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(54) Tail yarn cutting device for spinning machine

(57) Disclosed is a tail yarn cutting device for a spinning machine in which a tail yarn cutting member is provided on a blade so as to be capable of ascending and descending, with the tail yarn cutting member being constantly urged toward a spindle base by a coil spring. The tail yarn cutting member and the spindle base portion are equipped with a plurality of protrusions and recesses capable of being engaged with each other. In a state in which a roll or less or yarn is wound at a position somewhat below the portion where the tail yarn cutting member and the spindle base portion are in contact with each other, cop is pulled up by a doffing device, and the tail yarn cuttingmember is raised together with the cop halfway through the pulling-up, the yarn connected from the cop to a traveler being guided to a position between the tail yarn cutting member and the spindle base portion. Thereafter, the yarn is grasped between the tail yarn cutting member detached from the cop and the spindle base portion 5b, and the yarn is cut by a cutter portion.

FIG. 1A

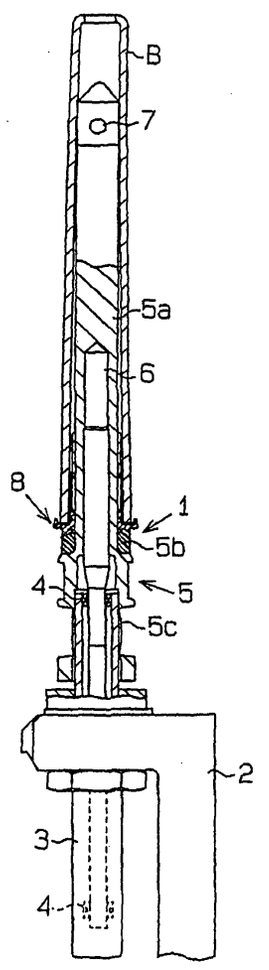

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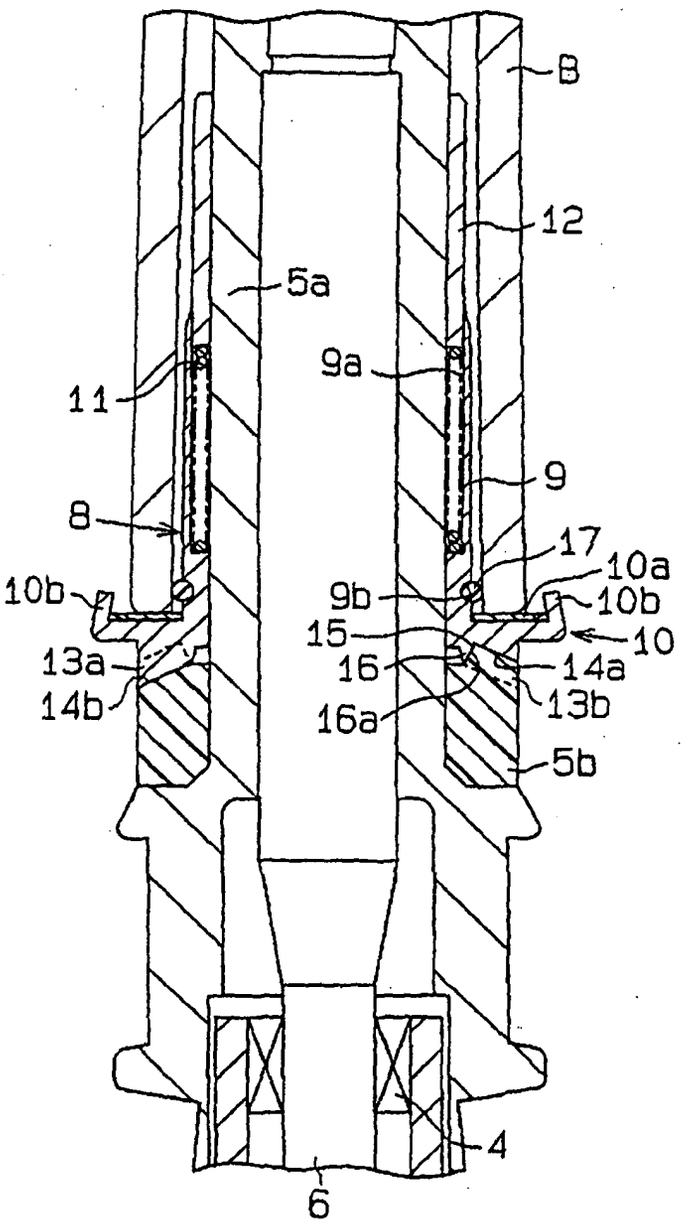
FIG. 1B



Description

BACKGROUND OF THE INVENTION

Field of the Invention:

[0001] The present invention relates to a tail yarn cutting device for a spinning machine and, more specifically, to a tail yarn cutting device for a spinning machine in which yarn is automatically taken up at the re-starting of the machine after the fitting of an empty bobbin onto a spindle from which cop has been pulled up by a doffing device.

Description of the Related Art:

[0002] In a spinning machine, such as a ring spinning machine or a ring twisting machine, in which yarn is taken up through a traveler, it is required, in order to automatically perform bobbin replacing operation in a full bobbin state, that yarn connected to a roller part be connected to the spindle while passing the traveler so that the yarn may be automatically taken up on an empty bobbin upon the re-starting of the machine after the bobbin replacement. To meet this requirement, there have conventionally been provided a tail yarn cutting portion on the spindle base portion and a tail yarn winding portion below the same; after a full bobbin state has been attained, a ring rail is abruptly lowered to perform oblique winding (barrel winding), and then yarn is wound around the tail yarn winding portion, the yarn (tail yarn) connected from the tail yarn winding portion to the full cop being cut by the tail yarn cutting portion when the full cop is pulled out.

[0003] In this cutting method, however, the tail yarn wound around the tail yarn winding portion remains thereon after doffing, and the amount of remnant yarn increases as doffing is repeated, so that it is necessary to frequently perform remnant yarn treatment. Further, since the winding length of the tail yarn is large, the remnant yarn is hard to remove.

[0004] To solve the above problems in the prior art, there has been proposed a tail yarn'cutting method (see, for example, JP 10-317233 A (paragraphs [0013] to [0018] of the specification, Figs. 1 to 4, and Fig. 7) and JP 2002-173837 A (paragraphs [0021] to [0028] of the specification and Figs. 1 to 3)) in which the yarn connected from the traveler to the cop is grasped by a grasping portion capable of opening/closing and in which the yarn connected from the grasping portion to the cop is cut by a cutter through the operation of pulling up the cop by a doffing device.

[0005] JP 10-317233 A discloses a device in which tail yarn is grasped by an under-winding collar fixed to a spindle and a slide sleeve provided so as to be vertically slidable on a wharve into which the spindle is fitted for fixation. As shown in Figs. 6 and 7 of the present application, in this device, an under-winding collar 52 is secured to the lower portion of a bobbin fitting portion 51 of a spindle 50, and a plurality of protrusions 53 extending in an axial direction of the spindle 50 are provided below the under-winding collar 52. On a wharve (whorl) 54 of the spindle 50, there is provided a slide sleeve 55 so as to be capable of sliding vertically while guided by the protrusions 53, and the sleeve 55 is urged by a compression spring 56 such that its upper end can abut the lower surface of the under-winding collar 52. A knife 57 is provided below the under-winding collar 52 and on the outer side of the sleeve 55.

[0006] In this device, halfway through the descent of a ring rail 58 to the tail yarn winding position at the time of doffing, a downwardly directed stopper 58a of the ring rail 58 abuts a stopper ring 55a of the sleeve 55, and then, with the descent of the ring rail 58, the sleeve 55 descends together with the ring rail 58 against the urging force of the compression spring 56. As shown in Fig. 6, in the state in which the ring rail 58 is arranged at the tail yarn winding position, yarn Y connected to cop 60 by way of a traveler 59 is placed between the lower surface of the under-winding collar 52 and the upper end of the sleeve 55. In this state, the ring rail 58 ascends again until it stops at the doffing position, whereby the tail yarn is grasped between the lower surface of the under-winding collar 52 and the upper end of the sleeve 55, with a roll or less of yarn wound around the spindle 50. In this state, the cop 60 is doffed, and, halfway through the doffing, the yarn Y connected to the cop 60 is cut by the knife 57. According to the disclosure, it is also possible to provide no knife 57 and press the yarn Y connected to the cop 60 against the edge of the under-winding collar 52 halfway through the doffing to tear off the yarn Y. Further, there is also disclosed a construction in which a notch is provided in the lower surface of the under-winding collar 52 and in which a notch to be engaged with the above-mentioned notch is provided at the upper end of the sleeve 55.

[0007] JP 2002-173837 A discloses a method in which, as shown in Fig. 8 of the present application, on a blade 50b up wardly extending from a spindle base portion 50a, there is provided a tail yarn cutting member 61 equipped with a bobbin fitting portion 61a and a cutter portion 61b so as to be capable of ascending and descending. The tail yarn cutting member 61 is constantly urged by a coil spring 62 toward the spindle base portion 50a. During suspension for doffing, a ring rail stops in the vicinity of a contact portion where the tail yarn cutting member 61 and the spindle base portion 50a are in contact with each other. And, the spindle 50 stops, with a roll or less of yarn wound at a position somewhat below the contact portion. Next, cop is pulled up by a doffing device, and the tail yarn cutting member 61 is raised together with the cop halfway through the pulling-up, yarn connected from the cop to a traveler being guided to a position between the tail yarn cutting member 61 and the spindle base portion 50a. Thereafter, the yarn is grasped between the tail yarn cutting member 61 de-

tached from the cop and the spindle base portion 50a, and the yarn is cut by the cutter portion 61b.

[0008] In the tail yarn cuttingmethods as described in JP 10-317233 A and JP 2002-173837 A, the grasping of tail yarn is possible with a roll or less of yarn wound. However, in the device disclosed in JP 10-317233 A, the compression spring 56, which holds the sleeve 55 in cooperation with the under-winding collar 52, such that its upper end abuts against the lower surface of the under-winding collar 52, is indispensable. It is necessary for the compression spring 56 to push up the sleeve 55 against the weight of the sleeve 55 and the stopper ring 55a and to abut the sleeve 55 against the lower surface of the under-winding collar 52 with the requisite force for grasping. Thus, the compression spring 56 must have a spring force larger than the urging force required for the grasping.

[0009] Generally speaking, in a ring spinning machine, there exist approximately 200 spindles on one side, and 400 spindles or more in the case of a long machine frame. Thus, it is necessary to lower the ring rail 58 against the urging force of a large number of compression springs 56, so that a large power is necessary for lowering the ring rail. Further, in the construction in which the lowering of the ring rail is passively effected by the weight of the ring rail, it is rather difficult to lower it to the predetermined tail yarn winding position. Further, the control operation conducted until the ring rail 58 is stopped at the doffing suspending position is rather complicated.

[0010] On the other hand, in the method as described in JP 2002-173837 A, the tail yarn cutting member 61 is moved from the grasping position to the releasing position together with the cop with the doffing operation of the doffing device, and it is only necessary for the ring rail to be lowered to the doffing suspending position, so that, as compared to the method of JP 10-317233 A, the lowering control for the ring rail is easier. The tail yarn cutting member 61 grasps the yarn between its lower, horizontal surface and the upper surface of the spindle base portion 50a, so that, if the pressurizing force of the tail yarn cutting member 61 is small, it may occur that the yarn is pulled out of the grasping portion at the take-up start after the fitting of the empty bobbin, making the take-up impossible. If, to increase the grasping force of the tail yarn cutting member 61, the weight of the tail yarn cutting member 61 itself is increased or the urging force of the coil spring 62 is increased, this may interfere with the operation of the doffing device.

SUMMARY OF THE INVENTION

[0011] The present invention has been made in view of the problems in the prior art. It is an object of the present invention to provide a tail yarn cutting device for a spinning machine which requires no complicated operation of the ring rail during suspension for doffing and which makes it possible to shorten the yarn (tail yarn) remaining on the spindle base portion without interfering with the operation of the doffing device.

[0012] In accordance with the present invention, there is provided a tail yarn cutting device for a spinning machine in which yarn is automatically taken up at re-starting of the spinning machine after fitting of an empty bobbin onto a spindle from which cop has been pulled up by a doffing device, the device including: a blade extending upwardly from a spindle base portion; a tail yarn cutting member equipped with a bobbin fitting portion which is provided on the blade so as to be capable of ascending and descending and onto which a bobbin is fitted, and a cutter portion provided below the bobbin fitting portion, the tail yarn cutting member having its lower end portion constantly in contact with the spindle base portion so as to be capable of grasping tail yarn between the tail yarn cutting member and the spindle base portion; a plurality of protrusions and recesses provided in a lower end portion of the tail yarn cutting member and an upper end portion of the spindle base portion opposed to the lower end portion of the tail yarn cutting member and capable of being engaged with each other; and a regulating means provided between the tail yarn cutting member and the blade and adapted to restrain the tail yarn cutting member from ascending by a predetermined height beyond a position where the tail yarn cutting member is in contact with the spindle base portion during doffing.

[0013] In the present invention, the bobbin is fitted onto the spindle, with its lower portion fitted onto the bobbin fitting portion of the tail yarn cutting member. During suspension for doffing, the ring rail is lowered, and stopped in a state in which the yarn connected to the cop by way of the traveler passes a position not higher than the contact portion where the tail yarn cutting member and the spindle base portion are in contact with each other. Then, the spindle stops, with yarn wound at a position not higher than the contact portion where tail yarn cutting member and the spindle base portion are in contact with each other. Next, the cop is pulled up by the doffing device, and halfway through the pulling-up, the yarn connected from the cop to the traveler is guided to a position between the tail yarn cutting member and the spindle base portion. Thereafter, the ascent of the tail yarn cutting member is restrained by the regulating means, and the tail yarn cutting member is detached from the cop and lowered. Then, the above-mentioned yarn is grasped between the tail yarn cutting member detached from the cop 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 tail yarn cutting member and the spindle base portion until the next doffing. The yarn grasped between the tail yarn cutting member and the spindle base portion is detached from the spindle together with the cop upon the next doffing. Due to the plurality of protrusions and recesses provided at the lower end of the tail yarn cutting member and the upper end portion of the spindle

base portion opposed to the above-mentioned lower end portion, the yarn is grasped while bent, so that even if the force with which the tail yarn cutting member is pressed against the spindle base portion is so small as not to interfere with the operation of the doffing device, the grasping of the yarn is reliably effected. Thus, no complicated operation of the ring rail is required during suspension for doffing, making it possible to shorten the yarn (tail yarn) remaining on the spindle base portion without interfering with the operation of the doffing device.

[0014] The plurality of protrusions and recesses can be formed so as to extend radially. Thus, the yarn is in a zigzag state when grasped by the plurality of protrusions and recesses, so that, even if the pressurizing force of the tail yarn cutting member is small, it is possible to keep the yarn in the grasped state.

[0015] The lower end portion of the tail yarn cutting member can be formed so as to constitute a part of the slope of an imaginary cone whose rotation center is the spindle and whose apex is situated above a plane including the outer periphery of the lower endportion and perpendicular to the spindle.

[0016] When a force to pull out the yarn from the grasping portion is applied to yarn wound around the spindle in a roll or less, a force directed radially and outwardly is applied to the yarn. In this process, when, as in the case of the present invention, the grasping surface is downwardly inclined, the resistance offered to the yarn is larger as compared to the case in which the grasping of the yarn is effected in a horizontal plane, making it harder for the yarn to be pulled out. As a result, the requisite pressurizing force for the tail yarn cutting member for grasping the yarn can be smaller as compared to the case in which the grasping surface is horizontal.

[0017] Preferably, there is provided an aligning means for securing coaxiality of the tail yarn cutting member with respect to the spindle base portion. Due to the action of the aligning means, the tail yarn cutting member is rotated coaxially with the spindle, so that oscillation is not easily generated during rotation, thus stabilizing the rotation even in the case of high speed rotation.

[0018] The aligning means may be equipped with curved surfaces provided at opposing positions of the tail yarn cutting member and the spindle base portion, the curved surfaces constituting the slopes of imaginary cones whose rotation center is the spindle. Due to this construction, when the tail yarn cutting member, which has been detached from the spindle base portion and moved upwardly therefrom at the time of doffing, is lowered to be engaged with the spindle base portion again, the above-mentioned curved surfaces are engagedwith eachother, whereby alignment is effected such that the tail yarn cuttingmember is coaxial with the spindle.

[0019] Of the spindle base portion and the portion of the tail yarn cutting member engaged with the spindle base portion, one may be formed of metal, and the other may be formed of resin. In the case in which both are formed of metal, when the tail yarn cutting member is detached from the cop and is lowered (dropped) to grasp the yarn between the tail yarn cutting member and the spindle base portion, there is a fear, in the case of a thin yarn, of the yarn being cut at the end portion of the grasping portion due to the impact applied from the grasping portion. In this case, the yarn extending from the spindle base portion to the traveler is cut, and automatic taking-up of yarn at the time of re-starting becomes impossible. By forming one of them of resin, it is possible, even in the case of a thin yarn, to prevent the yarn from being cut at the end portion of the grasping portion due to the grasping impact.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1A is a schematic side view, partly in section, of a spindle according to an embodiment of the present invention;

Fig. 1B is a sectional view showing how a tail yarn cutting member according to the embodiment of the present invention is mounted;

Fig. 2 is a schematic perspective view of a tail yarn cutting member and a spindle base portion;

Fig. 3 is a schematic partial development showing how yarn is grasped;

Figs. 4A through 4D are schematic main-portion side views for illustrating the operation at the time of doffing according to the embodiment of the present invention;

Fig. 5 is a schematic perspective view of a spindle base portion according to another embodiment of the present invention;

Figs. 6 and 7 are a main-portion sectional view and a partial enlarged view, respectively, of a conventional device; and

Fig. 8 is a sectional view of another conventional device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] An embodiment of the present invention will now be described with reference to Figs. 1A through 4D.

[0022] As shown in Fig. 1A, the spindle 1 is rotatably supported by a bolster 3 fixed to a spindle rail 2, through the intermediation of a bearing 4. The spindle 1 is equipped with a blade portion 5 and a spindle shaft 6 firmly attached to the lower central portion of the blade portion 5, and the spindle shaft 6 is rotatably supported by the bolster 3 while being inserted into the bolster 3. The blade portion 5 is equipped with a blade 5a onto which a bobbin B is fitted, a spindle base portion 5b formed under the blade 5a and of a larger diameter than

the blade 5a, and a belt wrapping portion 5c formed under the spindle base portion 5b. The blade portion 5 is formed of aluminum or an aluminum alloy except for the spindle base portion 5b, with the spindle base portion 5b, formed of resin, being fitted into the lower portion of the blade 5a for fixation. The spindle shaft 6 is insert-molded in the blade portion 5. In the upper portion of the blade 5a, there is provided a lock member (e.g., a button tip) 7 for locking the bobbin B so as to enable it to rotate integrally.

[0023] On the blade 5a extending upwards beyond the spindle base portion 5b, a tail yarn cutting member 8 is provided so as to be capable of ascending and descending. As shown in Fig. 1B, the tail yarn cutting member 8 is equipped with a bobbin fitting portion 9 onto which a bobbin B is fitted and a cutter portion 10 provided below the bobbin fitting portion 9. The cutter portion 10 includes a separate annular cutter member 10a and is equipped with a plurality of lock protrusions 10b for fixing the cutter member 10a. In this embodiment, the diameter of the forward end portion of the cutter member 10a is larger than the outer diameter of the lower end portion of the bobbin B.

[0024] The bobbin fitting portion 9 is formed in a cylindrical configuration, and has on its inner side a recess 9a for accommodating a coil spring 11. The lower end portion of the tail yarn cutting member 8 is kept in contact with the spindle base portion 5b, making it possible to grasp tail yarn between the tail yarn cutting member 8 and the spindle base portion 5b.

[0025] A collar 12 serving as a stopper is fixed to the blade 5a at a position where its lower portion is opposed to the upper end of the bobbin fitting portion 9 in a state in which the tail yarn cutting member 8 is in contact with the spindle base portion 5b. The outer diameter of the collar 12 is somewhat smaller than the inner diameter of the recess 9a, and the tail yarn cutting member 8 slides along the collar 12. The bobbin fitting portion 9 is formed such that its outer diameter gradually decreases toward its upper end.

[0026] The coil spring 11 is accommodated in the recess 9a, with its lower end abutting the lower end of the recess 9a and its upper end abutting the lower end of the collar 12. The coil spring 11 constitutes a spring for constantly urging the tail yarn cutting member 8 toward the spindle base portion 5b. Further, the coil spring 11 is provided between the tail yarn cutting member 8 and the blade 5a and constitutes a regulatingmeans adapted to restrain, at the time of doffing, the ascent of the tail yarn cutting member 8 beyond the position where the tail yarn cutting member 8 is in contact with the spindle base portion 5b by a predetermined height or more.

[0027] As shown in Fig. 1B and Fig. 2, on the lower end portion of the tail yarn cutting member 8 and on the upper end portion of the spindle base portion 5b opposed to the above-mentioned lower end portion, there are provided a plurality of radially extending protrusions 13a and 13b and recesses 14a and 14b that can be engaged with each other. Thus, the lower end portion of the tail yarn cutting member 8 and the upper end portion of the spindle base portion 5b are equipped with a plurality of teeth in mesh with each other. The configuration of the sections of the protrusions 13a and 13b and the recesses 14a and 14b perpendicular to the radial direction is a rectangular one. It is desirable that the height of the protrusions 13a and 13b and the depth of the recesses 14a and 14b be approximately 2 mm.

[0028] The lower end portion of the tail yarn cutting member 8 is formed so as to constitute a part of the slope of an imaginary cone whose rotation center is the spindle 1 and whose apex is situated above a plane including the outer periphery of the above-mentioned lower end portion and perpendicular to the spindle 1. The upper end portion of the spindle base portion 5b is also formed so as to constitute a part of the slope of an imaginary cone whose rotation center is the spindle 1 and whose apex is situated above a plane including the outer periphery of the above-mentioned lower endportion andperpendicular to the spindle 1.

[0029] End surfaces 15 on the blade 5a side of the protrusions 13b of the spindle base portion 5b are formed so as to be curved surfaces constituting the slope of a downwardly facing imaginary cone whose rotation center is the spindle 1. On the blade 5a side of the recesses 14a of the tail yarn cutting member 8, there is formed a wall 16 capable of abutting the end surfaces 15 and having a curved surface 16a forming the slope of an imaginary cone whose rotation center is the spindle. The end surfaces 15 and the wall 16 constitute an aligning means for securing coaxiality of the tail yarn cutting member 8 with respect to the spindle base portion 5b.

[0030] In the lower outer peripheral surface of the bobbin fitting portion 9, there is formed an annular groove 9b, in which a rubber ring 17 is accommodated so as to partially protrude from the groove 9b. The rubber ring 17 constitutes a fitting force enhancing means for enhancing the force with which the bobbin fitting portion 9 is fit-engaged with the bobbin B.

[0031] Next, the operation of the tail yarn cutting device, constructed as described above, will be illustrated.

[0032] The lower portion of the bobbin B is fitted onto the bobbin fitting portion 9 of the tail yarn cutting member 8, and is attached to the spindle 1 so as to be capable of integral rotation, with the upper portion thereof being engaged with the lock member 7. And, the spindle 1 is rotated through a belt (not shown) held in press contact with the belt wrapping portion 5c, the bobbin B rotating integrally with the spindle 1.

[0033] When a full bobbin is reached as the spinning is continued, predetermined stop operation is performed, and then the ring rail 8 is abruptly lowered as the same manner as the prior one, to form an oblique winding (barrel winding) 19a on the cop (full bobbin) 19 attached to the spindle 1. Thereafter, the ring rail 18 is stopped in a state in which the yarn Y connected to the

cop 19 by way of the traveler 20 passes a position below the contact portion where the tail yarn cutting member 8 and the spindle base portion 5b are in contact with each other. Then, braking is effected to stop the spindle 1 so as to attain a state in which approximately one roll of yarn is wound at a position somewhat below the contact portion where the tail yarn cutting member 8 and the spindle base portion 5b are in contact with each other. The lappet 2 is then arranged at a retracted position where it does not interfere with the doffing operation, thereby attaining the state as shown in Fig. 4A.

[0034] Next, as shown in Fig. 4B, the cop (full bobbin) 19 is pulled up by the doffing device 22. The tail yarn cutting member 8 is raised together with the cop 19 halfway through the pulling up, and the yarn Y connected from the cop 19 to the traveler 20 is guided to a position between the tail yarn cutting member 8 and the spindle base portion 5b. In the state as shown in Fig. 4A, when the tail yarn cutting member 8 rises together with the cop 19, the yarn Y wound around the spindle base portion 5b moves along the outer surface of the blade 5a.

[0035] When the tail yarn cutting member 8 ascending together with the cop 19 reaches a predetermined height, the tail yarn cutting member 8 is detached from the cop 19 due to the urging force of the coil spring 11. Then, the tail yarn cutting member 8 descends to the position where it abuts the spindle base portion 5b, and the yarn Y connected from the cop 19 to the traveler 20 is grasped between the tail yarn cutting member 8 and the spindle base portion 5b. Since the cop 19 continues to ascend, the yarn Y is brought into press contact with the edge member 10a in a tense state, and is thereby cut, resulting in the state as shown in Fig. 4C. Even if, halfway through the descent of the tail yarn cutting member 8 detached from the cop 19, the yarn Y is cut by the edge member 10a, the tail yarn cutting member 8 falls instantaneously to the position where it abuts the spindle base portion 5b after being detached from the cop 19, so that the yarn Y is grasped between the tail yarn cutting member 8 and the spindle base portion 5b.

[0036] Fig. 3 is a schematic partial development showing how the yarn Y is grasped through engagement of the tail yarn cutting member 8 and the spindle base portion 5b. The yarn Y is in a zigzag state while it is being grasped between the plurality of protrusions 13a and 13b and recesses 14a and 14b provided on the tail yarn cutting member 8 and the spindle base portion 5b. Since the height of the protrusions 13a and 13b and the depth of the recesses 14a and 14b are approximately 2 mm, even a thin yarn can be grasped without being cut. While Fig. 3 depicts the components as if there were gaps between the yarn Y, the protrusions 13a and 13b, and recesses 14a and 14b so as to facilitate the understanding of the relationship among the yarn Y, the protrusions 13a and 13b, and recesses 14a and 14b, the yarn Y is actually held between the protrusions 13a and 13b, and recesses 14a and 14b.

[0037] When the cop 19 undergoes doffing and then the state as shown in Fig. 4D is attained, an empty bobbin B is fitted onto the spindle 1, and the lappet 21 is brought by rotation to the take-up position, and then the machine frame is re-started. The end portion of the yarn Y connected to the traveler 20 is grasped between the tail yarn cutting member 8 and the spindle base portion 5b until the next doffing. The tail yarn grasped between the tail yarn cutting member 8 and the spindle base portion 5b is connected to the cop 19 at the time of the next doffing and is detached from the spindle 1.

[0038] This embodiment provides the following advantages:

(1) The tail yarn cutting member 8 equipped with the cutter portion 10 is raised together with the cop 19 at the time of doffing, and is then lowered, whereby the yarn Y connected from the cop 19 to the traveler 20 is grasped between the tail yarn cutting member 8 and the spindle base portion 5b, and is cut by the cutter portion 10. Thus, in contrast to the case of the conventional device in which the tail yarn is wound around the spindle 1 to be thereby grasped, there is no need to wind the tail yarn a plurality of number of times, making it possible to reduce the amount of yarn (tail yarn) remaining on the spindle base portion 5b. Further, the tail yarn grasped between the tail yarn cutting member 8 and the spindle base portion 5b is connected to the cop 19 upon the next doffing and is detached from the spindle 1, so that there is no need to perform a tail yarn removing operation.

(2) The yarn Y is grasped in a state in which it is bent by the plurality of radially extending protrusions 13a and 13b and recesses 14a and 14b provided on the lower end portion of the tail yarn cutting member 8 and the upper end portion of the spindle base portion 5b opposed to the above-mentioned lower end portion. Thus, even when the force with which the tail yarn cutting member 8 is pressurized toward the spindle base portion 5b is so small as not to interfere with the operation of the doffing device 22, it is possible to grasp the yarn Y reliably. As a result, there is no need for a complicated operation of the ring rail 18 during suspension for doffing, and it is possible to shorten the yarn (tail yarn) remaining on the spindle base portion 5b without interfering with the operation of the doffing device 22.

(3) The lower surfaces of the protrusions 13a and the bottom surfaces of the recesses 14a, constituting the lower end portion of the tail yarn cutting member 8, are formed so as to constitute a part of the slope of an imaginary cone whose rotation center is the spindle 1 and whose apex is situated above a plane including the outer periphery of the lower end portion and perpendicular to the spindle 1. When a force to pull out the yarn from the grasping portion is applied to the yarn Y wound around the

spindle in a roll or less, a radially and outwardly directed force is applied to the yarn Y. When, on that occasion, the lower surfaces of the protrusions 13a and the bottom surfaces of the recesses 14a, constituting the grasping surface, are downwardly inclined, the resistance offered to the yarn Y at the edges of the protrusions 13a and the recesses 14a is larger than that in the case in which the grasping of the yarn Y is effected in a horizontal plane, and the yarn is not easily pulled out. As a result, the requisite pressurizing force of the tail yarn cutting member 8 for grasping the yarn Y can be smaller as compared to the case in which the grasping surface is horizontal.

(4) There is provided an aligning means for securing coaxiality of the tail yarn cutting member 8 with respect to the spindle base portion 5b. Thus, due to the action of the aligning means, the tail yarn cutting member 8 is rotated coaxially with the spindle 1, so that oscillation is not easily generated during rotation, making it possible to realize a stable rotation even in the case of high speed rotation.

(5) The aligning means is provided at opposing positions on the tail yarn cutting member 8 and the spindle base portion 5b, and is equipped with an end surface 15 and a curved surface 16a constituting the slope of an imaginary cone whose rotation center is the spindle 1. Thus, when the tail yarn cutting member 8, which has been detached from the spindle base portion 5b at the time of doffing and moved to a position above the spindle base portion 5b, descends to be engaged with the spindle base portion 5b again, the end surface 15 and the curved surface 16a are engaged with each other, whereby alignment is effected such that the tail yarn cutting member 8 becomes coaxial with the spindle 1. Further, there is no need to secure a special space for providing the aligning means.

(6) The spindle base portion 5b is formed of resin, and the portion of the tail yarn cutting member 8 engaged with the spindle base portion 5b is formed of metal. If both the spindle base portion 5b and the tail yarn cutting member 8 are formed of metal, the tail yarn cutting member 8 is detached from the cop 19 and is dropped; in the case of thin yarn, there is a fear of the yarn Y being cut by the end portion of the grasping portion due to the impact applied from the grasping portion when the yarn Y is grasped between the grasping portion and the spindle base portion 5b. However, since the spindle base portion 5b is formed of resin, it is possible, even in the case of thin yarn, to prevent the yarn Y from being cut by the end portion of the grasping portion as a result of the grasping impact.

(7) Since the tail yarn cutting member 8 is constantly urged toward the spindle base portion 5b by the coil spring 11, it is possible to reliably grasp the yarn Y connected to the traveler 20 even if the tail yarn cutting member 8 is lightweight. Further, when the bobbin fitting portion 9 is detached from the bobbin B, due to the downward urging of the tail yarn cutting member 8 by the coil spring 11, if the yarn Y is cut during the fall of the tail yarn cutting member 8, the tail yarn cutting member 8 quickly reaches the position where it is in contact with the spindle base portion 5b and can grasp the yarn Y.

(8) The bobbin fitting portion 9 is equipped with a fit-engagement force enhancing means (rubber ring 17) for enhancing the force with which it is fit-engaged with the bobbin B. Thus, the tail yarn cutting member can reliably ascend to a predetermined height together with the cop 19 against the urging force of the coil spring 11.

[0039] The above-described embodiment should not be construed restrictively. For example, the present invention allows the following modifications:

[0040] The aligning means is not restricted to the combination of the wall 16, which is provided on the tail yarn cutting member 8 side and equipped with the curved surface 16a constituting the slope of an imaginary cone whose rotation center is the spindle, and the end surfaces 15 of the protrusions 13b on the spindle base portion 5b side. For example, as shown in Fig. 5, in the outer periphery of the recesses 14b formed in the spindle base portion 5b, there is formed a wall 23 having curved surfaces 23a constituting the slope of a downwardly directed imaginary cone whose rotation center is the spindle 1. And, the outer peripheral side end surfaces of the protrusions 13a of the tail yarn cutting member 8 are formed so as to be capable of abutting the curved surfaces 23a and as to constitute the slope of an imaginary cone whose rotation center is the spindle 1.

[0041] It is only necessary for the aligning means to have a function to arrange the tail yarn cuttingmember 8 coaxiallywith the spindle base portion 5b when the tail yarn cutting member 8 has been raised to a position where it is detached from the spindle base portion 5b, and then descends to the position where it is engaged with the spindle base portion 5b, and there is no need to provide a portion constituting the slope of an imaginary cone whose rotation center is the spindle 1. For example, it is also possible to provide a plurality of tapered slopes at opposing positions on the tail yarn cutting member 8 and the spindle base portion 5b. Further, it is also possible to partially form protrusions or recesses in the bottom surfaces of the recesses 14a and 14b, providing the protrusions 13a and 13b with recesses or protrusions to be fit-engaged with those protrusions or recesses.

[0042] The configuration of the sections of the protrusions 13a and 13b and the recesses 14a and 14b perpendicular to the radial direction is not restricted to the rectangular one; it may also be a triangular or some other configuration.

[0043] The protrusions 13a and 13b and the recesses

14a and 14b do not necessarily extend in the radial direction (radially); they may also extend, for example, so as to be parallel to each other.

[0044] The protrusions 13a and 13b and the recesses 14a and 14b may also constitute an annular structure whose center is the spindle 1. In this case, by tapering the forward ends of the protrusions 13a and 13b and the opening ends of the recesses 14a and 14b so as to increase in width on the end side, they can also serve as an aligning means.

[0045] It is possible to form the spindle base portion 5b of metal, and to form the tail yarn cutting member 8 of resin except for the edge member 10a. In this case also, it is possible to prevent the yarn Y from being cut when grasped even if it is thin. Further, it is also possible to form both the spindle base portion 5b and the tail yarn cutting member 8 of metal.

[0046] It is also possible to use, instead of a spring, a magnet as an urging means for urging the tail yarn cutting member 8 toward the spindle base portion 5b in the state in which the tail yarn cutting member 8 and the spindle base portion 5b are in contact with each other. For example, a magnet is embedded in the upper surface of the spindle base portion 5b, and a magnetic material (e.g., iron) is fixed to the lower surface of the bottom portion of the tail yarn cutting member 8. It is also possible to provide a magnet on either side of the spindle base portion 5b and the tail yarn cutting member 8, or provide a magnet on the tail yarn cutting member 8 side and a magnetic material on the spindle base portion 5b side. In this case, a retaining ring or a pin as a stopper is fixed to a predetermined position on the blade 5a as a regulating means for regulating the ascent of the tail yarn cutting member 8. The tail yarn cutting member 8 abuts the retaining ring or the pin during its ascent together with the cop 19, whereby it is detached from the cop 19.

[0047] In the construction in which no coil spring 11 is provided, instead of forming the recess 9a in the bobbin fitting portion 9, an axially extending guide groove is formed in the inner peripheral surface or an axially extending slit is formed. At the same time, the blade 5a is provided with an engagement protrusion (e.g., a pin) adapted to be engaged with the guide groove or the slit. In this case, after being detached from the cop 19, the tail yarn cuttingmember 8 is reliably lowered straight.

[0048] The end surfaces of the protrusions 13a and 13b and the bottom surfaces of the recesses 14a and 14b are not necessarily inclined outwardly and downwardly; they may also be horizontal. However, when a force to pull out the grasped yarn Y is applied, the resistance to the pulling-out of the yarn is larger in the case of the downwardly inclined configuration, making it harder for the yarn to be pulled out.

[0049] The fitting force enhancing means is not restricted to the rubber ring 17; it may also be a plate-like or linear spring material. The spring material is not restricted to a completely ring-like one; it is also possible to adopt a spring in the form of a partially cut-out ring. Further, it is also possible to accommodate a spring member in a recess formed in the outer surface of the bobbin fitting portion 9 such that its arcuate portion protrudes. It is also possible to provide a button urged by a spring.

[0050] The cutter portion 10 is not restricted to the construction in which the separate edge member 10a is fixedbythe lock protrusion 10b; it is also possible to form the edge portion integrally on the tail yarn cutting member 8. The outer configuration of the edge portion is not restricted to the circular one; it may also be of a sawtooth-like configuration.

[0051] The outer diameter of the cutter portion 10 may be smaller than the outer diameter of the bottom portion of the bobbin B. In this case, there is no fear of the yarn Y connected from cop 19 to the traveler 20 during doffing being cut before being grasped between the tail yarn cutting member 8 and the spindle base portion 5b.

[0052] The drive system for the spindle 1 is not restricted to belt drive; it is also possible to adopt a so-called single-spindle-drive system in which a motor is provided for each spindle.

Claims

1. A tail yarn cutting device for a spinning machine in which yarn is automatically taken up at re-starting of the spinning machine after fitting of an empty bobbin onto a spindle from which cop has been pulled up by a doffing device, the device comprising:

a blade extending upwardly from a spindle base portion;
a tail yarn cutting member equipped with a bobbin fitting portion which is provided on the blade so as to be capable of ascending and descending and onto which a bobbin is fitted, and a cutter portion provided below the bobbin fitting portion, the tail yarn cutting member having its lower end portion constantly in contact with the spindle base portion so as to be capable of grasping tail yarn between the tail yarn cutting member and the spindle base portion;
a plurality of protrusions and recesses provided in a lower end portion of the tail yarn cutting member and an upper end portion of the spindle base portion opposed to the lower end portion of the tail yarn cutting member and capable of being engaged with each other; and
a regulating means provided between the tail yarn cutting member and the blade and adapted to restrain the tail yarn cutting member from ascending by a predetermined height beyond a position where the tail yarn cutting member is in contact with the spindle base portion during doffing.

2. A tail yarn cutting device according to claim 1, wherein the plurality of protrusions and recesses are formed so as to extend radially.

3. A tail yarn cutting device according to claim 1, wherein the lower end portion of the tail yarn cutting member is formed so as to constitute a part of a slope of an imaginary cone whose rotation center is the spindle and whose apex is situated above a plane including an outer periphery of the lower end portion and perpendicular to the spindle.

4. A tail yarn cutting device according to claim 1, further comprising an aligning means for securing coaxiality of the tail yarn cutting member with respect to the spindle base portion.

5. A tail yarn cutting device according to claim 4, wherein the aligning means is equipped with curved surfaces provided at opposing positions of the tail yarn cutting member and the spindle base portion, the curved surfaces constituting slopes of imaginary cones whose rotation center is the spindle.

6. A tail yarn cutting device according to claim 1, wherein, of the spindle base portion and a portion of the tail yarn cutting member engaged with the spindle base portion, one is formed of metal, and the other is formed of resin.

7. A tail yarn cutting device according to Claim 1, further comprising a coil spring for urging the tail yarn cutting member toward the spindle base portion.

8. A tail yarn cutting device according to Claim 1, wherein the bobbin fitting portion of the tail yarn cutting member is equipped with a rubber ring for enhancing a force with which the bobbin is fit-engaged with the bobbin fitting portion.

FIG. 1A

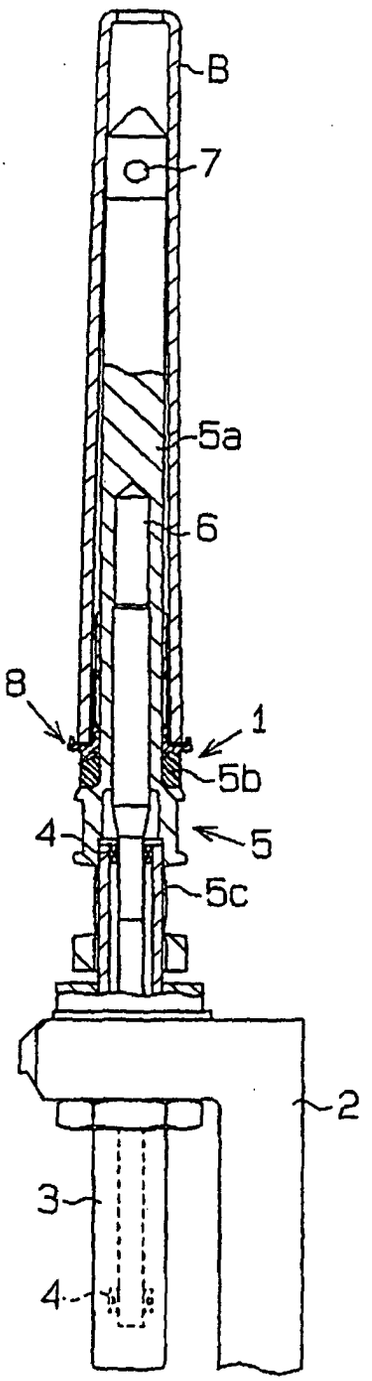

B
7
5a
6
8
1
5b
4
5
5c
2
3
4

FIG. 1B

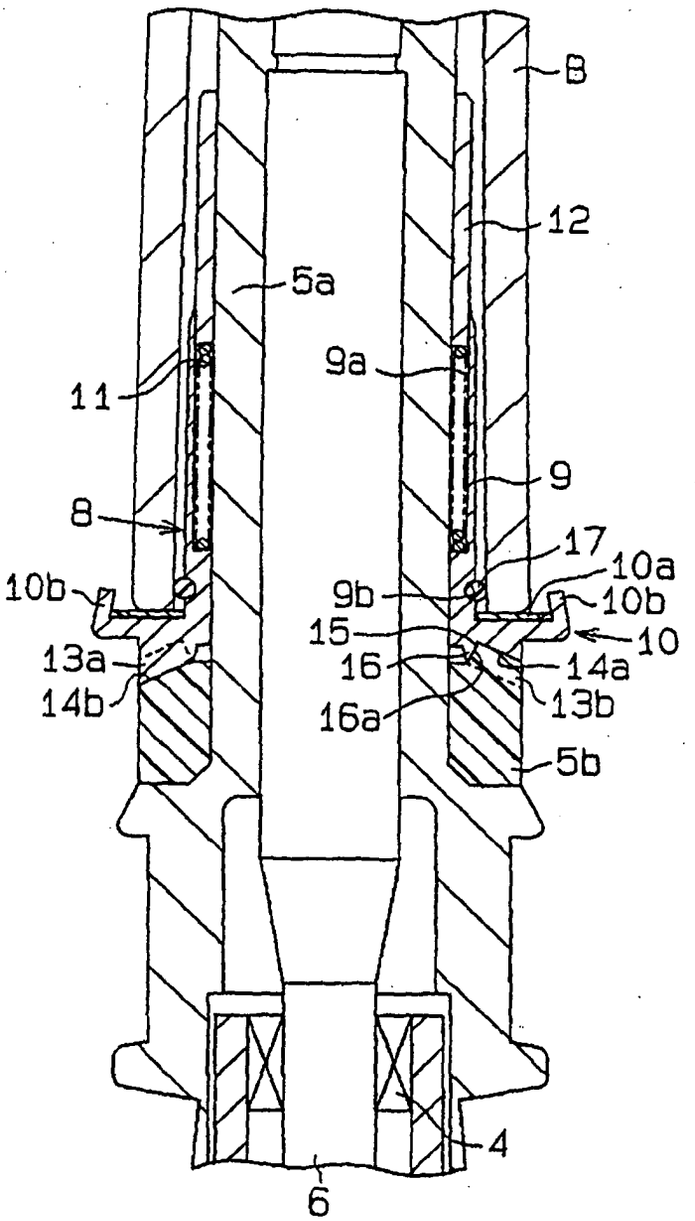

B
12
5a
9a
11
9
8
17
10a
10b
9b
10b
15
10
13a
16
14a
14b
16a
13b
5b
4
6

FIG. 2

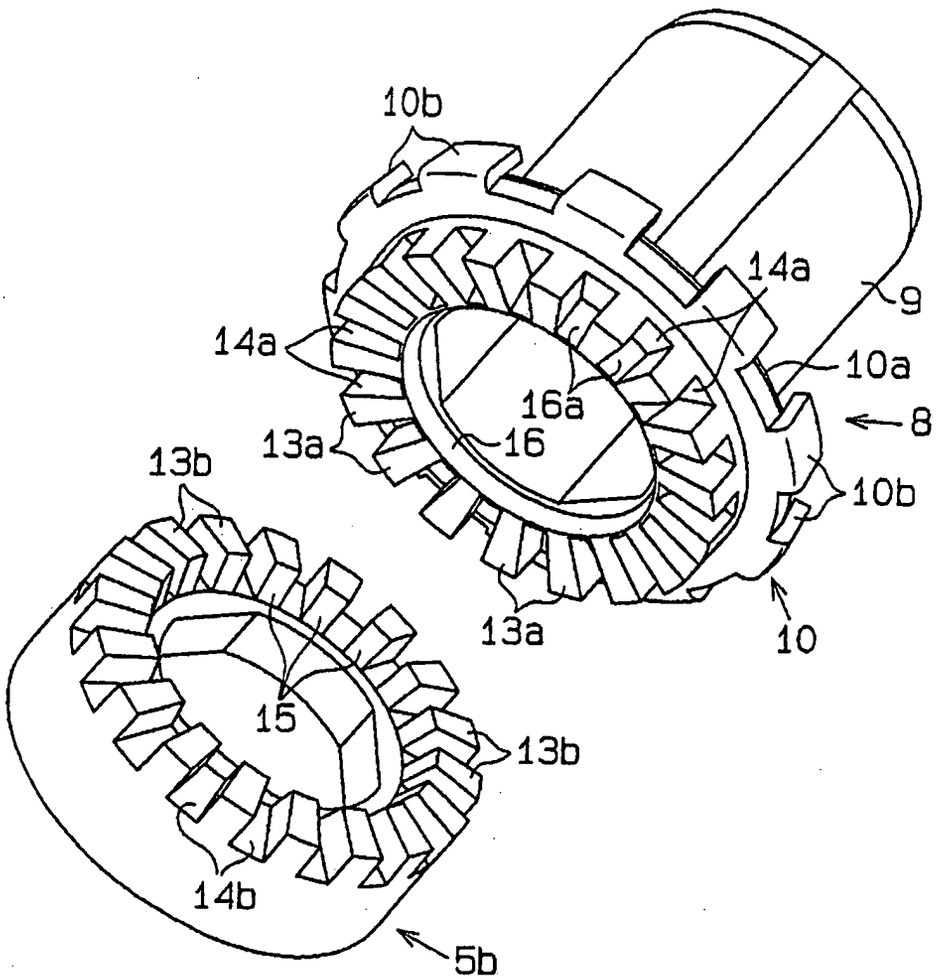

10b
14a
9
14a
10a
16a
8
13a
16
13b
10b
13a
10
15
13b
14b
5b

FIG. 3

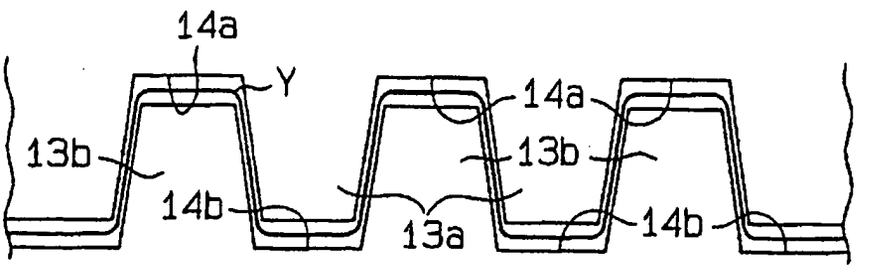

14a
Y
14a
13b
13b
14b
13a
14b

FIG. 4A

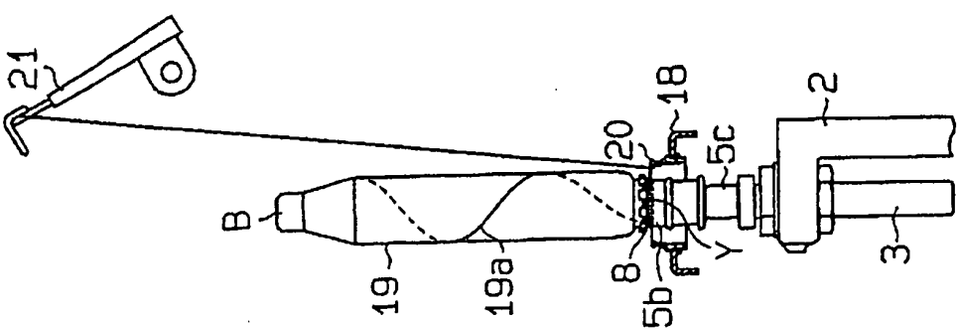


FIG. 4B

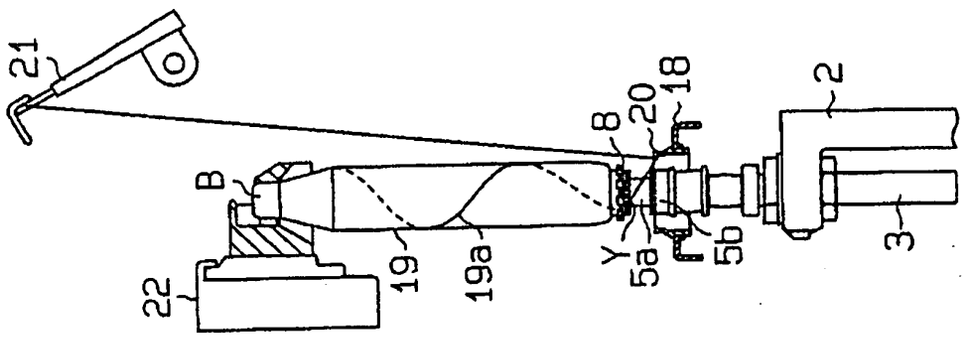


FIG. 4C

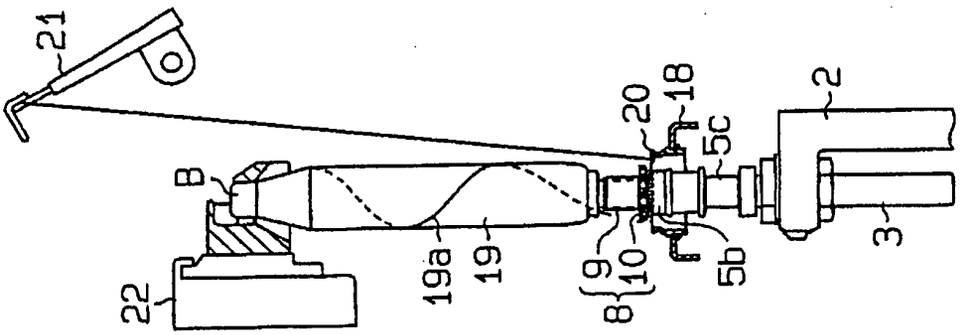


FIG. 4D

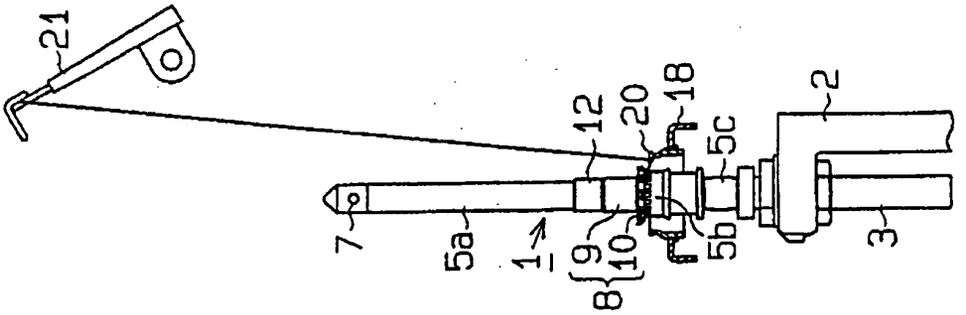


FIG. 5

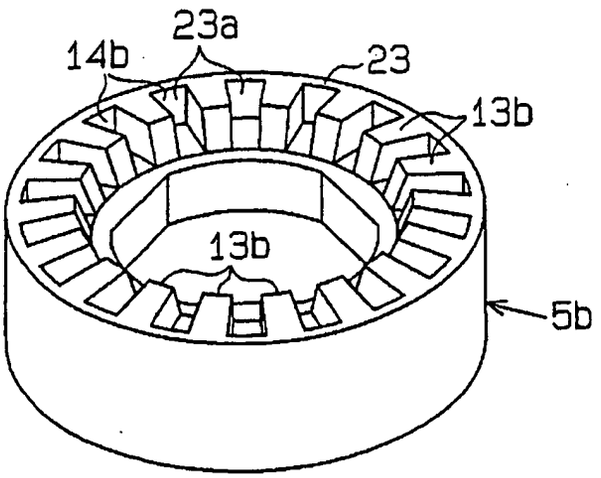


FIG. 6

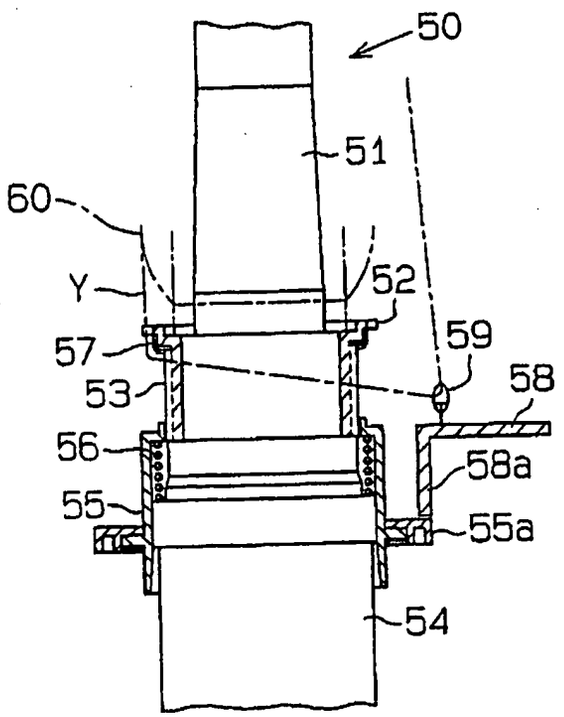


FIG. 7

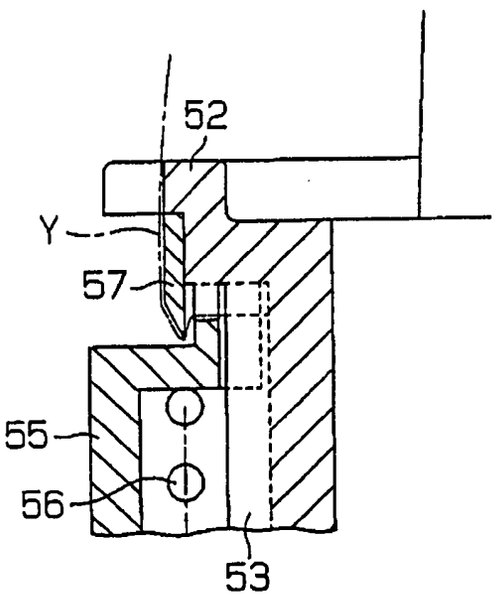


FIG. 8