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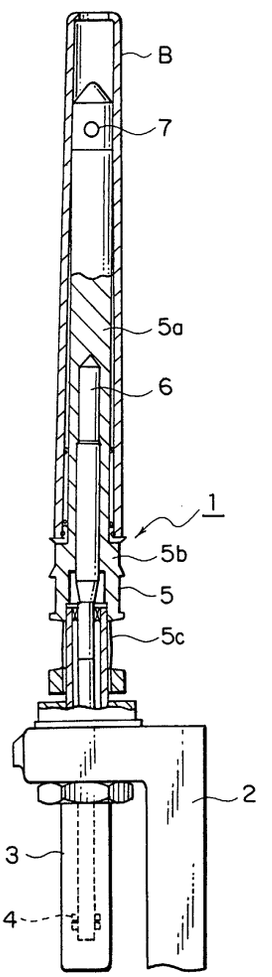
## (54) Thread-end cutting method and thread-end cutting apparatus for spinning machine

(57) In a thread-end cutting method in a spinning machine, a thread-end cutting member (8) provided with a bobbin inserting portion (9) and a cutter portion (10) is disposed so as to be raised and lowered with respect to a blade (5a) extending upward from a spindle base portion (5b). The thread-end cutting member is always biased to the spindle base portion (5b) by a coil spring (11). During suspension of doffing, a ring rail stops at a portion in the vicinity of an abutting portion between the thread-end cutting member (8) and the spindle base portion (5b). At a position slightly lower than the abutting portion, the spindle stops while the yarn is wound by about one roll or less. Then, bobbin yarn is pulled up by a doffing device, and the thread-end cutting member (8) is raised up to the middle of pulling together with the bobbin yarn, whereby yarn connected from the bobbin yarn to the traveler is guided between the thread-end cutting member (8) and the spindle base portion (5b). Thereafter, the yarn is grasped between the thread-end cutting member (8) having come off from the bobbin yarn and the spindle base portion, and the yarn is cut by the cutter portion.

FIG. 1A




EP 1 213 381 A2



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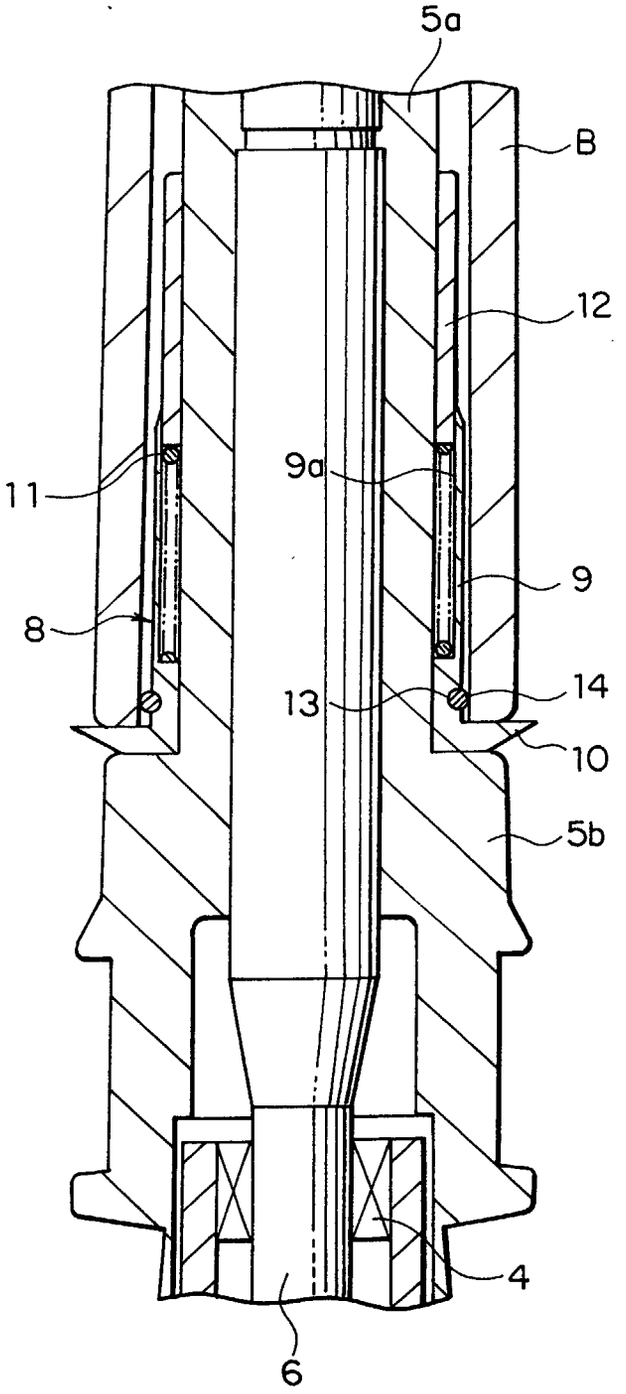
FIG. 1B



## Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

**[0001]** The present invention relates to a thread-end cutting method and a thread-end cutting apparatus during doffing in a spinning machine such as a ring spinner and a ring yarn twister.

2. Description of the Related Art

**[0002]** In a spinning machine such as a ring spinner and a ring yarn twister, in order to automatically conduct a cop exchange operation at a time of full bobbin, it is required that yarn connected to a roller part is connected to a spindle while extending through a traveler. The reason for this is to allow yarn to be automatically wound around an empty bobbin at a time of restarting after cop exchange. In order to satisfy this requirement, conventionally, a thread-end cutting portion is provided at a spindle base portion, and a thread-end winding portion is provided in a lower portion of the thread-end cutting portion. In such a configuration, after full bobbin is obtained, a ring rail is rapidly lowered to conduct oblique winding. Thereafter, yarn is wound around the thread-end winding portion. Then, at a time of pulling out full bobbin yarn, yarn (thread-end) connected from the thread-end winding portion to full bobbin yarn is cut at the thread-end cutting portion.

**[0003]** As the above-mentioned kind of cutting apparatus, Japanese Patent Application Laid-open No. 48-93735 discloses a cutting apparatus in which a bobbin seat for fitting a lower part of a bobbin therein is provided in a yarn holding device having a cutting blade. This cutting apparatus is designed so as to raise the yarn holding device together with full bobbin yarn (package) during doffing.

**[0004]** Further, Japanese Patent Application Laid-open No. 62-141135 discloses an apparatus in which a feather portion having directivity of being inclined in a circumferential direction is provided at a thread-end winding portion (thread-end engaging portion), and feathers having an inclined direction different from that of the feather portion are alternately provided.

**[0005]** Still further, Japanese Patent Application Laid-open No. 6-158442 discloses an apparatus including an underwinding crown fixed to a spindle, and a slide sleeve provided so as to be slidable vertically with respect to a warp through which a spindle is inserted to be fixed. In this apparatus, thread-end is designed to be grasped between the underwinding crown and the slide sleeve. This apparatus will be described with reference to FIGS. 9A and 9B. In this apparatus, an underwinding crown 53 is fixed immediately below a bobbin fitting portion 52 of a spindle 51. A slide sleeve 55 disposed so as to be slidable vertically with respect to a warp 54 is provided with an inner flange 57a for forming a receiving concave portion 56 at an upper portion. A coil spring 58 is inserted between the inner flange 57a and the upper surface of the warp 54. Due to the coil spring 58, the slide sleeve 55 is biased by pressure toward the underwinding crown 53. An outer flange 57b is formed below the inner flange 57a. An abrasion ring 59 is disposed on the outer flange 57b. Furthermore, on a lower surface of a ring rail 60, a protrusion 60a is formed so as to come into contact with the abrasion ring 59.

**[0006]** In this apparatus, during doffing, the ring rail 60 is lowered up to a thread-end winding position. While the ring rail 60 is lowered up to a thread-end winding position, the protrusion 60a of the ring rail 60 comes into contact with the abrasion ring 59. FIG. 9A shows a state in which the ring rail 60 is disposed at a thread-end winding position. In this state, the ring rail 60 resists the biasing force of the coil spring 58, and holds, via the abrasion ring 59, the slide sleeve 55 at a position where a predetermined thread-end winding range is kept between the upper end of the slide sleeve 55 and the lower surface of the under winding crown 53. After the thread-end is wound around the spindle 51 three to four times in this state, bobbin yarn 61 is doffed. During doffing, yarn connected to the bobbin yarn 61 is cut.

**[0007]** Next, when an empty bobbin is inserted into the spindle, the ring rail 60 is raised up to a winding start position. At this time, the slide sleeve 55 is raised up to a position where the underwinding crown 53 is accommodated in the receiving concave portion 56, as shown in FIG. 9B, by the biasing force of the coil spring 58. At this time, the thread-end wound around within the thread-end winding range is held in the receiving concave portion 56.

**[0008]** In the apparatus disclosed in Japanese Patent Application Laid-open No. 48-93735, thread-end is wound around a spindle several times during doffing, so that the amount of yarn remaining in the thread-end winding portion after doffing becomes large. In this case, every time doffing is repeated, the amount of remaining yarn is increased. This necessitates that disposal of remaining yarn is conducted often. Furthermore, since the winding length of thread-end is large, it is difficult to remove remaining yarn. In the apparatus disclosed in Japanese Patent Application Laid-open No. 6-158442, the slide sleeve must be raised up by the ring rail 60, which makes the structure of this apparatus very complicated. Furthermore, the remaining yarn is pushed into the receiving concave portion 56 after doffing, which makes it cumbersome to remove the remaining yarn.

**[0009]** On the other hand, in the apparatus disclosed in Japanese Patent Application Laid-open No. 62-141135, a yarn gripping portion (feather portion) with a special structure is provided in the thread-end winding portion. Therefore, the winding length of thread-end may be about one roll. Thus, compared with the prior art disclosed in Japanese Patent Application Laid-open No. 48-93735, the amount of remaining yarn becomes

smaller. However, it is required to form a special thread-end winding portion, which makes production cumbersome.

## SUMMARY OF THE INVENTION

**[0010]** Therefore, the present invention has been made with the foregoing in mind, and it is a primary object of the present invention to provide a thread-end cutting method in a spinning machine in which the amount of yarn (thread-end) remaining in a spindle base portion can be reduced with a simple structure.

**[0011]** It is a secondary object of the present invention to provide a thread-end cutting apparatus suitable for performing the above-mentioned cutting method.

**[0012]** In order to achieve the primary object, according to a main aspect of the present invention, a thread-end cutting method in a spinning machine includes the steps of: (i) providing a thread-end cutting member having a bobbin inserting portion in which a bobbin of the spinning machine is inserted and a cutter portion provided on the side lower than the bobbin inserting portion so that the thread-end cutting member is raised and lowered along a blade extending upward from a spindle base portion and yarn connected from a traveler to bobbin yarn is grasped between the thread-end cutting member and the spindle base portion; (ii) stopping a ring rail at a portion in the vicinity of an abutting portion between the thread-end cutting member and the spindle base portion during doffing; (iii) stopping a spindle at a position not higher than the abutting portion between the thread-end cutting member and the spindle base portion under the condition that the yarn is wound around the spindle; (iv) pulling up the bobbin yarn by a doffing device in this state; (v) raising the thread-end cutting member together with the bobbin yarn up to the middle of pulling (vi) guiding the yarn connected from the bobbin yarn to the traveler between the thread-end cutting member and the spindle base portion; and (vii) grasping the yarn between the thread-end cutting member having come off from the bobbin yarn and the spindle base portion, and cutting the yarn by the cutter portion.

**[0013]** According to the present invention, the bobbin is attached to the spindle under the condition that its lower portion is fitted in the bobbin inserting portion of the thread-end cutting member. The ring rail is lowered by the same operation as that in the prior art during doffing, and the ring rail stops at a portion in the vicinity of the abutting portion between the thread-end cutting member and the spindle base portion. Then, the spindle stops under the condition that the yarn is wound at a position not higher than the abutting portion between the thread-end cutting member and the spindle base portion. Next, the bobbin yarn is pulled up by the doffing device, and the thread-end cutting member is raised together with the bobbin yarn up to the middle of pulling, whereby yarn connected from the bobbin yarn to the traveler is guided between the thread-end cutting member and the spindle base portion. Thereafter, the yarn is grasped between the thread-end cutting member having come off from the bobbin yarn and the spindle base portion, and the yarn is cut by the cutter portion. The end portion of the yarn connected to the traveler is grasped between the thread-end cutting member and the spindle base portion until the subsequent doffing. Thus, the length of yarn required for fixing the yarn connected to the traveler to the spindle for the purpose of conducting the subsequent yarn winding can be shortened without providing a complicated yarn gripping portion. Furthermore, the thread-end grasped between the thread-end cutting member and the spindle base portion is connected to the bobbin yarn and comes off from the spindle during the subsequent doffing.

**[0014]** It is preferable that after the ring rail stops at a predetermined position, the spindle stops at a position not higher than the abutting portion between the thread-end cutting member and the spindle base portion under the condition that about one roll or less of yarn is wound.

**[0015]** Because of the above-mentioned configuration, the length of the yarn grasped between the thread-end cutting member and the spindle base portion during doffing can be further shortened. Thus, during the subsequent doffing, the yarn is exactly connected to the bobbin yarn and comes off from the spindle.

**[0016]** It is also preferable that there is provided suppressing means for suppressing the thread-end cutting member from being raised to a predetermined height or more together with the bobbin yarn, between the blade and the thread-end cutting member, and that the thread-end cutting member comes off from the bobbin yarn when the bobbin yarn is pulled up exceeding the predetermined height.

**[0017]** Because of the above-mentioned configuration, when the thread-end cutting member that is fitted in the bobbin yarn and raised during doffing reaches a predetermined height, the suppressing means suppresses the thread-end cutting member from being raised, and the thread-end cutting member exactly comes off from the bobbin yarn and grasps the yarn connected from the bobbin yarn to the traveler.

**[0018]** In order to achieve the secondary object, according to another aspect of the present invention, there is provided a thread-end cutting apparatus in a spinning machine wherein an empty bobbin is inserted into a spindle with bobbin yarn pulled up by a doffing device, and thereafter, yarn winding is restarted, characterized in that, the thread-end cutting apparatus including: (i) a thread-end cutting member having a bobbin inserting portion which is provided so as to be raised and lowered with respect to a blade extending upward from a spindle base portion and into which a bobbin is inserted, and a cutter portion provided on the side lower than the bobbin inserting portion, the thread-end cutting member always abutting against the spindle base portion so as to grasp thread-end between the thread-end cutting member and the spindle base portion; and (ii) suppressing means,

provided between the thread-end cutting member and the blade, for suppressing the thread-end cutting member from being raised by a predetermined distance or more from a position where the thread-end cutting member abuts against the spindle base portion, during doffing.

**[0019]** Because of the above-mentioned configuration, during doffing, the yarn connected from the bobbin yarn to the traveler is grasped between the thread-end cutting member and the spindle base portion, and cut on the bobbin yarn side.

**[0020]** Preferably, the suppressing means is a spring disposed between the inner side lower portion of the thread-end cutting member and a stopper provided at a predetermined position of the blade, which always biases the thread-end cutting member to the spindle base portion.

**[0021]** Because of the above-mentioned configuration, the thread-end cutting member exactly grasps the yarn between the thread-end cutting member and the spindle base portion by a biasing force of a spring. Furthermore, when the thread-end cutting member is raised to a predetermined position during doffing and comes off from the bobbin yarn to drop, the thread-end cutting member can rapidly reach a position where the thread-end cutting member abuts against the spindle base portion to grasp the yarn.

**[0022]** Furthermore, it is preferable that the suppressing means is a stopper, which is provided at a predetermined position of the blade and abuts against the thread-end cutting member to suppress the thread-end cutting member from being raised.

**[0023]** Because of the above-mentioned configuration, the constitution of the suppressing means for suppressing the thread-end cutting member from being raised becomes simple.

**[0024]** Furthermore, it is preferable that respective abutting surfaces of the spindle base portion and the cutter portion are inclined outwardly to the lower side.

**[0025]** Because of the above-mentioned configuration, the downward abutting surface of the cutter portion serves as a cover, and the yarn becomes difficult to come off by sliding friction caused by the upward abutting surface of the spindle base portion and the yarn.

**[0026]** Moreover, it is preferable that an inclined tooth portion projecting upwardly is formed on the abutting surface of the spindle base portion and that an inclined tooth portion projecting downwardly which is engaged with the inclined tooth portion projecting upwardly is formed on the abutting surface of the cutter portion.

**[0027]** Because of the above-mentioned configuration, sliding friction caused by both the inclined tooth portions, which are engaged with each other, becomes larger with respect to the yarn that intends to move downwardly on the slope. Thus, the yarn becomes more difficult to come off.

**[0028]** Furthermore, in order to press the thread-end cutting member against the spindle base portion, at least one of the spindle base portion and the thread-end cutting member can be provided with magnet(s).

**[0029]** Because of the above-mentioned configuration, the thread-end cutting member is pressed against the spindle base portion by an attracting force of a magnet at a position where the thread-end cutting member abuts against the spindle base portion, and the yarn can be exactly grasped between the thread-end cutting member and the spindle base portion.

**[0030]** Furthermore, it is preferable that the bobbin inserting portion is provided with fitting force enhancing means for enhancing a fitting force with respect to the bobbin. Because of this, the thread-end cutting member is exactly raised to a predetermined height together with bobbin yarn during doffing.

**[0031]** Furthermore, it is preferable that the outer diameter of the cutter portion of the thread-end cutting member is made smaller than that of a bottom portion of the bobbin. Because of this, during doffing, the yarn connected from the bobbin yarn to the traveler may not be cut before being grasped between the thread-end cutting member and the spindle base portion.

**[0032]** Furthermore, biasing means may be provided for biasing the thread-end cutting member to the spindle base portion under the condition that the thread-end cutting member is disposed at a position of abutting with the spindle base portion. Because of this, the yarn can be exactly grasped between the thread-end cutting member and the spindle base portion.

**[0033]** Furthermore, at least one of abutting surfaces between the thread-end cutting member and the spindle base portion may be made rough. The yarn can be more exactly grasped between the thread-end cutting member and the spindle base portion.

**[0034]** These and other advantages of the present invention will become apparent to those skilled in the art upon reading and understanding the following detailed description with reference to the accompanying figures.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0035]** In the accompanying drawings:

FIG. 1A is a partially broken-down schematic side view of a spindle in accordance with an embodiment of the present invention, and FIG. 1B is a cross-sectional view showing an attachment state of a thread-end cutting member;

FIGS. 2A and 2B are side views illustrating the functions during doffing.

FIGS. 3A and 3B are side views illustrating the functions during doffing;

FIG. 4 is a cross-sectional view of a thread-end cutting member in accordance with another embodiment of the present invention;

FIG. 5 is a cross-sectional view of a thread-end cutting member in accordance with still another embodiment of the present invention;

FIGS. 6A and 6B are cross-sectional views of fitting force enhancing means in accordance with another embodiment of the present invention;

FIGS. 7A and 7B are schematic cross-sectional views showing the relationship between a bobbin lower part and a cutter portion in accordance with another embodiment of the present invention;

FIG. 8 is a schematic front view showing a cutter portion in accordance with another embodiment of the present invention; and

FIG. 9A and 9B are cross-sectional views showing prior art.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

### Embodiment 1

**[0036]** Hereinafter, an embodiment of the present invention will be described with reference to FIGS. 1A to 3B.

**[0037]** As shown in FIG. 1A, a spindle 1 is rotatably supported by a bolster 3 fixed to a spindle rail 2 via a bearing 4. The spindle 1 includes a blade portion 5 and a spindle axis 6 fixed to a lower side central portion of the blade portion 5. The spindle axis 6 is rotatably supported by the bolster 3 under the condition of being inserted into the bolster 3.

**[0038]** The blade portion 5 is composed of a blade 5a to which a bobbin B is attached, a spindle base portion 5b formed on a lower side of the blade 5a and having a larger diameter than that of the blade 5a, and a belt hanging portion 5c formed on a lower side of the spindle base portion 5b, which are integrally formed. The blade portion 5 is made of aluminum or an aluminum alloy. A spindle axis 6 is subjected to insert molding with respect to the blade portion 5. In an upper portion of the blade 5a, an engaging member (e.g., a button chip) 7 is provided for engaging the bobbin B so that it is integrally rotated.

**[0039]** A thread-end cutting member 8 is provided in the blade 5a extending upward from the spindle base portion 5b in such a manner that the thread-end cutting member 8 can be moved vertically. As shown in FIG. 1B, the thread-end cutting member 8 includes a bobbin inserting portion 9 in which the bobbin B is inserted and a cutter portion 10 provided on the side lower than the bobbin inserting portion 9. The bobbin inserting portion 9 is formed in a cylindrical shape. Furthermore, a concave portion 9a for accommodating a coil spring 11 is formed on an inner side of the bobbin inserting portion 9.

**[0040]** A collar 12 is fixed to the blade 5a. Under the condition that the thread-end cutting member 8 is in contact with the spindle base portion 5b, the lower portion of the collar 12 functions as a stopper at a position opposed to the upper end of the bobbin inserting portion 9. The outer diameter of the collar 12 is formed slightly smaller than the inner diameter of the concave portion 9a. Therefore, the thread-end cutting member 8 can slide along the collar 12. The bobbin inserting portion 9 is formed so that its outer diameter becomes smaller toward an upper side.

**[0041]** The coil spring 11 is accommodated in the concave portion 9a. The lower end of the coil spring 11 is in contact with the lower end of the concave portion 9a, and the upper end thereof is in contact with the lower end of the collar 12. The coil spring 11 constitutes biasing means that always biases the thread-end cutting member 8 to the spindle base portion 5b. Furthermore, the coil spring 11 constitutes suppressing means for suppressing the thread-end cutting member 8 from being raised by a predetermined distance or more from the position where the thread-end cutting member 8 is in contact with the spindle base portion 5b.

**[0042]** The cutter portion 10 has a circular shape. In the present embodiment, the diameter of the end of the blade is formed so as to be larger than the outer diameter of the lower end of the bobbin B.

**[0043]** On a lower part outer peripheral surface of the bobbin inserting portion 9, an annular groove 13 is formed. In the groove 13, a rubber ring 14 is accommodated in such a state that a part thereof extends outside. The rubber ring 14 constitutes fitting force enhancing means for enhancing a fitting force between the bobbin inserting portion 9 and the bobbin B.

**[0044]** Next, the function of the apparatus constituted as described above will be described.

**[0045]** The bobbin B is attached to the spindle 1 so as to be integrally rotated under the condition that its lower part is fitted in the bobbin inserting portion 9 of the thread-end cutting member 8, and its upper part is engaged with the engaging member 7. When the spindle 1 is rotated via a belt (not shown) pressed against the belt hanging portion 5c, the bobbin B is rotated integrally with the spindle 1.

**[0046]** When spinning is continued, and the bobbin becomes full, a predetermined stop operation is conducted. Then, a ring rail 15 is rapidly lowered by the same operation as that of the prior art, whereby bobbin yarn (full bobbin) 16 attached to the spindle 1 is subjected to oblique winding 16a. Thereafter, the ring rail 15 stops at a portion in the vicinity of the abutting portion between the thread-end cutting member 8 and the spindle base portion 5b, while a traveler 17 on the ring rail 15 is positioned on the side slightly lower than the abutting portion between the thread-end cutting member 8 and the spindle base portion 5b. At a position on the side slightly lower than the abutting portion between the thread-end cutting member 8 and the spindle base portion 5b, a brake is applied so that about one roll of yarn is wound, and the spindle 1 is stopped. Then, a lappet 18 is disposed at a retracting position so as not to inhibit doffing to obtain the state shown in FIG. 2A.

**[0047]** Then, as shown in FIG. 2B, the bobbin yarn (full bobbin) 16 is pulled up by a doffing device 19. The thread-end cutting member 8 is raised together with the

bobbin yarn 16 up to the middle of pulling. Therefore, yarn Y connected from the bobbin yarn 16 to the traveler 17 is guided between the thread-end cutting member 8 and the spindle base portion 5b. When the thread-end cutting member 8 is raised together with the bobbin yarn 16 from the state shown in FIG. 2A, the yarn Y wound around the spindle base portion 5b moves along an outer surface of the blade 5a.

**[0048]** When the thread-end cutting member 8 that is raised together with the bobbin yarn 16 reaches a predetermined height, the thread-end cutting member 8 comes off from the bobbin yarn 16 by a biasing force of the coil spring 11. When the thread-end cutting member 8 is lowered to a position at which the thread-end cutting member 8 abuts against the spindle base portion 5b, the yarn Y connected from the bobbin yarn 16 to the traveler 17 is grasped between the thread-end cutting member 8 and the spindle base portion 5b. Since the bobbin yarn 16 is continued to be raised, the yarn Y is pressed in a tense state against the cutter portion 10 to be cut, whereby a state shown in FIG. 3A is obtained.

**[0049]** Even if the yarn Y is cut by the cutter portion 10 while the thread-end cutting member 8 comes off from the bobbin yarn 16 and is lowered, the thread-end cutting member 8 immediately drops to a position where the thread-end cutting member 8 abuts against the spindle base portion 5b after coming off from the bobbin yarn 16. Therefore, the yarn Y is grasped between the thread-end cutting member 8 and the spindle base portion 5b.

**[0050]** After the bobbin yarn 16 is doffed to obtain a state shown in FIG. 3B, an empty bobbin B is inserted into the spindle 1. Then, the lappet 18 is spun to be disposed at a taking-up position, and thereafter, the machine is started again. The end portion of the yarn Y connected to the traveler 17 is grasped between the thread-end cutting member 8 and the spindle base portion 5b until the subsequent doffing. The thread-end grasped between the thread-end cutting member 8 and the spindle base portion 5b is connected to the bobbin yarn 16 and comes off from the spindle 1 during the subsequent doffing.

**[0051]** The present embodiment provides the following effects.

(1) During doffing, the thread-end cutting member 8 provided with the cutter portion 10 is raised together with the bobbin yarn 16 and lowered, whereby the yarn Y connected from the bobbin yarn 16 to the traveler 17 is grasped between the thread-end cutting member 8 and the spindle base portion 5b and cut by the cutter portion 10. Thus, unlike a conventional apparatus in which thread-end is grasped by being wound around the spindle 1, it is not required to wind thread-end several times. Furthermore, the amount of yarn (thread-end) remaining in the spindle base portion can be decreased in a simple configuration without forming a special thread-end winding portion. Furthermore, thread-end grasped between the thread-end cutting member 8 and the spindle base portion 5b is connected to the bobbin yarn 16 and comes off from the spindle 1 during the subsequent doffing.

(2) There is provided suppressing means (coil spring) 11 for suppressing the thread-end cutting member 8 from being raised to a predetermined height or more together with the bobbin yarn 16. Therefore, when the bobbin yarn 16 is pulled up by a predetermined distance or more, the thread-end cutting member 8 comes off from the bobbin yarn 16. Therefore, when the thread-end cutting member 8 reaches a predetermined height during doffing, the thread-end cutting member 8 comes off from the bobbin yarn 16 without fail, and grasps the yarn connected from the bobbin yarn 16 to the traveler 17.

(3) The thread-end cutting member 8 is always biased to the spindle base portion 5b by the coil spring 11, so that the thread-end cutting member 8 can exactly grasp the yarn Y connected to the traveler 17 while abutting against the spindle base portion 5b. Furthermore, when the bobbin inserting portion 9 comes off from the bobbin B, the thread-end cutting member 8 is biased downward by the coil spring 11. Therefore, even if the yarn Y is cut while the thread-end cutting member 8 drops, the thread-end cutting member 8 can immediately reach a position where the thread-end cutting member 8 abuts against the spindle base portion 5b and grasp the yarn Y.

(4) The bobbin inserting portion 9 is provided with fitting force enhancing means (rubber ring 14) for enhancing a fitting force with respect to the bobbin B. Therefore, the thread-end cutting member 8 resists the biasing force of the coil spring 11 to be raised to a predetermined height together with the bobbin yarn 16 without fail.

Embodiment 2

**[0052]** Next, another thread grasping portion between a thread-end cutting member and a blade portion is described with reference to Fig. 4.

**[0053]** As shown in Fig. 4, respective abutting surfaces of a spindle base portion 5b and a cutter portion 10 (an upper surface of the spindle base portion 5b and a lower surface of the cutter portion 10) which constitute the thread grasping portion are inclined outwardly to the lower side. In the case where a yarn Y is pulled in the above structure, the yarn Y is going to come off from the center of the blade 5 while rotating outwardly. However, since the thread grasping portion is inclined, the yarn Y is hard to come off. That is, the lower surface of the cutter portion 10 serves as a cover, and thus, the yarn Y becomes difficult to come off due to the sliding friction caused by the upper surface of the spindle base portion 5b and the yarn Y.

**[0054]** Further, an inclined tooth portion 5b1 project-

ing upwardly is formed on the upper surface of the spindle base portion 5b, and an inclined tooth portion 10b projecting downwardly which is engaged with the inclined tooth portion 5b1 is formed on the lower surface of the cutter portion 10. Because of the above-mentioned configuration, the sliding friction caused by the inclined tooth portions 5b1 and 10b, which are engaged with each other, becomes larger with respect to the yarn Y that intends to move downwardly on the slope. Thus, the yarn Y becomes more difficult to come off.

**[0055]** The yarn Y becomes difficult to come off as described above, whereby a spring force of a coil spring 11 pressing the thread grasping portion can be made smaller.

Embodiment 3

**[0056]** Next, another embodiment of the thread-end cutting member will be described.

**[0057]** As biasing means for biasing the thread-end cutting member 8 to the spindle base portion 5b under the condition that the thread-end cutting member 8 abuts against the spindle base portion 5b, a magnet may be used in place of a spring.

**[0058]** For example, as shown in FIG. 5, a magnet 20 is buried in an upper surface of the spindle base portion 5b, and a magnetic material (e.g., iron) 21 is fixed onto a bottom part lower surface of the thread-end cutting member 8. Alternatively, magnets may be provided on both sides of the spindle base portion 5b and the thread-end cutting member 8. It may also be possible that a magnet is provided on the side of the thread-end cutting member 8, and a magnetic material is provided on the side of the spindle base portion 5b. Even in such a configuration, the yarn Y can be exactly grasped between the thread-end cutting member 8 and the spindle base portion 5b.

**[0059]** Furthermore, a spring is not used as biasing means, so that it is not required to form the concave portion 9a in the bobbin inserting portion 9. Furthermore, as suppressing means for suppressing the thread-end cutting member 8 from being raised, a stop ring 22 may be fixed at a predetermined position of the blade 5a as a stopper. The thread-end cutting member 8 abuts against the stop ring 22 while being raised together with the bobbin yarn 16, thereby coming off from the bobbin yarn 16.

Embodiment 4

**[0060]** Next, another embodiment of the fitting force enhancing means will be described.

**[0061]** In the first embodiment, although the rubber ring 14 is used as the fitting force enhancing means, the present invention is not limited thereto. For example, as shown in FIG. 6A, fitting force enhancing means may be formed by accommodating a spring material 23 in a concave portion 9b formed in an outer surface of the bobbin inserting portion 9 so that an arc portion projects therefrom. As the spring material, a plate-shaped or linear spring material can be used. The spring material may be formed in a partially cut-away ring shape, instead of being formed in a complete ring shape.

**[0062]** Furthermore, as shown in FIG. 6B, fitting force enhancing means can also be formed by providing a button 25 biased by a spring 24 in a concave portion formed in an outer surface of the bobbin inserting portion 9.

Embodiment 5

**[0063]** Next, the relationship between the bobbin lower part and the cutter portion in another embodiment will be described.

**[0064]** The outer diameter of the cutter portion 10 may be made smaller than the bottom part outer diameter of the bobbin B. For example, as shown in FIG. 7A, the lower end portion of the bobbin B may expand. Alternatively, as shown in FIG. 7B, the outer diameter of the cutter portion 10 may be made smaller without altering the shape of the bobbin B.

**[0065]** In the above-mentioned cases, the yarn Y connected from the bobbin yarn 16 to the traveler 17 may not be cut before being grasped between the thread-end cutting member 8 and the spindle base portion 5b during doffing.

Embodiment 6

**[0066]** Next, another embodiment of the cutter portion will be described.

**[0067]** The shape of the cutter portion 10 is not limited to a circle. As shown in FIG. 8, the cutter portion 10 may be provided with an annular blade 26 as a separate component and a number of caulking portions 27 for fixing the blade 26. The cutter portion 10 may also be formed in a sawtooth shape.

**[0068]** The present embodiment is not limited to the above. For example, the present embodiment may be as follows:

(A) The optimum length of yarn wound at a position not higher than the abutting portion between the thread-end cutting member 8 and the spindle base portion 5b is 1/3 to 1/2 rolls. In this case, the thread-end grasped between the thread-end cutting member 8 and the spindle base portion 5b is connected to the bobbin yarn 16 and becomes more likely to come off from the spindle 1 during the subsequent doffing.

(B) As means for exactly grasping the yarn between the thread-end cutting member 8 and the spindle base portion 5b, at least one of abutting surfaces between the thread-end cutting member 8 and the spindle base portion 5b may be made rough, in place of using biasing means for biasing the thread-

end cutting member 8 to the spindle base portion 5b. By making one of the abutting surfaces rough, a friction resistance can be enlarged. In this case, even if the yarn Y grasped between the thread-end cutting member 8 and the spindle base portion 5b is stretched during the subsequent winding of yarn, the yarn Y becomes unlikely to be pulled from between the thread-end cutting member 8 and the spindle base portion 5b.

(C) A driving system of the spindle 1 is not limited to belt driving, and may be a so-called single spindle driving system in which a motor is provided for each spindle.

**[0069]** Various other modifications will be apparent to and can be readily made by those skilled in the art without departing from the scope and spirit of this invention.

## Claims

**1.** A thread-end cutting method for a spinning machine, comprising the steps of:

providing a thread-end cutting member (8) having a bobbin inserting portion (9) in which a bobbin (B) of the spinning machine is inserted and a cutter portion (10) provided on the side lower than the bobbin inserting portion (9) so that the thread-end cutting member (8) is raised and lowered along a blade (5a) extending upward from a spindle base portion (5b) and yarn (Y) connected from a traveler (17) to bobbin yarn (16) is grasped between the thread-end cutting member (8) and the spindle base portion (5b);
stopping a ring rail (15) at a portion in the vicinity of an abutting portion between the thread-end cutting member (8) and the spindle base portion (5b) during doffing;
stopping a spindle (1) at a position not higher than the abutting portion between the thread-end cutting member (8) and the spindle base portion (5b) under the condition that the yarn (Y) is wound around the spindle;
pulling up the bobbin yarn (16) by a doffing device (19) in this state;
raising the thread-end cutting member (8) together with the bobbin yarn (16) up to the middle of pulling;
guiding the yarn (Y) connected from the bobbin yarn (16) to the traveler (17) between the thread-end cutting member (8) and the spindle base portion (5b); and
grasping the yarn (Y) between the thread-end cutting member (8) having come off from the bobbin yarn (16) and the spindle base portion (5b), and cutting the yarn (Y) by the cutter portion (10).

**2.** A thread-end cutting method for a spinning machine according to claim 1, wherein the spindle (1) stops at a position below the abutting portion between the thread-end cutting member (8) and the spindle base portion (5b) under the condition that about one roll of yarn is wound.

**3.** A thread-end cutting method for a spinning machine according to claim 1 or 2, further comprising suppressing means (11, 12, 22) provided between the blade (5a) and the thread-end cutting member (8) and adapted to suppress the thread-end cutting member (8) from being raised to a predetermined height or more together with the bobbin yarn (16), and wherein the thread-end cutting member (8) comes off from the bobbin yarn (16) when the bobbin yarn (16) is pulled up exceeding the predetermined height.

**4.** A thread-end cutting apparatus for a spinning machine wherein an empty bobbin (B) is inserted into a spindle (1) with bobbin yarn (16) pulled up by a doffing device (19), and thereafter, at the time of restarting the machine yarn is automatically wound, the thread-end cutting apparatus comprising:

a thread-end cutting member (8) having a bobbin inserting portion (9) which is provided so as to be raised and lowered with respect to a blade (5a) extending upward from a spindle base portion (5b) and into which a bobbin (B) is inserted, and a cutter portion (10) provided on the side lower than the bobbin inserting portion (9), the thread-end cutting member always abutting against the spindle base portion (5b) so as to grasp thread-end between the thread-end cutting member (8) and the spindle base portion (5b); and
suppressing means (11, 12, 22), provided between the thread-end cutting member (8) and the blade (5a), for suppressing the thread-end cutting member (8) from being raised by a predetermined distance or more from a position where the thread-end cutting member (8) abuts against the spindle base portion (5b), during doffing.

**5.** A thread-end cutting apparatus for a spinning machine according to claim 4, wherein the suppressing means is a spring (11) disposed between the inner side lower portion of the thread-end cutting member (8) and a stopper (12) provided at a predetermined position of the blade (5a), which always biases the thread-end cutting member (8) to the spindle base portion (5b).

**6.** A thread-end cutting apparatus for a spinning machine according to claim 4, wherein the suppressing

means is a stopper (12, 22) which is provided at a predetermined position of the blade (5a) and abuts against the thread-end cutting member (8) to suppress the thread-end cutting member (8) from being raised.

**7.** A thread-end cutting apparatus for a spinning machine according to claim 4, wherein respective abutting surfaces of the spindle base portion (5b) and the cutter portion (10) are inclined outwardly to the lower side.

**8.** A thread-end cutting apparatus for a spinning machine according to claim 7, wherein an inclined tooth portion (5b1) projecting upwardly is formed on the abutting surface of the spindle base portion (5b), and an inclined tooth portion (10b) projecting downwardly which is engaged with the inclined tooth portion (5b1) is formed on the abutting surface of the cutter portion (10).

**9.** A thread-end cutting apparatus for a spinning machine according to claim 4, wherein in order to press the thread-end cutting member (8) against the spindle base portion (5b), at least one of the spindle base portion (5b) and the thread-end cutting member (8) is provided with magnet(s) (20, 21).

**10.** A thread-end cutting apparatus for a spinning machine according to any one of claims 4 to 9, wherein the bobbin inserting portion (9) is provided with fitting force enhancing means (14, 23, 24, 25) for enhancing a fitting force with respect to the bobbin (B).

**11.** A thread-end cutting apparatus for a spinning machine according to any one of claims 4 to 10, wherein the outer diameter of the cutter portion (10) of the thread-end cutting member (8) is made smaller than that of a bottom portion of the bobbin (B).

**12.** A thread-end cutting apparatus for a spinning machine according to any one of claims 4 to 10, wherein biasing means (11) is provided for biasing the thread-end cutting member (8) to the spindle base portion (5b) under the condition that the thread-end cutting member (8) is disposed at a position of abutting with the spindle base portion (5b).

**13.** A thread-end cutting apparatus for a spinning machine according to any one of claims 4 to 11, wherein at least one of abutting surfaces between the thread-end cutting member ( 8 ) and the spindle base portion (5b) may be made rough.

FIG. 1A

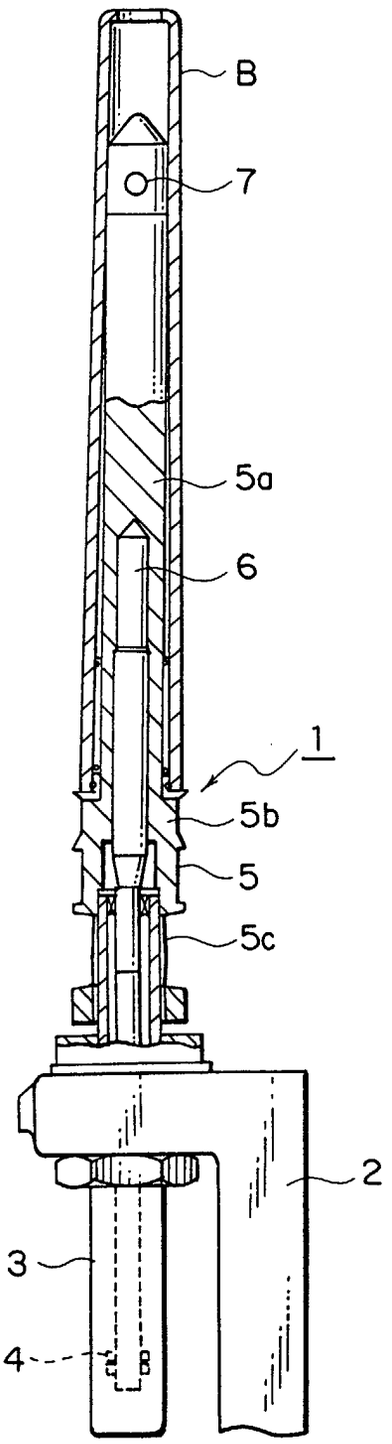



FIG. 1B

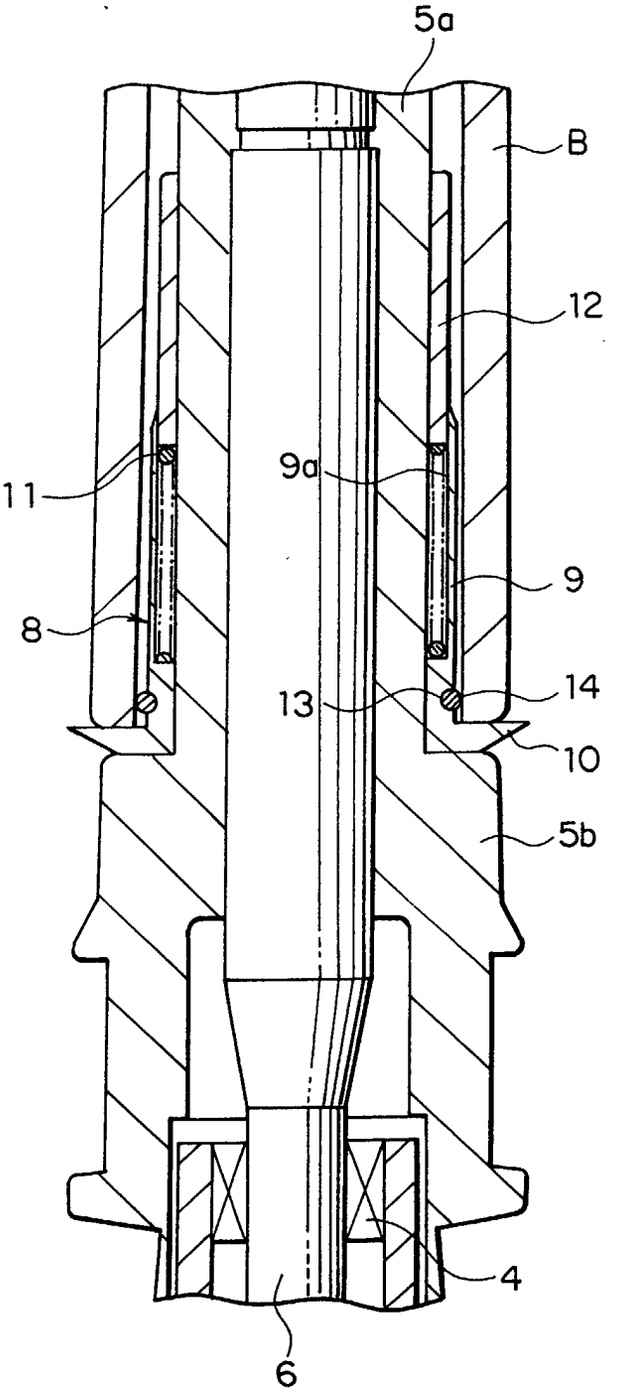


FIG. 2A

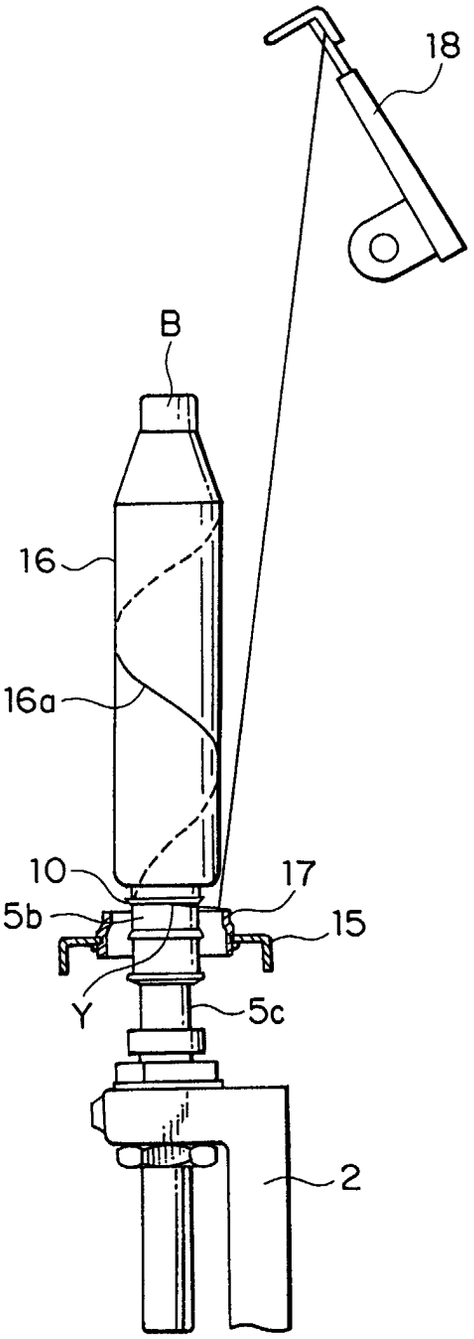



FIG. 2B

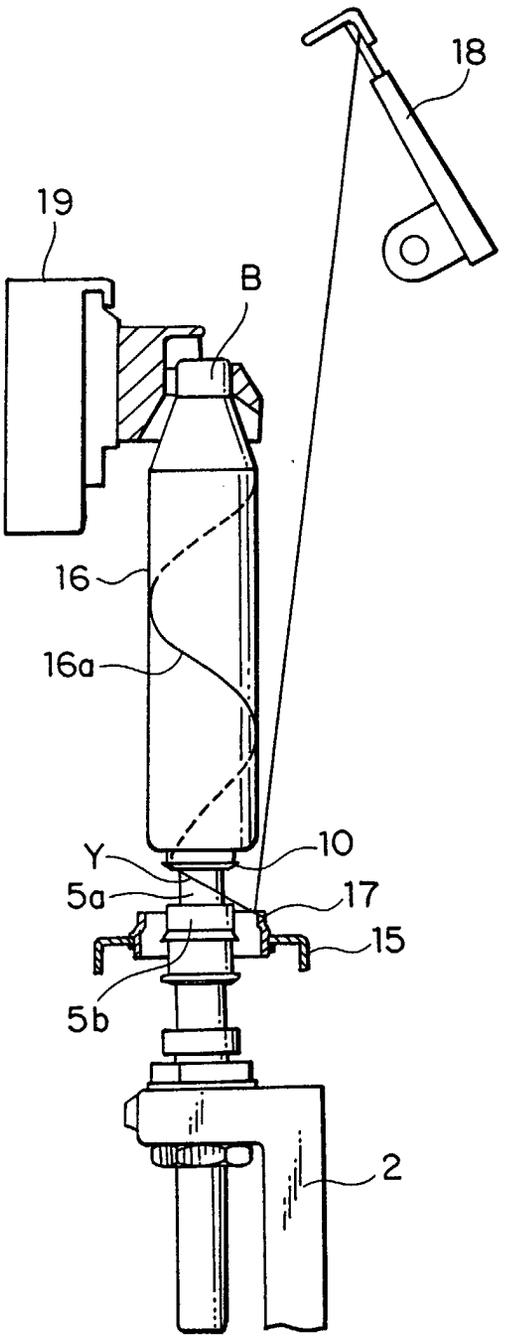


FIG. 3A

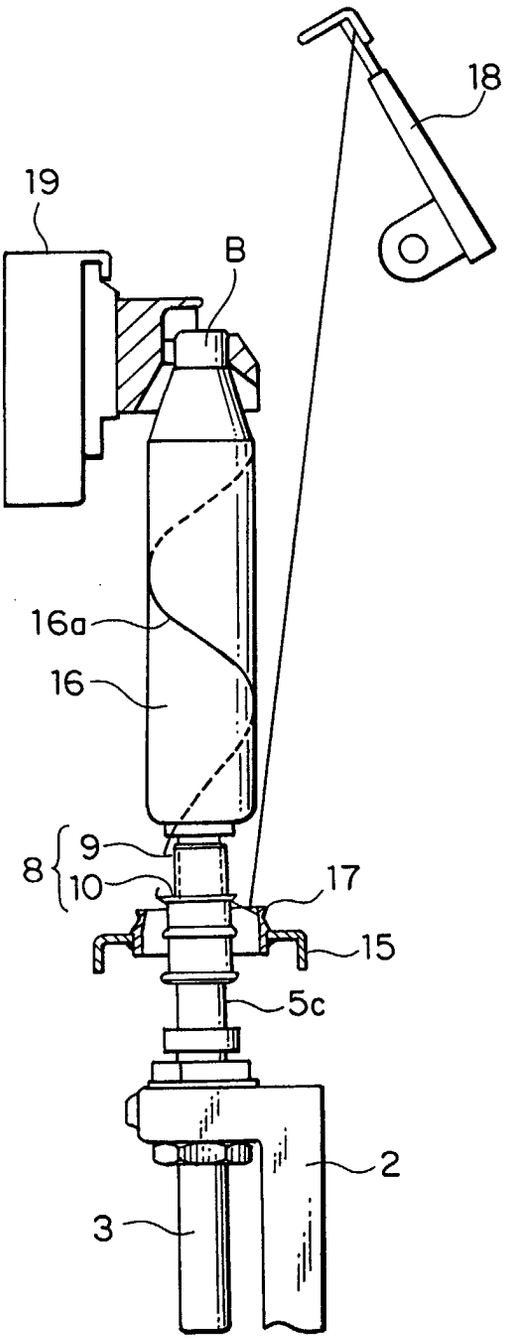



FIG. 3B

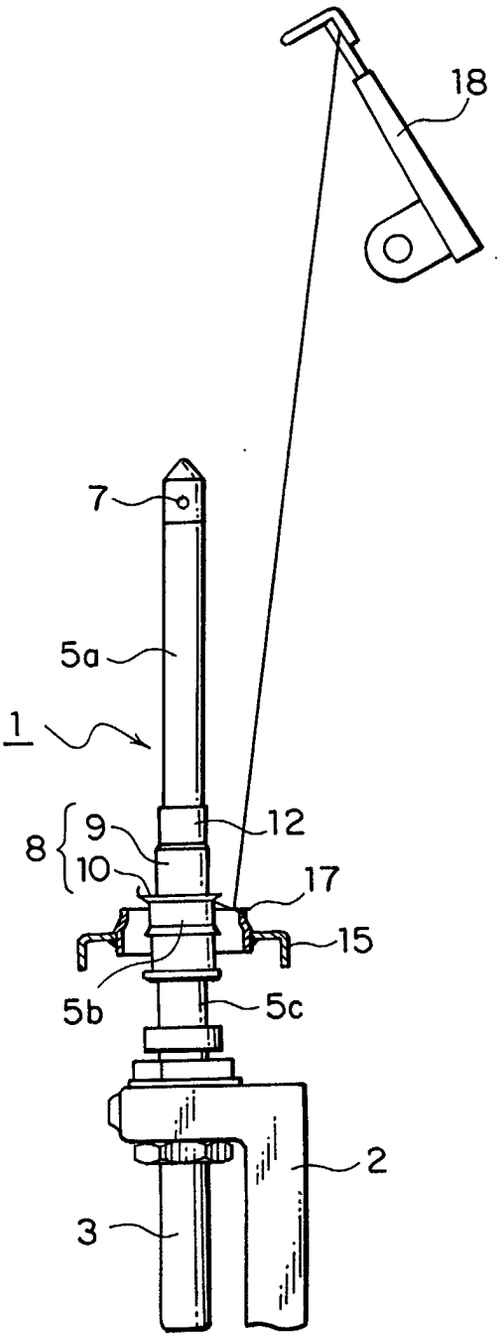


FIG. 4

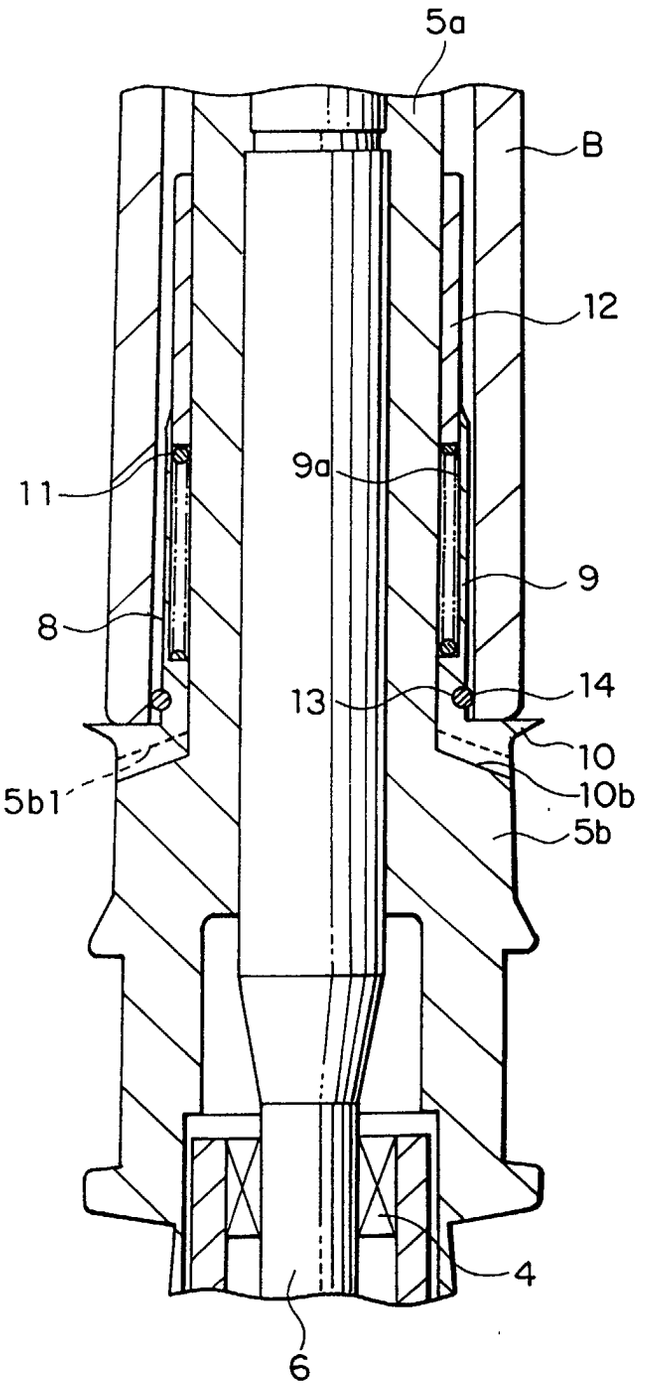


FIG. 5

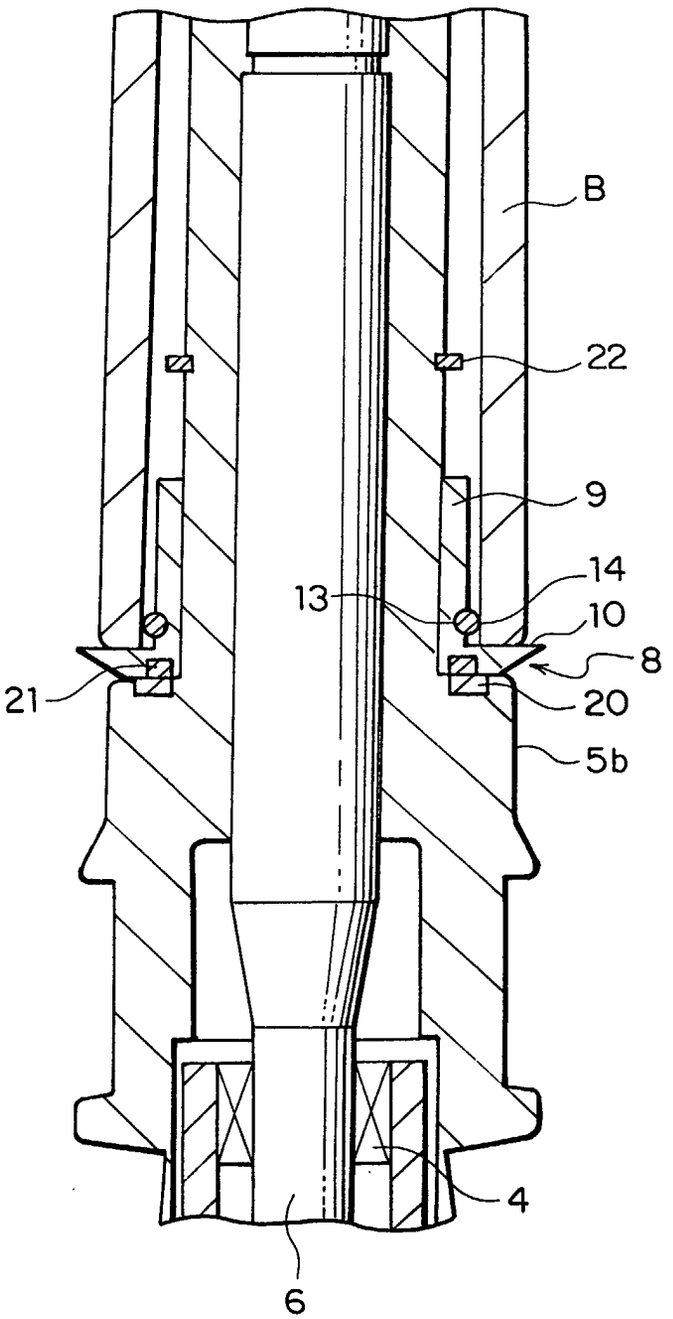



FIG. 6A

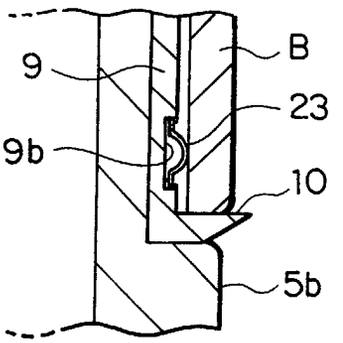



FIG. 6B

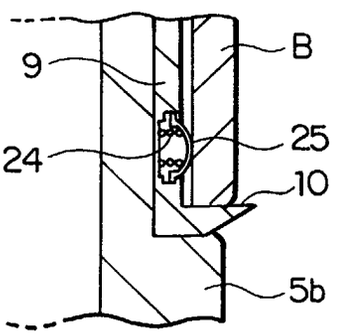


FIG. 7A

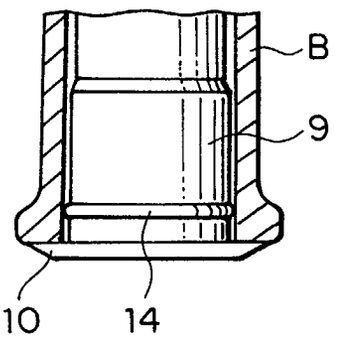



FIG. 7B

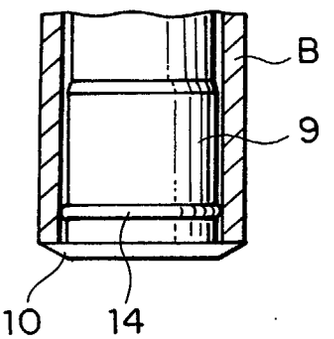



FIG. 8

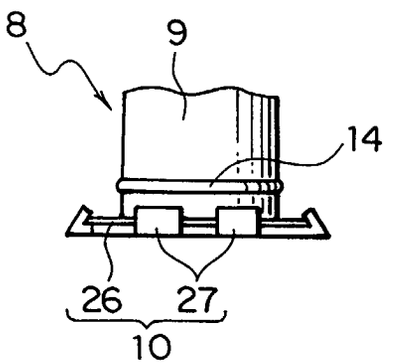


FIG. 9A
PRIOR ART

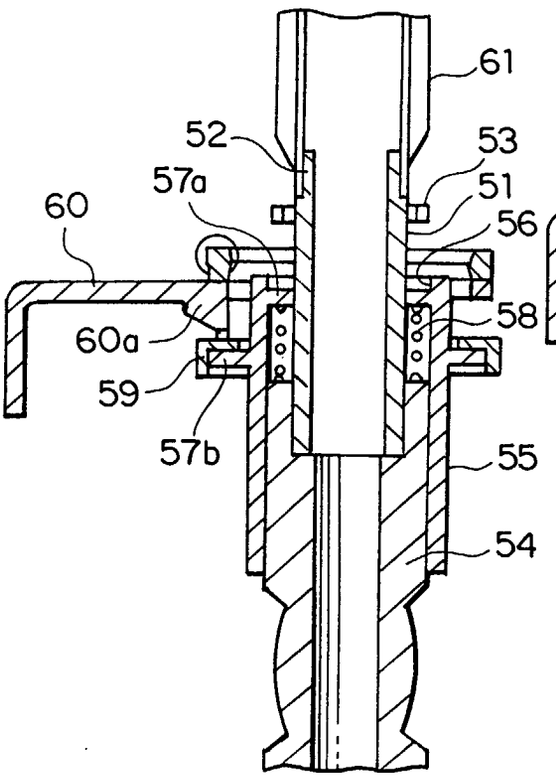



FIG. 9B
PRIOR ART