



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.02.2011 Bulletin 2011/07

(51) Int Cl.:
D01H 4/48 (2006.01) **D01H 15/00 (2006.01)**
B65H 51/22 (2006.01) **B65H 67/08 (2006.01)**

(21) Application number: **10161969.0**

(22) Date of filing: **05.05.2010**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
BA ME RS

(72) Inventor: **Oka, Masaki**
Kyoto-shi Kyoto 612-8686 (JP)

(74) Representative: **Liedl, Christine et al**
Hansmann & Vogeser
Patent- und Rechtsanwälte
Albert-Rosshaupter-Strasse 65
81369 München (DE)

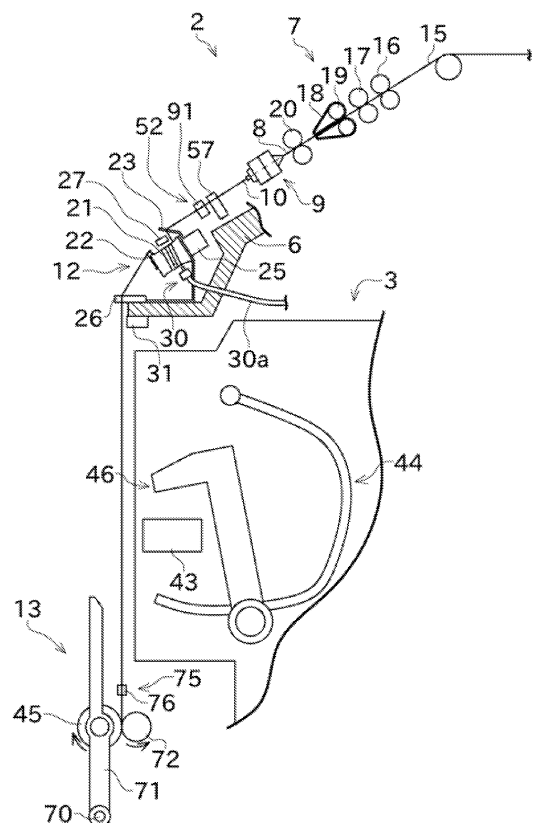
(30) Priority: **06.08.2009 JP 2009183655**

(71) Applicant: **Murata Machinery, Ltd.**
Minami-ku
Kyoto-shi
Kyoto 601-8326 (JP)

(54) **Spinning machine and yarn removing method for removing yarn remaining on yarn accumulating roller**

(57) A spinning frame (1) includes a spinning device (9), a yarn clearer (52), a yarn accumulating roller (21), a suction opening (46), a suction device (30), and a unit controller (60). The spinning device produces spun yarn by applying twists to a fiber bundle. The yarn clearer (52) is arranged downstream of the spinning device and detects a yarn defect in the travelling spun yarn. The yarn accumulating roller (21) is arranged downstream of the yarn clearer and accumulates the spun yarn by rotating while winding the spun yarn around an outer peripheral surface thereof. The suction opening of the suction device is arranged near a base end of the yarn accumulating roller (21). The suction device (30) can generate suction airflow at the suction opening (46). The unit controller (60) delays a stoppage timing, which is a timing at which feeding of the spun yarn is stopped, when the yarn clearer (52) detects a prescribed yarn defect in which yarn strength is low, compared with when other type of yarn defect is detected, and stops the yarn accumulating roller (21) after the stoppage timing.

FIG. 2



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a spinning machine including a yarn accumulating roller.

2. Description of the Related Art

[0002] Japanese Unexamined Patent Application Publication No. H11-268871 discloses a spinning machine, which includes a spinning device, a clearing device (a yarn defect detecting device), and a local control device (a control section).

[0003] The clearing device obtains data relating to thickness and length of spun yarn fed from the spinning device. Based on the data, the local control device determines whether or not yarn (spun yarn) at a position, where such data has been obtained, corresponds to a yarn defect which should be cut off. If the local control device determines that the yarn includes a yarn defect which should be cut off, the spun yarn is cut off in an appropriate manner. In addition, the spinning machine also includes a structure for displaying whether or not thickness and length of the yarn in a yarn defect part which has been actually cut off correspond accurately to a clearing limit.

[0004] Japanese Unexamined Patent Application Publication No. 2004-124333 discloses a spinning machine which includes a yarn slack eliminating device (a yarn accumulating device) and a yarn suction device.

[0005] The yarn slack eliminating device includes a yarn slack eliminating roller (a yarn accumulating roller) which can wound yarn around an outer peripheral surface thereof. The yarn slack eliminating roller winds yarn, which is fed continuously from the spinning device, around the outer peripheral surface thereof, and temporarily accumulates the yarn to prevent yarn slackening, which generates during a yarn splicing operation. The yarn suction device is arranged between the spinning device and the yarn slack eliminating roller, and generates suction airflow at a yarn suction opening. The yarn suction device has a function for sucking and removing fiber waste adhered on a cut-off yarn end, or the like.

[0006] Next, a description will be made on a case in which a yarn defect that should be cut off is detected during a winding operation in a spinning machine including the clearing device and the yarn slack eliminating device described above. As a precondition of the spinning machine described in the followings, a clearing device and a yarn cutting device are arranged upstream of the yarn slack eliminating device (closer to a spinning device than the yarn slack eliminating device), such as the structure of Japanese Unexamined Patent Application Publication No. 2004-124333.

[0007] When a yarn defect that should be cut off is

detected in the spinning machine during the winding operation, a yarn cutting process is carried out by an appropriate method for removing such a yarn defect. Yarn of a downstream portion of the cut-off spun yarn includes the yarn defect, and the yarn including such a yarn defect is wound around a package via the yarn slack eliminating device. Next, the yarn end of the spun yarn wound around the package and a yarn end at upstream of the yarn slack eliminating device are caught by an appropriate method, and are guided to a yarn splicing device. Then, the yarn defect portion is removed and a yarn splicing operation is carried out by the yarn splicing device. When the yarn splicing operation is completed, a spinning operation is restarted.

[0008] However, in such a structure, if a same process as described above is performed when a yarn defect having low yarn strength is detected, the downstream portion of the cut-off spun yarn may be torn off at such a yarn defect portion when passing through the yarn slack eliminating roller or the like. In such a case, since yarn located upstream of the torn-off portion cannot be pulled downstream by the winding device, the yarn remains on the yarn slack eliminating roller. Accordingly, a spinning operation can not be restarted as is. Moreover, a consideration can be made on a method of sucking and removing the yarn by a yarn suction device. However, since a yarn end of the yarn may not be located near a yarn suction opening of the yarn suction device, the yarn had to be removed by hand as a result in many cases. Accordingly, work efficiency was also difficult to be improved effectively by the yarn suction device.

SUMMARY OF THE INVENTION

[0009] The present invention has been made in view of the above-described circumstances, and it is an object of the present invention to provide a spinning machine which can efficiently remove spun yarn remaining on a yarn accumulating roller due to generation of a yarn defect in which yarn strength is low.

[0010] According to a first aspect of the present invention, the spinning machine includes a spinning device, a yarn defect detecting device, a yarn accumulating roller, a driving motor, a suction opening, a suction device, and a control section. The spinning device produces spun yarn by applying twists to a fiber bundle. The yarn defect detecting device is arranged downstream of the spinning device and detects a yarn defect in the travelling spun yarn. The yarn accumulating roller is arranged downstream of the yarn defect detecting device and accumulates the spun yarn fed from the spinning device by rotating while winding the spun yarn around an outer peripheral surface thereof. The driving motor drives and rotates the yarn accumulating roller. The suction opening is arranged near the outer peripheral surface of the yarn accumulating roller and near an edge of the yarn accumulating roller where the spun yarn is wound around. The suction device can generate suction airflow at the

suction opening. The control section controls the spinning device such that when the yarn defect detecting device detects a prescribed yarn defect in which yarn strength is low, a stoppage timing, which is a timing at which feeding of the spun yarn from the spinning device to the yarn accumulating roller is stopped, is delayed compared with when other type of yarn defect is detected, and controls the driving motor such that the yarn accumulating roller is stopped after the stoppage timing.

[0011] That is, when the spun yarn has the prescribed yarn defect in which yarn strength is low, a yarn breakage is likely to occur when such a portion of the yarn is unwound from the yarn accumulating roller. At this time, if the feeding of the spun yarn is stopped under a state in which a small amount of the spun yarn is sparsely wound around the yarn accumulating roller, a position where a yarn end is to be made moves away from the suction opening arranged near the edge of the yarn accumulating roller where the spun yarn is wound around, and sucking the yarn end becomes difficult. However, in the above-described structure, since the spun yarn is fed to the yarn accumulating roller for a while even after such a yarn breakage occurs, the spun yarn is wound around to near the edge of the yarn accumulating roller where the spun yarn is wound around. As a result, since a position of a yarn end made by stopping the feeding of the spun yarn comes close to the suction opening, such a yarn end can be easily sucked by the suction device. As described above, even when such a yarn breakage occurs, the spun yarn remaining on the yarn accumulating roller is not necessary to be removed by hand, and a spinning operation can be performed efficiently.

[0012] In the above-described spinning machine, the yarn defect detecting device detects a yarn portion in which yarn thickness is thicker for at least a preset level than thickness of normal yarn as a prescribed yarn defect. Accordingly, larger slub having low yarn strength can be detected, and the above-described control can be performed appropriately.

[0013] In the above-described spinning machine, the control section controls the rotation of the driving motor such that after the rotation of the yarn accumulating roller is stopped, the yarn accumulating roller is rotated in a opposite direction from a direction in which the yarn accumulating roller is rotated while winding the spun yarn. Accordingly, the unnecessary spun yarn sucked by the suction device can be removed automatically from the yarn accumulating roller. As a result, it is not necessary to remove the spun yarn remaining on the yarn accumulating roller by hand, and it is possible to perform the spinning operation efficiently.

[0014] In the above-described spinning machine, the control section controls the spinning device such that the feeding of the spun yarn is stopped by stopping twists applied by the spinning device. That is, by stopping twists of a fiber bundle applied by the spinning device, yarn strength in the spun yarn becomes lower. In such a case, since the spun yarn cannot endure tension and is cut off

like being torn off, fibers in the yarn end becomes untwisted. As a result, such a yarn end is likely to follow suction airflow near the suction opening, and the yarn end can be easily sucked by the suction opening.

[0015] According to a second aspect of the present invention, a yarn removing method for removing the spun yarn remaining on the yarn accumulating roller includes a yarn defect detecting step, a feeding stopping step, a yarn accumulating roller stopping step, a yarn end sucking step, and a yarn removing step. The yarn defect detecting step detects the prescribed yarn defect in which yarn strength is low. The feeding stopping step stops the feeding of the spun yarn after a prescribed period of time elapses from detection of the prescribed yarn defect. The yarn accumulating roller stopping step stops the rotation of the yarn accumulating roller. The yarn end sucking step sucks a yarn end of the spun yarn remaining on the yarn accumulating roller by the suction opening that is arranged near the outer peripheral surface of the yarn accumulating roller and near the edge of the yarn accumulating roller where the spun yarn is wound around. The yarn removing step sucks the yarn end of the spun yarn remaining on the yarn accumulating roller, and removes the spun yarn by rotating the yarn accumulating roller in a direction in which the spun yarn is unwound from the yarn accumulating roller.

[0016] That is, when the spun yarn has the prescribed yarn defect, a yarn breakage is likely to occur when such a yarn portion is unwound from the yarn accumulating roller. At this time, if the feeding of the spun yarn is stopped under the state in which a small amount of the spun yarn is wound sparsely around the yarn accumulating roller, a position where a yarn end is to be made moves away from the suction opening arranged near the edge of the yarn accumulating roller where the spun yarn is wound around, and sucking of the yarn end becomes difficult. However, in the above-described structure, since the spun yarn is fed to the yarn accumulating roller for a while even after such a yarn breakage occurs, the spun yarn is wound around to near the edge of the accumulating roller where the spun yarn is wound around. As a result, since a position of a yarn end made by stopping the feeding of the spun yarn comes close to the suction opening, such a yarn end can be easily sucked. As described above, even when such a yarn breakage occurs, the spun yarn remaining on the yarn accumulating roller is not necessary to be removed by hand, and a spinning operation can be performed efficiently.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a front view illustrating a general structure of a spinning frame.

Fig. 2 is a longitudinal sectional view of the spinning frame.

Fig. 3 is a block diagram illustrating a main structure

of the spinning frame.

Fig. 4 is a longitudinal sectional view of a yarn accumulating device.

Fig. 5 is an external perspective view of the yarn accumulating device.

Fig. 6 is a flowchart illustrating control for detecting a yarn defect and processing spun yarn remaining on the yarn accumulating roller.

Fig. 7 is a perspective view illustrating a state in which spun yarn cut off by a spinning device is wound by the yarn accumulating roller.

Fig. 8 is a longitudinal sectional view illustrating a state in which upper yarn and lower yarn are respectively caught by a suction pipe and a suction mouth.

Fig. 9 is a longitudinal sectional view illustrating a state in which the upper yarn and the lower yarn are guided to a splicer.

Fig. 10 is a perspective view illustrating a state immediately before a yarn breakage caused by large slub occurs.

Fig. 11 is a perspective view illustrating a state immediately after the yarn breakage caused by the large slub occurs.

Fig. 12 is a perspective view illustrating a state in which stopping of the spinning device is delayed and the spun yarn is wound around the yarn accumulating roller.

Fig. 13 is a perspective view illustrating a state in which the spun yarn remaining on the yarn accumulating roller is removed by a suction device.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0018] Next, by referring to the drawings, a description will be made on a spinning frame (a spinning machine) 1 according to an embodiment of the present invention. In the followings, "upstream" and "downstream" refer to an upstream side and a downstream side in a travelling direction of yarn during a spinning operation, respectively.

[0019] The spinning frame 1 as a spinning machine illustrated in Fig. 1 includes a plurality of units (spinning units 2) arranged next to one another. The spinning frame 1 includes a yarn splicing cart 3, a blower box 80, and a motor box 5.

[0020] As illustrated in Fig. 1, each spinning unit 2 includes a draft device 7, a spinning device 9, a yarn accumulating device 12, a lower-yarn sensor 31, and a winding device 13 as main components, which are arranged in this order from upstream to downstream. The draft device 7 is arranged near an upper end of a frame 6 of the spinning frame 1. A fiber bundle 8, which is fed from the draft device 7, is spun by the spinning device 9. After passing through a yarn clearer 52 which will be described later, spun yarn 10 fed from the spinning device 9 is fed by the yarn accumulating device 12 and is wound by the winding device 13, which forms a package 45.

[0021] The draft device 7 is used for producing the fiber bundle 8 by drafting a sliver 15. As illustrated in Fig. 2, the draft device 7 includes four rollers which are a back roller 16, a third roller 17, a middle bottom roller 19 provided with an apron belt roller 18, and a front roller 20. Such rollers are connected to motors (not illustrated in the drawings). The draft device 7 can be driven by driving such motors, and the draft device 7 can be stopped by stopping such motors. Moreover, driving and stopping of such motors are controlled by a unit controller (a control section) 60 as illustrated in Fig. 3.

[0022] A detailed structure of the spinning device 9 is not illustrated in the drawings; however, the present embodiment adopts a pneumatic type which applies twists to the fiber bundle 8 by whirling airflow. By generating the whirling airflow inside the spinning device 9, the spun yarn 10 can be produced. By stopping a generation of the whirling airflow inside the spinning device 9, production of the spun yarn 10 can be also stopped. Further, as illustrated in Fig. 3, the unit controller 60 controls the generation and a stoppage of the whirling airflow.

[0023] The yarn accumulating device 12 is located downstream of the spinning device 9. The yarn accumulating device 12 has a pulling function, a yarn slack preventing function, and a tension adjusting function. The pulling function is a function in which the yarn accumulating device 12 applies prescribed tension to the spun yarn 10 and pulls the spun yarn 10 from the spinning device 9. The yarn slack preventing function is a function in which the yarn accumulating device 12 accumulates the spun yarn 10 fed from the spinning device 9 and prevents the yarn slackening during a yarn splicing operation performed by the yarn splicing cart 3 or the like. The tension adjusting function is a function in which the yarn accumulating device 12 adjusts tension such that change in tension on the winding device 13 side is prevented from propagating to the spinning device 9 side. As illustrated in Fig. 2, the yarn accumulating device 12 includes a yarn accumulating roller 21, a yarn hooking member 22, an upstream guide 23, an electric motor (a driving motor) 25, a downstream guide 26, and an accumulated amount detecting sensor 27.

[0024] The yarn hooking member 22 is formed capable of being engaged with (hooking) the spun yarn 10. Under a state in which the yarn hooking member 22 is engaged with the spun yarn 10, the yarn hooking member 22 can guide the spun yarn 10 to the outer peripheral surface 21a of the yarn accumulating roller 21 by rotating integrally with the yarn accumulating roller 21.

[0025] The yarn accumulating roller 21 can accumulate the spun yarn 10 by winding the spun yarn 10 around the outer peripheral surface 21a thereof. The yarn accumulating roller 21 is rotationally driven by the electric motor 25. The yarn accumulating roller 21 is rotated such that the spun yarn 10, which has been guided to the outer peripheral surface 21a of the yarn accumulating roller 21 by the yarn hooking member 22, is wound around the yarn accumulating roller 21 so as to tighten the yarn ac-

cumulating roller 21. The spun yarn 10 would around the yarn accumulating roller 21 pulls the spun yarn 10 located upstream of the yarn accumulating device 12. Accordingly, the spun yarn 10 can be continuously pulled out from the spinning device 9.

[0026] The accumulated amount detecting sensor 27 detects an accumulated amount of the spun yarn 10 accumulated on the yarn accumulating roller 21 in a non-contact manner. The accumulated amount detecting sensor 27 transmits the detected remaining amount of the spun yarn 10 to the unit controller 60.

[0027] The upstream guide 23 is located slightly upstream of the yarn accumulating roller 21. The upstream guide 23 functions as a guiding member which appropriately guides the yarn to the outer peripheral surface 21a of the yarn accumulating roller 21. Further, the upstream guide 23 functions as a twist preventing member which prevents twists of the spun yarn 10 transmitted from the spinning device 9 from propagating downstream of the upstream guide 23.

[0028] The downstream guide 26 is located slightly downstream of the yarn accumulating roller 21. The downstream guide 26 restricts an orbit of the spun yarn 10 which is swung by the rotating yarn hooking member 22. The downstream guide 26 is formed as a guiding member which guides the spun yarn 10 while stabilizing a travelling route of the spun yarn located downstream of the downstream guide 26.

[0029] A suction device 30 is located near the yarn accumulating roller 21. A connection tube 30a is connected to the suction device 30. The connection tube 30a is connected to a blower (not illustrated in the drawings), which is provided in the blower box 80. Accordingly, suction airflow can be generated in the suction device 30.

[0030] The yarn clearer (the yarn defect detecting device) 52 is located in front of the frame 6 of the spinning frame 1 and at a position between the spinning device 9 and the yarn accumulating device 12. The yarn clearer 52 includes a clearer head 91 and an analyzer 92 (not illustrated in Fig. 2) as main components. The yarn clearer 52 monitors thickness of the travelling spun yarn 10 and a foreign substance or the like in the travelling spun yarn 10. When detecting a yarn defect in the spun yarn 10, the yarn clearer 52 transmits a yarn defect detection signal to the unit controller 60.

[0031] The analyzer 92 includes a Central Processing Unit (CPU) or the like (not illustrated in the drawings). If a detected value input from the clearer head 91 satisfies a prescribed condition, the analyzer 92 determines that the detected value corresponds to a yarn defect and transmits a prescribed yarn defect detection signal to the unit controller 60. For example, when a yarn portion which is 150% thicker than average thickness of the yarn continues for at least 3mm, the analyzer 92 determines such a yarn portion as slub or the like. In particular, in the present embodiment, when the a yarn portion which is equal to or thicker than a prescribed thickness with respect to the average thickness of the yarn (e.g. 300%

thicker than the average thickness of the yarn) is detected, the analyzer 92 determines such a yarn portion as large slub, and transmits a large slub detection signal as the yarn defect detection signal to the unit controller 60. In addition, a cutter 57 is provided near the yarn clearer 52 for cutting the spun yarn 10 when the package 45 is fully wound or the like.

[0032] As illustrated in Figs. 1 and 2, the yarn splicing cart 3 includes a splicer (a yarn splicing device) 43, a suction pipe 44, and a suction mouth 46. The yarn splicing cart 3 can travel on a rail 41 fixed to the frame 6. When a yarn breakage or a yarn cut occurs in one spinning unit 2, the yarn splicing cart 3 travels on the rail 41 to such a spinning unit 2, stops in front of such a spinning unit 2, and performs a yarn splicing operation.

[0033] The suction pipe 44 can swing around a shaft in a vertical direction. The suction pipe 44 sucks and catches a yarn end (an upper yarn) fed from the spinning device 9, and guides the yarn end to the splicer 43. The suction mouth 46 can swing around the shaft in a vertical direction. The suction mouth 46 sucks and catches a yarn end (a lower yarn) from the package 45 supported by the winding device 13, and guides the yarn end to the splicer 43. Although a detailed structure of the splicer 43 is not described, the upper yarn is spliced with the lower yarn by twisting each yarn end together by whirling airflow.

[0034] The lower-yarn sensor 31 is located at a position between the yarn accumulating device 12 and the winding device 13, and detects whether or not the spun yarn 10 exists at such a position. A lower yarn detection signal detected by the lower-yarn sensor 31 is transmitted to the unit controller 60.

[0035] The winding device 13 includes a cradle arm 71 supported around a supporting shaft 70 in a manner that the cradle arm 71 can be swung. The cradle arm 71 can support a bobbin 48 for winding the spun yarn 10 in a manner that the bobbin 48 can be rotated.

[0036] The winding device 13 includes a winding drum 72 and a traverse device 75. The winding drum 72 is rotationally driven while making contact with an outer peripheral surface of the bobbin 48 or an outer peripheral surface of the package 45, which is formed by winding the spun yarn 10 around the bobbin 48. The traverse device 75 includes a traverse guide 76 which can be engaged with the spun yarn 10. In such a structure, by driving the winding drum 72 by an electric motor (not illustrated in the drawings) while reciprocating the traverse guide 76 by a driving mechanism (not illustrated in the drawings), the package 45 making contact with the winding drum 72 is rotated, and the spun yarn 10 is wound into the package 45 while being traversed.

[0037] Next, by referring to Figs. 4 and 5, a detailed structure of the yarn accumulating device 12 will be described. The yarn accumulating roller 21 is a roller member formed of abrasion-resistant material. The yarn accumulating roller 21 is fixed to a motor shaft 25a of the electric motor 25. A side of the yarn accumulating roller 25 on which the yarn hooking member 22 is provided will

be referred to as a leading end, and a side where the electric motor 25 is provided will be referred to as a base end. An outer peripheral surface 21a of the yarn accumulating roller 21 includes a base-end taper portion 21b, a cylindrical portion 21c, and a leading-end taper portion 21d arranged in this order from the base end to the leading end thereof.

[0038] The cylindrical portion 21c slightly tapers towards the leading end thereof, and also is flatly connected (without difference in level) with the base-end taper portion 21b and the leading-end taper portion 21d. The accumulated amount detecting sensor 27 faces the cylindrical portion 21c. The accumulated amount detecting sensor 27 detects an accumulated amount of the spun yarn 10 wound around the yarn accumulating roller 21, and transmits a yarn accumulated amount detection signal to the unit controller 60.

[0039] Each of the base-end taper portion 21b and the leading-end taper portion 21d has a slightly tapered shape with a larger diameter at a corresponding end surface side. On the outer peripheral surface 21a of the yarn accumulating roller 21, the base-end taper portion 21b smoothly moves the supplied spun yarn 10 from a larger diameter portion to a smaller diameter portion towards the cylindrical portion 21c so as to orderly wind the spun yarn 10 around the surface of the cylindrical portion 21c. The leading-end taper portion 21d prevents a sloughing phenomenon in which the wound spun yarn 10 sloughs off all at once when unwinding the spun yarn 10 towards the downstream side. The leading-end taper portion 21d also has a function of sequentially rewinding the spun yarn 10 from the smaller diameter portion to the larger diameter portion at the end surface side so as to smoothly feed the spun yarn 10.

[0040] The suction device 30 is located near the yarn accumulating roller 21. The suction device 30 includes a suction pipe 30c formed in a pipe shape. One end of the suction pipe 30c, which is an open end, is provided with a suction opening 30b to generate suction airflow. The suction opening 30b is located near the outer peripheral surface 21a of the yarn accumulating roller 21, and is located so as to be close to a base-end end portion of the yarn accumulating roller 21. The spun yarn 10 wound around the base-end portion of the yarn accumulating roller 21 is subjected to an influence of the suction airflow generated by the suction device 30. Further, the suction pipe 30c is connected with the connection tube 30a. Accordingly, fiber waste and waste yarn sucked from the suction opening 30b are removed via the connection tube 30a, and are finally collected and discarded in a prescribed place.

[0041] As illustrated in Fig. 3, driving of the electric motor 25 (including a direction in which the electric motor 25 is driven) and stoppage thereof are controlled by the unit controller 60. Accordingly, the unit controller 60 can control driving of the yarn accumulating roller 21 or the like. During a normal winding operation, the unit controller 60 rotationally drives the yarn accumulating roller 21 in

a prescribed direction at a constant speed. Accordingly, the spun yarn 10 is wound around the yarn accumulating roller 21 at a constant speed, and the spun yarn 10 is pulled from the spinning device 9 at a constant speed by being pulled by the wound spun yarn 10. By controlling the electric motor 25, the unit controller 60 can stop rotation of the yarn accumulating roller 21 and can rotate the yarn accumulating roller 21 in an opposite direction from the above-described direction.

[0042] In addition, in the followings, rotating the yarn accumulating roller 21 in a rotational direction during the normal winding operation will be simply referred to as forward rotation, and rotating the yarn accumulating roller 21 in an opposite direction from the normal winding operation will be referred to as backward rotation.

[0043] As illustrated in Figs. 4 and 5, the yarn hooking member 22 located on a leading end of the yarn accumulating roller 21 is arranged coaxially with the yarn accumulating roller 21. The yarn hooking member 22 includes a flyer axis 33 and a flyer 38 fixed to a leading end of the flyer axis 33.

[0044] The flyer axis 33 is supported relatively rotatable with respect to the yarn accumulating roller 21. A permanent magnet is mounted on one of the flyer axis 33 and the yarn accumulating roller 21, and a magnetic hysteresis member is mounted on the other thereof. A resistance torque is generated against the rotation of the yarn hooking member 22 relative to the yarn accumulating roller 21 by such magnetic mechanisms. The yarn hooking member 22 rotates accompanying the rotation of the yarn accumulating roller 21 by the resistance torque. Accordingly, the yarn hooking member 22 and the yarn accumulating roller 21 rotate integrally. Meanwhile, when force that surpasses the resistance torque is applied to the yarn hooking member 22, the yarn hooking member 22 can rotate relatively with respect to the yarn accumulating roller 21.

[0045] The flyer 38 is curved appropriately toward the outer peripheral surface 21a of the yarn accumulating roller 21, and is formed in a shape in which the flyer 38 can be engaged with the spun yarn 10 (hook the spun yarn 10). Under a state in which yarn is not wound around the yarn accumulating roller 21, when the flyer 38 rotates integrally with the yarn accumulating roller 21 in a forward direction, the flyer 38 is engaged with the spun yarn 10. Then, the spun yarn 10 engaged with the rotating flyer 38 is swung around by such a flyer 38, and is guided to and wound around the outer peripheral surface 21a of the yarn accumulating roller 21 which is rotating in a forward direction.

[0046] As illustrated in Fig. 5, when the spun yarn 10 is wound around the outer peripheral surface 21a of the yarn accumulating roller 21, friction force acts between the spun yarn 10 and the yarn accumulating roller 21. Accordingly, under such a state, when the yarn accumulating roller 21 rotates at a constant speed in a forward direction, force to pull the spun yarn 10 located upstream of the yarn accumulating roller 21 acts, and the spun yarn

10 can be pulled from the spinning machine 9 at a constant speed.

[0047] Next, a description will be made on a state of the spun yarn 10 wound around the yarn accumulating roller 21 which rotates in a forward direction. The spun yarn 10 that has passed through the upstream guide 23 is guided from the base end of the yarn accumulating roller 21 to the outer peripheral surface 21a, and is wound around the cylindrical portion 21c a plurality of times. By being newly wound around the base end of the yarn accumulating roller 21 accompanying the forward rotation of the yarn accumulating roller 21, the spun yarn 10 wound around the cylindrical portion 21c is fed gradually from the base end of the yarn accumulating roller 21 to the leading end thereof. The spun yarn 10, which is fed from the leading end of the outer peripheral surface 21a, passes through the flyer 38, and is fed downward via the downstream guide 26.

[0048] As illustrated in Fig. 5, under a state in which the spun yarn 10 is wound around the yarn accumulating roller 21, when force is applied to pull the spun yarn 10 engaged with the flyer 38 downstream, force to attempt to rotate the yarn hooking member 22 so as to unwind the spun yarn 10 from the leading end of the yarn accumulating roller 21 is applied to the flyer 38. Accordingly, if yarn tension at downstream of the yarn accumulating device 12 (yarn tension between the yarn accumulating device 12 and the winding device 13) is strong enough to surpass the resistance torque, the yarn hooking member 22 rotates independently from the yarn accumulating roller 21 and the spun yarn 10 is gradually unwound from the leading end of the yarn accumulating roller 21 via the flyer 38.

[0049] Meanwhile, when the yarn tension at downstream of the yarn accumulating device 12 is not strong enough to surpass the resistance torque, the yarn hooking member 22 rotates integrally with the yarn accumulating roller 21. In such a case, the yarn hooking member 22 operates so as to prevent the spun yarn 10 from being unwound from the leading end of the rotating yarn accumulating roller 21.

[0050] As described above, the yarn accumulating device 12 can eliminate yarn slackening and apply appropriate tension by unwinding the yarn when the downstream yarn tension increases and by stopping the yarn from being unwound when the yarn tension decreases (when the yarn is likely to slacken).

[0051] As described above, the yarn hooking member 22 operates so as to absorb change in tension of the spun yarn 10 between the yarn accumulating device 12 and the winding device 13. Accordingly, such a change in tension is prevented from influencing the spun yarn 10 between the spinning device 9 and the yarn accumulating device 12. The spun yarn 10 can be pulled from the spinning machine 9 at a steady speed by the yarn accumulating device 12 having the above-described structure.

[0052] As described above, the yarn accumulating device 12 has various functions, and the accumulated

amount of the spun yarn 10 wound around the yarn accumulating roller 21 increases or decreases accompanying performance of such functions.

[0053] Next, by referring to Fig. 6, a description will be made on an operation performed when a yarn defect is detected in the spinning frame 1 according to the present embodiment. During a spinning operation, when detecting the yarn defect, the yarn clearer 52 transmits the yarn defect detection signal to the unit controller 60. When receiving the yarn defect detection signal (step S101), the unit controller 60 determines whether or not the yarn defect detection signal is the large slub detection signal (step S102). That is, the unit controller 60 stores a preset strength threshold value, and determines whether or not the received yarn defect detection signal value is equal to or less than such a strength threshold value. In the present embodiment, the unit controller 60 detects a yarn defect in which yarn thickness is at least a preset thickness threshold value as a yarn defect in which yarn strength is equal to or less than the preset strength threshold value.

[0054] First, by referring to Figs. 7 through 9, a description will be made on a case in which the yarn defect detection signal other than the large slub detection signal is received. When receiving the yarn defect detection signal other than the large slub detection signal, the unit controller 60 stops the spinning device 9 immediately (step S103 of Fig. 6). Accordingly, since twists are not applied to the fiber bundle 8, the spun yarn 10 is cut off at a position of the spinning device 9 in a manner in which a fiber sloughs off. Further, fiber waste is adhered on a yarn end 10a of the cut-off spun yarn 10.

[0055] Then, by stopping the driving of the electric motor 25, the unit controller 60 stops the rotation of the yarn accumulating roller 21 (step S104). As described above, there exists a little time lag between a timing in which the spinning device 9 is stopped and a timing in which the rotation of the yarn accumulating roller 21 is stopped. During the time lag, since the yarn accumulating roller 21 is rotated forward, the spun yarn 10 including the yarn end 10a is wound around the yarn accumulating roller 21. In such a case, as illustrated in Fig. 7, the yarn end 10a is guided from the base end of the yarn accumulating roller 21 to the outer peripheral surface 21a of the yarn accumulating roller 21.

[0056] As described above, the suction opening 30b is located near the outer peripheral surface of the base end of the yarn accumulating roller 21. Immediately after being wound around the yarn accumulating roller 21, the yarn end 10a is subjected to an influence of the suction airflow generated by the suction opening 30b. Accordingly, before the fiber waste adhered on the yarn end 10a flies apart from the yarn end 10a, the fiber waste can be sucked and removed by the suction opening 30b.

[0057] Further, since a winding operation is still continued by the winding device 13 in such a case, the spun yarn 10 including the yarn end 10a is unwound from the leading end of the yarn accumulating roller 21 towards

downstream, and is wound around the package 45 by the winding device 13. Furthermore, since the yarn defect detected by the yarn clearer 52 is included in the spun yarn 10 located downstream of the spinning device 9, a yarn portion including the yarn defect is also wound around the package 45 temporarily.

[0058] It may also be considered that the spun yarn 10 including the yarn end 10a is sucked by the suction device 30 under a state in which the yarn end 10a receives an influence of the suction airflow at the suction opening 30b. However, also in this case, since the influence of the suction airflow at the suction opening 30b is weak compared with force in which the winding device 13 pulls the spun yarn 10, the spun yarn 10 is also wound around the package.

[0059] The unit controller 60 controls the yarn splicing cart 3 to travel to front of the spinning unit 2 and to start a splicing operation (step S105 of Fig. 6). First, the unit controller 60 controls the suction mouth 46 to swing to the vicinity of a surface the package 45 (refer to Fig. 8), generates suction airflow at a suction opening of the suction mouth 46, and also rotates the package 45 backward by the winding device 13. Accordingly, the yarn end (the lower yarn) is drawn from the outer peripheral surface of the package 45, and the lower yarn is sucked and caught by the suction mouth 46. Further, the yarn including the yarn defect can be removed from the package 45 by being drawn from the package 45 and being sucked by the suction mouth 46.

[0060] Next, while rotating the package 45 backward, the unit controller 60 controls the suction mouth 46 sucking the lower yarn to swing upward to guide the lower yarn to the splicer 43 (refer to Fig. 9). When the lower yarn is guided to the splicer 43, the unit controller 60 stops rotation of the package 45.

[0061] Before or after a swinging movement of the suction mouth 46, the unit controller 60 controls the suction pipe 44 to swing to the vicinity of the downstream side of the spinning device 9 (refer to Fig. 8). The unit controller 60 re-drives the spinning device 9 or the like to restart the spinning operation, and suction airflow is generated at a suction opening of the suction pipe 44 to catch the yarn end (the upper yarn) at the spinning device 9 side. Then, by swinging the suction pipe 44 downward while continuing such suction, the spun yarn 10 is pulled from the spinning device 9 and the suction pipe 44 guides the spun yarn 10 to the splicer 43 (refer to Fig. 9).

[0062] When the upper yarn and the lower yarn are guided to the splicer 43, the yarn splicing operation is performed by the splicer 43. During the yarn splicing operation, although the winding operation performed by the winding device 13 is stopped, the spun yarn 10 is continuously fed from the spinning device 9. As a result, yarn slackening is generated if the spun yarn 10 is left as it is. Even during the yarn splicing operation, since the yarn accumulating roller 21 continues to rotate forward, slackening of the spun yarn 10 can be prevented by winding the spun yarn 10 around the yarn accumulating roller 21.

As described above, the yarn accumulating device 12 functions as a yarn slack eliminating device during the yarn splicing operation. Further, when the splicing operation performed by the splicer 43 is completed, the normal winding operation performed by the winding device 13 is restarted.

[0063] Next, by referring to Figs. 10 through 13, a description will be made on a case in which the yarn defect detection signal detected by the yarn clearer 52 is the large slub detection signal. Fig. 10 is a perspective view illustrating a state immediately before a yarn breakage caused by the large slub occurs. Fig. 11 is a perspective view illustrating a state immediately after the yarn breakage caused by the large slub occurs. Fig. 12 is a perspective view illustrating a state in which stopping of the spinning device 9 is delayed and the spun yarn 10 is wound around the yarn accumulating roller 21. Fig. 13 is a perspective view illustrating a state in which the spun yarn 10 remaining on the yarn accumulating roller 21 is removed by the suction device 30. Further, to simplify understanding of effects of the present embodiment, in the followings, a description will be made on a case in which a yarn accumulated amount on the yarn accumulating roller 21 is relatively low when the large slub is detected.

[0064] The large slub is a defective part having thickness which is equal to or thicker than the prescribed thickness compared with the average thickness of the yarn. Since the yarn has few yarn twists at a portion having the large slub, the yarn strength of such yarn portion is low; therefore, a yarn breakage is likely to occur. Such a large slub 10b is illustrated in Fig. 10.

[0065] If the above-described control (control performed for the yarn defect detection signal other than the large slub detection signal) is also performed when the large slub 10b is detected, the following problem arises. When the large slub 10b is detected, the unit controller 60 immediately stops the spinning device 9 to cut off the spun yarn 10 at upstream of the yarn accumulating roller 21. When a yarn breakage caused by the large slub 10b occurs in the yarn accumulating device 12 or the like, unnecessary spun yarn 10 remains on the yarn accumulating roller 21 in which one end of such spun yarn 10 is a yarn end generated by a stoppage of the spinning device 9 and another end of such spun yarn 10 is a yarn end generated by the yarn breakage caused by the large slub 10b. Since such unnecessary spun yarn 10 is also cut off from the yarn at the winding device 13 side, the unnecessary spun yarn 10 cannot be unwound even from the yarn accumulating roller 21 by being pulled towards the winding device 13. Accordingly, there is no method to remove the remaining spun yarn 10, and the spinning operation may not be restarted.

[0066] Therefore, the unit controller 60 performs the following control to avoid the above-described state in the present embodiment. That is, when receiving the large slub detection signal, the unit controller 60 does not stop the spinning device 9 immediately and controls

the spinning device 9 to operate for a prescribed period of time (for example, for a period of time required to wind the yarn ten times around the yarn accumulating roller 21) (step S106 of Fig. 6).

[0067] Since the yarn accumulating roller 21 keeps rotating even after the large slub 10b is detected, the spun yarn 10 including the large slub 10b is wound around the yarn accumulating roller 21. In addition, since the winding device 13 also continues the winding operation, the spun yarn 10 is kept being pulled downstream.

[0068] Since the large slub 10b is subjected to drag force upward in a substantially vertical direction (to an upper side in Fig. 10) when making contact with the flyer 38, a yarn breakage may occur at such a part (refer to Fig. 10). When the yarn breakage caused by the large slub 10b occurs as described above, the large slub 10b is divided into an upstream large slub 10c, which is a yarn end located upstream, and a downstream large slub 10d, which is a yarn end located downstream (refer to Fig. 11).

[0069] The downstream large slub 10d as well as the spun yarn 10 including the downstream large slub 10d are subjected to tension by the winding device 13, and are temporarily wound around the package 45. Meanwhile, since the yarn accumulating roller 21 still keeps rotating, the upstream large slub 10c may move accompanying such rotation; however, normally the upstream large slub 10c remains near the leading end of the yarn accumulating roller 21.

[0070] After a prescribed period of time elapses, the unit controller 60 stops the spinning device 9 (step S106). The spun yarn 10, which is generated during a time that elapses before the spinning device 9 is stopped, is wound around toward the base end of the outer peripheral surface 21a of the yarn accumulating roller 21 as described above (refer to Fig. 12). Further, as described above, the fibers are mostly untwisted in the yarn end 10a that is cut off by stoppage of the spinning device 9 (refer to Fig. 12). Further, another end of the yarn end 10a is the upstream large slub 10c. As described above, when the large slub 10b in which yarn strength is low is generated, the unnecessary spun yarn 10 remains on the yarn accumulating roller 21.

[0071] After the stoppage of the spinning device 9, when a period of time necessary for winding the yarn end 10a around the yarn accumulating roller 21 elapses, the unit controller 60 stops the driving of the electric motor 25 to stop the rotation of the yarn accumulating roller 21 (step S107 of Fig. 6).

[0072] Meanwhile, as described above, the suction opening 30b on the suction device 30 is located near the outer peripheral surface 21a of the yarn accumulating roller 21 and near the base end of the yarn accumulating roller 21, and generates the suction airflow. When being wound around the yarn accumulating roller 21, the yarn end 10a rotates so as to be swung around in a radial direction of the yarn accumulating roller 21 at the base end thereof. Further, since the rotation of the yarn accu-

mulating roller 21 is stopped while the rotating movement of the yarn end 10a is being carried out, the rotating movement of the yarn end 10a is performed in a slow manner. Since the yarn end 10a moves as described above, the spun yarn 10 including the yarn end 10a is promptly caught by the suction opening 30b before or after the rotation of the yarn accumulating roller 21 is stopped (refer to Fig. 12).

[0073] As described above, according to the present embodiment, the spinning device 9 is driven for a while after the large slub 10b is detected in step S106 of Fig. 6. If the spinning device 9 is stopped promptly after the large slub 10b is detected, the following problems arise especially in a case in which an accumulated amount on the yarn accumulating roller 21 is low. That is, since the spun yarn 10 is sparsely wound around the yarn accumulating roller 21 in such a case, the rotating movement of the yarn end 10a is performed not at a position on the base end, but at a position that is slightly closer to the leading end than the former position. Accordingly, catching the yarn end 10a becomes difficult at the suction opening 30b located on the base end. Further, the spun yarn 10 may be unwound closer to the leading end by the yarn end 10a being swung. In such a case, the yarn end 10a is swung at a position closer to the leading end and likelihood that the suction opening 30b catches the yarn end 10a is further reduced. In such a case, the spun yarn 10 remaining on the yarn accumulating roller 21 must be removed by hand. According to the present embodiment, the likelihood that the suction device 30 catches the yarn end 10a can be raised by delaying the stoppage of the spinning device 9 at the detection of the large slub 10b as described above.

[0074] The unit controller 60 controls the yarn accumulating roller 21 to rotate backward promptly after stopping the rotation of the yarn accumulating roller 21 (step S108). Accompanying such backward rotation, the spun yarn 10 accumulated on the yarn accumulating roller 21 is sequentially unwound from the base end of the yarn accumulating roller 21. At the same time, the spun yarn 10 accumulated on the yarn accumulating roller 21 is sequentially sucked by the suction device 30 (refer to Fig. 13). In the above-described structure, the spun yarn 10 remaining on the yarn accumulating roller 21 when the large slub 10b has generated can be sucked and removed by the suction device 30.

[0075] Then, in the same as a manner as when a yarn defect other than the large slub is detected, the yarn splicing operation is started (step S105 of Fig. 6) and the spinning device 9 is driven. The produced spun yarn 10 has been caught by the suction pipe 44, and the spun yarn 10 including the downstream large slub 10d is caught by the suction mouth 46. Then, both of the spun yarns 10 are guided to the splice 43, and the yarn splicing operation is performed. Next, the normal winding operation performed by the winding device 13 is restarted.

[0076] By carrying out the above-described control, even when a yarn breakage occurs at the flyer 38 or the

like on the yarn accumulating roller 21, the unnecessary spun yarn 10 is automatically removed and the spinning operation can be restarted.

[0077] As described above, the spinning frame 1 according to the present embodiment includes the spinning device 9, the yarn clearer 52, the yarn accumulating roller 21, the electric motor 25, the suction opening 30b, the suction device 30, and the unit controller 60. The spinning device 9 produces the spun yarn 10 by applying twists to the fiber bundle 8. The yarn clearer 52 is arranged downstream of the spinning device 9 and detects the yarn defect of the travelling spun yarn 10. The yarn accumulating roller 21 is arranged downstream of the yarn clearer 52 and accumulates the spun yarn 10 by rotating while winding the spun yarn around the outer peripheral surface 21a. The electric motor 25 drives and rotates the yarn accumulating roller 21. The suction opening 30b is arranged near the outer peripheral surface 21a of the yarn accumulating roller 21 and near the base end of the yarn accumulating roller 21. The suction device 30 can generate suction airflow at the suction opening 30b. The controller 60 controls the electric motor 25 such that when the yarn clearer 52 detects a prescribed yarn defect in which yarn strength is low, a stoppage timing, which is a timing at which the feeding of spun yarn 10 is stopped, is delayed compared with when other type of yarn defect is detected, and after such a stoppage timing, the rotation of the yarn accumulating roller 21 is stopped.

[0078] That is, when the spun yarn 10 has the prescribed yarn defect, a yarn breakage is likely to occur when such a yarn portion is unwound from the yarn accumulating roller 21. At this time, under a state in which a small amount of the spun yarn 10 is sparsely wound around the yarn accumulating roller 21, when feeding of the spun yarn 10 from upstream is stopped, a position where the yarn end 10a is to be formed moves away from the suction opening 30b located near the base end of the yarn accumulating roller 21, and it becomes difficult for the suction opening 30b to suck the yarn end 10a. However, according to the above-described structure, since the spun yarn 10 is fed to the yarn accumulating roller 21 for a while even after such a yarn breakage occurs, the spun yarn 10 is wound around to the vicinity of the base end of the yarn accumulating roller 21. As a result, since the position of the yarn end 10a to be formed by stopping the feeding of the spun yarn 10 comes close to the suction opening 30b, the suction device 30 can easily suck the yarn end 10a. As described above, the unnecessary spun yarn 10 wound around the yarn accumulating roller 21 is not necessary to be removed by hand even when such a yarn breakage occurs, and the spinning operation can be performed efficiently.

[0079] In the spinning frame 1 according to the present embodiment, the yarn clearer 52 detects a yarn portion in which yarn thickness is thicker for at least a preset level than thickness of normal yarn as a prescribed yarn defect as the large slub 10b. Accordingly, the spinning frame 1 detects the large slub 10b in which yarn strength

is low, and can appropriately perform control for removing the spun yarn 10 remaining on the yarn accumulating roller 21.

[0080] In the spinning frame 1 according to the present embodiment, after the unit controller 60 controls to stop the rotation of the yarn accumulating roller 21, the unit controller 60 controls the yarn accumulating roller 21 to rotate backward. Accordingly, the unnecessary spun yarn 10 sucked by the suction device 30 can be removed automatically from the yarn accumulating roller 21. As a result, the spun yarn 10 remaining on the yarn accumulating roller 21 is not necessary to be removed by hand, and the spinning operation can be performed efficiently.

[0081] In the spinning frame 1 according to the present embodiment, the unit controller 60 stops the feeding of the spun yarn 10 by stopping twists applied by the spinning device 9. That is, by stopping the twists applied to the fiber bundle 8 by the spinning device 9, yarn strength in the spun yarn 10 becomes lower. In such a case, since the spun yarn 10 cannot endure tension and is cut off like being torn off, fibers in the yarn end becomes untwisted. Accordingly, such a yarn end 10a is likely to follow the suction airflow near the suction opening 30b, and the suction device 30 can easily suck the yarn end 10a.

[0082] While preferred embodiments of the present invention have been described as above, the structure can be modified as below, for example.

[0083] In the present embodiment, although the large slub has been described as a prescribed yarn defect, other defects such as an irregularity in thickness, in which yarn thickness is extremely thin can be considered as the prescribed yarn defect as long as the yarn defect has low yarn strength. In addition, a determination standard for determining a large slub is not limited to the above-described embodiment, and the determination standard may be modified according to a shape or the like of the flyer 38 or the like.

[0084] The present embodiment has been described by referring to a case in which a yarn breakage occurs due to the large slub 10b making contact with the flyer 38; however, control of the present embodiment is also effective when a yarn breakage occurs at other positions. For example, such a yarn breakage may be a yarn breakage that may be caused by friction of the yarn against the outer peripheral surface 21a of the yarn accumulating roller 21, the downstream guide 26, or the like.

[0085] In the present embodiment, the feeding of the spun yarn 10 is stopped by stopping the spinning device 9. However, other structures may be adopted instead of such a structure. For example, the feeding of the spun yarn 10 fed from the spinning device 9 to the yarn accumulating roller 21 can be stopped by other methods such as cutting the spun yarn 10 by the cutter 57 and stopping the back roller 16 of the draft device 7.

[0086] A shape of the suction device 30 is not limited to the above-described shape. For example, instead of a structure in which the suction opening 30b is made on a leading end of the suction pipe 30c, a suction opening

may be formed on a leading end of a square tube shaped member.

[0087] Instead of a structure in which the yarn splicing cart 3 performs the yarn splicing operation, each spinning unit 2 may include a structure for performing a yarn splicing operation.

[0088] The yarn hooking member 22 and the yarn accumulating roller 21 are not necessarily provided to be relatively rotatable. For example, like a slack eliminating device disclosed in Japanese Unexamined Patent Application Publication No. 2004-124333, a notch section formed on a slack eliminating roller can serve as a yarn hooking section.

[0089] A method for applying torque to the yarn hooking member 22 and the yarn accumulating roller 21 is not limited to a magnetic mechanism as described above, and frictional force or an electromagnetic mechanism can be used.

Claims

1. A spinning machine (1) **characterized by** comprising:

a spinning device (9) that produces spun yarn by applying twists to a fiber bundle,
a yarn defect detecting device (52) that is arranged downstream of the spinning device (9) and detects a yarn defect in the travelling spun yarn,

a yarn accumulating roller (21) that is arranged downstream of the yarn defect detecting device (52) and accumulates the spun yarn fed from the spinning device (9) by rotating while winding the spun yarn around an outer peripheral surface thereof,

a driving motor (25) that drives and rotates the yarn accumulating roller (21),

a suction opening (30b) that is arranged near the outer peripheral surface (21a) of the yarn accumulating roller (21) and near an edge of the yarn accumulating roller (21) where the spun yarn is wound around,

a suction device (30) that can generate suction airflow at the suction opening (30b), and

a control section (60) that controls rotation of the driving motor (25) such that when the yarn defect detecting device (52) detects a yarn defect in which yarn strength is equal to or less than a preset strength threshold value, a stoppage timing, which is a timing at which feeding of the spun yarn from the spinning device (9) to the yarn accumulating roller (21) is stopped, is delayed compared with when other type of yarn defect is detected, and after the stoppage timing, the rotation of the yarn accumulating roller (21) is stopped.

2. The spinning machine (1) according to claim 1, **characterized in that** as the yarn defect in which the yarn strength is equal to or less than the preset strength threshold value, the yarn defect detecting device (52) detects a yarn defect in which yarn thickness is at least a preset thickness threshold value.

3. The spinning machine (1) according to claim 1 or claim 2, **characterized in that** the control section (60) controls the rotation of the driving motor (25) such that after the rotation of the yarn accumulating roller (21) is stopped, the yarn accumulating roller (21) is rotated in an opposite direction from a direction in which the yarn accumulating roller (21) is rotated while winding the spun yarn.

4. The spinning machine (1) according to any one of claim 1 through claim 3, **characterized in that** the control section (60) stops feeding of the spun yarn by stopping an operation of the spinning device (9).

5. A removing method for removing spun yarn remaining on a yarn accumulating roller (21), **characterized by** comprising:

a yarn defect detecting step of detecting a prescribed yarn defect in which yarn strength is equal to or less than a preset strength threshold value, in a spun yarn produced by a spinning device (9),

a feeding stopping step of stopping feeding of the spun yarn from the spinning device (9) after a prescribed period of time elapses from detection of the prescribed yarn defect,

a yarn accumulating roller stopping step of stopping rotation of the yarn accumulating roller (21),
a yarn end sucking step of sucking a yarn end of the spun yarn remaining on the yarn accumulating roller (21) by a suction opening (30b) that is arranged near an outer peripheral surface (21a) of the yarn accumulating roller (21) and near an edge of the yarn accumulating roller (21) where the spun yarn is wound around, and

a yarn removing step of removing the spun yarn by rotating the yarn accumulating roller (21) in a direction in which the spun yarn is unwound from the yarn accumulating roller (21).

FIG. 1

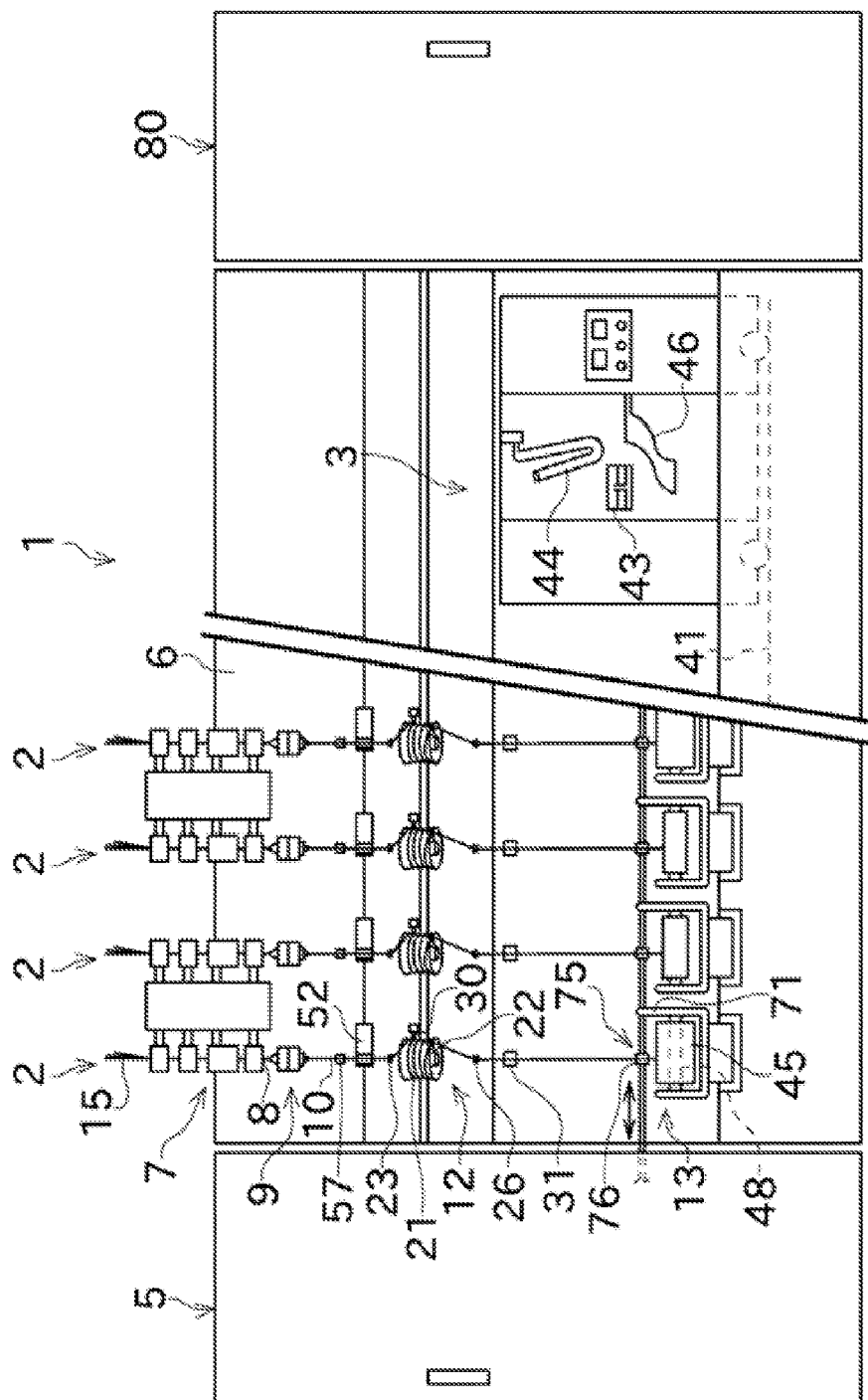


FIG. 2

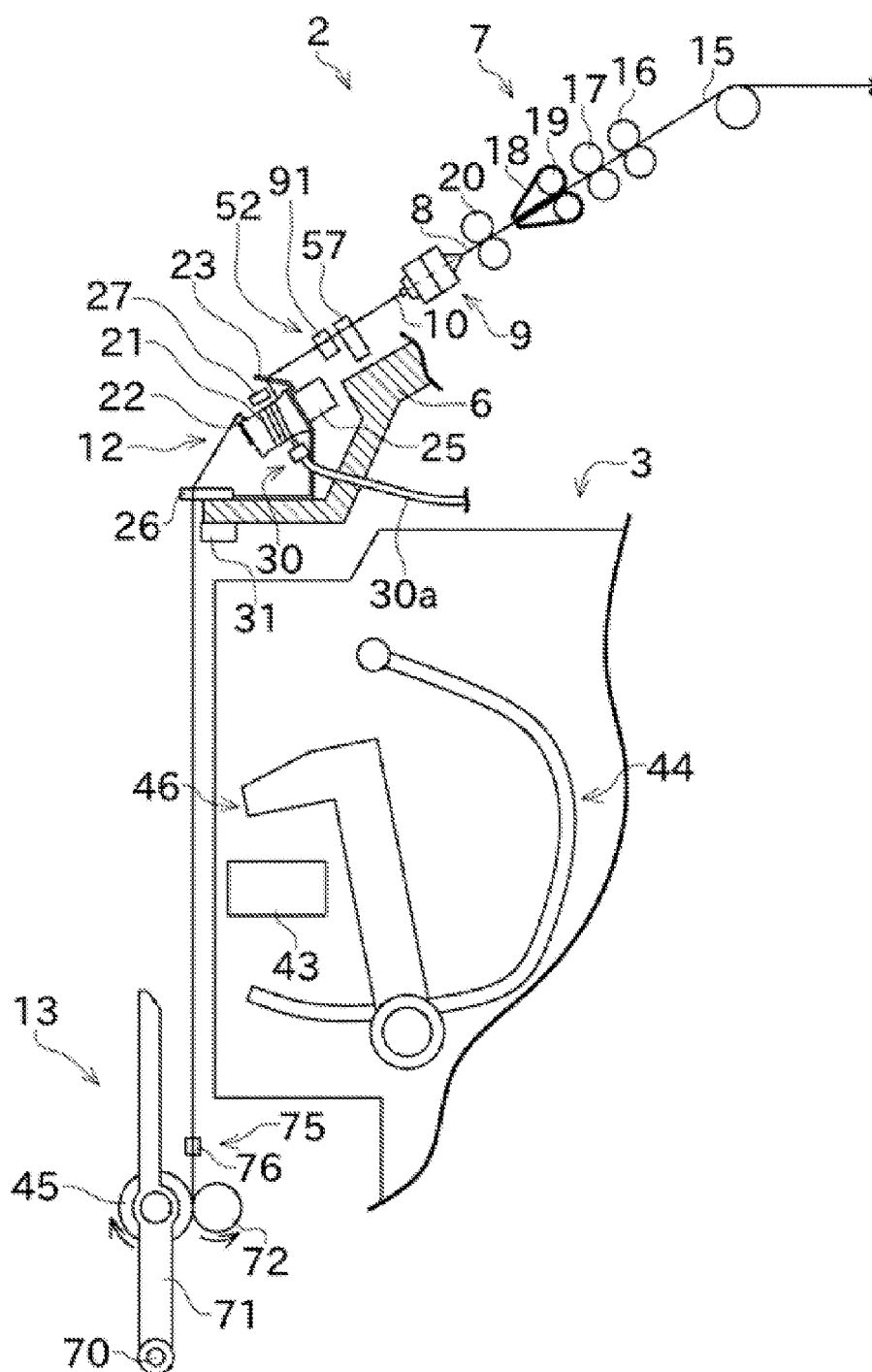


FIG. 3

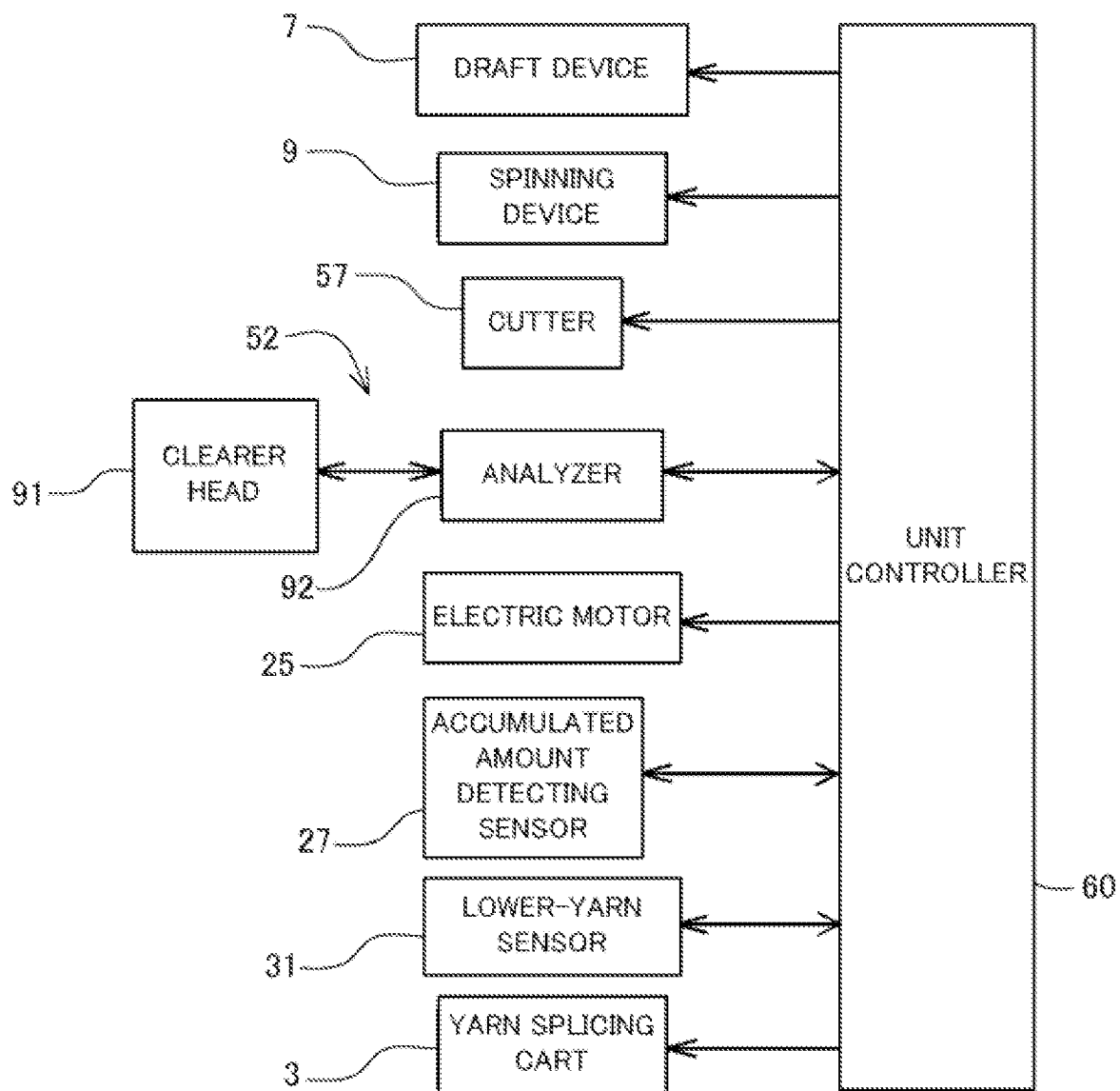


FIG. 4

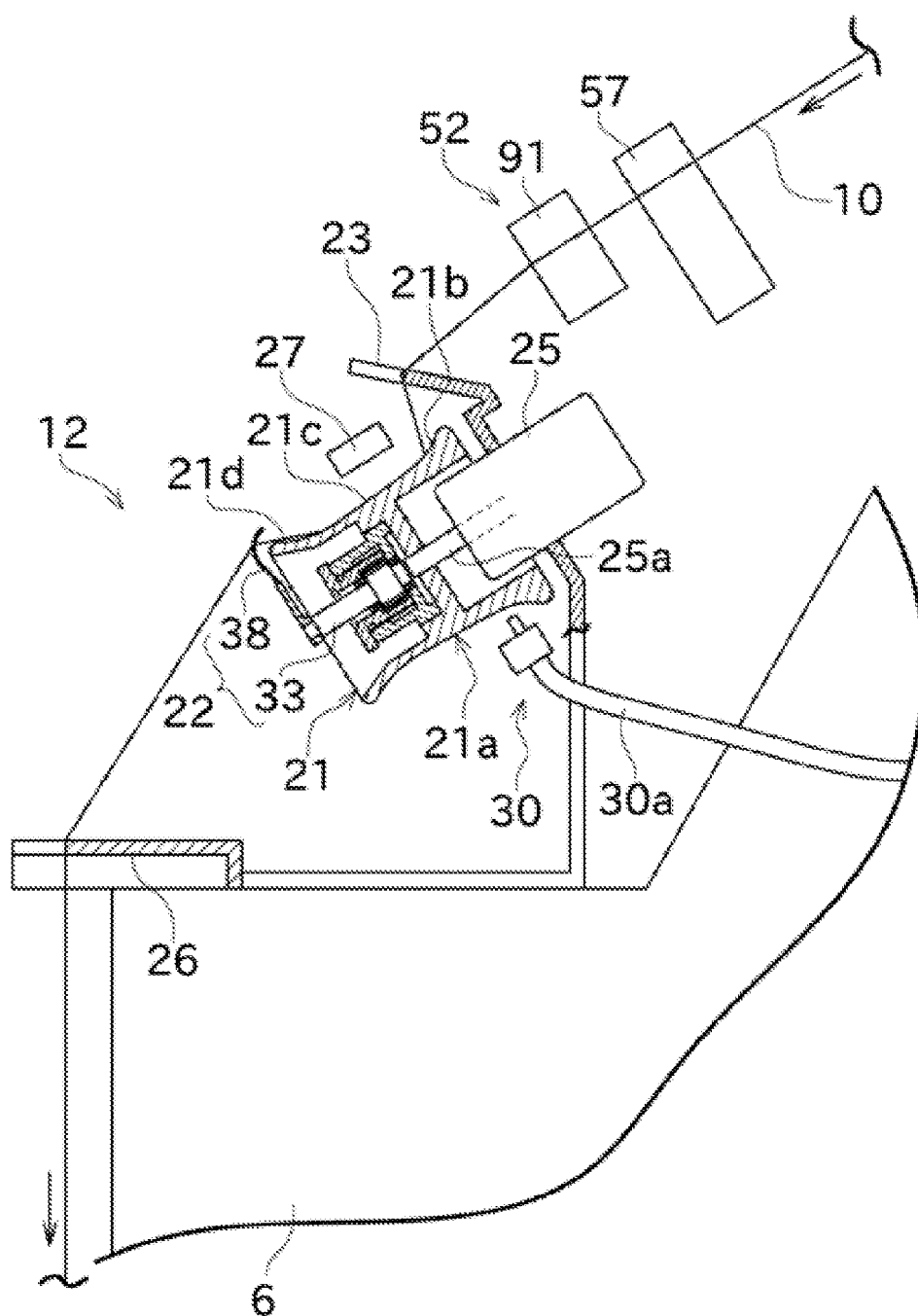


FIG. 5

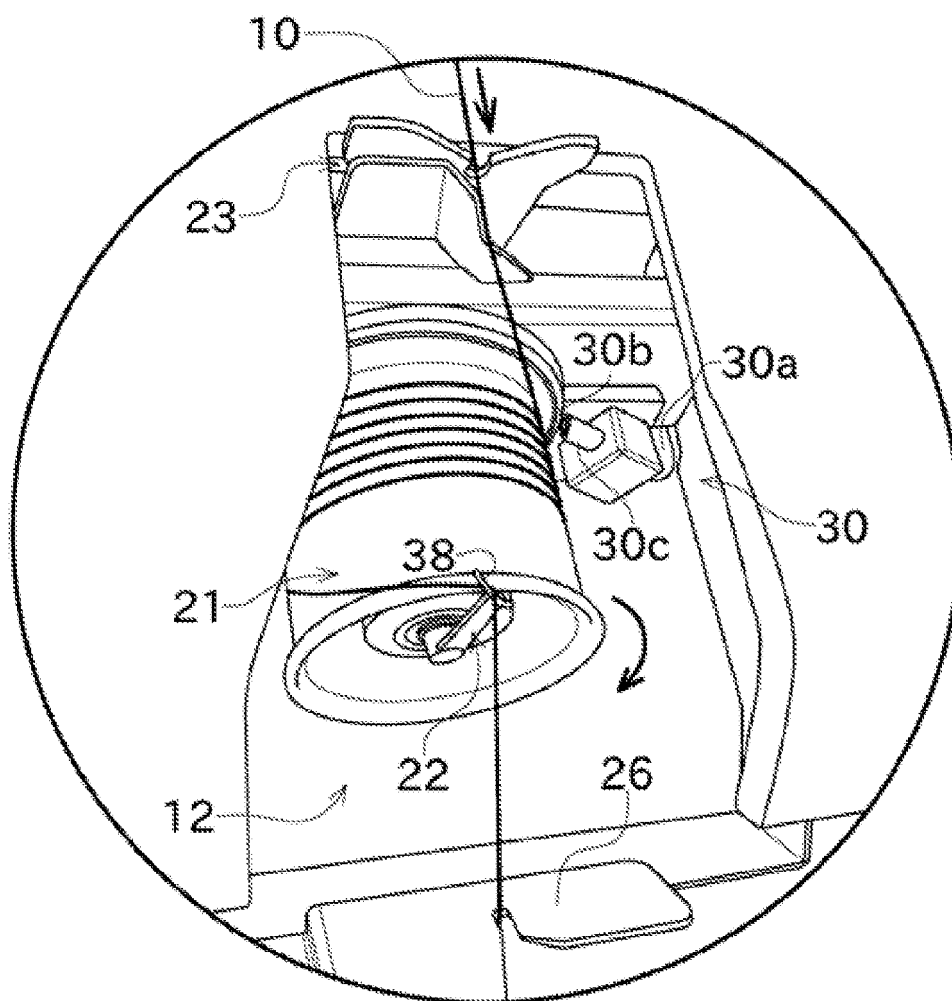


FIG. 6

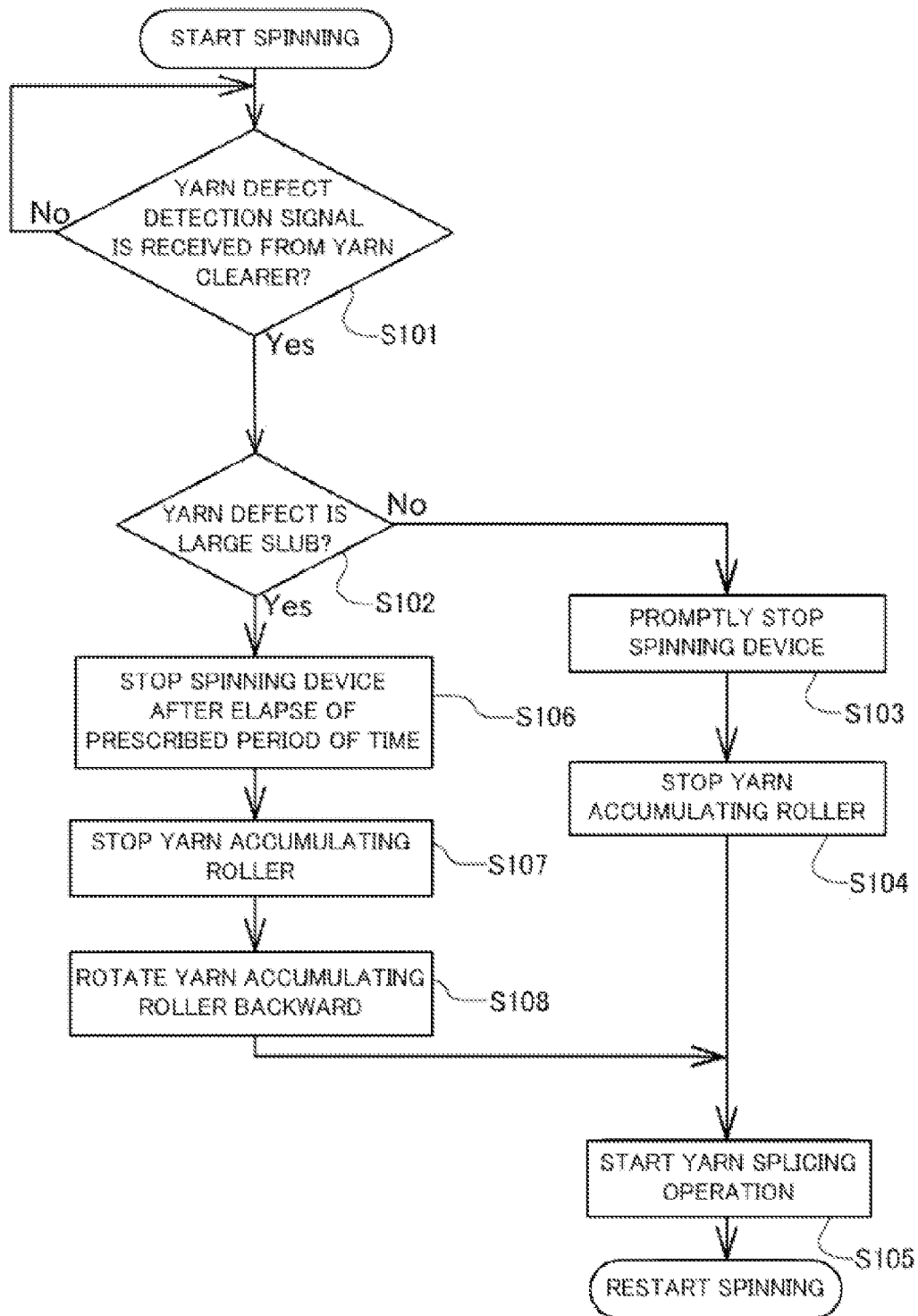


FIG. 7

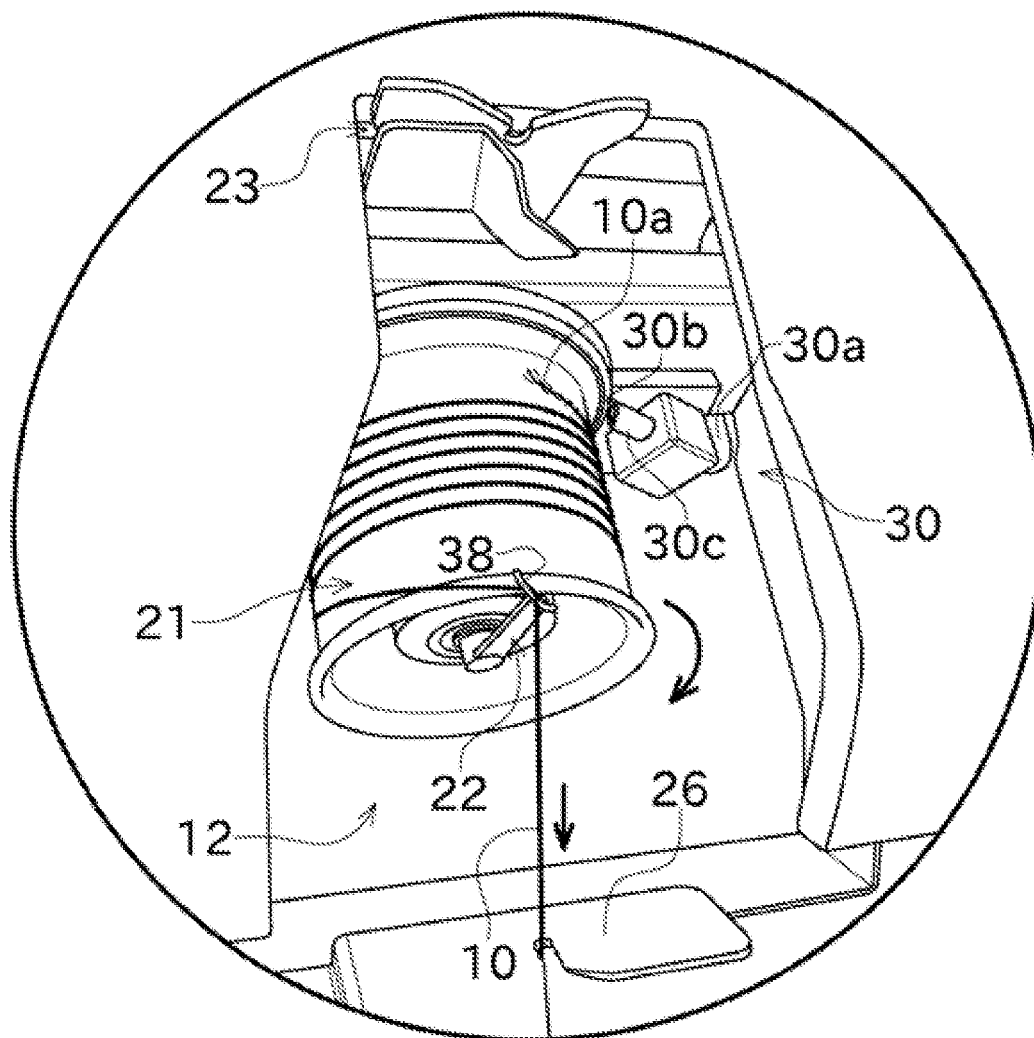


FIG. 8

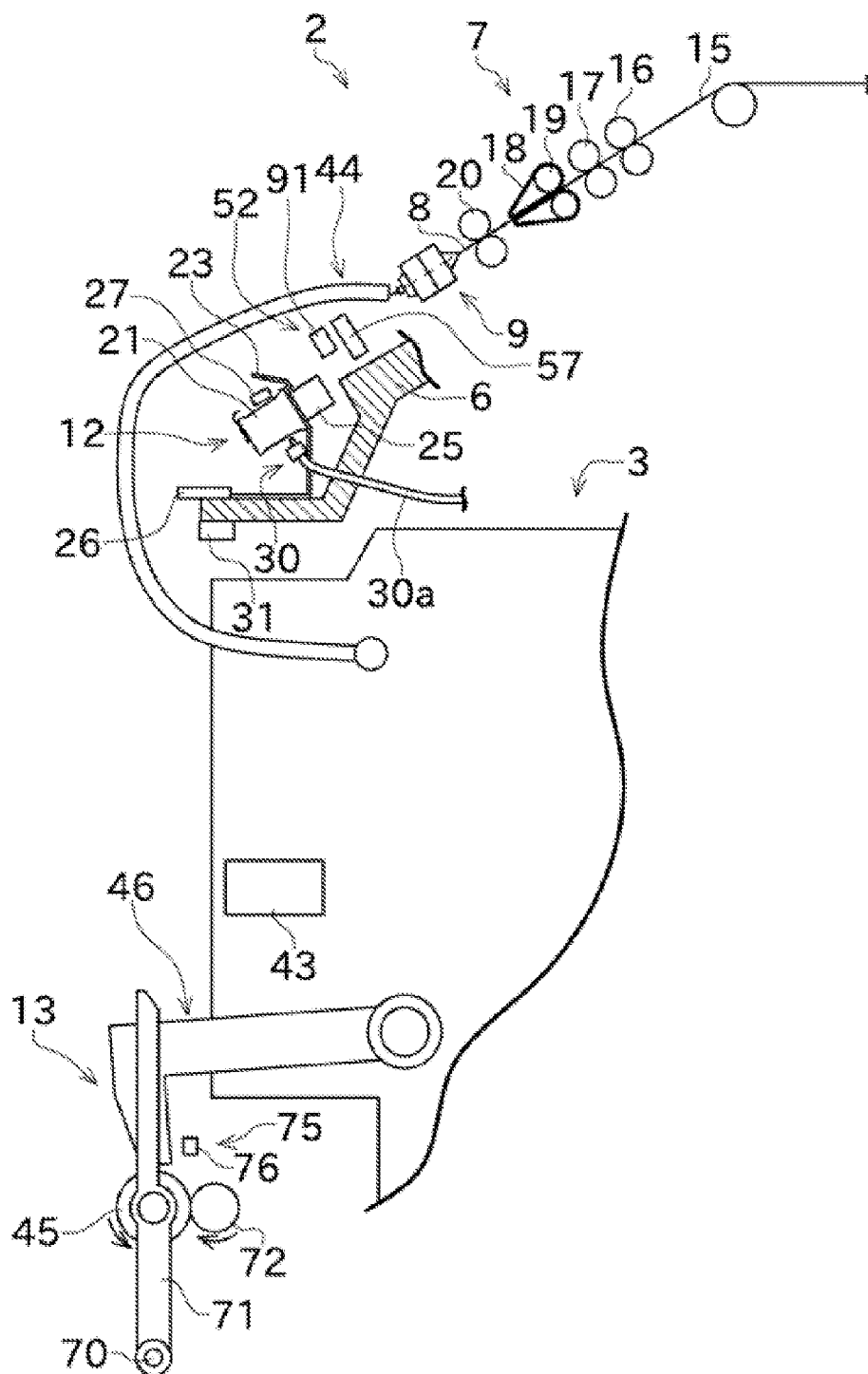


FIG. 9

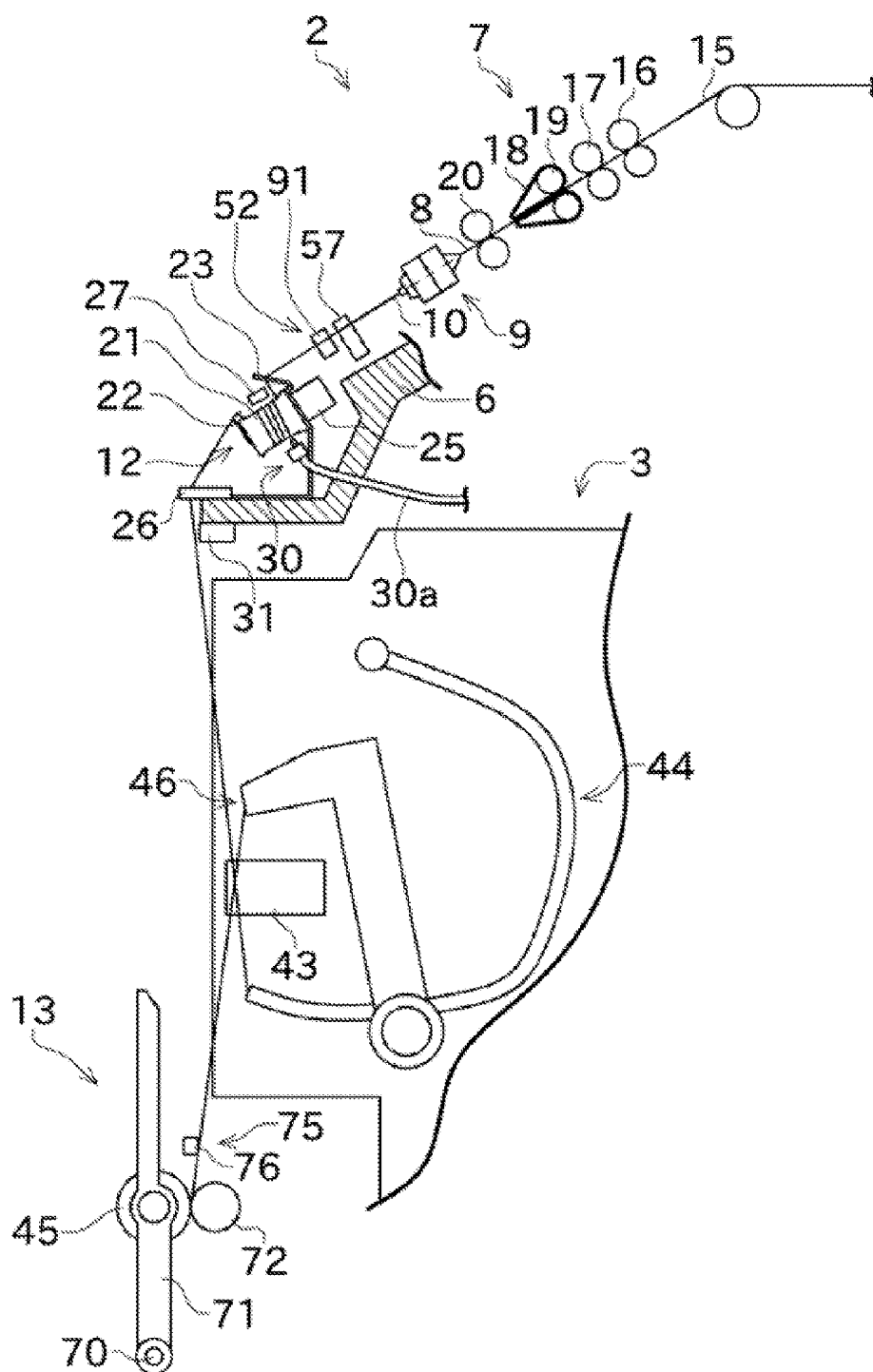


FIG. 10

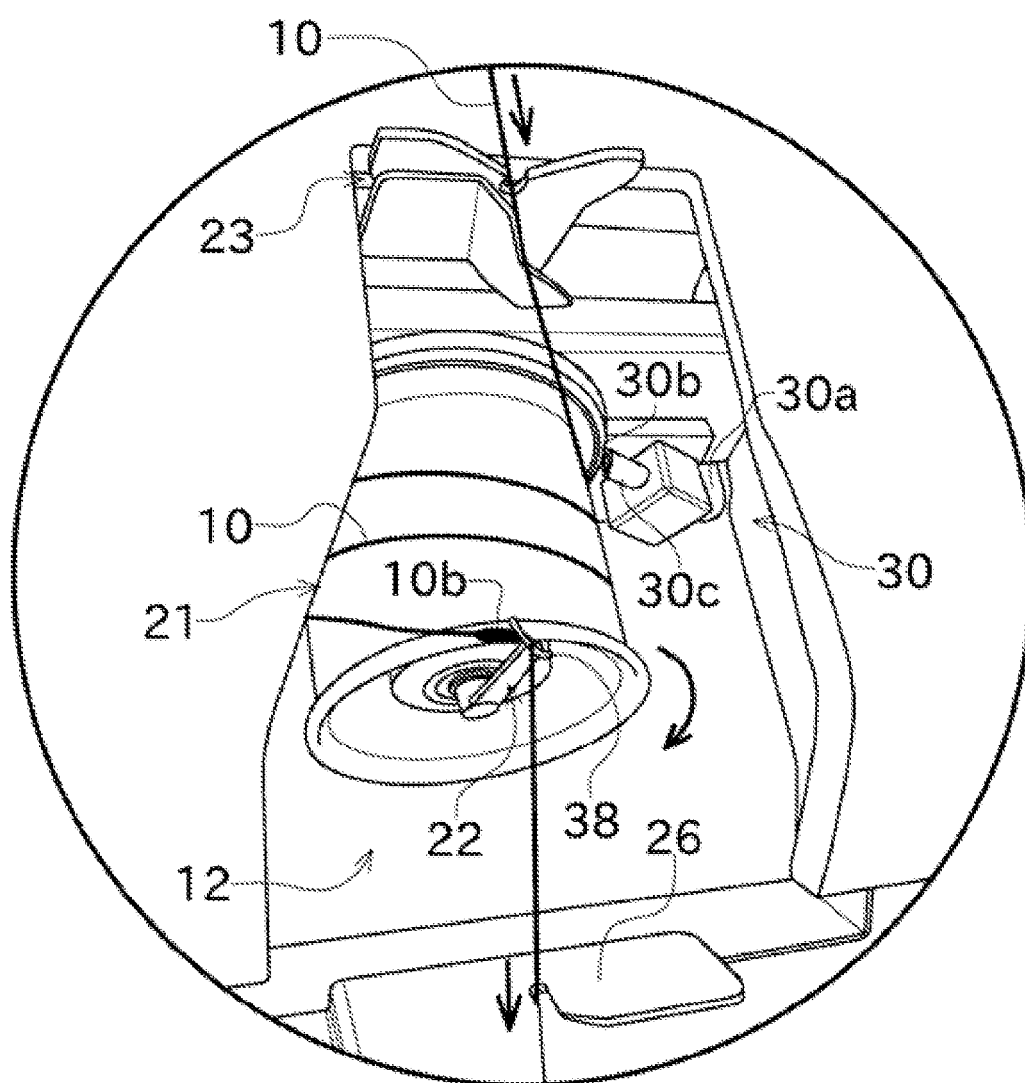


FIG. 11

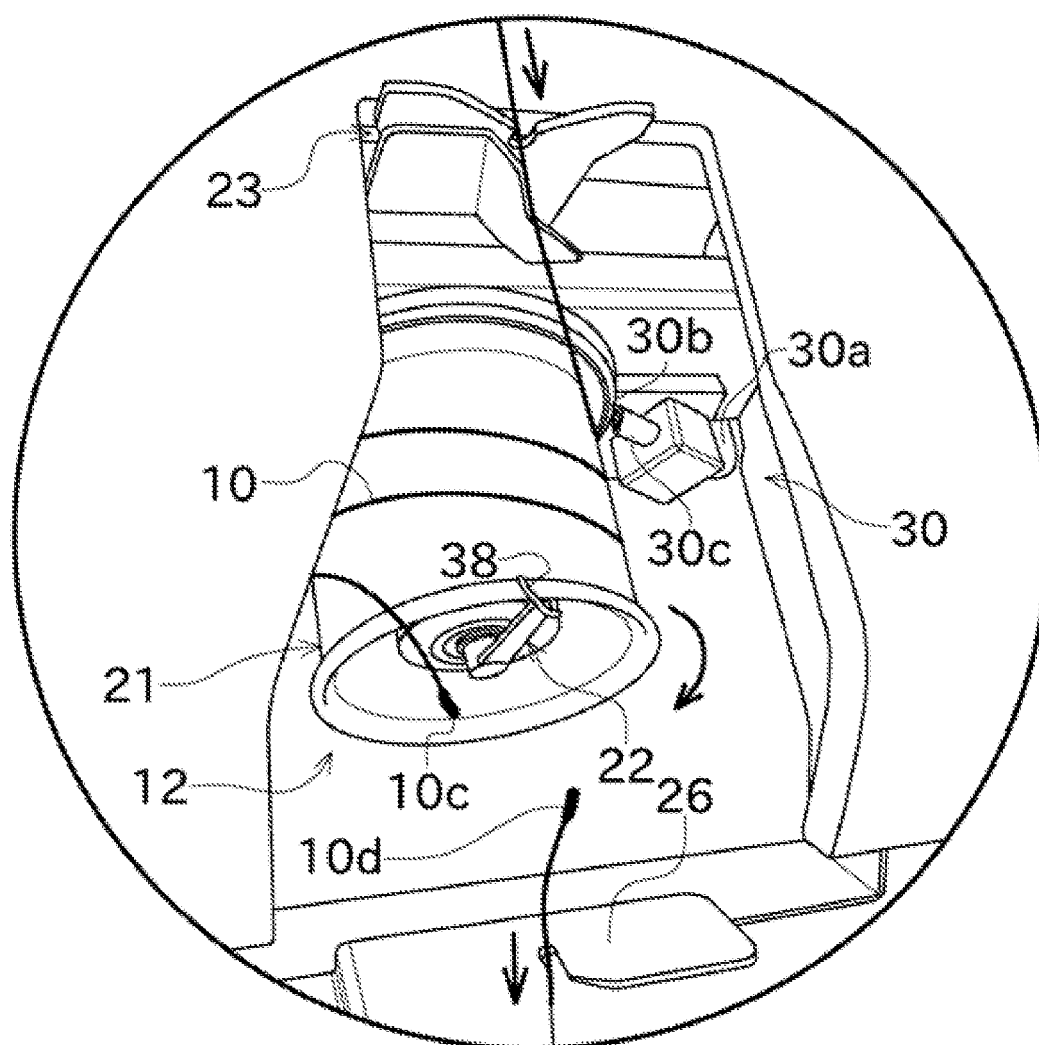


FIG. 12

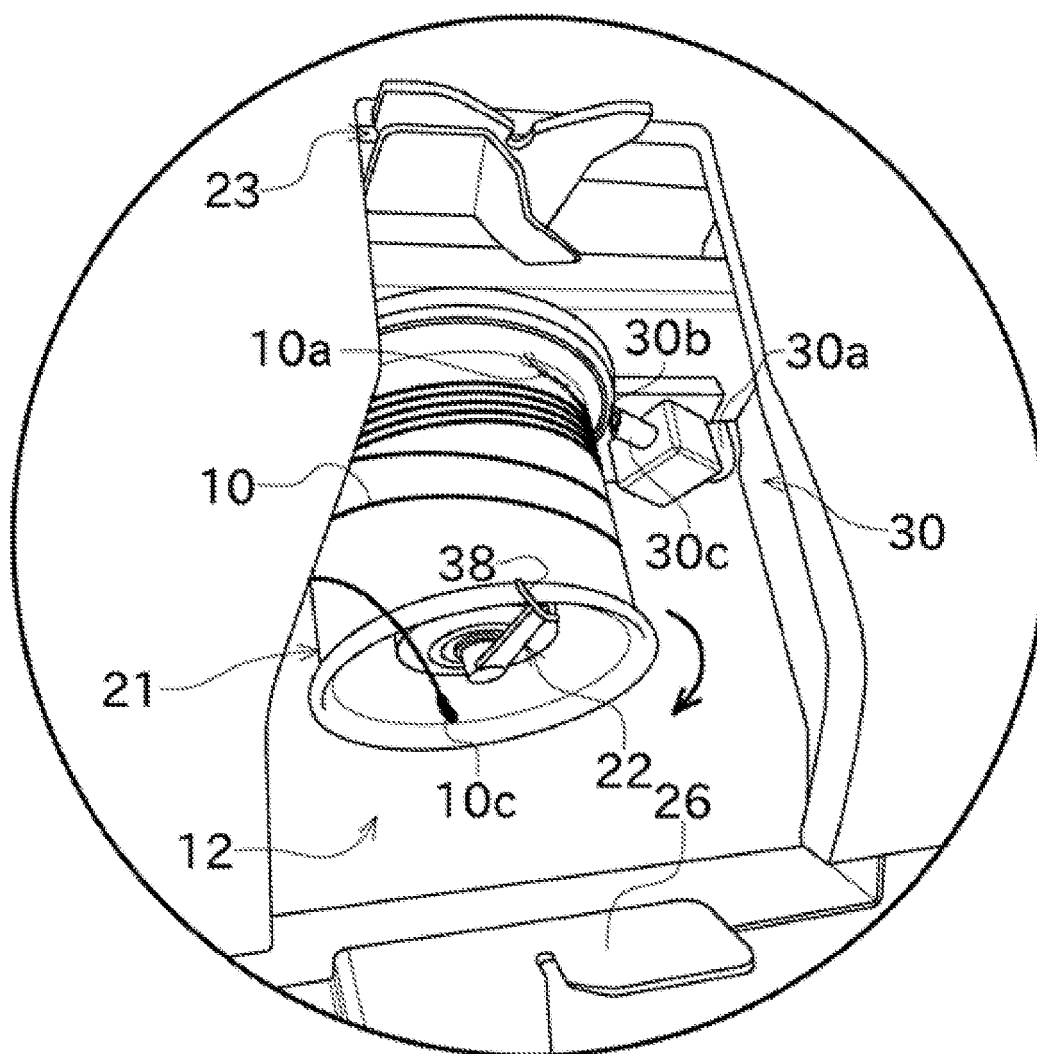
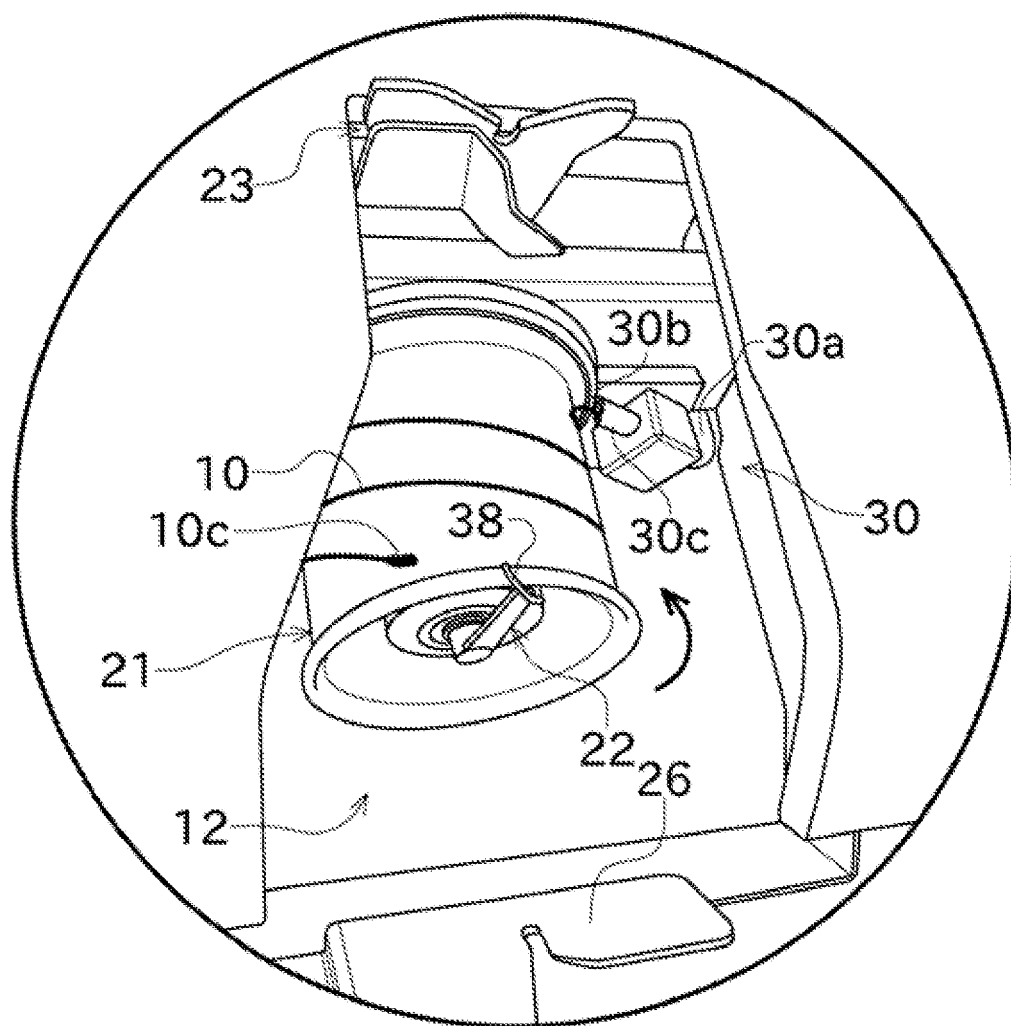


FIG. 13





EUROPEAN SEARCH REPORT

Application Number
EP 10 16 1969

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 075 358 A2 (MURATA MACHINERY LTD [JP]) 1 July 2009 (2009-07-01) * claim 1; figure 1 * -----	1-5	INV. D01H4/48 D01H15/00 B65H51/22 B65H67/08
A	EP 2 075 359 A2 (MURATA MACHINERY LTD [JP]) 1 July 2009 (2009-07-01) * claim 1; figure 1 * -----	1-5	
			TECHNICAL FIELDS SEARCHED (IPC)
			D01H B65H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 16 December 2010	Examiner Dupuis, Jean-Luc
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 16 1969

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-12-2010

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 2075358	A2	01-07-2009	CN 101469468 A	01-07-2009
			JP 2009155757 A	16-07-2009

EP 2075359	A2	01-07-2009	CN 101469469 A	01-07-2009
			JP 2009155779 A	16-07-2009

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP H11268871 B [0002]
- JP 2004124333 A [0004] [0006] [0088]