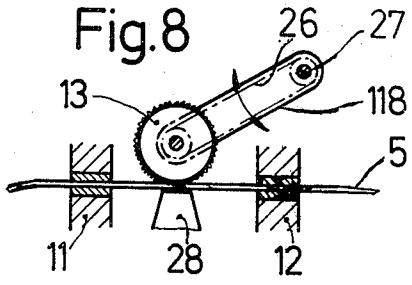


Fig.9

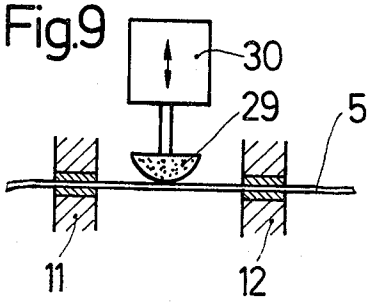


Fig.10

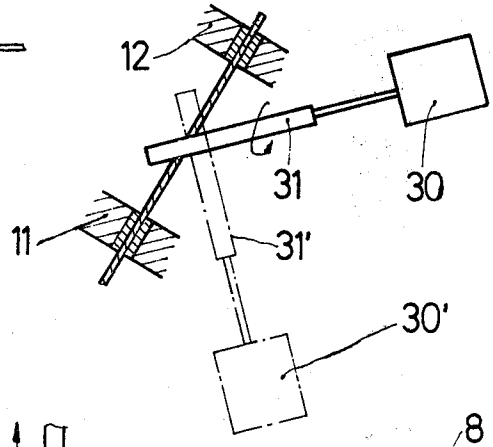
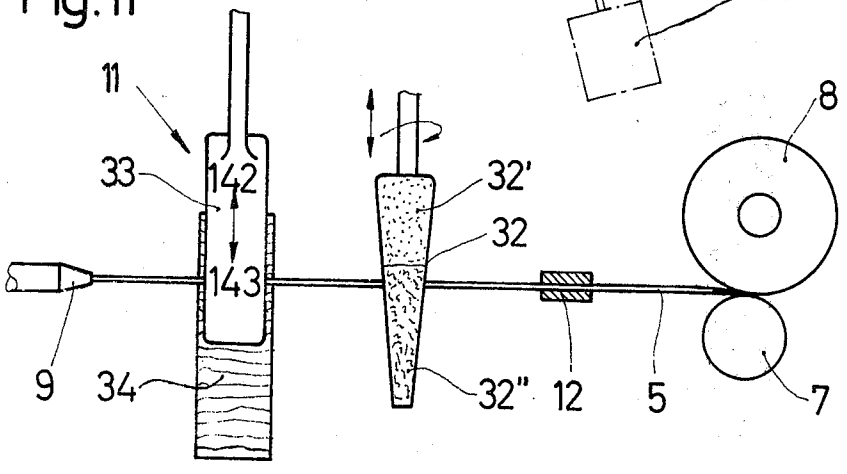


Fig.11



APPARATUS FOR PIECING A THREAD IN AN OPEN-END SPINNING UNIT

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to an apparatus for piecing a thread in an open-end spinning unit with a device for returning the thread end into a spinning rotor containing a ring of opened-up fibers. Related applications of applicants to be filed herewith, having similar titles as the present application, and based on U.S. applications Ser. Nos. 513,775 and 513,776, both filed on even date herewith, are incorporated herein to the extent necessary for a complete understanding of the present invention.

Piecing of a thread is necessary in an open-end spinning unit if the machine is to be started after a standstill or if a thread break is to be eliminated. For this purpose, a thread end of the already spun thread is returned into the spinning rotor, attached to the fiber ring present therein, and again withdrawn. Devices have been contemplated which execute this procedure semi-automatically or fully automatically. Certain conditions must be maintained exactly in this process, such as, for example the dimensioning of the length of the thread end to be returned, or the selection of the instant, and the speeds, at which the thread end is again withdrawn. In practice, it was found that the piecing zones lead to difficulties, since they are of a lower quality due to the fact that their tear strength is lower than in the remaining length of thread, on the one hand, and thickening of the yarn occurs frequently at the piecing point, on the other hand. Therefore, in most instances, subsequent rewinding steps are required in order to remove the piecing points and replace same by knots. This additional operating step requires an increased expenditure in machinery and time.

The invention is based on the problem of constructing an apparatus of the type mentioned hereinabove so that the piecing procedure is improved by avoiding thickened portions in the yarn and reductions in tear strength in the zone of the piecing points. The invention contemplates providing an opening means for the thread end containing a rubbing or friction tool serving for fraying the thread end at a predetermined point. By this fraying process, the thread end is converted into an opened up condition corresponding very much to the condition of the ring of opened up fibers present in the spinning rotor, so that the piecing step is substantially improved. The attachment of the opened up thread end to the fiber ring present in the spinning rotor is accomplished so satisfactorily that thickened portions are practically avoided, while the tear strength corresponds extensively to the tear strength in the remaining length of yarn.

In a structurally advantageous embodiment of this invention, the opening means contains two clamping zones or points for the thread end, between which the friction tool is disposed, which tool can be moved adjustably toward the thread end.

In a further embodiment of the invention, the provision is made that one of the clamping zones contains two clamping surfaces displaceable with respect to each other at right angles to the longitudinal direction of the thread end. This affords the additional possibility of further opening the thread end, by overcoming the spinning twist of the thread end in this area by a mutual shifting of the clamping surfaces. To ensure a flawless engagement of the thread end by the friction tool, another embodiment of the invention provides that a supporting means is arranged oppositely to the friction tool on the other side of the thread end. Advantageously, an air nozzle oriented toward the thread end can serve as the supporting means.

These and further objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawings which show, for purposes of illustration only, several embodiments in accordance with the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of an apparatus constructed in accordance with this invention;

FIGS. 2 and 3 are schematic views depicting another preferred embodiment of opening means for use in the apparatus of FIG. 1 in various operating positions;

FIG. 4 is a lateral schematic view of the opening means of FIGS. 2 and 3;

FIGS. 5 and 6 are schematic partial views of further preferred embodiments of opening means having friction tools with a reciprocating drive, for use in the apparatus of FIG. 1;

FIGS. 7 to 10 are schematic partial views of further preferred embodiments of opening means having friction tools with a rotary drive, for use in the apparatus of FIG. 1; and

FIG. 11 is a schematic partial view of a further preferred embodiment of opening means wherein the thread end, in addition to being frayed, is freed of its spinning twist by untwisting.

DETAILED DESCRIPTION OF THE DRAWINGS

Only a spinning rotor 2 of a spinning unit 1 is shown in FIG. 1, to which are continuously fed fibers opened up with the aid of feeding and opening means not shown in detail. These fibers are deposited in the spinning rotor 2 in the form of a ring 3. From the spinning rotor 2, a yarn takeoff duct 4 leads toward the outside; the spun thread is withdrawn via this duct. The spun thread is then wound up on a windup spool 8 which, during normal operation, rests on a windup roll 6 and is driven by the latter.

In the illustrated position, the windup spool 8 is lifted off its windup roll 6 in order to execute a piecing step. The spool is resting on an auxiliary windup roll 7 pertaining to a device, with the aid of which the thread 5 is pulled off from the windup spool 8, returned into the spinning rotor 2 via the yarn takeoff duct 4, and can thereafter again be withdrawn as a spun thread. For this purpose, the auxiliary windup roll 7 can be driven in both directions of rotation.

Before the thread end is returned into the spinning rotor 2, the thread end is prepared and opened up in order to facilitate the piecing operation. For this purpose, an opening means 10 is provided into which the thread 5 can be inserted manually or automatically. The opening means 10 contains two clamping zones 11 and 12 for the thread 5, between which a friction tool 13 is arranged which can be adjustably moved toward the thread 5. The friction tool 13, which rotates in the embodiment of FIG. 1, serves for opening up and severing the thread 5 at a certain location by fraying. The opened up thread end is then offered, by means of the clamping zone 12 arranged on an rocking lever 14, to

the yarn takeoff duct 4 by pivoting this rocking lever about its axle 15 in the direction of arrow 14*a*. Via the takeoff duct 4, the thread end is then sucked into the spinning rotor 2 with the aid of a vacuum. In order to expose the thread to the friction tool 13 in a tensioned condition, the clamping zone 11 is likewise arranged on a lever 16 pivotable about an axle 17. The rocking lever 16 can be spring-biased, for example, so that the thread is under tensile stress while underneath the friction tool. As a result of this tensile stress, the partially frayed thread is still further opened up by stretching and is finally severed with the aid of this stretching effect.

In FIGS. 2 to 4, an opening means is shown with a reciprocating friction tool 18 in various views and before and after the use thereof. The friction tool 18 which has, for example, an abrading surface roughened in the manner of a file, rests with its inherent weight on the thread 5. The friction tool is articulated to a lever 19 pulled against a drivable eccentric 21 by means of a spring 20. The eccentric 21 can drive the friction tool 18 so that it is set into reciprocating motion, whereby the thread 5 is frayed and finally severed. Lever 19 is pivotally mounted at pivot axle 107. In this connection, the further provision can be made of equipping the friction tool 18 with an extension 22 fashioned as a blade intended for the final severing of the thread 5. This blade-like extension 22 can be shifted, for example, by way of an additional drive, not shown, into the area of the thread 5 after a certain amount of fraying has been obtained. The drive for the extension can be tripped, for instance, after a specific number of revolutions of the eccentric 21, corresponding to a specific friction effect.

FIG. 5 shows another reciprocating friction tool 23 having a friction surface fashioned like a brush. In the embodiment of FIG. 6, a vibrating motor 25 is provided as a drive means for a likewise reciprocating friction tool 24 which can be coated on its friction surface, for example, with an emery cloth.

In the construction of FIG. 7, a friction tool 13 fashioned as a rotational element in accordance with the embodiment of FIG. 1 is provided. The direction of rotation of the friction tool 13, which latter is driven by way of a shaft in a manner not illustrated in detail, is chosen advantageously so that the friction tool executes a pulling motion on the thread end which later on is to be introduced into the yarn takeoff duct; thus, a certain combing out effect is also attainable thereby at the thread end to be opened up. A similar embodiment is shown in FIG. 8 wherein the friction tool 13, which is arranged on a swivel arm in a manner not shown in detail, is driven with the aid of a gear belt 26 which loops around a gear wheel of a fixed shaft 27. The swivel arm 118 for the friction tool 13 is suitably fashioned to be pivotable about the shaft 27. In order to hold the zone to be frayed securely against the friction tool 13, this embodiment includes a blast or air jet nozzle 28 arranged on the side of the thread end in opposition to the friction tool.

In the embodiment of FIG. 9, a body of rotation having the shape of a mushroom head serves as the friction tool 29; this body is driven directly by a small electric motor 30. The friction tool 29 can be shifted together with the motor 30 at right angles to the longitudinal direction of the thread end 5. In the embodiment of FIG. 10, which is similar to that of FIG. 9, a cylindrical body is employed as the friction tool 31, which is driven by a small electric motor 30. The motor 30 can be adjusted, together with the friction tool 31, in various inclinations with respect to the longitudinal direction of the thread 5. Thus, different fraying conditions can be chosen (see the position 30' and 31' shown in dot-dash lines). This makes it possible, on the one hand, to determine the extent to which the thread is to be opened up while, on the other hand, the opening means can be adapted to the direction of the spinning twist of the thread 5.

In the embodiment of FIG. 11, again a body of rotation is provided as the friction tool 32, this body having a conical configuration and being disposed to be adjustable at right angles to the longitudinal direction of the thread 5. This conical friction tool 32 is provided with friction surfaces 32' and 32'' differently fashioned over its length so that the part having the smaller diameter effects a preliminary roughening and the area with the larger diameter executes a subsequent severing of the thread 5. In the embodiment of FIG. 11, the clamping zone 11 is formed by two clamping jaws 33 and 34 which are mutually displaceable (arrows 142, 143) with the aid of a drive means not shown in detail. By the mutual shifting of the clamping jaws 33 and 34, the thread 5 is twisted in this zone, whereby the spinning twist still inherent therein can be annulled, so that an even further improved opening effect is obtained.

In all embodiments, the piece of thread remaining in the region of the clamping zone 11 after severing of the thread 5 can be removed by means of a suction nozzle 9 which is illustrated by way of example in the arrangements of FIGS. 2 and 11. Moreover, it can be advantageous in all embodiments to arrange underneath the thread and in opposition to the friction tool a supporting device which can be constituted, for example, by a blast nozzle 28 according to FIG. 8 or also by a resiliently mounted support.

While we have shown and described several embodiments in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of numerous changes and modifications as known to those skilled in the art and we therefore do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

We claim:

1. Apparatus for piecing a thread end in an open-end spinning unit having a spinning rotor with a ring of opened-up fibers comprising:

opening means including friction tool means for fraying the thread end at a predetermined location,

and a device for returning the thread end into the spinning rotor after fraying thereof by the friction tool means.

2. Apparatus according to claim 1, wherein the opening means includes a pair of clamping devices for clamping said thread at respective opposite sides of the predetermined location where said friction tool means frays said thread.

3. Apparatus according to claim 2, wherein said opening means includes means for moving said friction tool means toward and away from said thread.

4. Apparatus according to claim 1, wherein said friction tool means includes a file member which is driven in a reciprocating motion at right angles to the longitudinal direction of the thread.

5. Apparatus according to claim 1, wherein said friction tool means includes a brush member which is driven in a reciprocating motion at right angles to the longitudinal direction of the thread.

6. Apparatus according to claim 3, wherein said friction tool means includes a file member which is driven in a reciprocating motion at right angles to the longitudinal direction of the thread.

7. Apparatus according to claim 3, wherein said friction tool means includes a brush member which is driven in a reciprocating motion at right angles to the longitudinal direction of the thread.

8. Apparatus according to claim 1, wherein said friction tool means includes a body of rotation with a roughened friction surface which is driven about an axis extending transverse to the longitudinal direction of the thread.

9. Apparatus according to claim 3, wherein said friction tool means includes a body of rotation with a roughened friction surface which is driven about an axis extending transverse to the longitudinal direction of the thread.

10. Apparatus according to claim 8, wherein said axis extends obliquely to the longitudinal direction of the thread.

11. Apparatus according to claim 10, wherein adjusting means are provided for adjusting the angular inclination of said axis with respect to the longitudinal direction of the thread to accommodate for the direction and inclination of spinning fibers forming said thread.

12. Apparatus according to claim 9, wherein said axis extends obliquely to the longitudinal direction of the thread.

13. Apparatus according to claim 12, wherein adjusting means are provided for adjusting the angular inclination of said axis with respect to the longitudinal direction of the thread to accommodate for the direction and inclination of spinning fibers forming said thread.

14. Apparatus according to claim 2, wherein the clamping device disposed on the side of the friction tool means which is closest to the extreme free end of the thread is mounted for movement in the longitudinal direction of the thread, and wherein means are provided for moving said last-mentioned clamping device in said longitudinal direction to effect separation of said thread at the frayed part thereof.

15. Apparatus according to claim 14, wherein a windup means for said thread is disposed at a position spaced from said clamping device.

16. Apparatus according to claim 4, wherein the clamping device disposed on the side of the friction tool means which is closest to the extreme free end of the thread is mounted for movement in the longitudinal direction of the thread, and wherein means are provided for moving said last-mentioned clamping device in said longitudinal direction to effect separation of said thread at the frayed part thereof.

17. Apparatus according to claim 5, wherein the clamping device disposed on the side of the friction tool means which is closest to the extreme free end of the thread is mounted for movement in the longitudinal direction of the thread, and wherein means are provided for moving said last-mentioned clamping device in said longitudinal direction to effect separation of said thread at the frayed part thereof.

18. Apparatus according to claim 8, wherein the clamping device disposed on the side of the friction tool means which is closest to the extreme free end of the thread is mounted for movement in the longitudinal direction of the thread, and wherein means are provided for moving said last-mentioned clamping device in said longitudinal direction to effect separation of said thread at the frayed part thereof.

19. Apparatus according to claim 2, wherein one of said clamping devices contains two clamping surfaces which are mutually displaceable at right angles to the longitudinal direction of the thread while in a clamped position for effecting at least partial elimination of the spinning twist in said thread.

20. Apparatus according to claim 4, wherein one of said clamping devices contains two clamping surfaces which are mutually displaceable at right angles to the longitudinal direction of the thread while in a clamped position for effecting at least partial elimination of the spinning twist in said thread.

21. Apparatus according to claim 5, wherein one of said clamping devices contains two clamping surfaces which are mutually displaceable at right angles to the longitudinal direction of the thread while in a clamped position for effecting at least partial elimination of the spinning twist in said thread.

22. Apparatus according to claim 8, wherein one of said clamping devices contains two clamping surfaces which are mutually displaceable at right angles to the longitudinal direction of the thread while in a clamped position for effecting at least partial elimination of the spinning twist in said thread.

23. Apparatus according to claim 14, wherein one of said clamping devices contains two clamping surfaces which are mutually displaceable at right angles to the longitudinal direction of the thread while in a clamped position for effecting at least partial elimination of the spinning twist in said thread.

24. Apparatus according to claim 1, wherein a thread supporting device is arranged in facing relationship to said friction tool means for supporting said thread during fraying operations.

25. Apparatus according to claim 4, wherein a thread supporting device is arranged in facing relationship to said friction tool means for supporting said thread during fraying operations.

26. Apparatus according to claim 5, wherein a thread supporting device is arranged in facing relationship to said friction tool means for supporting said thread during fraying operations.

27. Apparatus according to claim 8, wherein a thread supporting device is arranged in facing relationship to said friction tool means for supporting said thread during fraying operations.

28. Apparatus according to claim 24, wherein an air nozzle oriented toward the thread serves as the supporting device.

29. Apparatus according to claim 1, wherein said friction tool means is a conical file member having differently fashioned friction surfaces over its length with a first friction surface on a smaller diameter portion for effecting a preliminary roughening of the thread and a second friction surface as a larger diameter portion for executing a subsequent severing of the thread.

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