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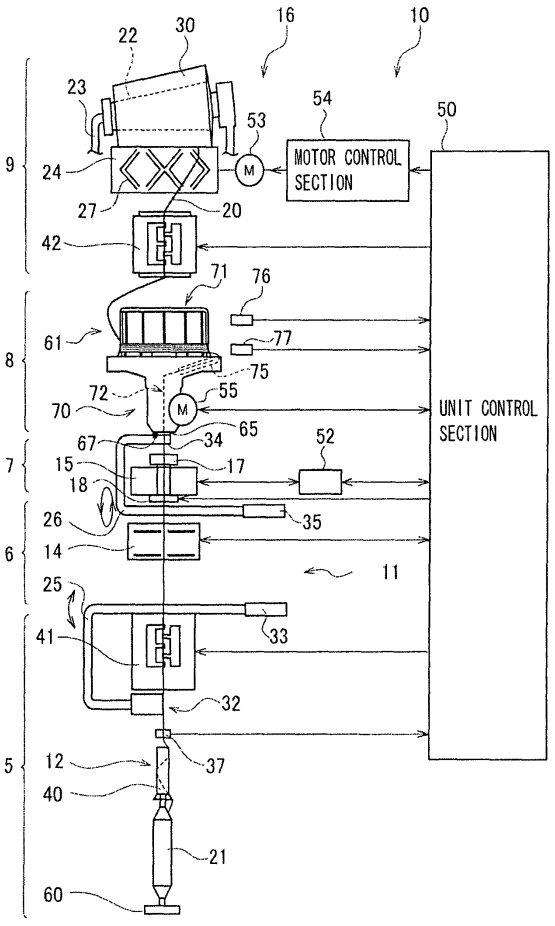
(54) Textile Machine

(57) An automatic winder includes a yarn winding section winding a yarn 20, an accumulator 61 that accumulates the yarn before being wound by the yarn winding section, a splicer device 14 performing a yarn splicing operation, and a downstream-side yarn guide pipe 26 catching a yarn end located on a downstream side of the splicer device 14 to guide the caught yarn end to the splicer device 14. The downstream-side yarn guide pipe 26 is configured so as to be movable between a catch position where the downstream-side yarn guide pipe 26 catches the yarn end and a guide position where the downstream-side yarn guide pipe 26 guides the yarn end to the splicer device 14. The downstream-side yarn guide pipe 26 normally stands by in the vicinity of the catch position. The downstream-side yarn guide pipe 26 in the catch position is configured so as to be able to catch the yarn positioned between the splicer device 14 and the accumulator 61 (Fig. 1).

FIGURE 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a textile machine, and specifically, to catching of a yarn end during a yarn splicing operation.

Description of Related Art

[0002] The Unexamined Japanese Utility Model Application Publication (Jikkai-Hei) No. 5-3269 discloses an automatic wider (textile machine) including a yarn splicing means. The automatic winder disclosed in the Unexamined Japanese Utility Model Application Publication (Jikkai-Hei) No. 5-3269 is configured such that a yarn from a bobbin fixed at the bottom of the winder is compressed against a traverse drum and wound into a rotating package. In the automatic winder, when the yarn is broken, a suction nozzle and a suction mouth provided in a yarn splicing device such as a knotter or a splicer are pivotally moved. The suction nozzle then sucks and grips the yarn end of a lower yarn located on the bobbin side. The suction mouth sucks and grips the yarn end of an upper yarn located on the surface of the package. The suction nozzle and the suction mouth are then pivotally moved to introduce both yarns into the yarn splicing means for yarn splicing. In the automatic winder disclosed in the Unexamined Japanese Utility Model Application Publication (Jikkai-Hei) No. 5-3269, a traverse device is configured so as to allow a traverse width to be changed. Furthermore, the opening width of the suction mouth is set to be almost equal to the maximum traverse width.

[0003] Besides the above-described configuration, a yarn winder which, when yarn breakage occurs, performs a yarn splicing operation without suspending a winding operation is disclosed in U. S. Patent No. 3,314,621. In the yarn winder disclosed in U.S. Patent No. 3,314,621, a yarn drawn out from a yarn supplying bobbin is accumulated in an accumulation container. When yarn breakage occurs, the yarn splicing operation is performed using the accumulated yarn, to allow the winding operation to be continued.

BRIEF SUMMARY OF INVENTION

[0004] However, in the configuration in which the suction mouth sucks and catches the yarn, end located on the surface of the package as disclosed in the Unexamined Japanese Utility Model Application Publication (Jikkai-Hei) No. 5-3269, a surface portion of the package may be drawn by the suction force of the suction mouth. This may disturb the traversing. When an attempt is made to catch the yarn end on the package, for example, the yarn end may slip down along an end surface of the package. This may hinder the yarn splicing operation from being smoothly performed. Since the suction mouth is formed to have a large opening width, a high pressure is required to allow the suction mouth to suck and catch the yarn end. This results in, for example, the need to increase the capacity of a relevant negative pressure source or an increase in running costs.

[0005] The yarn winder disclosed in U.S. Patent No. 3,314,621 performs the yarn splicing operation using the accumulated yarn, to allow the package winding operation to be continued. However, the yarn winder disclosed in U.S. Patent No. 3,314,621 still needs to be improved in order to allow the yarn end to be more efficiently caught.

[0006] The present invention has been made in view of these circumstances. An object of the present invention is to provide a textile machine that allows a yarn splicing operation to be quickly performed without degrading the quality of a package.

[0007] The problems to be solved by the present invention have been described. A means for solving the problems and the effects of the means will be described below.

[0008] According to an aspect of the present invention, a textile machine configured as described below is provided. That is, the textile machine comprises a yarn winding section, a yarn accumulating device, a yarn splicing means, and a yarn catching means. The yarn winding section winds a yarn. The yarn accumulating device that accumulates the yarn before being wound by the yarn winding section. The yarn splicing means is located on an upstream side of the yarn accumulating device to perform a yarn splicing operation. The yarn catching means catches a yarn end located on a downstream side of the yarn splicing means to guide the yarn end to the yarn splicing means. The yarn catching means is configured so as to be movable between a catch position where the yarn catching means catches the yarn end and a guide position where the yarn catching means guides the caught yarn end to the yarn splicing means. The yarn catching means normally stands by at or near the catch position. The textile machine is configured so as to enable the yarn catching means in the catch position to catch the yarn positioned between the yarn splicing means and the yarn accumulating device.

[0009] Thus, when the yarn splicing operation is required, the yarn catching means can quickly start catching the yarn in the catch position. Thus, the cycle time of the yarn splicing operation can be reduced to improve the operating efficiency of the textile machine. The yarn can be drawn out from the yarn accumulating device for the yarn splicing operation, with the yarn winding section continuing the winding. Moreover, the yarn required for the yarn splicing operation is not drawn out from the yarn winding section but from the yarn accumulating device. This allows adverse effects such as the disturbance of the yarn wound by the yarn winding section to be inhibited or eliminated.

[0010] The above-described textile machine is prefer-

ably configured as follows. That is, the yarn winding section of the textile machine is configured so as to wind the yarn while traversing the yarn. The yarn catching means has a suction port in which the yarn is sucked and caught. The suction port is formed to have a width smaller than the traverse width of the yarn winding section.

[0011] Thus, the suction port can be formed to be small, enabling the size of the yarn catching means to be easily reduced. Furthermore, the pressure required for the suction and catching can be reduced to save energy.

[0012] The above-described textile machine is preferably configured as described below. That is, the yarn accumulating device has an introduction guiding section guiding a path of the introduced yarn. The catch position is located in a vicinity of the introduction guiding section.

[0013] Thus, the path of the yarn introduced into the yarn accumulating device is guided (regulated) by the introduction guiding section. Thus, the yarn end can be located in a given narrow area during the yarn splicing operation. Thus, even a small suction port allows the yarn end to be easily caught. This enables a catch success rate to be improved.

[0014] In the textile machine, the yarn catching means preferably moves from the catch position through the guide position back to the catch position or a vicinity thereof while following a looped track surrounding the yarn splicing means.

[0015] Thus, after guiding the yarn to the yarn splicing means, the yarn catching means can return from the guide position to the normal position in such a way as to move around through an area opposite to the yarn splicing means. Thus, even after the yarn splicing by the yarn splicing means is completed, the yarn catching means can be returned to the normal position without interfering with the yarn.

[0016] In the above-described textile machine, the yarn catching means is preferably configured so as to be rotatable through 360 degrees.

[0017] Thus, the simple arrangement that rotates the yarn catching means allows the yarn catching means to be moved without interfering with the yarn.

[0018] The above-described textile machine preferably comprises upstream-side yarn catching means for catching the yarn end located on the upstream side of the yarn splicing means and guiding the yarn end to the yarn splicing means.

[0019] Thus, the yarn catching means can quickly catch and guide the downstream-side yarn end to the yarn splicing means. The upstream-side yarn splicing means can catch and guide the upstream-side yarn end to the yarn splicing means. Therefore, the yarn splicing operation can be efficiently performed.

[0020] Other features, elements, processes, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments of the present invention with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Figure 1 is a front view schematically showing the configuration of a winding unit provided in an automatic winder according to an embodiment of the present invention.

[0022] Figure 2 is a side view schematically showing the configuration of a winding unit.

[0023] Figure 3 is a schematic sectional view showing how an accumulator operates.

[0024] Figure 4 is a perspective view showing the positional relationship between a downstream-side yarn guide pipe in a standby position and the accumulator.

[0025] Figure 5 is a front view showing the positional relationship between the downstream-side yarn guide pipe and an upstream-side yarn guide pipe during a yarn splicing operation.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0026] A preferred embodiment of the present invention will be described with reference to the drawings. Figure 1 is a front view schematically showing the configuration of a winding unit 10 provided in an automatic winder according to an embodiment of the present invention. Figure 2 is a side view of the winding unit 10.

[0027] The winding unit 10 shown in Figures 1 and 2 winds a yarn 20 unwound from a yarn supplying bobbin 21 around a yarn winding bobbin 22 while traversing the yarn 20. The winding unit 10 thus forms a package 30 with a predetermined length and a predetermined shape. The automatic winder (textile machine) according to the present embodiment includes a plurality of winding units 10 arranged in a line and a frame control device (not shown in the drawings) located at one end of the arrangement of the winding units 10 in the direction of the arrangement. As shown in Figure 2, each of the winding units 10 includes a unit frame 19 provided on one lateral side of the winding unit 10 in a front view, and a winding unit main body 16 provided on one side of the unit frame 19.

[0028] As shown in Figure 1, the winding unit main body 16 includes a yarn supplying section 5, a yarn splicing section 6, a yarn defect detecting section 7, a yarn accumulating section 8, and a yarn winding section 9. In the description below, an upstream side and a downstream side in the direction in which the yarn 20 travels are sometimes simply referred as the "upstream side" and the "downstream side", respectively.

[0029] The yarn supplying section 5 includes a yarn supplying bobbin holding section 60, a yarn unwinding assisting device 12, and a first tension control mechanism 41.

[0030] The yarn supplying bobbin holding section 60 is configured so as to be able to replace and set the yarn supplying bobbin 21 from which the yarn 20 is fed. The yarn supplying bobbin holding section 60 connects to a

bobbin supplying device (not shown in the drawings) that supplies the yarn supplying bobbin 21 to the yarn supplying bobbin holding section 60. For example, a magazine type supplying device or a tray type supplying device may be adopted as the bobbin supplying device.

[0031] Once all of the yarn 20 is drawn out from the yarn supplying bobbin 21 set in the yarn supplying bobbin holding section 60 and the yarn supplying bobbin 21 becomes empty, the empty bobbin is discharged from the yarn supplying bobbin holding section 60. The bobbin supplying device can sequentially supply a new yarn supplying bobbin 21 to the yarn supplying bobbin holding section 60 having discharged the respective empty bobbin.

[0032] The yarn unwinding assisting device 12 lowers a regulating member 40 that covers a core tube of the yarn supplying bobbin 21, in conjunction with unwinding of the yarn from the yarn supplying bobbin 21. The yarn unwinding assisting device 12 thus assists in unwinding the yarn 20 from the yarn supplying bobbin 21. The regulating member 40 comes into contact with a balloon formed above the yarn supplying bobbin 21 by the rotation and centrifugal force of the yarn 20 unwound from the yarn supplying bobbin 21. The regulating member 40 thus applies an appropriate tension to the balloon to assist in unwinding the yarn 20. A sensor (not shown in the drawings) is provided in the vicinity of the regulating member 40 to detect a chase portion of the yarn supplying bobbin 21. When the sensor detects that the chase potion has lowered, the regulating member 40 is controllably lowered by, for example, an air cylinder (not shown in the drawings) in conjunction with the lowering of the chase portion.

[0033] A yarn filler (lower yarn detecting sensor) 37 that can determine whether or not the yarn 20 is present is provided in the vicinity of the yarn unwinding assisting device 12. The yarn filler 37 is configured so as to be able to detect that the yarn 20 to be drawn out from the yarn supplying bobbin 21 is exhausted, to transmit a yarn absence detection signal to a unit control section 50.

[0034] The first tension control mechanism 41 applies a predetermined tension to the traveling yarn 20. The first tension control mechanism 41 may be, for example, of a gate type including movable comb teeth arranged with respect fixed comb teeth. The movable comb teeth can be pivotally moved by a rotary solenoid (not shown in the drawings) so as to be engaged with or released from the fixed teeth. The first tension control mechanism 41 is not limited to the gate type. For example, a disc type tension control mechanism may be used.

[0035] The yarn splicing section 6 is located on the downstream side of the yarn supplying section 5. The yarn splicing section 6 includes a yarn splicing unit 11 that catches and splices yarn ends. The yarn splicing unit 11 includes a splicer device (yarn splicing means) 14, a downstream-side yarn guide pipe (yarn catching means) 26, and an upstream-side yarn guide pipe (upstream-side yarn catching means) 25.

[0036] When, for example, a clearer 15 described below detects a yarn defect or the yarn being unwound from the yarn supplying bobbin 21 is broken, the splicer device 14 splices an upstream-side yarn 20 located on the yarn supplying bobbin 21 side and a downstream-side yarn 20 located on a package 30 side. For example, the splicer device 14 may be of a mechanical type or may use a fluid such as compressed air.

[0037] The upstream-side yarn guide pipe 25, which catches and guides the upstream-side yarn 20 located on the yarn supplying bobbin 21 side, is provided below the splicer device 14. The downstream-side yarn guide pipe 26, which catches and guides the downstream-side yarn 20 located on the package 30 side, is provided above the splicer device 14.

[0038] The downstream-side yarn guide pipe 26 is configured so as to be movable between a catch position where the downstream-side yarn guide pipe 26 catches the downstream-side yarn 20 and a guide position where the downstream-side yarn guide pipe 26 guides the caught downstream-side yarn 20 to the splicer device 14.

[0039] The downstream-side yarn guide pipe 26 stands by in the vicinity of the catch position (which is shown by a solid line in Figure 2) while the yarn winding section 9 is winding the yarn 20 from the yarn supplying bobbin 21 (normal state). On the other hand, during a yarn splicing operation, the downstream-side yarn guide pipe 26 holding a caught accumulator 61-side yarn 20 (downstream-side yarn) moves pivotally around a shaft 35 to the guide position (which is shown by a chain line in Figure 2). Thus, the downstream-side yarn 20 can be drawn out to the upstream side and guided to the splicer device 14. After delivering the downstream-side yarn 20 to the splicer device 14, the downstream-side yarn guide pipe 26 can move pivotally in such a way as to travel around behind the splicer device 14, to return to the normal position. Thus, the downstream-side yarn guide pipe 26 is configured so as to be rotatable through 360 degrees around the shaft 35. The downstream-side yarn guide pipe 26 is configured so as to be able to make one rotation from the normal, standby position so that the tip thereof follows a track (see Figure 2) appearing to have a circular loop shape in a side view and surrounding the splicer device 14 (see Figure 2), to return to the standby position again.

[0040] The upstream-side yarn guide pipe 25 is configured so as to be able to move between a catch position (which is shown by a solid line in Figure 2) where the upstream-side yarn guide pipe 25 catches the upstream-side yarn 20 and a guide position (which is shown by a chain line in Figure 2) where the downstream-side yarn guide pipe 26 guides the caught downstream-side yarn 20 to the splicer device 14. The upstream-side yarn guide pipe 25 is mounted so as to be movable reciprocatingly and pivotally over a predetermined angular range around a shaft 33 in front of the splicer device 14.

[0041] A suction port 32 is formed at the tip of the upstream-side yarn guide pipe 25. Similarly, a suction port

34 is formed at the tip of the downstream-side yarn guide pipe 26. The upstream-side yarn guide pipe 25 and the downstream-side yarn guide pipe 26 are connected to respective negative pressure sources so that suction flows can act on the suction port 32 and the suction port 34.

[0042] The yarn defect detecting section 7 is located on the downstream side of the yarn splicing section 6. The yarn defect detecting section 7 includes a clearer (yarn defect detector) 15 that monitors the thickness of the traveling yarn 20.

[0043] The clearer 15 includes an appropriate sensor and is configured so as to be able to detect yarn defects such as slab by allowing an analyzer 52 to process signals from the sensor. The clearer 15 can also function as a sensor that senses the traveling speed of the yarn 20 and as a sensor that simply senses whether or not the yarn 20 is present.

[0044] A cutter (yarn cutting means) 18 is located in the vicinity of the clearer 15 to cut the yarn 20 when the clearer 15 detects a yarn defect. A waxing device 17 is located on the downstream side of the clearer 15 to wax the traveling yarn 20. Moreover, a suction section (not shown in the drawings) is provided on the downstream side of the waxing device 17. The suction section is connected to an appropriate negative pressure source. The suction section can suck and remove wax cake, yarn waste, and the like.

[0045] The yarn accumulating section 8 is located on the downstream side of the yarn defect detecting section 7. The yarn accumulating section 8 includes an accumulator (yarn accumulating device 61) that allows the yarn 20 unwound from the yarn supplying bobbin 21 to be accumulated. The yarn 20 unwound from the yarn supplying bobbin 21 is accumulated in the accumulator 61. The yarn 20 is thereafter drawn out from the accumulator 61 and wound into the package 30.

[0046] The accumulator 61 is configured so as to be able to simultaneously draw out the accumulated yarn 20 both to the upstream side and to the downstream side. In this configuration, while being wound into the package 30, the accumulated yarn 20 can be drawn out to the yarn supplying bobbin 21 side for a yarn splicing operation. The configuration of the accumulator 61 will be described below in detail.

[0047] The yarn winding section 9 is located on the downstream side of the yarn accumulating section 8. The yarn winding section 9 includes a cradle 23 configured so as to be able to hold the yarn winding bobbin 22, a winding drum (traverse drum) 24 that traverses the yarn 20 while rotating the yarn winding bobbin 22, and a second tension control mechanism 42.

[0048] The cradle 23 is configured so as to be swingable in a direction in which the cradle 23 approaches or leaves the winding drum 24. Thus, the cradle 23 can absorb an increase in the diameter of package 30 in conjunction with winding of the yarn 20. A spiral traverse groove 27 is formed in an outer peripheral surface of the winding drum 24 to allow the yarn 20 to be traversed. Thus, a package 30 with a predetermined winding width can be formed.

[0049] The second tension control mechanism 42 is located on the downstream side of the accumulator 61 to control tension generated when the yarn 20 is unwound from the accumulator 61. Thus, the yarn drawn out from the accumulator 61 is wound around the yarn winding bobbin 22 under an appropriate tension. Like the first tension control mechanism 41, the second tension control mechanism 42 may be of a gate type including movable comb teeth arranged with respect fixed comb teeth or of a disc type.

[0050] The yarn winding bobbin 22 is driven by rotationally driving the winding drum 24, located opposite the yarn winding bobbin 22. The winding drum 24 is coupled to an output shaft of a drum driving motor 53. The operation of the drum driving motor 53 is controlled by a motor control section 54. The motor control section 54 is configured to controllably operate and stop the drum driving motor 53 upon receiving operation signals from a unit control section 50.

[0051] Now, the accumulator 61 will be described with reference to Figure 3. Figure 3 is a schematic sectional view schematically showing the accumulator 61. As shown in Figure 3, the accumulator 61 includes a rotating shaft casing 70, an accumulation section 71, and a yarn guiding section 72. The rotating shaft casing 70 includes a cylindrical cylinder portion 78 that is open at the top thereof, and a flange portion 79 formed at an open-side end of the cylinder portion 78.

[0052] The accumulation section 71 is located above the flange portion 79. The accumulation section 71 includes a support plate 81 formed like a disc, a plurality of rod members projecting upward from the support plate 81, and a disc-like mounting plate 83 to which the tip portions of the plurality of rod members 82 are connected. The accumulation section 71 is located so as to form a gap between the support plate 81 and the flange portion 79. An accumulation guide arm 75 can rotate through the gap.

[0053] The support plate 81 is located horizontally. The plurality of rod members 82 are arranged on the circumference of the top surface of the support plate 81 at equal intervals. The accumulation section 71 is configured such that the rod members 82 form a generally cylindrical shape. By being wound around an outer peripheral portion of the accumulation section 71 with the generally cylindrical shape composed of the plurality of rod members 82, the yarn 20 is accumulated in the accumulation section 71.

[0054] The yarn guiding section 72 is located inside the rotating shaft casing 70. In the rotating shaft casing 70, an introduction hole (introduction guiding section) 80 is formed at the bottom of the cylinder portion 78 (at the end of the cylinder portion 78 located opposite the accumulation section 71). The yarn 20 drawn out from the yarn supplying bobbin 21 is guided from the introduction

hole 80 to the yarn guiding section 72.

[0055] A rotating shaft 73 is located inside the cylinder portion 78. The rotating shaft 73 is supported so as to be rotatable relative to the rotating shaft casing 70 and the accumulation section 71. A servo motor (yarn accumulation driving section) 55 is incorporated between the rotating shaft 73 and the cylinder portion 78. The servo motor 55 can rotate the rotating shaft 73 forward and backward. A shaft hole-like yarn passage 74 is formed in the center of the rotating shaft 73.

[0056] The cylindrically formed accumulation guide arm (winding means) 75 is fixed to one end (located opposite the introduction hole 80) of the rotating shaft 73. The accumulation guide arm 75 is configured so as to extend in a radial direction in such a way as to pass through the gap between the rotating shaft casing 70 (flange portion 79) and the support plate 81 while inclining slightly upward. A part of the tip portion of the accumulation guide arm 75 protrudes slightly outward from the rotating shaft casing 70. The accumulation guide arm 75 is configured so as to rotate integrally with the rotating shaft 73. The interior of the accumulation guide arm 75 is connected to the yarn passage 74.

[0057] In the above-described configuration, the yarn 20 is guided from the introduction hole 80 in the yarn guiding section 72 into the rotating shaft casing 70. The yarn 20 then passes through the interior of the yarn passage 74 and the accumulation guide arm 75. The yarn 20 is then discharged from the tip of the accumulation guide arm 75 and guided to a side surface potion of the accumulation section 71. Consequently, driving the servo motor 55 in a forward direction allows the accumulation guide arm 75 to rotate together with the rotating shaft 73. Thus, the yarn 20 is wound around the side surface portion. To return the yarn 20 from the accumulator 61 to the upstream side, the servo motor 55 is brought into a neutral state (in which the servo motor 55 is freely rotatable). The downstream-side yarn guide pipe 26 holding the sucked and caught downstream-side yarn 20 rotates downward to draw out the yarn 20 to the upstream side. At this time, in conjunction with the draw-out of the yarn 20, the accumulation guide arm 75 rotates, together with the rotating shaft 73, in a direction in which the yarn 20 is drawn out. The servo motor 55 is reversely rotated in a direction opposite to the driving direction in which the yarn 20 is wound around a yarn pool section 71.

[0058] Each of the plurality of rod members 82 arranged in the accumulation section 71 is located so as to incline toward the inside of the accumulation section 71 as the rod member 82 extends from the support plate 81-side end thereof toward the mounting plate 83-side end thereof. Since the first tension control mechanism 41 applies the constant tension to the yarn 20, the inclination of the rod member 82 allows the yarn 20 wound around the accumulation section 71 to move naturally in such a way as to slide upward. Thus, when the yarn 20 is continuously wound by the accumulation guide arm 75, a portion of the yarn 20 which is wound around the inclining portion moves upward. Consequently, the yarn 20 is spirally alignigly accumulated on the side surface portion composed of the rod members 82.

[0059] In the present embodiment, the servo motor 55 is used as a driving section (yarn accumulation driving section) for the accumulation guide arm 75. Thus, the quick stop of rotation of the accumulation guide arm 75, acceleration or deceleration thereof, or the like can be precisely performed. This enables the amount by which the yarn 20 is drawn out from the accumulation section 71 to the upstream side, timing for the draw-out, and the like to be accurately controlled. The yarn splicing operation can be more smoothly performed.

[0060] As shown in Figure 1, the winding unit 10 includes a first accumulation sensor 76 located on an upper portion of the accumulation section 71 and a second accumulation sensor 77 located on a lower portion of the accumulation section 71. Each of the two accumulation sensors (yarn accumulation amount detecting means) 76, 77 is composed of a non-contact type optical sensor or the like and electrically connected to the unit control section 50.

[0061] The first accumulation sensor 76 is located on the upper end side of the accumulation section 71 so as to be able to detect a portion of the yarn 20 which is wound on the upper end side of the rod members 82, provided in the accumulation section 71. The first accumulation sensor 76 thus senses the maximum accumulation condition of the accumulator 61. The second accumulation sensor 77 is located on the downstream side of the accumulation section 71 so as to be able to detect a portion of the yarn 20 which is wound on the lower end side of the rod members 82. The second accumulation sensor 77 senses the shortage of yarn accumulation in the accumulator 61. Based on yarn detection signals from the first accumulation sensor 76 and the second accumulation sensor 77, the unit control section 50 controls the rotation speed of the servo motor 55 (the speed at which the yarn 20 is supplied to the accumulation section 71). This enables the amount of yarn 20 accumulated in the accumulator 61 to be adjusted so that the amount is not excessive or insufficient.

[0062] When yarn winding is started, the speed at which the yarn 20 is wound around the accumulation section 71 of the accumulator 61 (in other words, the speed at which the yarn 20 is supplied to the accumulation section 71) is controlled so as to be equal to or higher than the speed at which the yarn 20 is wound into the package 30 and which increases with the elapse of time. Then, when a predetermined time elapses from the beginning of the winding and an amount of yarn 20 required for the yarn splicing operation is accumulated in the accumulator 61, the yarn 20 is controllably wound around the accumulation section 71 at a speed equal to the yarn winding speed for the package 30. Thus, the amount of yarn 20 accumulated in the accumulator 61 is maintained. The amount of yarn 20 required for the yarn splicing operation is the sum of the amount of yarn 20 drawn out from the

accumulator 61 to the upstream side for the yarn splicing operation performed in the splicer device 14, described below, and the amount of yarn 20 drawn out from the accumulator 61 to the downstream side for the winding of the yarn 20 into the package 30, which is performed in parallel with the yarn splicing operation. The accumulation section 71 preferably always maintains a condition in which an amount of yarn 20 equal to or more than the required amount is accumulated.

[0063] The yarn 20 unwound from the accumulation section 71 of the accumulator 61 is wound into the package 30, which is driven by the winding drum 24. At this time, the tension applied to the yarn 20 by the second tension control mechanism 42 is controlled by the unit control section 50 according to the winding speed.

[0064] Now, the control of the position of the downstream-side yarn guide pipe 26 will be described with reference to Figures 4 and 5. Figure 4 is a perspective view showing the positional relationship between downstream-side yarn guide pipe 26 in the standby position and the accumulator 61. Figure 5 is a front view showing the positional relationship between downstream-side yarn guide pipe 26 and the upstream-side yarn guide pipe 25 during the yarn splicing operation. The "standby position" as used herein refers to the position where the downstream-side yarn guide pipe 26 is held during the normal winding operation before the yarn splicing operation is started.

[0065] While the downstream-side yarn guide pipe 26 is held in the standby position, the tip portion of the downstream-side yarn guide pipe 26 is positioned below and in the vicinity of the cylinder portion 78 of the accumulator 61 as shown in Figure 4. The downstream-side yarn guide pipe 26 stands by on the rear side of the apparatus with respect to the traveling yarn 20. During the yarn splicing operation, the downstream-side yarn guide pipe 26 moves pivotally downward in such a way as to fall down toward the front side. The downstream-side yarn guide pipe 26 thus catches and guides the yarn 20 to the splicer device 14. The catch position is set such that the yarn end is caught between the accumulator 61 and the clearer 15. Thus, the yarn 20 can be caught before entering the accumulator 61.

[0066] A clamp section 65 is attached to the tip portion of the downstream-side yarn guide pipe 26. The clamp section 65 is formed like a cover and installed on the downstream-side yarn guide pipe 26 so as to cover the tip portion of the downstream-side yarn guide pipe 26. A clamp wall is formed in the clamp section 65 and can come into tight contact with the tip surface of the downstream-side yarn guide pipe 26 to close the suction port 34.

[0067] The clamp section 65 is pivotally movably supported by the downstream-side yarn guide pipe 26. The clamp section 65 can be switched between a closed position where the clamp wall comes into tight contact with the tip surface of the downstream-side yarn guide pipe 26 to close the suction port 34 and an open position where the suction port 34 is open. A bias spring (not shown in the drawings) is attached to the clamp section 65. The bias spring always biases the clamp section 65 toward the closed position.

[0068] As shown in Figure 4, a cam portion 67 formed like a plate is attached to the bottom of the cylinder portion 78 of the accumulator 61 via a support bar. A protruding portion 66 is formed in the clamp section 65. The protruding portion 66 comes into contact with the cam portion 67 and is pushed by the cam portion 67. Then, the clamp section 65 is switched from the closed position to the open position.

[0069] In the above-described configuration, while the downstream-side yarn guide pipe 26 is in the standby position, the protruding portion 66 is separate from the cam portion 67. Then, the downstream-side yarn guide pipe 26 in the standby position moves pivotally toward the front side of the apparatus, with the tip of the downstream-side yarn guide pipe 26 approaching the yarn 20. At almost the same time, the protruding portion 66 comes into contact with the cam portion 67. The clamp section 65 is pushed toward the open position to open the suction port 34. Alternatively, the protruding portion 66 and the cam portion 67 may be initially in contact with each other in the standby position so that the suction port 34 is always open.

[0070] Now, the yarn splicing operation performed when the clearer 15 detects a yarn defect will be described. Upon detecting a yarn defect by monitoring the thickness of the yarn 20, the clearer 15 transmits a yarn defect detection signal to the unit control section 50. Based on the yarn defect detection signal, the unit control section 50 operates the cutter 18 to cut the yarn 20. At the same time, the unit control section 50 stops the servo motor 55 of the accumulator 61 to stop the rotation of the accumulation guide arm 75. Thus, the downstream-side yarn 20 is stopped below the introduction hole 80 in the accumulator 61.

[0071] Then, the unit control section 50 pivotally moves the downstream-side yarn guide pipe 26 held in the standby position, downward to the guide position shown by the chain line in Figure 2, via the catch portion. Thus, the yarn defect portion detected by the clearer 15 is unwound from the accumulation section 71 and returned to the upstream side of the accumulator 61.

[0072] Then, immediately before the downstream-side yarn guide pipe 26 reaches the catch position, the cam portion 67, located on the accumulator 61, comes into contact with the protruding portion 66 of the clamp section 65. Consequently, the suction port 34 is opened. Thus, a suction flow acts on the vicinity of the suction port 34 to allow the yarn end hanging from the introduction port 80 to be sucked and caught in the suction port 34. The downstream-side yarn guide pipe 26 further moves pivotally to leave the catch position. At almost the same time, the cam portion 67 stops pressing the protruding portion 66 to allow the clamp portion 65 to return to the closed position again under the force of the bias spring.

At this time, since a part of the yarn end remains sucked in the suction port 34, the yarn end is sandwiched between the tip portion of the downstream-side yarn guide pipe 26 and the clamp section 65.

[0073] As described above, in conjunction with the passage of the downstream-side yarn guide pipe 26 through the catch position, a series of operations are performed in which the clamp section 65 is switched from the closed position to the open position and then back to the closed position. Thus, the downstream-side yarn guide pipe 26 need not necessarily be controllably stopped at the catch position. The downstream-side yarn guide pipe 26 may quickly catch the yarn 20 at the moment when the downstream-side yarn guide pipe 26 passes through the catch position. The downstream-side yarn guide pipe 26 can thus guide the downstream-side yarn to the splicer device 14 in a nonstop manner. To reliably suck and catch the yarn 20, the downstream-side yarn guide pipe 26 can be controllably stopped at the catch position.

[0074] The downstream-side yarn guide pipe 26 having clamped the yarn end moves pivotally to the guide position shown by the chain line in Figure 2. The downstream-side yarn guide pipe 26 is then stopped. Then, the upstream-side yarn guide pipe 25 sucks and catches the upstream-side yarn 20 in the standby position. The upstream-side yarn guide pipe 25 then moves pivotally to the guide position shown by a chain line in Figure 5. The pivotal movement guides the upstream-side yarn 20 to the splicer device 14.

[0075] When the upstream-side yarn guide pipe 25 and the downstream-side yarn guide pipe 26 guide the upstream-side yarn end and the downstream-side yarn end to the splicer device 14, the splicer device 14 starts the yarn splicing operation. The yarn end of the downstream-side yarn containing the yarn defect is cut by the cutter of the splicer device 14.

[0076] After delivering the downstream-side yarn 20 to the splicer device 14, the downstream-side yarn guide pipe 26 in the guide position shown by the chain line in Figure 2 moves pivotally around behind the splicer device 14. The downstream-side yarn guide pipe 26 thus returns to the standby position. At this time, the cam portion (not shown in the drawings) placed below the splicer device 14 moves the clamp section 65 to the open position. Thus, the nipping by the clamp section 65 is canceled to allow the cut yarn end to be sucked into the downstream-side yarn guide pipe 26 for removal.

[0077] After the splicer device 14 completes the yarn splicing operation, the accumulation of the yarn 20 in the accumulator 61 is resumed before the downstream-side yarn guide pipe 26 returns to the standby position. As a result, a travel path for the yarn 20 is formed in front of the splicer device 14. The downstream-side yarn guide pipe 26 moves pivotally around behind the splicer device 14 and can thus return smoothly to the standby position without interfering with the yarn 20 traveling in front of the splicer device 14. On the other hand, after delivering the upstream-side yarn 20 to the splicer device 14, the upstream-side yarn guide pipe 25 passes in front of the splicer device 14 and back to the standby position.

[0078] The above-described yarn splicing operation is performed in parallel with the operation of winding the yarn 20 into the package 30. Thus, the yarn defect can be removed without the need to stop or reversely rotate the winding drum 24. Once the yarn splicing operation is completed, the servo motor 55 starts rotating forward to resume the supply of the yarn 20 to the accumulator 61. To recover an amount of yarn 20 consumed by the yarn splicing operation, the speed at which the yarn 20 is supplied to the accumulation section 71 is controllably set to be higher than the winding speed for the package 30. Once a predetermined amount of yarn 20 is accumulated, the unit control section 50 sets the speed at which the yarn 20 is supplied to the accumulator 61 to be equal to the yarn winding speed for the package 30 again.

[0079] Now, the yarn splicing operation performed to allow the yarn supplying bobbin 21 to be replaced will be described. Upon detecting that the yarn 20 to be fed from the yarn supplying bobbin 21 is exhausted, the yarn filler 37 transmits a yarn absence detection signal to the unit control section 50. Upon receiving the yarn absence detection signal, the unit control section 50 stops the supply of the yarn 20 to the accumulator 61. At this time, preferably, the timing for stopping the servo motor 55 is adjusted such that the yarn end is stopped at a predetermined position. This facilitates the catching of the yarn and further inhibits a possible waste of the yarn 20.

[0080] Then, the unit control section 50 pivotally moves the downstream-side yarn guide pipe 26 to allow the downstream-side yarn guide pipe 26 to suck and catch the yarn 20 in the vicinity of the inlet of the accumulator 61. In this condition, the unit control section 50 pivotally moves the downstream-side yarn guide pipe 26 downward to the guide position to guide the downstream-side yarn to the splicer device 14. After guiding the yarn 20 to the splicer device 14, the downstream-side yarn guide pipe 26 moves pivotally around behind the splicer device 14, to the standby position. The pivotal movement of the downstream-side yarn guide pipe 26 is similar to that performed when a yarn defect is detected, and will thus not be described in detail.

[0081] When the bobbin supply device supplies a new bobbin, the yarn 20 on the new yarn supplying bobbin 21 side is guided to the splicer device 14 by the upstream-side yarn guide pipe 25. The downstream-yarn 20 and the upstream-side yarn 20 are then spliced by the splicer device 14. Thereafter, the servo motor 55 is controlled so as to rotate the accumulation guide arm 75 in the direction in which the yarn 20 is accumulated.

[0082] The above-described yarn splicing operation is performed in parallel with the operation of winding the yarn 20 into the package 30. Thus, the yarn supplying bobbin 21 can be replaced with a new one without the need to stop or reversely rotate the winding drum 24. Once the yarn splicing operation is completed, the servo

motor 55 starts rotating forward to supply the yarn 20 from the new yarn supplying bobbin 21 to the accumulator 61.

[0083] As shown above, the automatic winder according to the present embodiment includes the yarn winding section 9, the accumulator 61, the splicer device 14, and the downstream-side yarn guide pipe 26. The yarn winding section 9 winds the yarn 20. The accumulator 61 that accumulates the yarn 20 before being wound by the yarn winding section 9. The splicer device 14 is located on the upstream side of the accumulator 61 to perform the yarn splicing operation. The downstream-side yarn guide pipe 26 catches the yarn end located on the downstream side of the splicer device 14 to guide the caught yarn end to the splicer device 14. The downstream-side yarn guide pipe 26 is configured so as to be movable between the catch position where the downstream-side yarn guide pipe 26 catches the yarn end and the guide position where the downstream-side yarn guide pipe 26 guides the yarn end to the splicer device 14. The downstream-side yarn guide pipe 26 normally stands by at or near the catch position. The automatic winder is configured so as to enable the downstream-side yarn guide pipe 26 in the catch position to catch the yarn 20 positioned between the splicer device 14 and the accumulator 61.

[0084] Thus, when the yarn splicing operation is required, the downstream-side yarn guide pipe 26 can move to the catch position in a short time to quickly start catching the yarn 20. Thus, the cycle time of the yarn splicing operation can be reduced to improve the efficiency with which the winding unit 10 produces the package 30. The yarn 20 can be drawn out from the accumulator 61 for the yarn splicing operation, with the yarn winding section 9 continuing the winding. The yarn 20 required for the yarn splicing operation is not drawn out from the yarn winding section 9 but from the accumulator 61. This prevents the traversing from being disturbed when the surface of the package 30 is pulled by the suction mouth and also prevents the yarn 20 from slipping down along the end surface of the package 30; the traversing disturbance and the yarn slip-down occur frequently in the conventional configurations. In this manner, the adverse effects of the yarn splicing operation on the winding of the package 30 can be inhibited or eliminated. Moreover, the yarn winding section 9 continuously performs the yarn winding operation, allowing a constant package winding condition to be established. As a result, a high-quality package 30 can be formed.

[0085] In the present embodiment, the yarn winding section 9, provided in the automatic winder, is configured so as to wind the yarn 20 while traversing the yarn 20 through the traverse groove 27 in the winding drum 24. The downstream-side yarn guide pipe 26 has the suction port 34, in which the yarn 20 is sucked and caught. The suction port 34 is formed to have a width smaller than the traverse width of the yarn winding section 9.

[0086] This eliminates the need to form the suction port 34 to be wide enough to cover the winding width of the package 30 as in the case of the conventional suction mouths. Thus, the downstream-side yarn guide pipe 26 can be configured to be compact. Since the suction port 34 can be formed to be small, the pressure required for the suction and catching can be reduced to save energy.

[0087] In the present embodiment, the accumulator 61 has the introduction hole 80 through which the path of the introduced yarn 20 is guided. The catch position is located in the vicinity of the introduction hole 80. During the yarn splicing operation, the suction port 34 of the downstream-side yarn guide pipe 26 catches the yarn 20 in the vicinity of the introduction hole 80.

[0088] Thus, the path of the yarn 20 introduced into the accumulator 61 is guided through (regulated by) the introduction hole 8. Thus, the yarn end can be located in a narrow area below the introduction hole 80 of the accumulator 61 during the yarn splicing operation. Thus, even the small suction port 34 allows the yarn end to be easily caught. This enables a catch success rate to be improved.

[0089] The downstream-side yarn guide pipe 26, provided in the automatic winder according to the present embodiment, is configured to move from the catch position through the guide position back to the catch position or the vicinity thereof in such a way as to follow the looped track surrounding the splicer device 14, as shown in Figure 2.

[0090] Thus, after guiding the yarn 20 to the splicer device 14, the downstream-side yarn guide pipe 26 can return from the guide position to the normal position in such a way as to move around behind the splicer device 14. Thus, even after the yarn splicing by the yarn splicing means is completed, the downstream-side yarn guide pipe 26 can be returned to the normal position without interfering with the yarn 20.

[0091] The downstream-side yarn guide pipe 26, provided in the automatic winder according to the present embodiment, is configured so as to be rotatable through 360 degrees.

[0092] Thus, the simple arrangement that rotates the downstream-side yarn guide pipe 26 allows the downstream-side yarn guide pipe 26 to move from the catch position through the guide position to the vicinity of the catch position without interfering with the yarn 20.

[0093] The automatic winder according to the present embodiment includes the upstream-side yarn guide pipe 25 which catches the yarn end located on the upstream side of the splicer device 14 and which then guides the yarn end to the splicer device 14.

[0094] Thus, the downstream-side yarn guide pipe 26 can quickly catch and guide the downstream-side yarn end to the splicer device 14. The upstream-side yarn guide pipe 25 can catch and guide the upstream-side yarn end to the splicer device 14. Therefore, the yarn splicing operation can be efficiently performed.

[0095] The preferred embodiment of the present invention has been described. The above-described configuration can further be modified as described below.

[0096] In the above-described embodiment, the downstream-side yarn guide pipe 26 stands by behind the area in which the yarn 20 is introduced into the accumulator 61. However, the standby position of the downstream-side yarn guide pipe 26 may be appropriately changed provided that the resulting standby position is close to the accumulator 61. For example, the downstream-side yarn guide pipe 26 can stand by in the catch position, where the downstream-side yarn guide pipe 26 catches the yarn 20. This enables a reduction in the time from the beginning of the yarn splicing operation until the yarn 20 is caught. As a result, the efficiency of the yarn splicing operation can further be improved.

[0097] The configuration of the above-described embodiment may be modified such that if the yarn filler 37 detects that the yarn 20 on the yarn supplying bobbin 21 is exhausted, the supply of the yarn 20 to the accumulator 61 is decelerated instead of being stopped. That is, even if the yarn 20 is not completely stopped, provided that the downstream-side yarn guide pipe 26 can catch the yarn end before the yarn end is completely drawn into the accumulator 61, the yarn 20 can be guided to the splicer device 14 for the yarn splicing operation. Thus, when the yarn 20 on the yarn supplying bobbin 21 is exhausted, with the yarn 20 continuously wound into the package 30 on the downstream side, the yarn end can be easily caught at a position upstream of the accumulator 61. Then, the yarn end can be spliced with the yarn 20 on the new yarn supplying bobbin.

[0098] In the above-described embodiment, when a yarn defect is detected, the yarn 20 is cut immediately after being drawn out from the accumulator 61. The embodiment may be modified such that the yarn 20 is cut at any timing after the yarn defect portion has been drawn out from the accumulator 61.

[0099] The present invention is not limited to the automatic winder but is applicable to various other textile machines. For example, the present invention is applicable to, for example, a spinning machine spinning a yarn from a sliver to form a package with a predetermined length.

[0100] The spinning machine to which the present invention is applied may be configured, for example, as follows. That is, the spinning machine includes a casing, a plurality of spinning units, a blower box, and a motor box. Each of the spinning units includes a draft device, a spinning device, a yarn feeding device, a yarn accumulating device, and a yarn winding device as main components. The draft device is provided in the vicinity of the upper end of the casing of the spinning machine main body. A fiber bundle fed from the drafty device is spun by the spinning device. The yarn spun by the spinning device is fed by the yarn feeding device to the yarn accumulating device, located below. The yarn is then accumulated in the yarn accumulating device. The yarn accumulated in the yarn accumulating device is further wound into a package by the yarn winding device. A clearer is provided between the spinning device and the yarn accumulating device to detect a yarn defect and to cut the yarn to remove the yarn defect portion.

[0101] The spinning machine further includes a yarn splicing means for performing a yarn splicing operation, an upstream-side yarn guiding means for guiding a yarn located on the upstream side of the yarn splicing means, and a downstream-side yarn guiding means for guiding a yarn located on the downstream side of the yarn splicing means. The downstream-side yarn catching means stands by at a position in the vicinity of the yarn accumulating device. In this configuration, if the yarn splicing operation is required to detect a yarn defect or to replace a sliver with a new one, the downstream-side yarn catching means catches and guides the yarn accumulating device-side yarn to the yarn splicing means. The upstream-side yarn catching means catches and guides the spinning device-side yarn to the yarn splicing means. The guided upstream-side yarn and the downstream-side yarn are spliced by the yarn splicing means. In this case, the winding operation is continuously performed without being stopped, allowing the productivity of the spinning machine to be improved.

[0102] While the present invention has been described with respect to preferred embodiments thereof, it will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other than those specifically set out and described above. Accordingly, it is intended by the appended claims to cover all modifications of the present invention that fall within the true spirit and scope of the present invention.

Claims

1. A textile machine **characterized by** comprising:

a yarn winding section (9) winding a yarn;
a yarn accumulating device (61) that accumulates the yarn before being wound by the yarn winding section (9);
a yarn splicing means (14) located on an upstream side of the yarn accumulating device (61) to perform a yarn splicing operation; and
a yarn catching means (26) catching a yarn end located on a downstream side of the yarn splicing means (14) to guide the yarn end to the yarn splicing means (14), the yarn catching means (26) being configured so as to be movable between a catch position where the yarn catching means (26) catches the yarn end and a guide position where the yarn catching means (26) guides the caught yarn end to the yarn splicing means (14), the yarn catching means (26) normally standing by at or near the catch position, and
in that the textile machine is configured so as to enable the yarn catching means (26) in the catch position to catch the yarn positioned between

the yarn splicing means (14) and the yarn accumulating device (61).

2. The textile machine according to Claim 1, **characterized in that** the yarn winding section (9) is configured so as to wind the yarn while traversing the yarn,
the yarn catching means (26) has a suction port (34) in which the yarn is sucked and caught, and
the suction port (34) is formed to have a width smaller than the traverse width of the yarn winding section (9).

3. The textile machine according to Claim 2, **characterized in that** the yarn accumulating device (61) has an introduction guiding section (80) guiding a path of the introduced yarn, and
the catch position is located in a vicinity of the introduction guiding section (80).

4. The textile machine according to any one of Claims 1 to 3, **characterized in that** the yarn catching means (26) moves from the catch position through the guide position back to the catch position or a vicinity thereof while following a looped track surrounding the yarn splicing means (14).

5. The textile machine according to Claim 4, **characterized in that** the yarn catching means (26) is configured so as to be rotatable through 360 degrees.

6. The textile machine according to any one of Claims 1 to 5, **characterized by** further comprising an upstream-side yarn catching means (25) for catching the yarn end located on the upstream side of the yarn splicing means (14) and guiding the yarn end to the yarn splicing means (14).

FIGURE 1

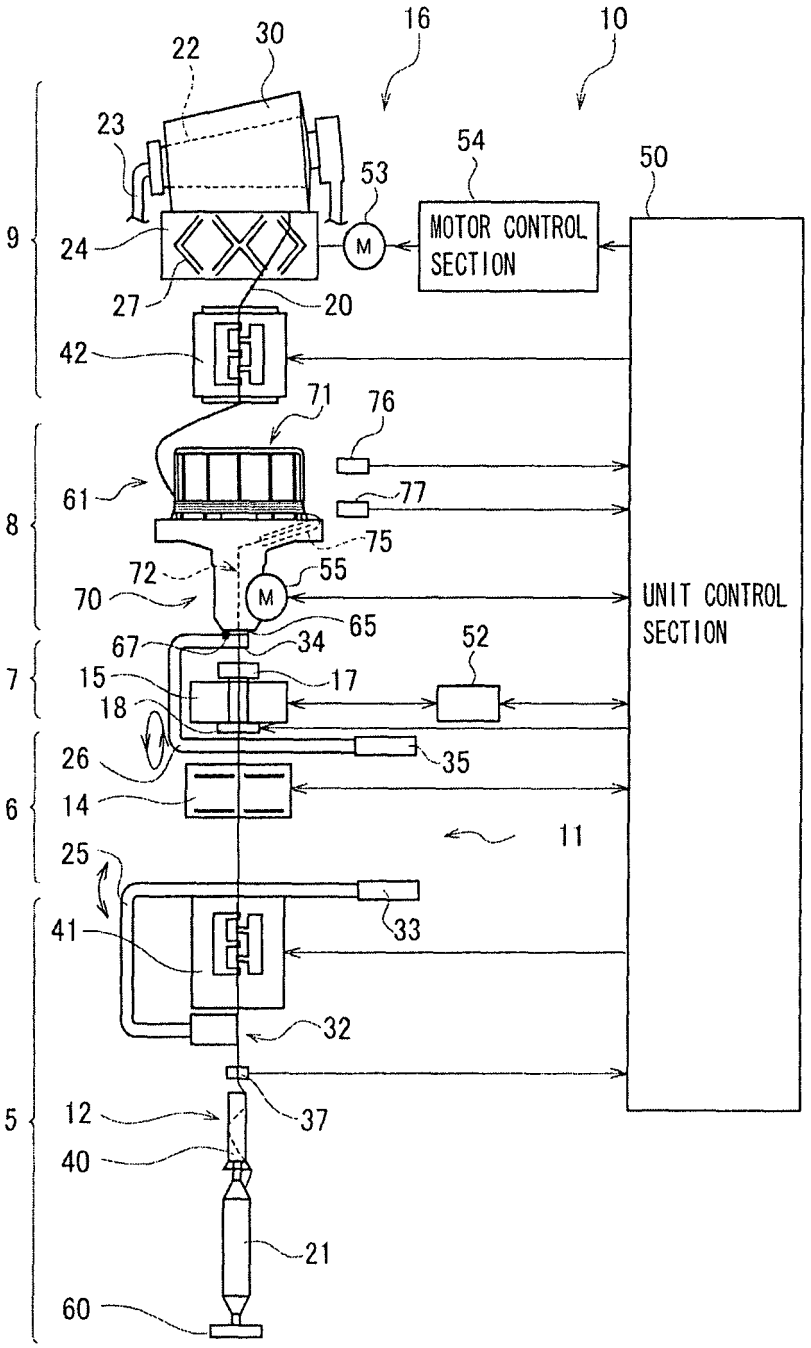
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FIGURE 2

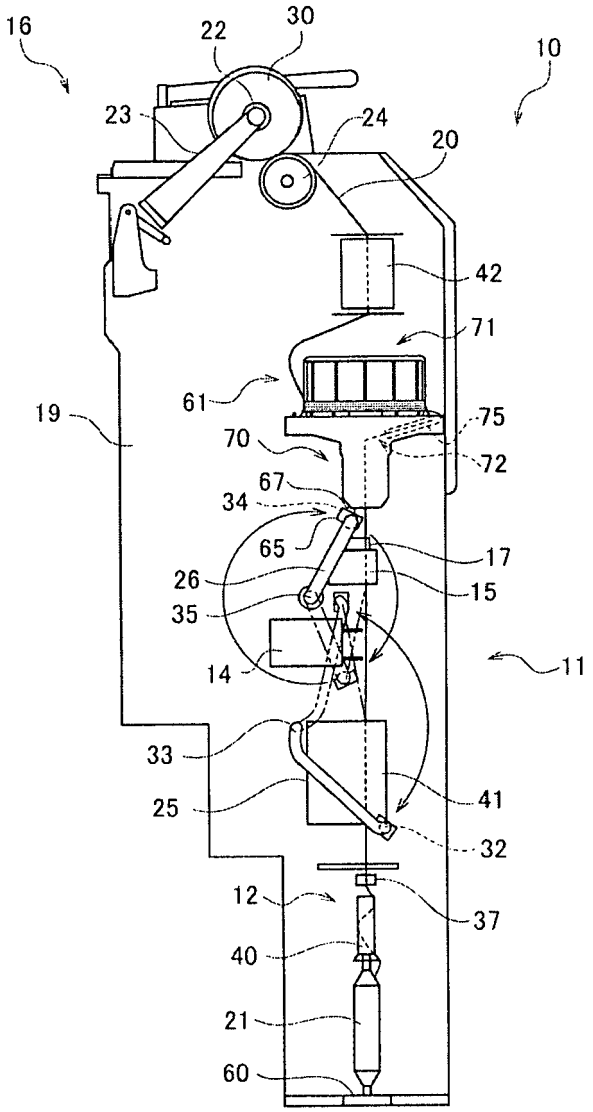
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FIGURE 3

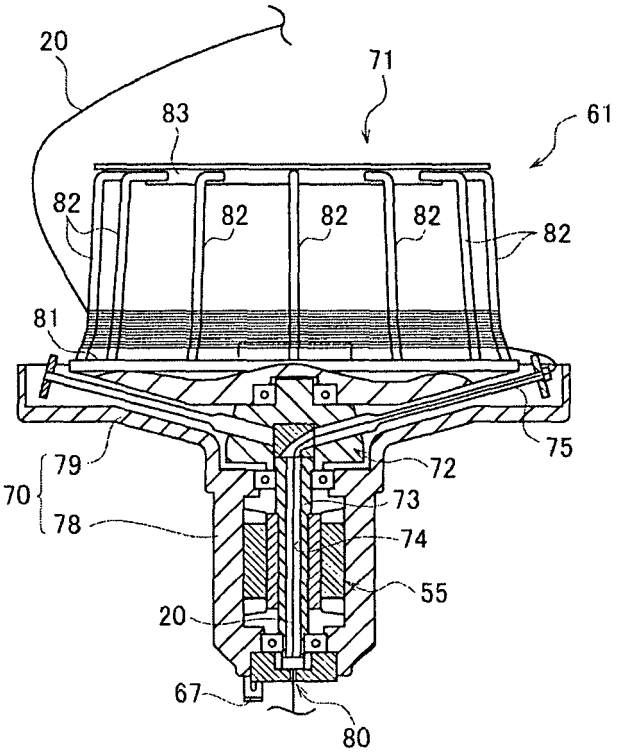


FIGURE 4

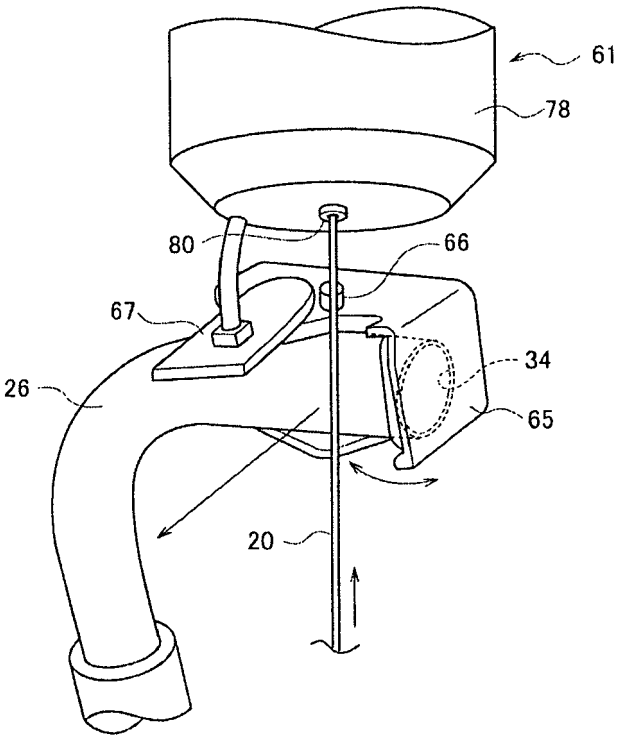
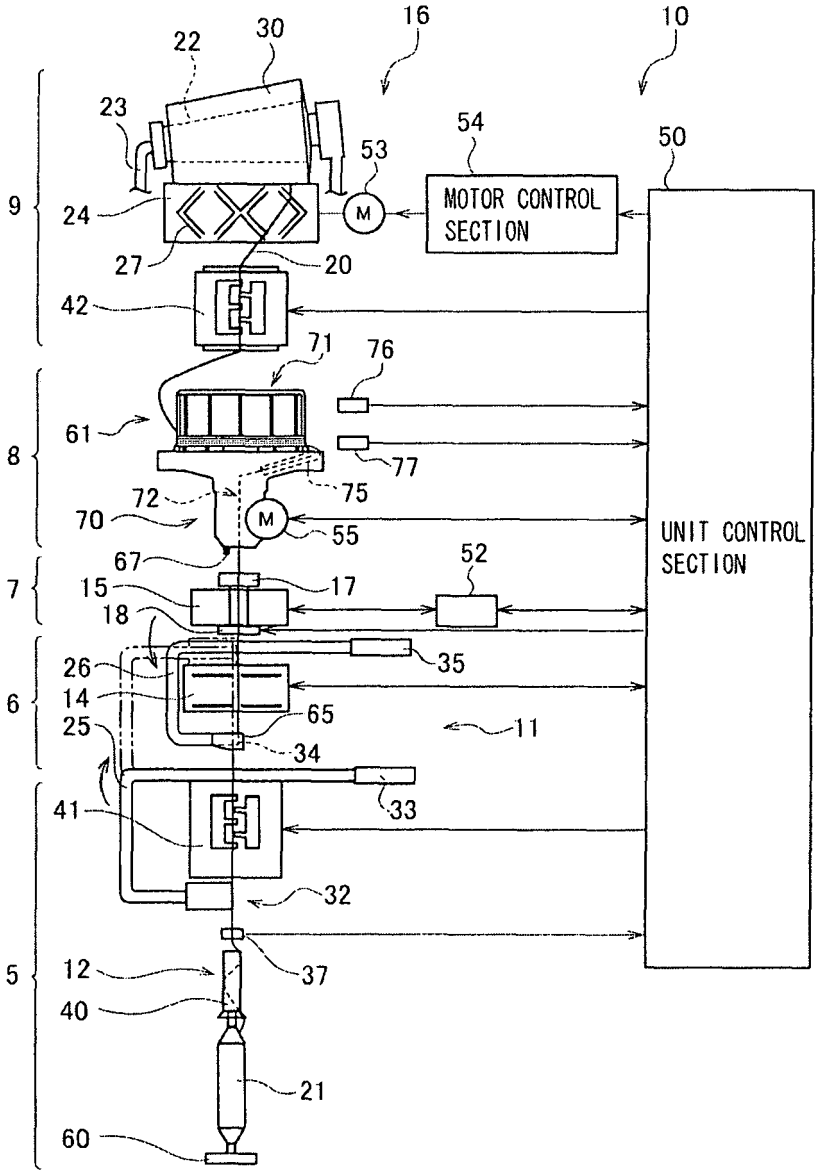


FIGURE 5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REFERENCES CITED IN THE DESCRIPTION

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