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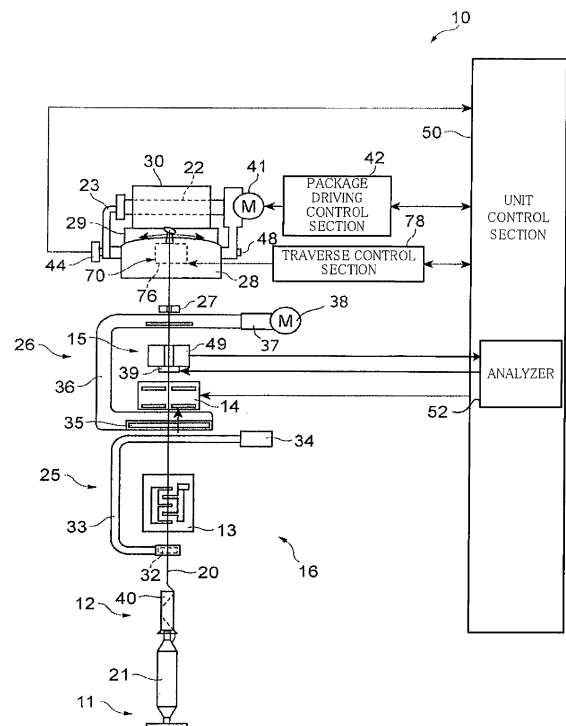
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(54) **Yarn winding machine, and textile machine including the yarn winding machine**

(57) A winder unit 10 includes a winding unit main body 16 adapted to form a package 30 by winding a yarn 20, a first catching and guiding device 26 adapted to suck and catch the yarn 20 from the package 30 and to guide the yarn 20, a control section 50 adapted to control the first catching and guiding device 26 to perform a first catching operation at a catching region R1 to suck and catch the yarn 20 from the package 30 by the first catching and guiding device 26 and a second catching operation at the catching region R1 to suck and catch the yarn 20 from the package 30 again by the first catching and guiding device 26, and a setting section 91 adapted to set a control value relating to adjustment of the second catching operation by the first catching and guiding device 26.

FIG. 2



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding machine and a textile machine including the yarn winding machine.

2. Description of the Related Art

[0002] Conventionally, as an art in this field, there has been known a yarn withdrawal method of a winding package disclosed in Japanese Unexamined Patent Application Publication No. 2-75674. In the yarn withdrawal method of the winding package, when a suction mouth adapted to suck a yarn end from the winding package is adjacent to the package, an initial driving to reversely rotate a winding drum at a low speed is started and, after the rotation is performed a set number of times, the winding drum is switched to a normal reverse rotation, which is faster.

SUMMARY OF THE INVENTION

[0003] In a yarn winding machine, when the yarn end from the package is sucked and caught, a double withdrawal in which a yarn on a surface of the package is also sucked and caught may occur, which may cause defects to the package.

[0004] An object of the present invention is to provide a yarn winding machine capable of preventing defects in the package.

[0005] A yarn winding machine according to the present invention includes a winding unit main body adapted to form a package by winding a yarn, a first catching and guiding device provided in the winding unit main body and adapted to suck and catch the yarn from the package and to guide the yarn, a control section adapted to control the first catching and guiding device to perform a first catching operation at a catching region to suck and catch the yarn from the package by the first catching and guiding device, a separating operation to separate the first catching and guiding device farther away from the package than the catching region to withdraw the yarn, which has been sucked and caught by the first catching and guiding device from a surface of the package, a guiding operation to guide the yarn to a target region by the first catching and guiding device, and a second catching operation at the catching region to suck and catch the yarn from the package again by the first catching and guiding device between the separating operation and the guiding operation, and a setting section adapted to set a control value relating to adjustment of the second catching operation by the first catching and guiding device.

[0006] In the yarn winding machine, the control section performs the first catching operation, which is performed

for the first time as a catching operation at the catching region to suck and catch the yarn from the package, and the second catching operation, which is a catching operation performed for the second time. By the second catching operation, a yarn waste, which is generated by a yarn cut performed after a double withdrawal occurs, can be sucked and removed. In addition, in a case where a sucking and catching error occurs in the first catching operation, the yarn end that could not be caught can be caught. Furthermore, since the setting section adapted to adjust the second catching operation is provided, the second catching operation can be performed under an optimal condition that suits a yarn winding condition. Accordingly, this preferably allows removing the yarn waste and catching the yarn end that could not be caught.

[0007] In one embodiment, the yarn winding machine further includes a yarn supplying section adapted to supply the yarn to be wound around the package, a second catching and guiding device adapted to catch the yarn from the yarn supplying section and to guide the yarn, a yarn joining device adapted to join the yarn from the package guided by the first catching and guiding device and the yarn from the yarn supplying section guided by the second catching and guiding device when continuation of the yarn is disconnected between the yarn supplying section and the package, and the yarn detecting device provided in a path where the yarn travels during yarn winding operation and adapted to determine whether or not the yarn from the package has been guided to the yarn joining device by the first catching and guiding device. The target region is a receiving position where the yarn joining device receives the yarn. Since this configuration allows the determination to be made whether or not the yarn from the package has been guided to the yarn joining device, a determination can be made whether or not to be able to perform yarn joining by the yarn joining device, which is a next step. In addition, with the above-described configuration, since determinations whether or not the yarn joining has been performed are collectively made after carrying out the catching operation, the separating operation, the standby operation and the guiding operation two times, waiting time can be saved in comparison with a configuration in which the determination is made between the operations. Furthermore, since success rate of catching the yarn is improved by performing the catching operation two times, entire operation efficiency is improved by collectively making the determinations. When a large amount of failures occurs, operation efficiency may be reduced in some cases by collectively making the determinations, however, in this case, the entire operation efficiency can be improved by adjusting the second catching operation with the setting section and by improving the success rate.

[0008] In one embodiment, in a case where a determination is made by the yarn detecting device that guiding of the yarn from the package to the yarn joining device by the first catching and guiding device has failed, the control section controls the first catching and guiding de-

vice to perform a repeating operation in which each of the first catching operation, the separating operation, the second catching operation and the guiding operation is repeated by the first catching and guiding device. With this configuration, in a case where the guiding of the yarn from the package to the yarn guiding device has failed, since the repeating operation in which each of the first catching operation, the separating operation, the second catching operation and the guiding operation is repeated by the first catching and guiding device is performed, the guiding of the yarn from the package can be performed again without manual operation by an operator.

[0009] In one embodiment, the setting section is configured to be capable of setting the control value relating to the adjustment of the second catching operation by the first catching and guiding device in performing the repeating operation. With this configuration, in the case where the guiding of the yarn from the package to the yarn joining device has failed, the first catching and guiding device can be controlled under a different condition when performing the repeating operation in which each of the first catching operation, the separating operation, the second catching operation and the guiding operation is performed. Consequently, success rate of guiding of the yarn from the package is improved.

[0010] The setting section includes at least either one of a time setting section adapted to set a period of time in which the second catching operation is performed or a number-of-rotation setting section adapted to set the number of rotations for the second catching operation. The control section controls the first catching and guiding device to perform the second catching operation based on, as the control value relating to the adjustment of the second catching operation, at least either one of the period of time set by the time setting section or the number of rotations set by the number-of-rotation setting section. Consequently, the second catching operation can be performed under an optimal condition that suits production purpose.

[0011] In one embodiment, the control section controls the first catching and guiding device to perform the second catching operation with a priority on the period of time in a case where the setting section sets both the period of time with the time setting section and the number of rotations with the number-of-rotation setting section. With this configuration, since the period of time is applied on a priority basis, the second catching operation is prevented from unnecessarily taking time, thereby improving production efficiency.

[0012] In one embodiment, the control section is adapted to control the first catching and guiding device to perform the second catching operation with a priority on the number of rotations in the case where the setting section sets both the period of time with the time setting section and the number of rotations with the number-of-rotation setting section. With this configuration, since the number of rotations is applied on a priority basis, which allows rotation of the package as much as required in the second

catching operation, prevention of the yarn waste from mixing in and prevention of a yarn catching error can be both realized, thereby improving production quality.

[0013] In one embodiment, the yarn detecting device serves as a yarn defect detecting device adapted, in a case where a yarn defect is included in the yarn being wound around the package, to detect the yarn defect. With this configuration, the yarn detecting device can double as the yarn defect detecting device, thereby allowing a configuration of the yarn winding machine to be simplified.

[0014] In one embodiment, the yarn supplying section is configured to be capable of setting a yarn supplying bobbin around which a yarn is wound. With this configuration, in an automatic winder, yarn joining operation is appropriately performed and thereby winding the yarn around the package can be smoothly resumed in the yarn winding machine.

[0015] In one embodiment, a textile machine including a plurality of the yarn winding machines further includes a machine setting device adapted to control each of the yarn winding machines. The setting section is arranged in the machine setting device. With this configuration, since setting of the yarn winding machine provided in plural can be collectively changed by the setting section in the machine setting device, change in the setting is not required to be performed in every yarn winding machine, thereby saving trouble of the operator.

[0016] With the present invention, defect in the package can be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a schematic view of an automatic winder including a winder unit according to one embodiment;

FIG. 2 is a schematic view and a block diagram illustrating a structure of the winder unit;

FIG. 3 is an enlarged left-side view of a portion in proximity to a traverse device of the winder unit;

FIG. 4 is an enlarged right-side view illustrating a portion in proximity to a cradle of the winder unit;

FIG. 5 is a left-side view of the winder unit;

FIG. 6 is a left-side view of the winder unit;

FIG. 7 is a left-side view of the winder unit;

FIG. 8 is a left-side view illustrating a package moving to a non-contact position or a contact position;

FIG. 9 is a diagram illustrating a relation between rotational speeds of the package and movements of an upper-yarn catching member;

FIG. 10 is a diagram illustrating a relation between the rotational speeds of the package and the movements of the upper-yarn catching member according to an alternative embodiment;

FIG. 11 is a diagram illustrating a relation between the rotational speeds of the package and the move-

ments of the upper-yarn catching member according to a still further alternative embodiment;
 FIG. 12 is a diagram illustrating a relation between the rotational speeds of the package and the movements of the upper-yarn catching member according to a still further alternative embodiment;
 FIG. 13 is a diagram illustrating a relation between the rotational speeds of the package and the movements of the upper-yarn catching member according to a still further alternative embodiment;
 FIG. 14 is a block diagram illustrating a schematic structure of the winder unit and a machine setting device;
 FIGS. 15 are each a schematic operation diagram according to the embodiment of FIG. 13;
 FIG. 15A illustrates a first catching operation of the upper-yarn catching member;
 FIG. 15B illustrates a separating operation of the upper-yarn catching member;
 FIG. 15C illustrates a second catching operation of the upper-yarn catching member;
 FIG. 15D illustrates a standby operation of the upper-yarn catching member; and
 FIG. 15E illustrates a guiding operation of the upper-yarn catching member.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0018] A preferred embodiment of the present invention will be hereinafter described in detail with reference to the attached drawings. The same reference numerals are denoted on the same or corresponding portions throughout the drawings, and redundant description will be omitted.

[0019] An overall configuration of an automatic winder (textile machine) 1 including a winder unit (yarn winding machine) 10 of the present embodiment will be described with reference to FIG. 1. "Upstream" and "downstream" in the present specification respectively indicate upstream and downstream in a travelling direction of a yarn 20 at the time of yarn winding.

[0020] As illustrated in FIG. 1, the automatic winder 10 includes as main components, a plurality of the winder units 10 arranged next to each other, an automatic doffing device 80 and a machine setting device 90.

[0021] Each of the winder units 10 is capable of forming a package 30 by winding the yarn 20 unwound from a yarn supplying bobbin 21 while traversing the yarn 20.

[0022] When the package 30 is fully wound in each winder unit 10, the automatic doffing device 80 travels to a position of the relevant winder unit 10 and removes the fully-wound package 30 from the winder unit 10. The automatic doffing device 80 may supply an empty bobbin to the winder unit 10 after removing the package 30.

[0023] The machine setting device 90 includes as main components, a setting section (inputting section) 91 and a display section 92. The setting section 91 is capable

of performing setting to each winder unit 10 when an operator inputs a predetermined set value (control value) or selects an appropriate control method. The display section 92 is capable of displaying a winding status of the yarn 20 of each winder unit 10, contents of an occurred trouble, or the like.

[0024] Next, a configuration of the winder unit 10 will be specifically described with reference to FIGS. 2 to 8. As illustrated in FIG. 2, each winder unit 10 includes a winding unit main body 16 and a unit control section (control section) 50.

[0025] The winding unit main body 16 includes a yarn unwinding assisting device 12, a tension applying device 13, a splicer device (yarn joining device) 14 and a clearer (yarn defect detecting section) 15 sequentially arranged from a side of the yarn supplying bobbin 21 in a yarn travelling path between the yarn supplying bobbin 21 and a contact roller 29.

[0026] A yarn supplying section 11 adapted to supply the yarn 20 to a winding bobbin 22 is provided in a lower part of the winding unit main body 16 in a direction of machine height. The yarn supplying section 11 is capable of holding at a predetermined position, the yarn supplying bobbin 21 transported by a bobbin transporting system, which is not illustrated.

[0027] By lowering a regulating member 40 adapted to cover a core tube of the yarn supplying bobbin 21 in conjunction with unwinding of the yarn 20 from the yarn supplying bobbin 21, the yarn unwinding assisting device 12 assists the unwinding of the yarn 20 from the yarn supplying bobbin 21. The regulating member 40 makes contact with a balloon of the yarn 20, which is formed in an upper portion of the yarn supplying bobbin 21 with swinging and centrifugal force of the yarn 20 unwound from the yarn supplying bobbin 21, and controls the balloon to an appropriate size to assist the unwinding of the yarn 20. A sensor (not illustrated) adapted to detect a chase section of the yarn supplying bobbin 21 is provided in proximity to the regulating member 40. When the sensor detects lowering of the chase section, the yarn unwinding assisting device 12 can lower the regulating member 40 with an air cylinder (not illustrated), e.g., following the chase section.

[0028] The tension applying device 13 applies a predetermined tension on the travelling yarn 20. The tension applying device 13 may be, e.g., a gate type in which movable comb teeth are arranged with respect to fixed comb teeth. The movable comb teeth can be swung by a rotary solenoid such that the movable comb teeth and the fixed comb teeth can be engaged with each other or released from each other. The tension applying device 13 may be, e.g., a disc type other than the above-described gate type.

[0029] The splicer device 14 joins a lower yarn from the yarn supplying bobbin 21 and an upper yarn from the package 30 at the time of a yarn cut performed by the clearer 15 upon detection of a yarn defect, at the time of a yarn breakage during unwinding of the yarn 20 from

the yarn supplying bobbin 21, or the like. As a yarn joining device adapted to join the upper yarn and the lower yarn in such a manner, a mechanical type, a type that uses fluid such as compressed air, or the like may be employed.

[0030] The clearer 15 includes a clearer head 49 in which a sensor (not illustrated) adapted to detect a thickness of the yarn 20 is arranged, and an analyzer 52 adapted to process a yarn thickness signal from the sensor. The clearer 15 detects the yarn defect such as a slub by monitoring the yarn thickness signal from the sensor. A cutter 39 is provided in proximity to the clearer head 49 to immediately cut the yarn 20 upon detection of the yarn defect by the clearer 15. The clearer 15 may detect a presence or an absence of a foreign substance included in the yarn 20 as a presence or an absence of the yarn defect.

[0031] Below and above the splicer device 14, there are respectively provided a lower-yarn catching member (second catching and guiding device) 25 adapted to catch a yarn end from the yarn supplying bobbin 21 and to guide the yarn end to the splicer device 14, and an upper-yarn catching member (first catching and guiding device) 26 adapted to catch a yarn end from the package 30 and to guide the yarn end to the splicer device 14. The lower-yarn catching member 25 includes a lower-yarn pipe arm 33 and a lower-yarn suction mouth 32 that is formed at a tip end of the lower-yarn pipe arm 33. The upper-yarn catching member 26 includes an upper-yarn pipe arm 36 and an upper-yarn suction mouth (suction mouth) 35 that is formed at a tip end of the upper-yarn pipe arm 36.

[0032] The lower-yarn pipe arm 33 and the upper-yarn pipe arm 36 are respectively swingable with shafts 34 and 37 as a center. An appropriate negative pressure source is connected to each of the lower-yarn pipe arm 33 and the upper-yarn pipe arm 36. In this manner, suction flow is generated in the lower-yarn suction mouth 32 and the upper-yarn suction mouth 35, and thereby the yarn ends of the upper yarn and the lower yarn can be sucked and caught. The upper-yarn catching member 26 is swung independently from the lower-yarn catching member 25 by a motor 38. As the motor 38, various types of motors such as a servomotor, a step motor, and an induction motor may be employed.

[0033] As illustrated in FIGS. 5 to 7, the upper-yarn catching member 26 is arranged in a movable manner such that the upper-yarn suction mouth 35 is located at a catching region R1, a standby region R2 and a yarn joining region (target region) R3. The catching region R1 is located in proximity to the package 30 and is a region where the yarn end 30a of the package 30 can be caught. The standby region R2 is a region where the upper-yarn suction mouth 35 is located farther away from the package 30 than the catching region R1 by the upper-yarn pipe arm 36 of the upper-yarn catching member 26 being swung in a direction to be farther away from the package than the catching region R1. The yarn joining region R3

is a region where the yarn end 30a, which has been caught in the catching region R1, is guided to the splicer device 14 and is received and joined by the splicer device 14. The standby region R2 and the yarn joining region R3 are regions where the upper-yarn catching member 26 is located when moving from the catching region R1 to the splicer device 14.

[0034] As illustrated in FIG. 2, the winding unit main body 16 includes a cradle 23 adapted to support the winding bobbin 22 in a removable manner, and a contact roller 29 capable of rotating in contact with a peripheral surface of the winding bobbin 22 or a peripheral surface of the package 30. The winding unit main body 16 includes in proximity to the cradle 23, an arm-type traverse device 70 adapted to traverse the yarn 20, and is capable of winding the yarn 20 around the package 30 while traversing the yarn 20 with the traverse device 70.

[0035] A guide plate 28 is provided slightly upstream of a traverse portion and is adapted to guide the upstream yarn 20 to the traverse portion. A ceramics traverse fulcrum 27 is arranged farther upstream of the guide plate 28. The traverse device 70 traverses the yarn 20 in a winding width direction of the package 30 (a direction indicated by an arrow in FIG. 2) with the traverse fulcrum 27 as a fulcrum.

[0036] The cradle 23 is capable of swinging with a swinging shaft 48 as a center. An increase in a yarn layer diameter of the package 30 associated with winding of the yarn 20 around the winding bobbin 22 can be absorbed with swinging of the cradle 23.

[0037] A package driving motor 41 formed of a servomotor, e.g., is mounted to the cradle 23. The winder unit 10 winds the yarn 20 by rotationally driving the winding bobbin 22 with the package driving motor 41. The package driving motor 41 is capable of rotationally driving the winding bobbin 22 (the package 30) in a winding direction as well as in an unwinding direction A.

[0038] When the winding bobbin 22 is supported by the cradle 23, a motor shaft of the package driving motor 41 is coupled to the relevant winding bobbin 22 so as not to relatively rotate with respect to the winding bobbin 22 (a so-called direct drive system). Operation of the package driving motor 41 is controlled by a package driving control section (control section) 42. The package driving control section 42 controls the package driving motor 41 to operate or stop in response to a drive signal from a unit control section 50. As the package driving motor 41, various types of motors such as a step motor or an induction motor may be employed without being limited to the servomotor.

[0039] An angle sensor (diameter acquiring section) 44 adapted to detect an angle of the cradle 23 is mounted to the swinging shaft 48. The angle sensor 44 is formed of a rotary encoder, e.g., and transmits an angle signal, which corresponds to the angle of the cradle 23, to the unit control section 50. Since the angle of the cradle 23 changes as a wound diameter of the package 30 increases, the diameter of the package 30 can be detected by

detecting a swing angle of the cradle 23 with the angle sensor 44. Any appropriate configuration may be employed to detect the diameter of the package 30 other than the angle sensor 44. For example, a configuration that uses a Hall IC, an absolute type encoder, or the like may be employed to detect the diameter of the package 30.

[0040] Next, a layout of a configuration of the traverse device 70 and a configuration in proximity to the traverse device 70 will be described with reference to FIG. 3. In the present embodiment, since the contact roller 29 is arranged such that an axial direction thereof corresponds to a lateral direction of the winding unit main body 16, a side view such as FIG. 3, e.g., can be a view in the axial direction of the contact roller 29. In FIG. 3, rotation of the package 30 in the winding direction is clockwise and rotation of the package 30 in the unwinding direction is counterclockwise.

[0041] As illustrated in FIG. 3, the traverse device 70 includes a traverse driving motor 76, an output shaft 77 and a traverse arm (traverse guide) 74.

[0042] The traverse driving motor 76 is adapted to drive the traverse arm 74 and is formed of a servomotor or the like. As illustrated in FIG. 2, operation of the traverse driving motor 76 is controlled by a traverse control section 78. The traverse driving motor 76 may be another motor such as a step motor or a voice coil motor.

[0043] The traverse control section 78 is formed of hardware such as a dedicated microprocessor or the like, and is adapted to control the traverse driving motor 76 to operate or stop in response to a signal from the unit control section 50.

[0044] Power of the traverse driving motor 76 is transmitted to a base-end portion of the traverse arm 74 via the output shaft 77 illustrated in FIG. 3. Since a rotor of the traverse driving motor 76 forwardly and reversely rotates, the traverse arm 74 swings into and/or out of the page of FIG. 3 (in a left-right direction (traverse direction) in FIG. 2). The traverse arm 74 illustrated in FIG. 3 indicates a position at a traverse end portion.

[0045] A hook-shaped yarn guiding section 73 is formed at a tip-end portion of the traverse arm 74. The yarn guiding section 73 can hold and guide the yarn 20. The yarn guiding section 73 reciprocates in a state of holding the yarn 20, thereby allowing traverse of the yarn 20.

[0046] Next, a configuration of the cradle 23 will be described in further detail with reference to FIG. 4. As illustrated in FIG. 4, the winding unit main body 16 includes a swinging plate 17 adapted to be capable of swinging with the swinging shaft 48 as a center. The cradle 23 swings with the swinging shaft 48 as a center in a unified manner with the swinging plate 17. A spring 18 formed as a tension spring for gradually decreasing contact pressure and an air cylinder 60 are both connected to the swinging plate 17. A predetermined swinging torque can be applied to the cradle 23 by the spring 18 and the air cylinder 60.

[0047] The air cylinder 60 is formed as a double-acting cylinder including a piston 601 in an interior thereof. In FIG. 4, compressed air of air pressure P1 and compressed air of air pressure P2 are respectively supplied to a cylinder chamber in a right side and a cylinder chamber in a left side of a drawing of the piston 601.

[0048] An electro-pneumatic regulator 61 is connected to a pipe that supplies the compressed air of the air pressure P2 to the air cylinder 60. The electro-pneumatic regulator 61 is capable of adjusting the air pressure P2 steplessly. The electro-pneumatic regulator 61 controls the air pressure P2 based on a control signal input from the unit control section 50.

[0049] In a configuration illustrated in FIG. 4, since force of the air cylinder 60 to pull the cradle 23 increases when the air pressure P2 is decreased, torque that causes the cradle 23 to swing to a front side of the winding unit main body 16 with the swinging shaft 48 as a center increases. Since the contact roller 29 is arranged closer to the front side of the winding unit main body 16 than the swinging shaft 48, contact pressure between the package 30 and the contact roller 29 can be increased with the decrease of the air pressure P2. On the contrary, since the force of the air cylinder 60 to pull the cradle 23 decreases when the air pressure P2 is increased, torque that causes the cradle 23 to swing to a rear side of the winding unit main body 16 with the swinging shaft 48 as a center increases. Consequently, the contact pressure between the package 30 and the contact roller 29 can be weakened. By further increasing the air pressure P2, the package 30 can even be located away from a surface of the contact roller 29.

[0050] The air cylinder 60 can swing the cradle 23 and thereby move the package 30. In this case, the package 30 can be moved to a position where the package 30 is located away from the contact roller 29 (a position where the package is not in contact with the contact roller 29) and a position where the package is in contact with the contact roller 29.

[0051] The unit control section 50 includes, e.g., a CPU, a RAM, a ROM, an I/O port and a communication port. A program to control each component of the winding unit main body 16 is recorded in the ROM. Each section, which is provided in the winding unit main body 16, and the machine setting device 90 are connected to the I/O port and the communication port, which enables communication of control information or the like. Consequently, the unit control section 50 can control operations of each section provided in the winding unit main body 16.

[0052] The unit control section 50 transmits a drive signal to the package driving control section 42 to control rotational driving (a rotational speed) of the package driving motor 41. The unit control section 50 controls movements of the lower-yarn catching member 25 and the upper-yarn catching member 26 (swings of the lower-yarn pipe arm 33 and the upper-yarn pipe arm 36). Specifically, the unit control section 50 controls the motor 38 of the upper-yarn catching member 26 to perform a catch-

ing operation at the catching region R1 to suck and catch the yarn 20, a standby operation to be under standby at the standby region R2 and a guiding operation to guide the yarn 20 to the yarn joining region R3.

[0053] The unit control section 50 adjusts the standby operation of the upper-yarn catching member 26 at the standby region R2 according to the package diameter of the package 30 detected by the angle sensor 44, a length of a yarn defect in the yarn 20 detected by the clearer 15 and a rotational speed of the package 30. The unit control section 50 adjusts at least one of a stopped position of the upper-yarn suction mouth 35 at the standby region R2, a period of time the upper-yarn suction mouth 35 is stopped at the standby region R2, a speed at which the upper-yarn catching member 26 moves from the catching region R1 to the standby region R2, and acceleration of the upper-yarn catching member 26 moving from the catching region R1 to the standby region R2.

[0054] Specifically, the unit control section 50 sets, e.g., a period of standby time (stopping time) of the upper-yarn catching member 26 at the standby region R2 based on the length of the yarn defect in the yarn 20 detected by the clearer 15. The unit control section 50 sets both of a separation distance between the package 30 and the catching region R1 and a separation distance between the package 30 and the stopped position of the upper-yarn suction mouth 35 at the standby region R2 to be large according to an increase in the diameter of the package 30 detected by the angle sensor 44. That is, the unit control section 50 controls the upper-yarn catching member 26 such that the upper-yarn suction mouth 35 is farther away from the package 30 as the diameter of the package 30 becomes large. The unit control section 50 sets the stopped position of the upper-yarn suction mouth 35 at the standby region R2 according to the rotational speed (a yarn guiding speed) of the package 30.

[0055] The setting section 91 of the machine setting device 90 illustrated in FIG. 1 sets a number of rotations, which is a number of times the package 30 is rotated at a yarn-end catching speed (to be described later in detail) in the unwinding direction A when continuation of the yarn 20 is disconnected (hereinafter referred to as a "yarn disconnection and the like") by a yarn cut performed by the clearer 15 upon detection of the yarn defect, a yarn breakage during unwinding of the yarn 20 from the yarn supplying bobbin 21, or the like. The setting section 91 sets the number of rotations of the package 30 based on, e.g., the diameter of the package 30 detected by the angle sensor 44, or the like. In a case, e.g., where the diameter of the package 30 is small, the setting section 91 sets the number of rotations large since the yarn end 30a is unlikely to come off the surface of the package 30. In a case where the diameter of the package 30 is large, the setting section 91 sets the number of rotations small since the yarn end 30a is likely to come off the surface of the package 30. The setting section 91 transmits the set number of rotations of the package 30 to the unit

control section 50.

[0056] The setting section 91 may set the number of rotations of the package 30 in the unwinding direction A at the time of yarn disconnection based on information that has been set and input in advance. In other words, the setting section 91 sets the number of rotations of the package 30 based on information input from the setting section 91 with a key operation and the like by an operator. In such a configuration, the operator can set the number of rotations of the package 30 to a desired number.

[0057] In the above-described winder unit 10, when the yarn disconnection and the like occurs, the lower yarn and the upper yarn are required to be joined by the splicer device 14. Thus, the lower yarn from the yarn supplying bobbin 21 is required to be caught by the lower-yarn suction mouth 32 and the upper yarn from the package 30 is required to be caught and withdrawn by the upper-yarn suction mouth 35. Control of a withdrawal operation of the upper yarn and a yarn withdrawal method both performed in the winder unit 10 will be described in detail with reference to FIGS. 2 to 9.

[0058] As illustrated in FIG. 3, the surface of the package 30 is in contact with the contact roller 29 during winding operation before the yarn disconnection and the like occurs. As just described, a position of the package 30 where the package 30 is in contact with the contact roller 29 is hereinafter referred to as a "contact position" and is indicated by a reference symbol "Q2" in FIGS. 4 and 8.

[0059] Immediately after the yarn disconnection and the like occurs during the winding operation, the unit control section 50 transmits a drive signal to the electro-pneumatic regulator 61. Since the electro-pneumatic regulator 61 is driven based on the drive signal, the air pressure P2 of the air cylinder 60 is changed, thereby, as illustrated in FIGS. 5 and 8, causing the cradle 23 to be driven in a direction to be located away from the contact roller 29. The unit control section 50 transmits a drive signal to the traverse control section 78 to drive the traverse driving motor 76 and causes the traverse arm 74 to be under standby at a position located at one end in the traverse direction.

[0060] The package 30 is moved away from the contact roller 29 and is held at a predetermined position where the package 30 is not in contact with the contact roller 29. The position of the moved package 30 at this time is hereinafter referred to as a "non-contact position" and is indicated by a reference symbol "Q1" in FIG. 8. Simultaneously, the unit control section 50 transmits a drive signal to the package driving control section 42 to decelerate and stop the rotation of the package 30 and then to start rotating the package 30 in the unwinding direction (a direction indicated by an arrow A). At this time, as illustrated in FIG. 9, the unit control section 50 rotationally drives the package driving motor 41 at the yarn-end catching speed (a first speed).

[0061] The unit control section 50 sets the yarn-end catching speed, e.g., as follows. In the case where the

diameter of the package 30 is small, since the yarn end 30a is unlikely to come off the surface of the package 30, the unit control section 50 sets the yarn-end catching speed so as to slowly rotate the package 30. In the case where the diameter of the package 30 is large, since the yarn end 30a is likely to come off the surface of the package 30, the unit control section 50 sets the yarn-end catching speed faster in comparison with the case where the diameter of the package 30 is small.

[0062] Furthermore, the unit control section 50 swings the upper-yarn pipe arm 36 by transmitting a drive signal to the upper-yarn catching member 26 and, as illustrated in FIGS. 5 and 9, moves the upper-yarn suction mouth 35 to a position at the catching region R1 in proximity to the surface of the package 30. Then, under a state where the package 30 at the non-contact position Q1 is being rotated at the yarn-end catching speed in the unwinding direction A, the upper-yarn suction mouth 35 performs the catching operation. With the above-described catching operation, the yarn end 30a of the upper yarn connected to the package 30 can be sucked and caught by the upper-yarn suction mouth 35.

[0063] When the package 30 is rotated at the yarn-end catching speed the number of times set by the setting section 91 and the yarn end 30a is sucked and caught by the upper-yarn suction mouth 35 in the above-described catching operation, the unit control section 50 drives the cradle 23 in a direction to be closer to the contact roller 29. Consequently, the package 30 returns to the contact position Q2 where the package 30 is in contact with the contact roller 29. At this time, since the rotation of the package 30 in the unwinding direction A is continued, the package 30 is rotated in the unwinding direction A while being in contact with the contact roller 29, and thereby the contact roller 29 rotates with the package 30.

[0064] When the yarn end 30a of the package 30 is sucked and caught by the upper-yarn suction mouth 35, the unit control section 50 controls the upper-yarn catching member 26 to swing the upper-yarn pipe arm 36 and, as illustrated in FIGS. 6 and 9, moves the upper-yarn suction mouth 35 to a position at the standby region R2 where the upper-yarn suction mouth 35 is located away from the package 30 and then stops the upper-yarn suction mouth 35. Simultaneously, the unit control section 50 transmits a drive signal to the package driving control section 42 and, as illustrated in FIG. 9, rotationally drives the package 30 at the yarn guiding speed, which is faster than the yarn-end catching speed, in the unwinding direction A. With the above-described catching operation, the upper yarn of the package 30 is further sucked and caught by the upper-yarn suction mouth 35.

[0065] Subsequently, the unit control section 50 controls the upper-yarn catching member 26 to swing the upper-yarn pipe arm 36 and, as illustrated in FIGS. 7 and 9, moves the upper-yarn suction mouth 35 to the yarn joining region R3. Simultaneously, the unit control section 50 transmits a drive signal to the package driving control

section 42 to decelerate and stop the rotation of the package 30. Consequently, the package 30 stops to be rotationally driven. As described above, the yarn end 30a of the package 30 is caught by the upper-yarn suction mouth 35 and the yarn 20 is guided to the splicer device 14.

[0066] When the yarn end 30a of the package 30 is guided to the splicer device 14, the guided yarn end 30a is almost simultaneously guided to the clearer 15 as well. Since the clearer 15 is arranged along a path in which the yarn 20 travels at the time of yarn winding operation, when the upper yarn is guided to the splicer device 14, which is also arranged along the yarn travelling path, by the upper-yarn catching member 26, the upper yarn is simultaneously guided to the clearer 15. The clearer 15 is thus used as a yarn detecting device adapted to determine whether or not the yarn from the package 30 has been guided to the splicer device 14 by the upper-yarn catching member 26. More specifically, in a case where the clearer 15 can detect the upper yarn that has been guided after a completion of the guiding operation, a determination can be made that the yarn end 30a of the package 30 has been successfully guided to the splicer device 14. On the contrary, in a case where the clearer 15 cannot detect the upper yarn that has been guided after the completion of the guiding operation, a determination can be made that guiding of the yarn end 30a of the package 30 to the splicer device 14 has failed. The guiding failure may be a failure in the catching operation, a failure in the guiding operation, or the like. In the case where the determination is made that the guiding has failed, the unit control section 50 controls the upper-yarn catching member 26 to perform the catching operation, the standby operation and the guiding operation again, and causes the yarn end 30a of the package 30 to be guided to the splicer device 14.

[0067] As described above, in the winder unit 10 of the present embodiment, the unit control section 50 controls the upper-yarn catching member 26 to perform the catching operation at the catching region R1 to suck and catch the yarn end 30a of the package 30, and then to perform the standby operation to stop and be under standby at the standby region R2 where the upper-yarn catching member 26 is farther away from the package 30 than the catching region R1. The standby operation of the upper-yarn catching member 26 is adjusted according to the diameter of the package 30, the length of the yarn defect included in the yarn 20 and the rotational speed of the package 30. Accordingly, this allows prevention of a double withdrawal in the winder unit 10 in which a yarn 20 on the surface of the package 30 is also sucked and caught when the yarn end 30a is sucked from the package 30. In addition, the yarn end 30a of the package 30 can be reliably caught. In the winder unit 10, defect in the package 30 thus can be prevented.

[0068] In the present embodiment, when the upper-yarn catching member 26 is located at the standby region R2 after catching at the catching region R1, the yarn end

30a of the package 30 rotating at the yarn-end catching speed, the unit control section 50 controls the package driving motor 41 to rotationally drive the package 30 at the yarn guiding speed that is faster than the yarn-end catching speed. Consequently, in the winder unit 10, the yarn 20 can be guided to the splicer device 14 at a high speed by the upper-yarn catching member 26, thereby allowing reduction in time. In the winder unit 10, operation efficiency thus can be improved.

[0069] In the present embodiment, the unit control section 50 controls the package driving motor 41 to rotationally drive the package 30 at the yarn-end catching speed the number of rotations set by the setting section 91. Then, after the package 30 is rotated the number of rotations, the unit control section 50 controls the package driving motor 41 to proceed to the operation of rotationally driving the package 30 at the yarn guiding speed. In this manner, in the winder unit 10, since an assumption is made without using a sensor or the like that the upper-yarn catching member 26 has caught the yarn end 30a of the package 30, switching from the yarn-end catching speed to the yarn guiding speed can be performed with a simple configuration and control.

[0070] In the present embodiment, when continuation of the yarn 20 is disconnected, the unit control section 50 controls the traverse arm 74 to be under standby at one end in the traverse direction. Therefore, in the winder unit 10, when performing the yarn joining operation or the like upon the disconnection of the yarn 20, the yarn 20 can be prevented from being caught in the traverse arm 74. Consequently, damage on the traverse arm 74 and/or a disconnection of the yarn 20 guided by the upper-yarn catching member 26 can be prevented.

[0071] In the present embodiment, when the upper-yarn catching member 26 catches the yarn end 30a of the package 30, in other words, when the upper-yarn suction mouth 35 of the upper-yarn catching member 26 is located at the catching region R1, the air cylinder 60 of the winder unit 10 brings the package 30 and the contact roller 29 into a non-contact state. Consequently, in the winder unit 10, when catching the yarn end 30a of the package 30, the yarn end 30a can be prevented from being sandwiched between the package 30 and the contact roller 29 and from sticking to the surface of the package 30. In the winder unit 10, the yarn end 30a of the package 30 thus can be reliably caught.

[0072] In the present embodiment, the upper-yarn catching member 26 is driven by the independently provided motor 38. In the winder unit 10, operation of the upper-yarn catching member 26 thus can be independently and accurately controlled.

[0073] The present invention is not limited to the above-described embodiment. As illustrated in FIG. 10, the unit control section 50 may control the package driving motor 41 such that the rotational speed of the package 30 at the yarn-end catching speed is changed in two stages. The yarn-end catching speed includes the first speed at which the upper-yarn catching member 26 starts catch-

ing the yarn end 30a of the package 30 and a second speed that is faster than the first speed.

[0074] The unit control section 50 controls the package driving motor 41 such that the package 30 is rotated at the second speed after being rotationally driven at the first speed. Consequently, the yarn end 30a of the package 30 can be further reliably caught by the upper-yarn suction mouth 35 of the upper-yarn catching member 26.

[0075] As illustrated in FIG. 11, the unit control section 50 rotationally drives the package 30 at the yarn-end catching speed in the unwinding direction A, and causes the upper-yarn suction mouth 35 of the upper-yarn catching member 26 to be located at the catching region R1 to catch the yarn end 30a of the package 30. After rotationally driving the package 30 in the unwinding direction A a predetermined number of times, the unit control section 50 moves the upper-yarn suction mouth 35 of the upper-yarn catching member 26 in the direction to be located away from the package 30, and rotationally drives the package 30 in the winding direction. Then, after rotationally driving the package 30 in the winding direction a predetermined number of times, the unit control section 50 rotationally drives the package 30 at the yarn-end catching speed in the unwinding direction A, and causes the upper-yarn suction mouth 35 of the upper-yarn catching member 26 to be located at the catching region R1 again.

[0076] Subsequently, the unit control section 50 rotationally drives the package 30 at the yarn guiding speed in the unwinding direction A, and causes the upper-yarn suction mouth 35 of the upper-yarn catching member 26 to be located at the standby region R2. Consequently, since a slack of the yarn 20 can be eliminated on the package 30, the upper-yarn catching member 26 can be prevented from catching the yarn 20 that exists on a surface layer of the package 30.

[0077] As illustrated in FIG. 12, when the upper-yarn catching member 26 is located at the catching region R1 and the standby region R2, the unit control section 50 may control the rotational speed of the package driving motor 41 to be constant.

[0078] In the above-described embodiment, the package 30 is rotationally driven directly by the package driving motor 41, however, in the present invention, a method in which the contact roller 29 is rotationally driven to rotate the package 30 may be also employed. In this case, if the package 30 is moved to the non-contact position Q1 and is rotated in the unwinding direction A, a mechanism for rotating the package 30 in the unwinding direction A is further provided in the winder unit 10. In the case of the method in which the contact roller 29 is rotationally driven to rotate the package 30, the rotational speed of the package 30 is not directly controlled, but rotational speed of the contact roller 29 is controlled.

[0079] In the above-described embodiment, although the arm-type traverse device 70 is described as an example, the traverse device may be a drum having a traverse groove, a belt-type traverse or a rod-type

traverse. In a case of traversing with the drum having the traverse groove, the package driving motor 41 directly drives the drum having the traverse groove. In this case, by making contact with the driven drum having the traverse groove, the package 30 rotates in response to drive force from the drum having the traverse groove. Therefore, at the time of the above-described withdrawal operation of the upper yarn, the package 30 is rotated in the unwinding direction A while being in contact with the drum having the traverse groove.

[0080] The above-described embodiment allows prevention of the double withdrawal from the package 30, however, the double withdrawal is not completely resolved. In particular, in a case where after the double withdrawal occurs, the yarn 20 is cut and a yarn waste, which is a cut yarn end 30a, is wound around the package 30, a serious problem may occur in subsequent processing. In addition, in a case where the upper yarn of the package 30 cannot be sucked and caught by the upper-yarn suction mouth 35 in the catching operation or in a case where a sucking and catching error occurs in which, e.g., the upper yarn sucked and caught by the upper-yarn suction mouth 35 disengages from the upper-yarn suction mouth 35, a yarn joining cycle (the catching operation, the standby operation and the guiding operation) needs to be repeated as described above, which is not preferable since operation efficiency is reduced.

[0081] Description will be made on an upper-yarn withdrawal operation for preventing repetition of the yarn joining cycle in the case where the upper yarn of the package 30 cannot be sucked and caught by the upper-yarn suction mouth 35 or in the case where the sucking and catching error in which, e.g., the upper yarn sucked and caught by the upper-yarn suction mouth 35 disengages from the upper-yarn suction mouth 35 occurs. Redundant description of a configuration in common with the above-described embodiment will be omitted.

[0082] As illustrated in FIGS. 13 and 15, the unit control section 50 rotationally drives the package 30 at the yarn-end catching speed in the unwinding direction A, and causes the upper-yarn suction mouth 35 of the upper-yarn catching member 26 to be located at the catching region R1 to perform a first catching operation to catch the yarn end 30a of the package 30 (FIG. 15A). Subsequently, after rotationally driving the package 30 in the unwinding direction A a predetermined number of times in the first catching operation, the unit control section 50 causes a separating operation to move the upper-yarn suction mouth 35 in a direction to be located away from the package 30 (FIG. 15B) to be performed. In the present embodiment, the upper-yarn suction mouth 35 is moved to the standby region R2 in the separating operation. The yarn end 30a of the package 30, which sticks to the surface of the package 30, can be peeled from the surface of the package 30 by this movement. Although the upper-yarn withdrawal operation can be performed by the separating operation, the above-described yarn cut after the double withdrawal may occur according to a yarn type or

a yarn state. Furthermore, the case where the upper yarn cannot be sucked and caught by the upper-yarn suction mouth 35 or the sucking and catching error in which the upper yarn that has been sucked and caught by the upper-yarn suction mouth 35 disengage from the upper-yarn suction mouth 35 may occur.

[0083] The unit control section 50 thus controls the upper-yarn suction mouth 35 to perform a second catching operation, which is a catching operation for the second time, after the separating operation and before the standby operation (FIG. 15C). In the second catching operation, the upper-yarn suction mouth 35 is moved to the catching region R1 again and is caused to perform the catching operation. In the present embodiment, the first catching operation that is a catching operation for the first time and the second catching operation that is the catching operation for the second time are performed. Since, also in the second catching operation, a catching operation is performed by the upper-yarn suction mouth 35 at the catching region R1 as in the first catching operation, the yarn waste, which has been generated by the yarn cut after the double withdrawal, can be sucked and removed by the upper-yarn catching member 26. In addition, in a case where the sucking and catching error occurs in the first catching operation, the yarn end 30a that could not be caught can be caught.

[0084] Subsequently, the unit control section 50 controls the upper-yarn catching member 26 to perform the standby operation to stop and be under standby at the standby region R2 where the upper-yarn catching member 26 is located farther away from the package 30 than the catching region R1 (FIG. 15D). The standby operation of the upper-yarn catching member 26 is adjusted according to the diameter of the package 30, the length of the yarn defect included in the yarn 20 and the rotational speed of the package 30. This allows prevention of the double withdrawal in the winder unit 10 in which a yarn 20 on the surface of the package 30 is also sucked and caught when sucking the yarn end 30a from the package 30 and removing the yarn defect. In addition, the yarn end 30a of the package 30 can be reliably caught. Then, the unit control section 50 performs the guiding operation (FIG. 15E).

[0085] Although, in the above-described embodiment, the upper-yarn suction mouth 35 is stopped at the standby region R2 in the separating operation, the separating operation merely needs to peel the yarn end 30a of the package 30, which sticks to the surface of the package 30, from the surface of the package 30 by the movement. Therefore, a separating region in which the upper-yarn suction mouth 35 is stopped in the separating operation may be provided separately from the standby region R2. The separating region is a region where the yarn end 30a can be peeled from the surface of the package 30 and, if the separating region is a position where the yarn end 30a sucked and caught by the upper-yarn suction mouth 35 does not disengage from the upper-yarn suction mouth 35, an operator can decide the separating region

at his/her discretion.

[0086] In the present embodiment, a control value relating to adjustment of the second catching operation can be set in detail by the setting section 91 to reliably remove the yarn waste and catch the yarn end in the second catching operation.

[0087] As illustrated in FIG. 14, the unit control sections 50 of a plurality of the winder units 10 are connected to the machine setting device 90 that includes the setting section 91. In FIG. 14, although merely two winder units 10 are described, several tens of winder units 10 can be connected. As described above, the motor 38 is connected to the unit control section 50, and the upper-yarn catching member 26 is driven by the motor 38. In the present embodiment, the machine setting device 90 includes the setting section 91, however, a configuration in which each unit control section 50 includes an own setting section may be employed.

[0088] The setting section 91 includes a time setting section 911 adapted to set a period of time in which the second catching operation is performed, and a number-of-rotation setting section 912 adapted to set the number of rotations for the second catching operation. The unit control section 50 controls the upper-yarn catching member 26 to perform the second catching operation based on at least either one of the period of time set by the time setting section 911 or the number of rotations set by the number-of-rotation setting section 912.

[0089] In a case where both the period of time and the number of rotations are set in the setting section 91 as the control value relating to the adjustment of the second catching operation, a determination can be made which setting is to be applied on a priority basis. In a case, e.g., where production efficiency is considered important, the period of time is applied on a priority basis and, in a case where product quality is considered important, the number of rotations is applied on a priority basis. In a case the number of rotations is applied on a priority basis, a yarn waste can be reliably removed by rotating a predetermined number of rotations. Furthermore, since the diameter of the package 30 becomes large as the yarn 20 is wound, as the winding operation proceeds, time for rotating the package one time becomes longer. Thus, the number of rotations may be applied at the time of a small diameter in which a wound amount of the package 30 is small and thereby the time for one rotation of the package 30 is short. The period of time may be applied at the time of a large diameter in which the wound amount of the package 30 is large and thereby the time for one rotation of the package 30 is long.

[0090] When the clearer 15 cannot detect the upper yarn that has been guided after the completion of the guiding operation, the determination can be made that guiding of the yarn end 30a of the package 30 to the splicer device 14 has failed. The guiding failure may be a failure in the first catching operation, a failure in the second catching operation, a failure in the guiding operation, or the like. In a case where the determination is

made that the guiding has failed, the unit control section 50 controls the upper-yarn catching member 26 to perform a repeating operation in which the catching operation, the standby operation and the guiding operation are repeated. With this configuration, since there is performed the repeating operation in which each of the operations is repeated by the upper-yarn catching member 26 in the case where guiding of the yarn 20 from the package 30 to the yarn joining device 14 has failed, guiding of the yarn 20 from the package 30 can be performed again without manual operation by the operator. The unit control section 50 is configured capable of setting the control value relating to the adjustment of the second catching operation of the upper-yarn catching member 26 in performing the repeating operation. With this configuration, in the case where guiding of the yarn 20 from the package 30 to the splicer device 14 has failed, the second catching operation by the upper-yarn catching member 26 can be controlled under a different condition when the repeating operation to repeat each of the above-described operations is being performed. The period of time or the number of rotations of the second catching operation, e.g., can be sufficiently large. Consequently, success rate of the guiding of the yarn 20 from the package 30 can be improved. Furthermore, since the repeating operation is performed only at the time of the guiding failure, even if the period of time and the number of rotations are sufficiently large, operation time is not considerably extended.

[0091] In the above-described embodiment, the diameter of the package 30 is detected by detecting the swing angle of the cradle 23 with the angle sensor 44. However, the diameter of the package 30 may be detected by another method. The diameter of the package 30 can be acquired based on, e.g., a total length of the yarn 20 wound around the package 30, a winding speed of the yarn 20 and a yarn type (a thickness or the like of the yarn 20).

[0092] The diameter of the package 30 may also be acquired by measuring time from the start of winding the yarn 20. In a case where the winding speed and the yarn type (the thickness or the like of the yarn 20) are known, the diameter of the package 30 can be acquired by calculating based on the time elapsed from the start of winding the yarn 20. By storing in the unit control section 50 in advance, a relation between the time elapsed from the start of winding and the diameter of the package 30, the diameter of the package 30 can be acquired based on the elapsed time. When the winding is interrupted by the yarn disconnection, the yarn joining operation, or the like, measurement of the time elapsed from the start of winding is interrupted.

[0093] The diameter of the package 30 may also be calculated based on a travelling speed of the yarn 20. Specifically, a traverse angle is calculated by the travelling speed and a traverse speed of the yarn 20. Furthermore, a peripheral speed of the package 30 is acquired based on the traverse angle and the yarn travelling

speed. Then, the diameter of the package 30 is calculated based on the rotational speed and the peripheral speed of the package 30.

Claims

1. A yarn winding machine (10) comprising:

a winding unit main body (16) adapted to form a package (30) by winding a yarn (20);
 a first catching and guiding device (26) provided in the winding unit main body (16) and adapted to suck and catch the yarn (20) from the package (30) and to guide the yarn (20); **characterized by**
 a control section (50) adapted to control the first catching and guiding device (26) to perform a first catching operation at a catching region (R1) to suck and catch the yarn (20) from the package (30), a separating operation to separate the first catching and guiding device (26) at the catching region (R1) from the package (30) to withdraw the yarn (20), which has been sucked and caught, from a surface of the package (30), a guiding operation to guide the yarn (20) to a target region (R3), and a second catching operation at the catching region (R1) to suck and catch the yarn (20) from the package (30) again between the separating operation and the guiding operation; and
 a setting section (91) adapted to set a control value relating to adjustment of the second catching operation by the first catching and guiding device (26).

2. The yarn winding machine (10) according to claim 1, further comprising:

a yarn supplying section (11) adapted to supply the yarn (20) to be wound around the package (30);
 a second catching and guiding device (25) adapted to catch the yarn (20) from the yarn supplying section (11) and to guide the yarn (20);
 a yarn joining device (14) adapted to join the yarn (20) from the package (30) guided by the first catching and guiding device (26) and the yarn (20) from the yarn supplying section (11) guided by the second catching and guiding device (25) when continuation of the yarn (20) between the package (30) and the yarn supplying section (11) is disconnected; and
 a yarn detecting device (15) provided in a path where the yarn (20) travels during yarn winding operation, the yarn detecting device (15) being adapted to determine whether or not the yarn (20) from the package (30) has been guided to

the yarn joining device (14) by the first catching and guiding device (26), **characterized in that** the target region (R3) is adapted to serve as a receiving position where the yarn joining device (14) receives the yarn (20).

3. The yarn winding machine (10) according to claim 1 or claim 2, **characterized in that** the control section (50) is adapted to control the first catching and guiding device (26) to perform a repeating operation to perform each of the first catching operation, the separating operation, the second catching operation and the guiding operation again in a case where a determination is made by the yarn detecting device (15) that guiding of the yarn (20) from the package (30) to the yarn joining device (14) by the first catching and guiding device (26) has failed.

4. The yarn winding machine (10) according to claim 3, **characterized in that** the setting section (91) is adapted to be capable of setting a control value relating to adjustment of the second catching operation by the first catching and guiding device (26) in performing the repeating operation.

5. The yarn winding machine (10) according to any one of claim 1 through claim 4, **characterized in that** the setting section (91) includes at least either one of a time setting section (911) adapted to set a period of time in which the second catching operation is performed or a number-of-rotation setting section (912) adapted to set the number of rotations for the second catching operation, the control section (50) is adapted to control the first catching and guiding device (26) to perform the second catching operation based on at least either one of the period of time set by the time setting section (911) or the number of rotations set by the number-of-rotation setting section (912).

6. The yarn winding machine (10) according to claim 5, **characterized in that** the control section (50) is adapted to control the first catching and guiding device (26) to perform the second catching operation with a priority on the period of time in a case where the setting section (91) sets both of the period of time with the time setting section (911) and the number of rotations with the number-of-rotation setting section (912).

7. The yarn winding machine (10) according to claim 5, **characterized in that** the control section (50) is adapted control the first catching and guiding device (26) to perform the second catching operation with a priority on the number of rotations in the case where the setting section (91) sets both of the period of time with the time setting section (911) and the number of rotations with the number-of-rotation setting section (912).

8. The yarn winding machine (10) according to any one of claim 2 through claim 7, **characterized in that** in a case where a yarn defect is included in the yarn (20) being wound around the package (30), the yarn detecting device (15) is a yarn defect detecting section (15) adapted to detect the yarn defect. 5
9. The yarn winding machine (10) according to claim 8, **characterized in that** a yarn supplying bobbin around which a yarn is wound can be set in the yarn supplying bobbin (11). 10
10. A textile machine (1) comprising a plurality of the yarn winding machines (10) according to any one of claim 1 through claim 9, the textile machine (1) being **characterized by** including a machine setting device (90) adapted to control each of the yarn winding machines (10), wherein the setting section (91) is provided in the machine setting device (90). 15
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- 50
- 55

FIG. 1

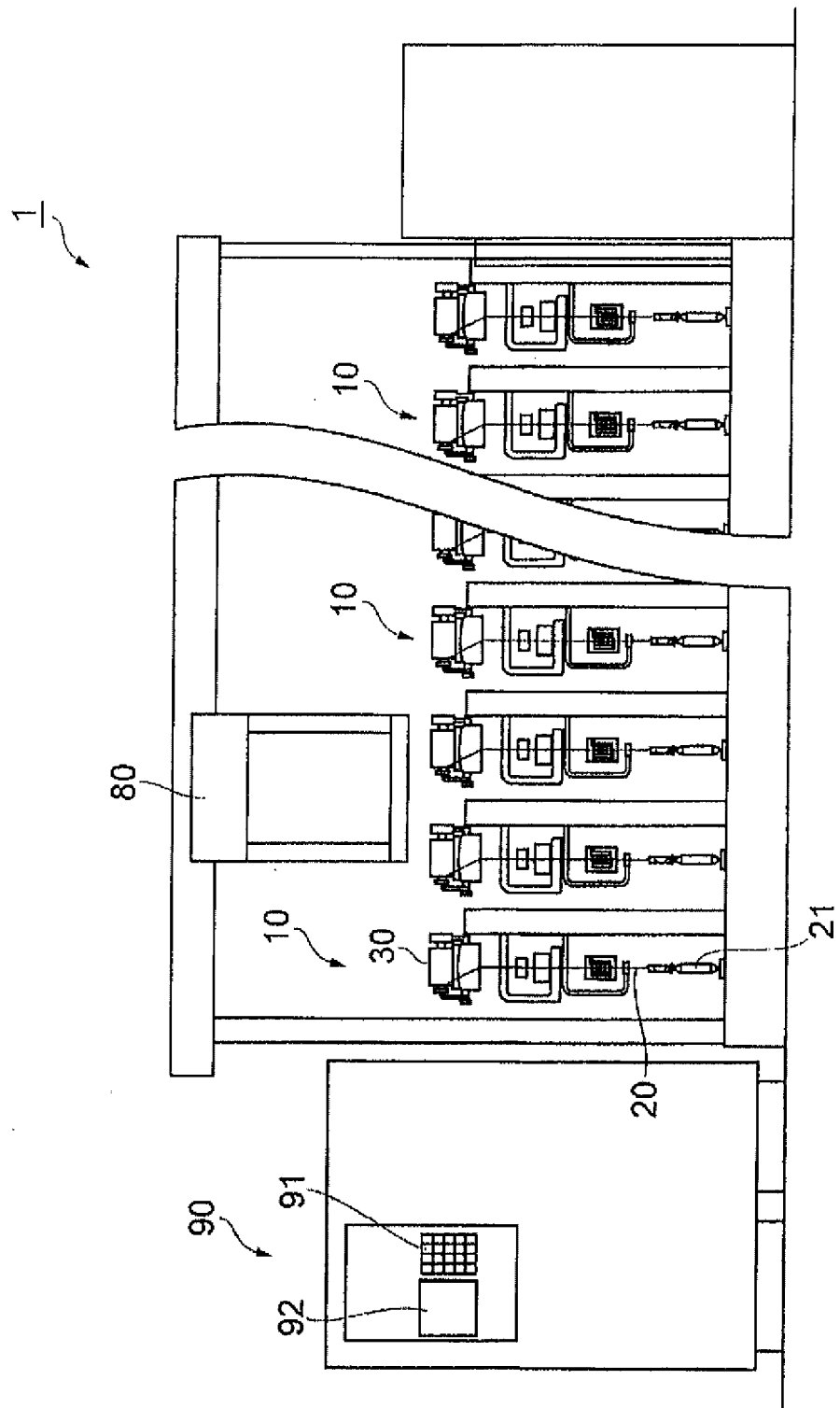


FIG. 2

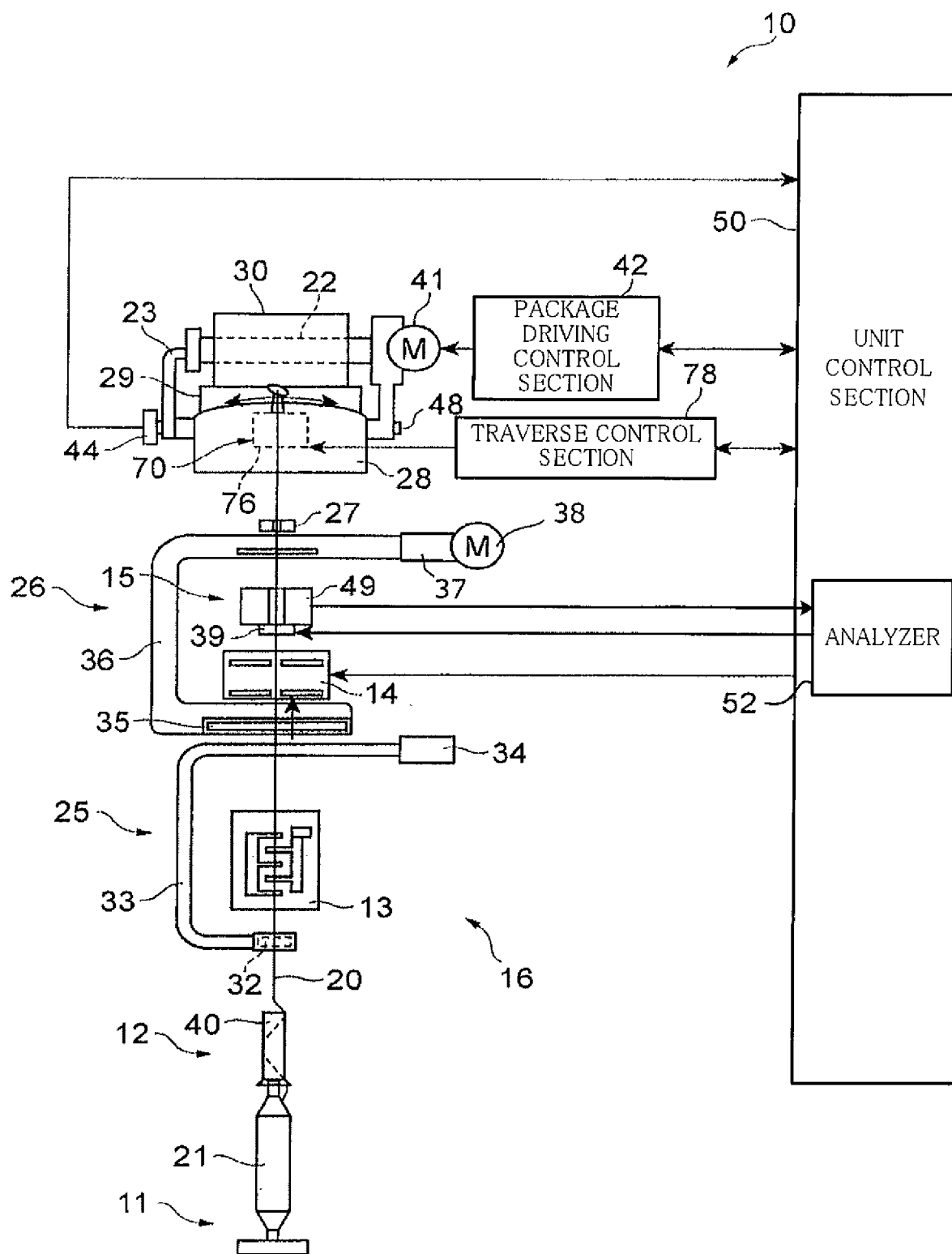


FIG. 3

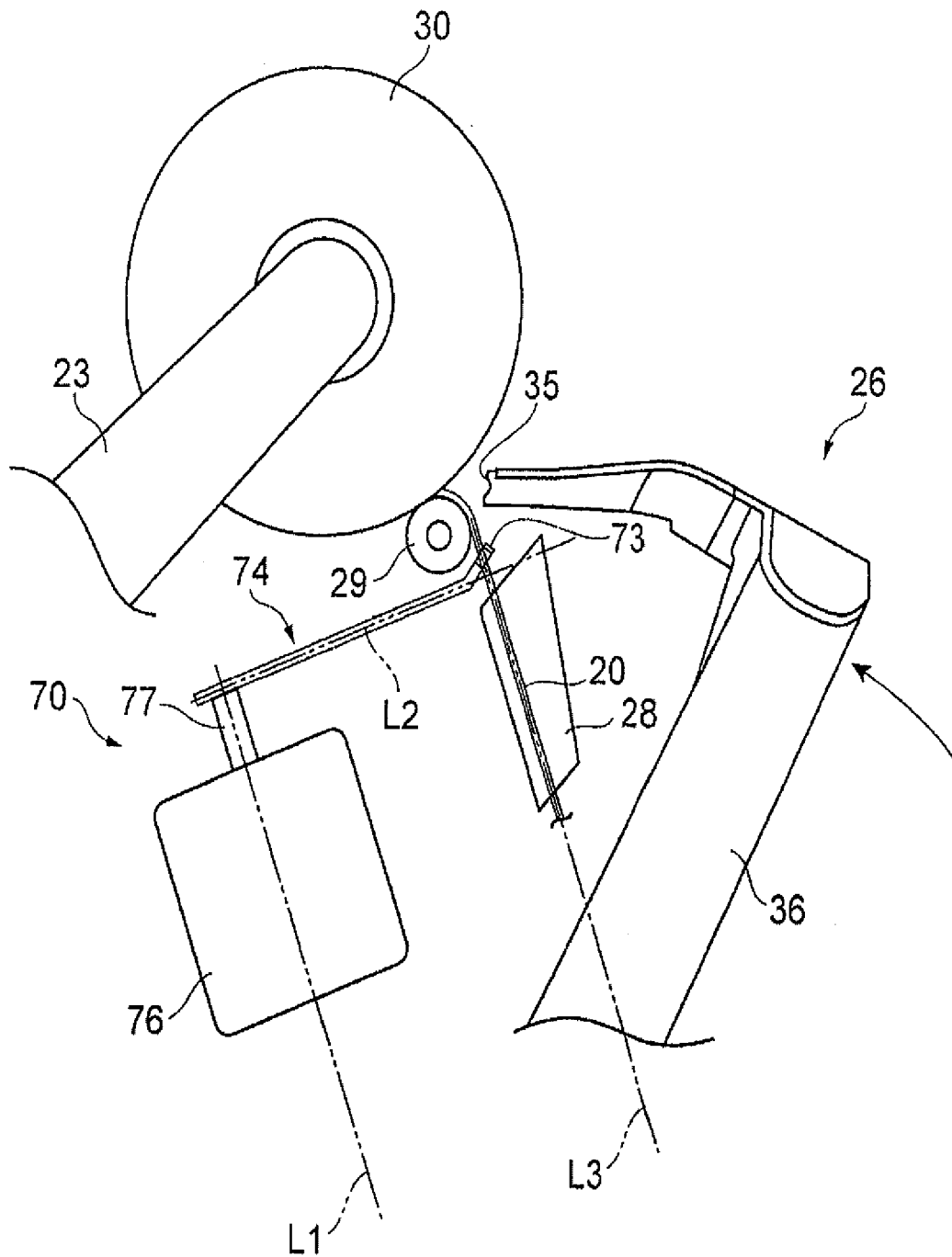


FIG. 4

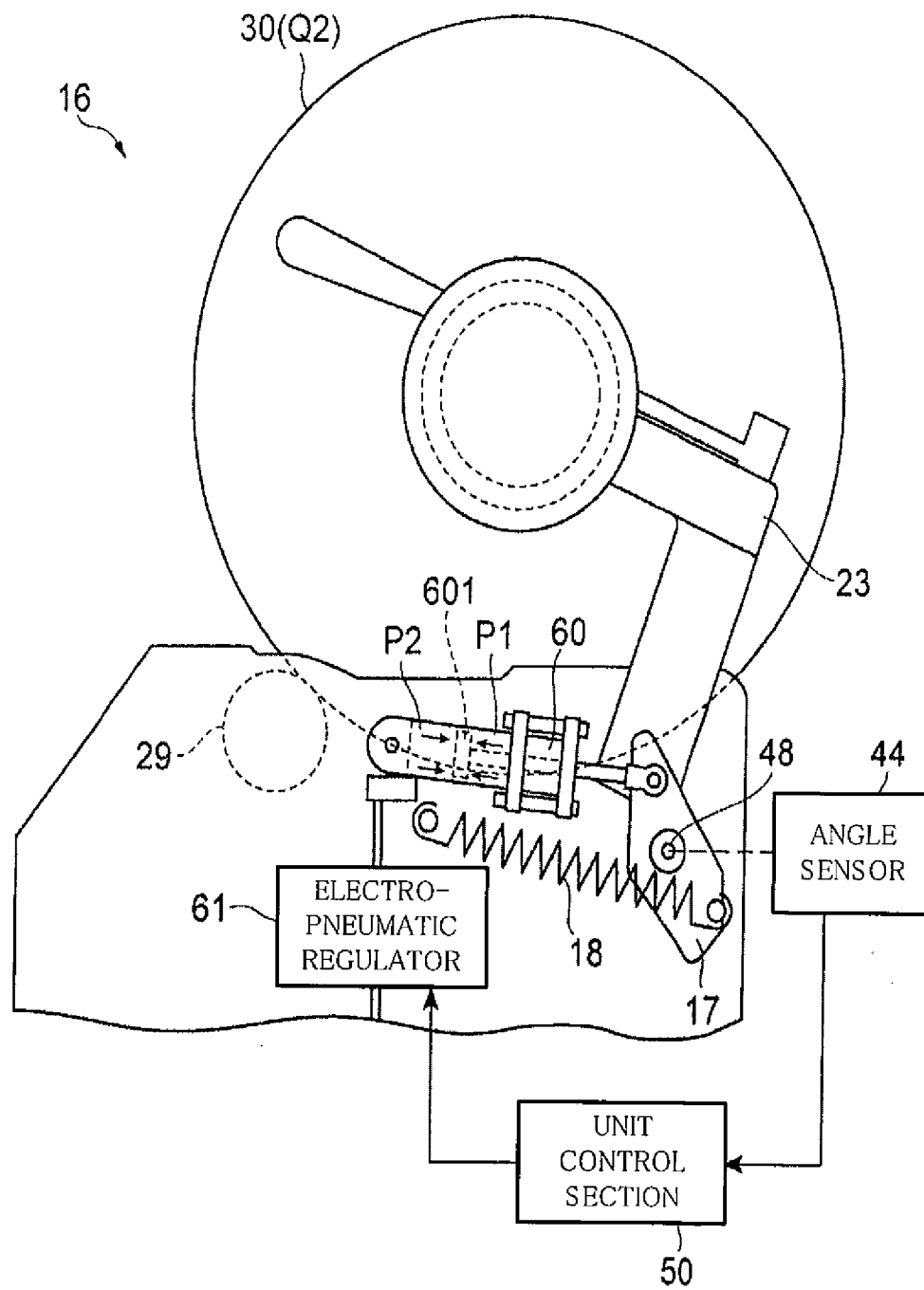


FIG. 7

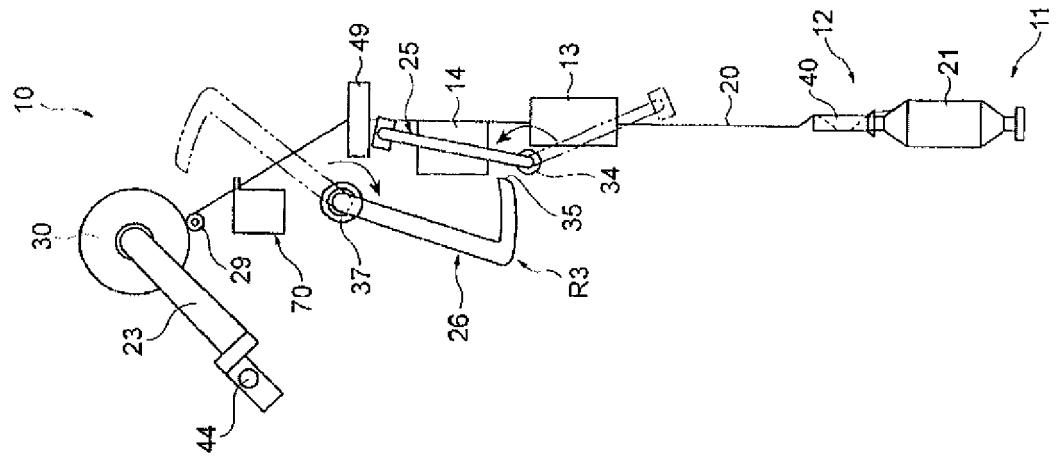


FIG. 6

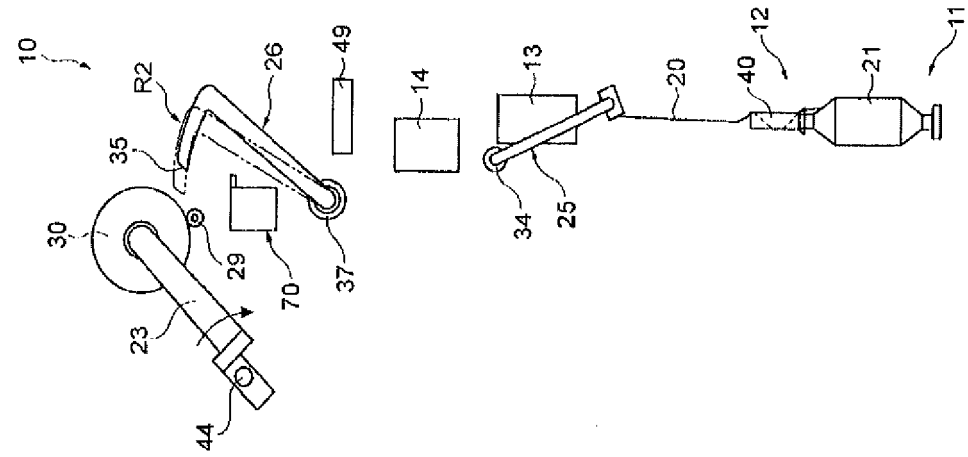


FIG. 5

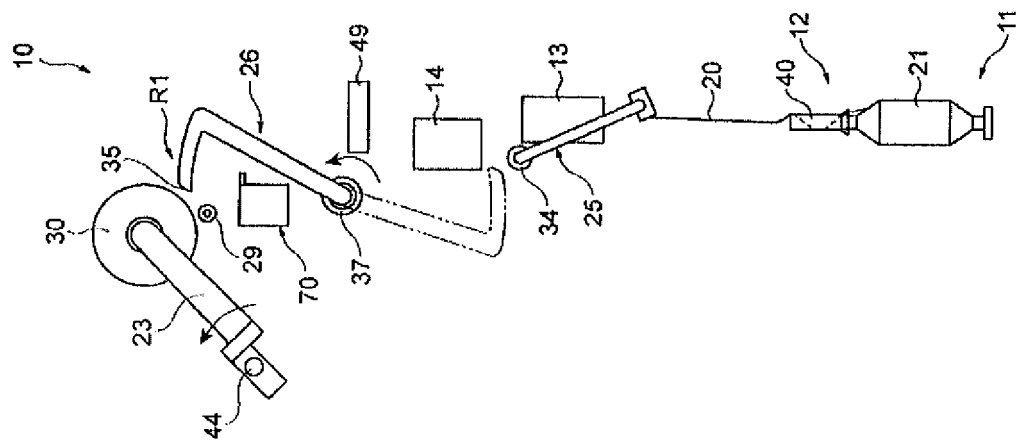


FIG. 8

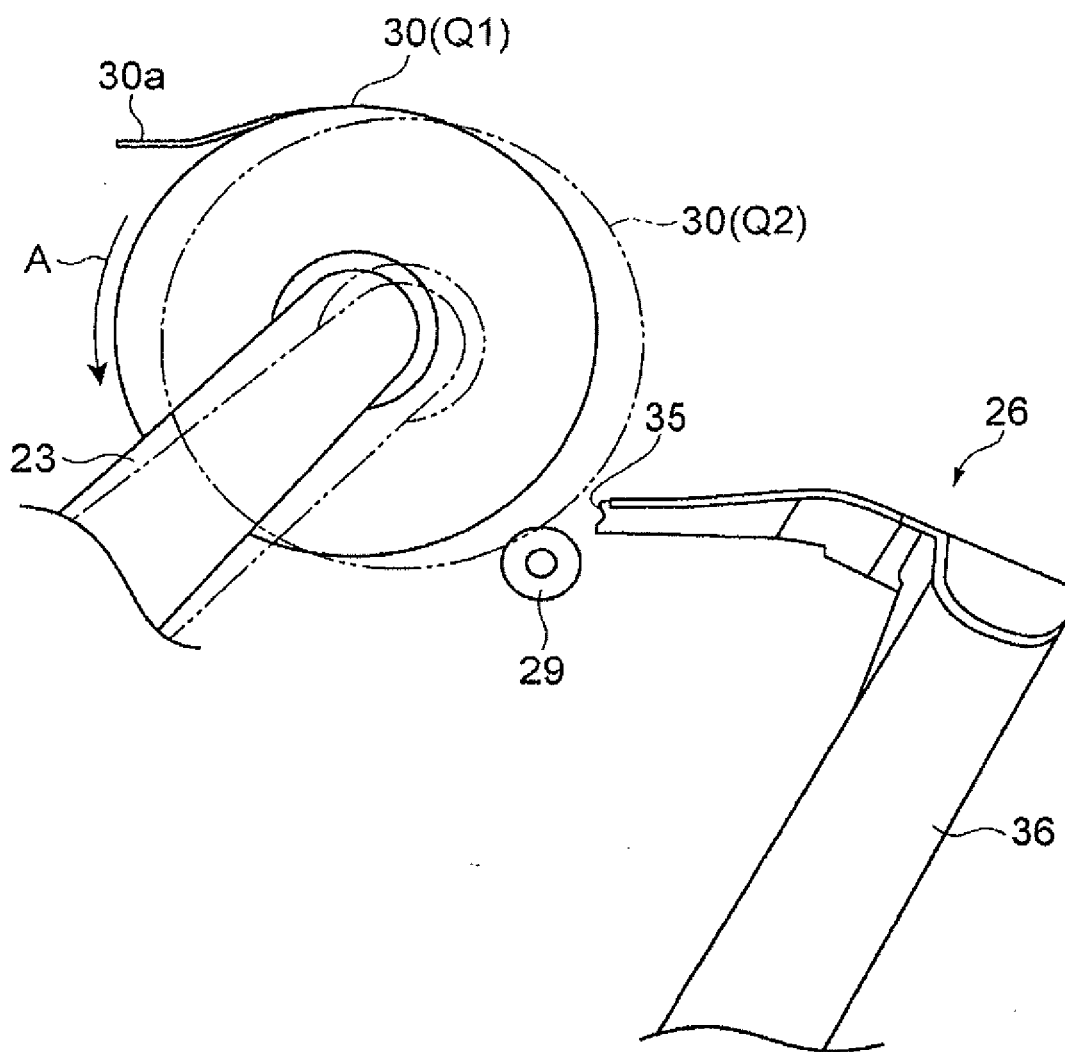


FIG. 9

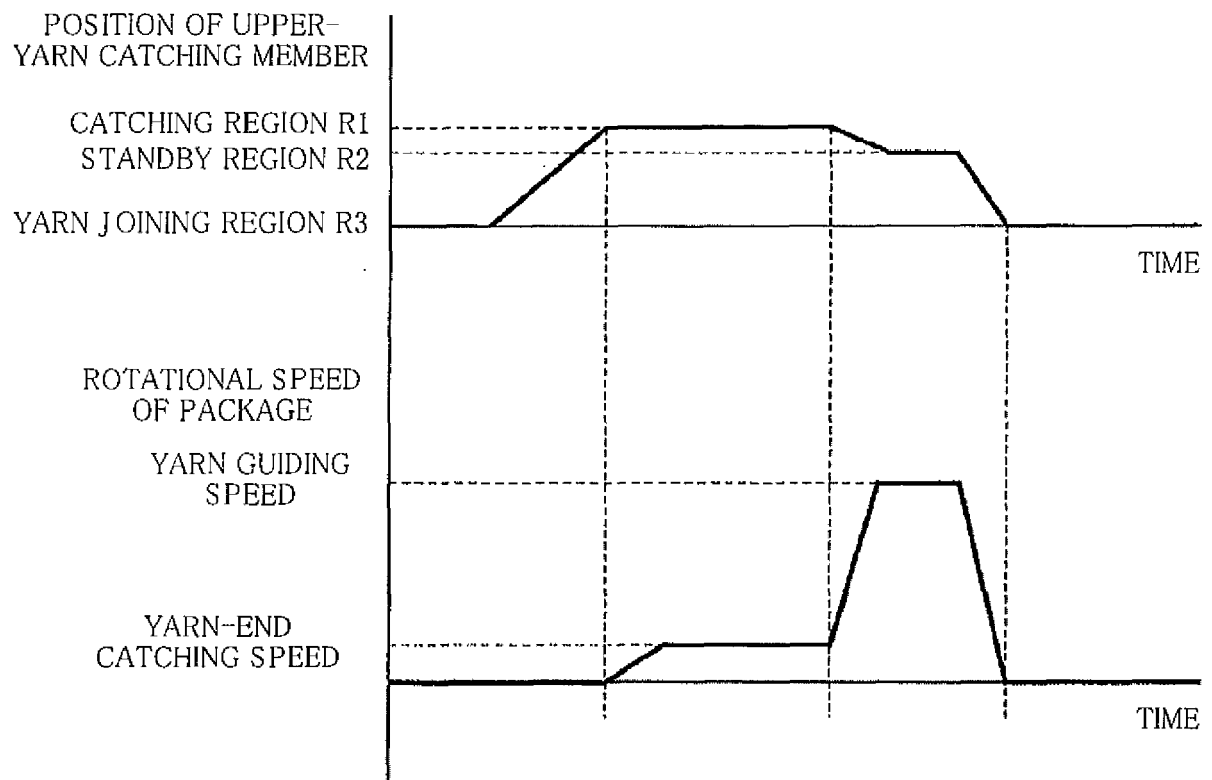


FIG. 10

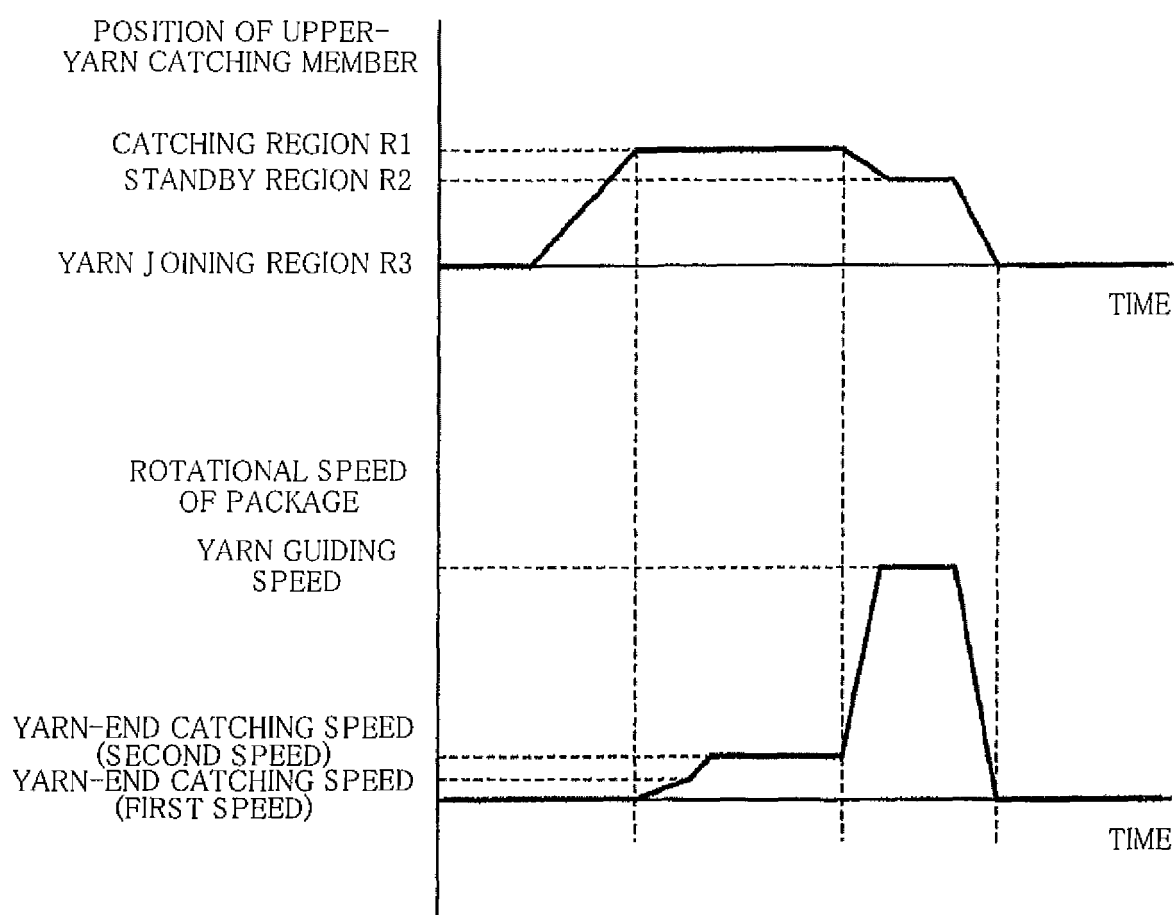


FIG. 11

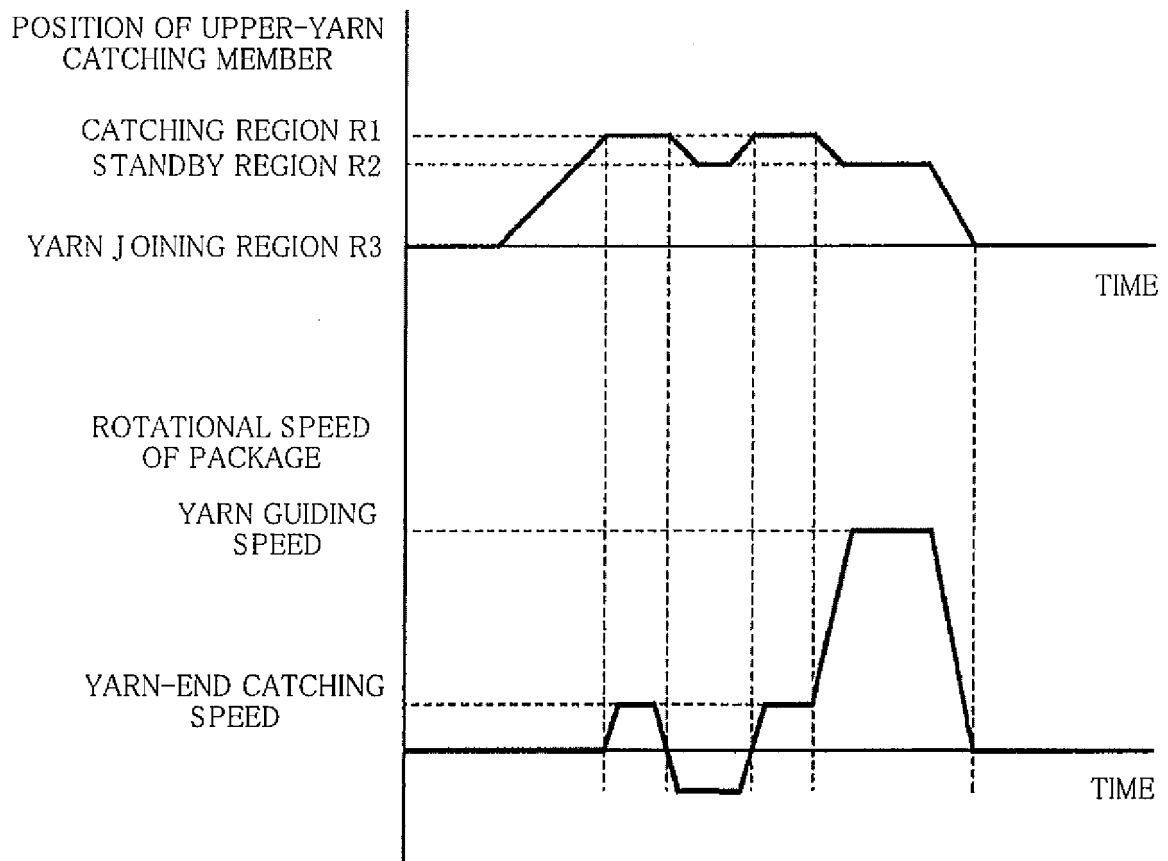


FIG. 12

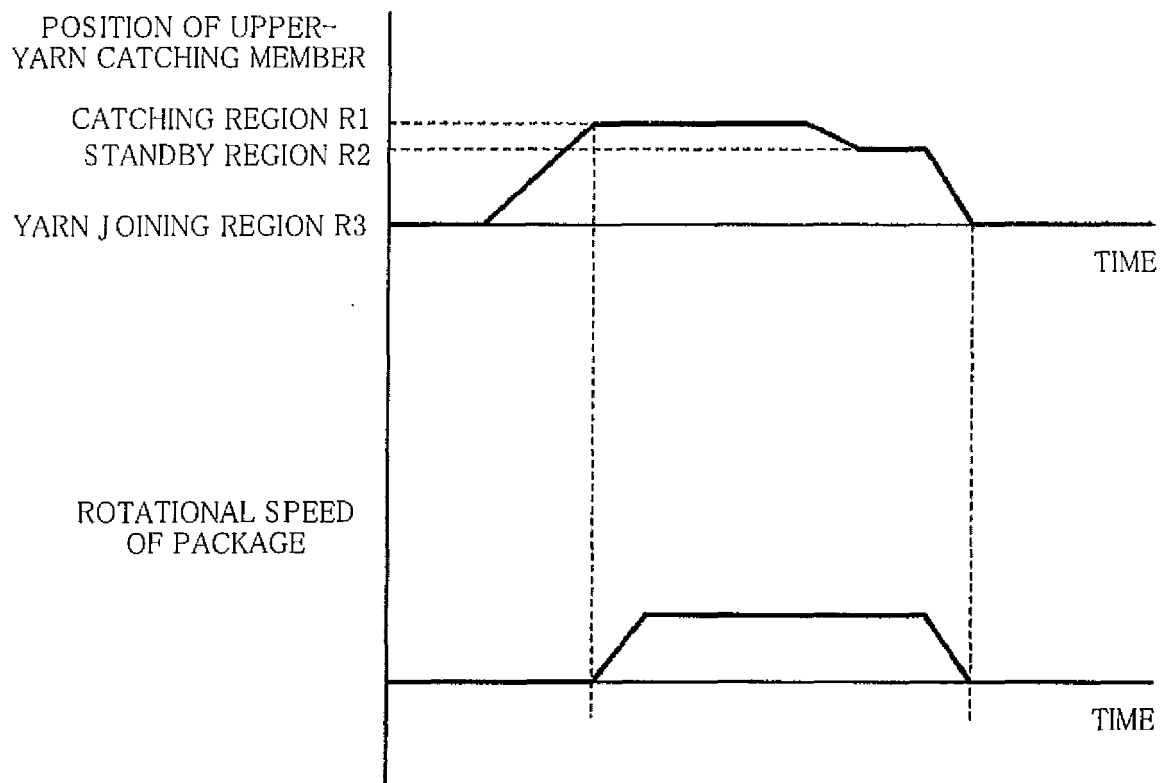


FIG. 13

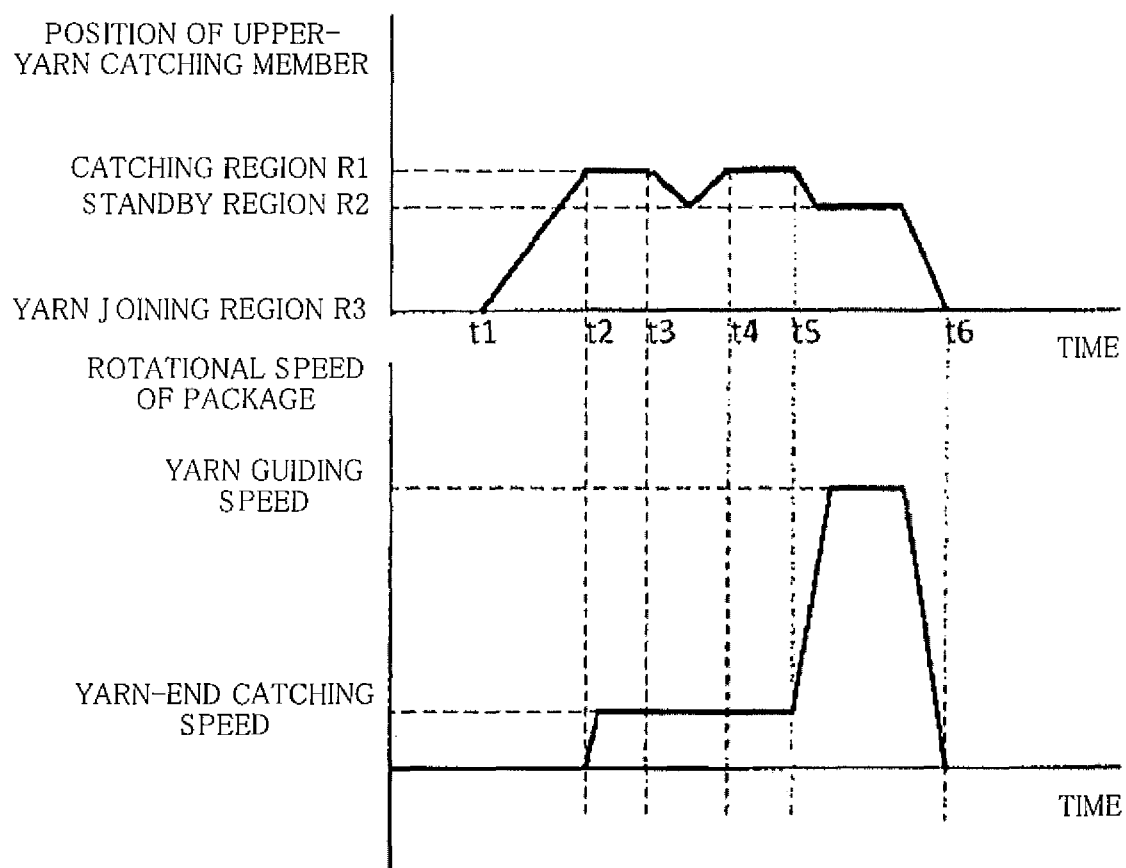


FIG. 14

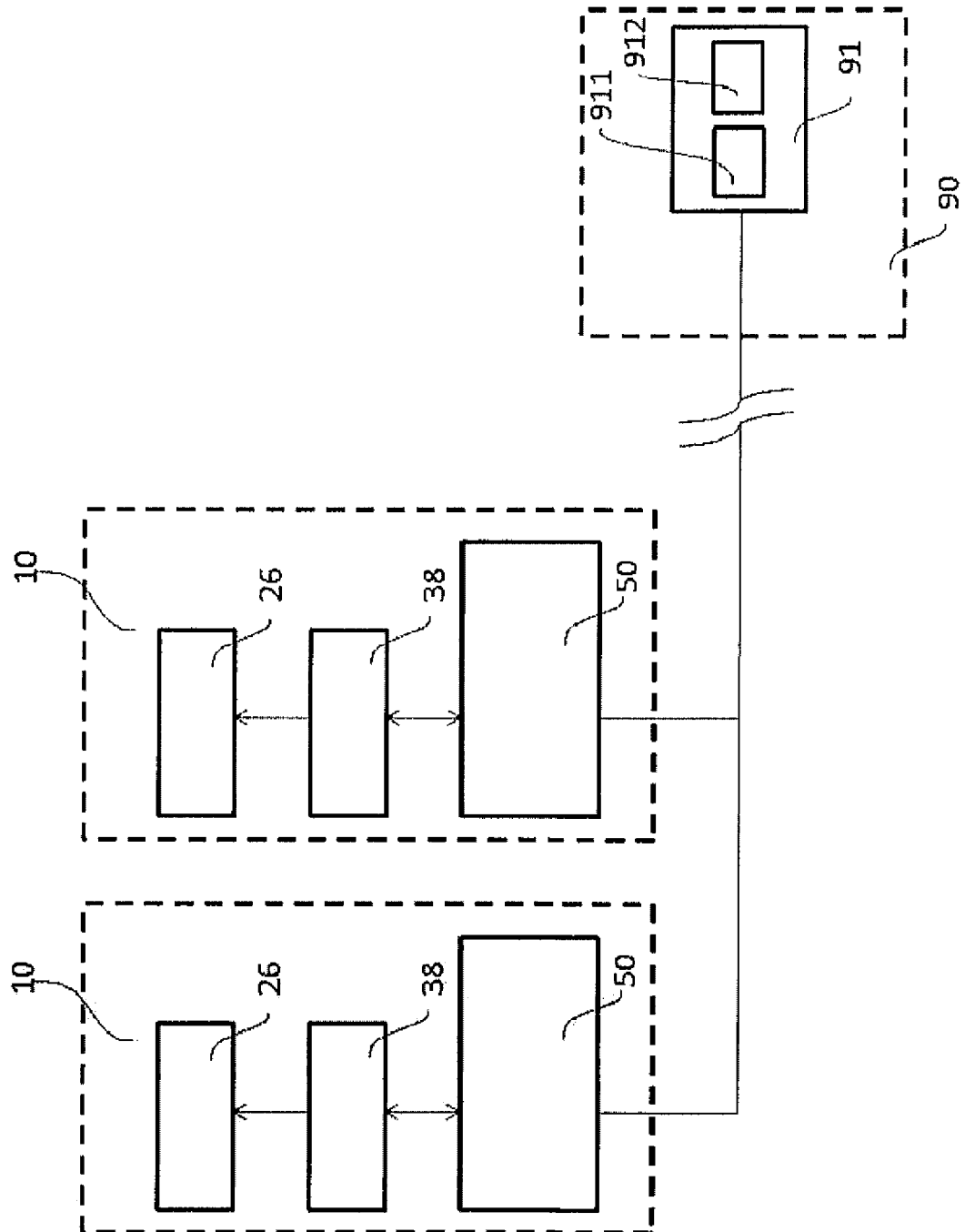
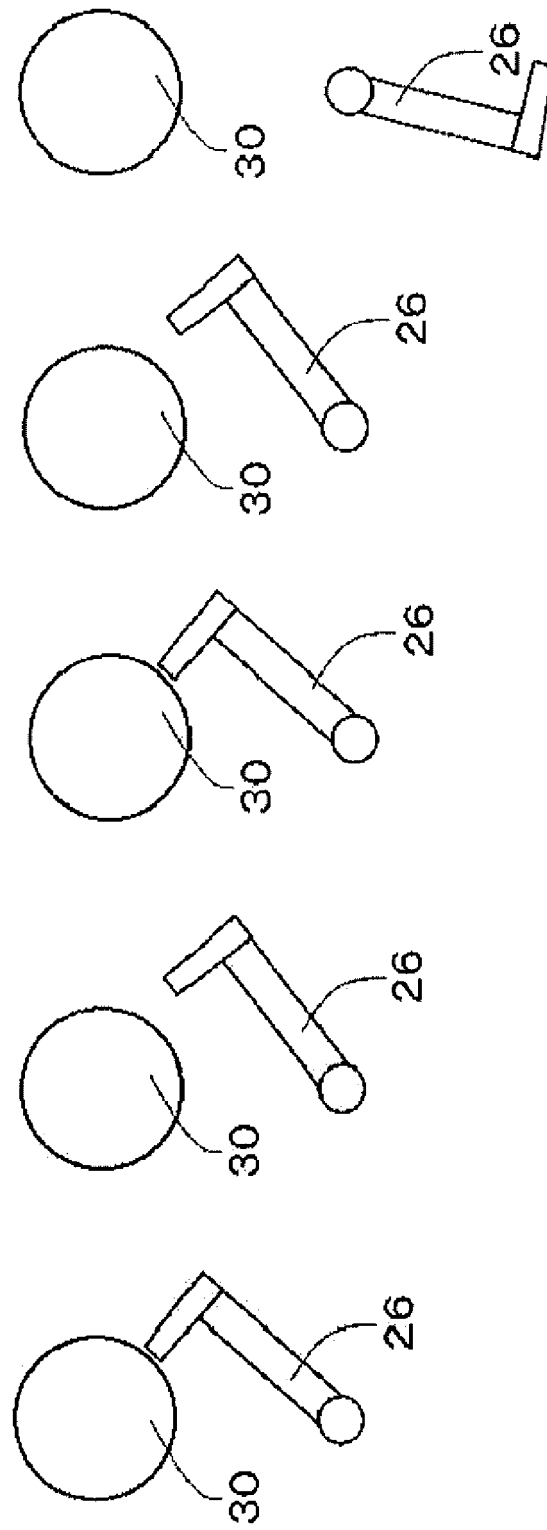


FIG. 15A FIG. 15B FIG. 15C FIG. 15D FIG. 15E



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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