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(72) Inventors:
• **KAWAMOTO Kenji**
Kyoto-shi
Kyoto 612-8686 (JP)
• **IDO Kenichi**
Kyoto-shi
Kyoto 612-8686 (JP)

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(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

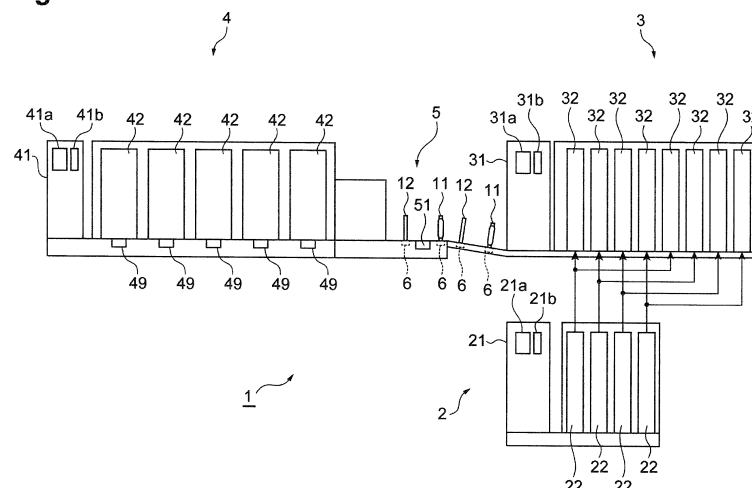
(71) Applicant: **Murata Machinery, Ltd.**
Kyoto-shi, Kyoto 601-8326 (JP)

(54) **YARN WINDING SYSTEM, AUTOMATIC WINDER, SPINNING FRAME AND YARN WINDING METHOD**

(57) A yarn winding system 1 includes: a spinning frame 3 configured to form a yarn supply bobbin 11; and an automatic winder 4 configured to wind yarn 14 from the yarn supply bobbin 11 to form a package 15. The spinning frame 3 includes an output unit 31c configured to output winding information related to a winding state of the yarn 14 in the formed yarn supply bobbin 11. The automatic winder 4 includes: an acquisition unit 41c con-

figured to acquire the winding information from the spinning frame 3; a winding unit 43b configured to unwind the yarn 14 from the yarn supply bobbin 11 and wind the unwound yarn 14; and a control unit 52 configured to control winding operation of the winding unit 43b. The control unit 52 determines a winding speed of the yarn 14 in the winding unit 43b, based on the winding information acquired by the acquisition unit 41c.

Fig.1



Description

Technical Field

[0001] The present invention relates to a yarn winding system, an automatic winder, a spinning frame, and a yarn winding method.

Background Art

[0002] A yarn winding system including: a spinning frame including a plurality of spinning units each configured to form a yarn supply bobbin; and an automatic winder including a plurality of winder units each configured to wind yarn from the yarn supply bobbin to form a package has been known (see Patent Literature 1, for example).

Citation List

Patent Literature

[0003] [Patent Literature 1] European Patent Application Publication No. 2080825

Summary of Invention.

Technical Problem

[0004] Yarn supply bobbins differ in pitches of winding of yarn, tightness of winding of yarn, etc. depending on the settings in the spinning frame. In a conventional automatic winder, yarn is unwound and then wound at a constant speed for all yarn supply bobbins, irrespective of a winding state of yarn in the yarn supply bobbins. However, if yarn is unwound at a constant speed from all yarn supply bobbins, the problem as described below may arise.

[0005] For example, when the pitch in downward winding of yarn (the process in which the yarn spun by a ring spinning frame is wound from above to below when wound on a yarn supply bobbin disposed upright) in a yarn supply bobbin is relatively narrow, if the yarn unwinding speed is high, the unwound yarn drags the adjacent yarn, possibly causing a phenomenon called sloughing in which the yarn drops off in the form of a ring-shaped mass. When sloughing occurs, yarn breakage is more likely to happen. It is therefore necessary to temporarily stop winding yarn and perform splicing operation, which may reduce the work efficiency. By contrast, when the pitch in downward winding of yarn in a yarn supply bobbin is relatively wide, sloughing is less likely to occur. In this case, it is not efficient to set the unwinding speed of yarn to the same speed as when the pitch of yarn is relatively narrow.

[0006] Various aspects of the present invention aim to provide a yarn winding system, an automatic winder, a spinning frame, and a yarn winding method that can improve the work efficiency.

Solution to Problem

[0007] A yarn winding system according to one aspect of the present invention is a yarn winding system including: a spinning frame configured to form a yarn supply bobbin; and an automatic winder configured to wind yarn from the yarn supply bobbin to form a package. The spinning frame includes an output unit configured to output winding information related to a winding state of the yarn in the formed yarn supply bobbin. The automatic winder includes an acquisition unit configured to acquire the winding information from the spinning frame, a winding unit configured to unwind the yarn from the yarn supply bobbin and wind the unwound yarn, and a control unit configured to control winding operation of the winding unit. The control unit determines a winding speed of the yarn in the winding unit, based on the winding information acquired by the acquisition unit.

[0008] In this yarn winding system, the output unit of the spinning frame outputs winding information related to a winding state of the yarn in the yarn supply bobbin. The automatic winder acquires the winding information output from the output unit of the spinning frame by the acquisition unit to determine a winding speed of the yarn in the winding unit based on the acquired winding information. With this configuration, in the automatic winder, the yarn can be unwound from the yarn supply bobbin, according to the winding state of the yarn in the yarn supply bobbin. Accordingly, in the automatic winder, since unwinding of yarn suitable for the winding state of yarn in the yarn supply bobbin can be carried out (unwinding of yarn under a condition inappropriate for the winding state of yarn can be avoided), reduction in work efficiency due to sloughing and reduction in efficiency resulting from the winding speed of yarn can be suppressed. As a result, in the yarn winding system, the work efficiency can be improved.

[0009] In one embodiment, the winding information may include at least one of information indicating pitch of winding of the yarn in the yarn supply bobbin, information indicating tightness of winding of the yarn in the yarn supply bobbin, and information indicating yarn tension during winding of the yarn in the yarn supply bobbin. The winding information includes these pieces of information whereby in the automatic winder, the operation of the winding unit can be controlled according to each information. Accordingly, in the yarn winding system, the yarn can be wound according to the winding state of yarn in the yarn supply bobbin.

[0010] In one embodiment, the output unit and the acquisition unit may be connected to be able to communicate with each other. The output unit may output the winding information to the acquisition unit, and the acquisition unit may acquire the winding information output from the output unit. In this manner, the winding information is directly output from the output unit to the acquisition unit whereby the automatic winder can acquire the winding information accurately and promptly.

[0011] An automatic winder according to one aspect of the present invention is an automatic winder configured to wind yarn of a yarn supply bobbin supplied from a spinning frame to form a package. The automatic winder includes: an acquisition unit configured to acquire winding information related to a winding state of the yarn in the yarn supply bobbin from the spinning frame; a winding unit configured to unwind the yarn from the yarn supply bobbin and wind the unwound yarn; and a control unit configured to control winding operation of the winding unit. The control unit determines a winding speed of the yarn in the winding unit, based on the winding information acquired by the acquisition unit.

[0012] In this automatic winder, the acquisition unit acquires winding information related to a winding state of the yarn in the yarn supply bobbin from the spinning frame. The control unit determines a winding speed of the yarn in the winding unit, based on the winding information acquired by the acquisition unit. With this configuration, in the automatic winder, the yarn can be unwound from the yarn supply bobbin according to the winding state of the yarn in the yarn supply bobbin. Accordingly, in the automatic winder, since unwinding of yarn suitable for the winding state of yarn in the yarn supply bobbin can be carried out (unwinding of yarn under a condition inappropriate for the winding state of yarn can be avoided), reduction in work efficiency due to sloughing and reduction in efficiency resulting from the winding speed of yarn can be suppressed. As a result, in the automatic winder, the work efficiency can be improved.

[0013] A spinning frame according to one aspect of the present invention is a spinning frame configured to form a yarn supply bobbin to be supplied to an automatic winder. The spinning frame includes an output unit configured to output winding information related to a winding state of yarn in the yarn supply bobbin.

[0014] In this spinning frame, the output unit outputs winding information related to a winding state of yarn in the yarn supply bobbin. When the automatic winder acquires the winding information output from the output unit, in the automatic winder, the yarn can be unwound from the yarn supply bobbin according to the winding state of yarn in the yarn supply bobbin. Accordingly, in the automatic winder, since unwinding of yarn suitable for the winding state of yarn in the yarn supply bobbin can be carried out (unwinding of yarn under a condition inappropriate for the winding state of yarn can be avoided), reduction in work efficiency due to sloughing and reduction in efficiency resulting from the winding speed of yarn can be suppressed. As a result, in the spinning frame, the work efficiency can be improved.

[0015] In one embodiment, the output unit may output the winding information to the automatic winder. Thus, in the spinning frame, the yarn can be wound according to the winding state of yarn in the yarn supply bobbin in the automatic winder that has acquired the winding information.

[0016] A yarn winding method according to one aspect

of the present invention is a yarn winding method performed in a yarn winding system including a spinning frame configured to form a yarn supply bobbin and an automatic winder configured to wind yarn from the yarn supply bobbin to form a package. The yarn winding method includes: outputting, by the spinning frame, winding information related to a winding state of the yarn in the formed yarn supply bobbin; and acquiring, by the automatic winder, the winding information output from the spinning frame to determine a winding speed of the yarn based on the winding information.

[0017] In this yarn winding method, the automatic winder acquires the winding information output from the spinning frame to determine a winding speed of the yarn based on the winding information. Thus, the yarn can be unwound from the yarn supply bobbin, according to the winding state of yarn in the yarn supply bobbin. Accordingly, since unwinding of yarn suitable for the winding state of yarn in the yarn supply bobbin can be carried out (unwinding of yarn under a condition inappropriate for the winding state of yarn can be avoided), reduction in work efficiency due to sloughing and reduction in efficiency resulting from the winding speed of yarn can be suppressed. As a result, in the yarn winding method, the work efficiency can be improved.

[0018] In one embodiment, the spinning frame may output the winding information including information indicating pitch of winding of the yarn in the yarn supply bobbin, and the automatic winder may set the winding speed to a first reference speed or higher when pitch of winding of the yarn is equal to or greater than a first reference value, and may set the winding speed to less than the first reference speed when pitch of winding of the yarn is less than the first reference value. Thus, in the yarn winding method, unwinding of yarn can be carried out according to the pitch of winding of yarn in the yarn supply bobbin.

[0019] In one embodiment, the spinning frame may output the winding information including information indicating tightness of winding of the yarn in the yarn supply bobbin, and the automatic winder may set the winding speed to a second reference speed or higher when tightness of winding of the yarn is equal to or greater than a second reference value, and may set the winding speed to less than the second reference speed when tightness of winding of the yarn is less than the second reference value. Thus, in the yarn winding method, unwinding of yarn can be carried out according to the tightness of winding of yarn in the yarn supply bobbin.

[0020] In one embodiment, the spinning frame may output the winding information including information indicating yarn tension during winding of the yarn in the yarn supply bobbin, and the automatic winder may set the winding speed to a third reference speed or higher when yarn tension is equal to or greater than a third reference value. Thus, in the yarn winding method, unwinding of yarn can be carried out according to the yarn tension during winding of yarn in the yarn supply bobbin.

Advantageous Effects of Invention

[0021] According to various aspects of the present invention, the work efficiency can be improved.

Brief Description of Drawings

[0022]

FIG. 1 is a front view of a yarn winding system according to one embodiment;

FIG. 2 is a perspective view of trays, empty bobbins, and a yarn supply bobbin that are conveyed in the yarn winding system in FIG. 1;

FIG. 3 is a side view of a spinning unit of the yarn winding system in FIG. 1;

FIG. 4 is a side view of a winder unit of the yarn winding system in FIG. 1;

FIG. 5 is a block diagram illustrating a configuration of the yarn winding system; and

FIG. 6 is a partially enlarged view of the yarn supply bobbin.

Description of Embodiments

[0023] Preferred embodiments will be described in detail below with reference to the accompanying drawings. In the description of the drawings, like or equivalent elements are designated by like numerals, and duplicate description is omitted.

[0024] As depicted in FIG. 1, a yarn winding system 1 includes a roving frame 2, a spinning frame 3, an automatic winder 4, and a bobbin transfer device 5. The roving frame 2 generates roved yarn from a sliver, and winds the roved yarn to form a roved yarn bobbin. The spinning frame 3 generates yarn from the roved yarn, and winds the yarn to form a yarn supply bobbin 11. The automatic winder 4 winds the yarn from the yarn supply bobbin 11 to form a package. The bobbin transfer device 5 transfers the yarn supply bobbin 11 from the spinning frame 3 to the automatic winder 4, and transfers an empty bobbin 12 (bobbin around which yarn is not wound) from the automatic winder 4 to the spinning frame 3. The bobbin transfer device 5 is provided with a bobbin preparation device and a residual yarn processing device, for example. The bobbin preparation device performs preliminary preparation for the automatic winder 4 to process the yarn of the yarn supply bobbin 11. When yarn remains on the bobbin 12 that has been discharged from the yarn supply bobbin 11, the residual yarn processing device removes the yarn to form an empty bobbin 12. For this purpose, the bobbin transfer device 5 has a complicated transfer path having many curves.

[0025] The yarn supply bobbin 11 and the empty bobbin 12 are transferred in a manner being set on respective trays 6. As depicted in FIG. 2, each of the trays 6 has a disk-like base portion 61, a pin 62 protruding upward from the base portion 61, and a radio frequency (RF) tag 63

embedded in the base portion 61. The pin 62 is inserted into the bottom portion 12a of each of the bobbins 12 whereby the yarn supply bobbin 11 and the empty bobbin 12 are set on the respective trays 6 with the top portions 12b of the bobbins 12 facing upward. The RF tag 63 stores therein information on the yarn supply bobbin 11 set on the tray 6. In the yarn winding system 1, the status of the yarn supply bobbin 11 set on the tray 6 is managed by a radio frequency identification (RFID: individual identification using radio waves) technology.

[0026] As depicted in FIG. 1, the roving frame 2 includes a control device 21 configured to control operation of the roving frame 2 and a plurality of roving units 22 each configured to form a roved yarn bobbin. The control device 21 includes a display unit 21a such as a display and an operation unit 21b such as input keys. The display unit 21a displays, for example, an operating status of each roving unit 22. The operation unit 21b allows an operator to set operating conditions, for example, of each roving unit 22.

[0027] The spinning frame 3 includes a control device 31 configured to control operation of the spinning frame 3 and a plurality of spinning units 32 each configured to form a yarn supply bobbin 11. The control device 31 includes a display unit 31a such as a display, an operation unit 31b such as input keys, and a communication unit (output unit) 31c (see FIG. 5). The display unit 31a displays, for example, an operating status of each of the spinning units 32. The operation unit 31b allows the operator to set operating conditions, for example, of each of the spinning unit 32. The communication unit 31c communicates with the automatic winder 4. The communication unit 31c is connected to be able to communicate with the communication unit 41c described later by radio or by wire.

[0028] As depicted in FIG. 3, the spinning unit 32 includes a drafting device 33 and a twisting device 34.

[0029] The drafting device 33 includes a back roller pair 33a, a middle roller pair 33b, and a front roller pair 33c. Each pair of the back roller pair 33a, the middle roller pair 33b, and the front roller pair 33c are configured with a bottom roller and a top roller. Around the rollers constituting the middle roller pair 33b, apron belts are each wound. In the drafting device 33, the back roller pair 33a, the middle roller pair 33b, and the front roller pair 33c are rotated at a predetermined speed ratio, whereby a roved yarn 13 that has been unwound from a roved yarn bobbin is drafted.

[0030] The twisting device 34 includes a spindle shaft 35, a ring rail 36, a ring 37, and a traveller 38. The spindle shaft 35 holds the bottom portion 12a of a bobbin 12 with the top portion 12b of the bobbin 12 facing upward, and rotates the bobbin 12. The ring rail 36 is movable in the axial direction of the bobbin 12. The ring 37 is fixed to the ring rail 36. The traveller 38 is supported by the ring 37, and is movable along the ring 37.

[0031] In the twisting device 34, roved yarn 13 that has been drafted by the drafting device 33 is inserted into a

space between the ring 37 and the traveller 38, and an end portion of the roved yarn 13 is fixed to the bobbin 12. In the twisting device 34, in this state, when the spindle shaft 35 rotates the bobbin 12, the traveller 38 moves along the ring 37 in a manner being pulled by the roved yarn 13. At this time, the ring rail 36 gradually moves from the bottom portion 12a side to the top portion 12b side while reciprocating within a predetermined range along the axial direction of the bobbin 12. In the twisting device 34, rotation of the traveller 38 lags behind rotation of the bobbin 12, whereby the roved yarn 13 is twisted to form yarn 14, and the yarn 14 is wound by the bobbin 12 to form a yarn supply bobbin 11.

[0032] The spinning frame 3 including the spinning units 32 each configured as described above is of what is called a simultaneous doffing type. Specifically, the spinning frame 3 stocks a plurality of empty bobbins 12 transferred from the automatic winder 4 by the bobbin transfer device 5, simultaneously sets the empty bobbins 12 on the respective spinning units 32, and simultaneously starts yarn winding. When winding of yarn has been completed in the respective spinning units 32 and yarn supply bobbins 11 have been formed, the spinning frame 3 simultaneously doffs all of the yarn supply bobbins 11. Subsequently, the spinning frame 3 pulls empty bobbins 12 that have been already stocked out of the corresponding trays 6 and simultaneously sets the empty bobbins on the respective spinning units 32 again and, instead, simultaneously sets the doffed yarn supply bobbins 11 on the trays 6.

[0033] The communication unit 31c of the control device 31 transmits winding information related to a winding state of yarn 14 in the yarn supply bobbin 11 formed in the spinning unit 32 to the automatic winder 4. The winding information at least includes information indicating the pitch of winding of yarn 14 in the yarn supply bobbin 11, information indicating the tightness of winding of yarn 14 in the yarn supply bobbin 11, and information indicating the yarn tension during winding of yarn 14 in the yarn supply bobbin 11.

[0034] In the present embodiment, the winding information is setting values related to formation of the yarn supply bobbin 11 that are input by the operator in the operation unit 31b. Specifically, as depicted in FIG. 6, the setting values include an upward winding pitch P1 of yarn and a downward winding pitch P2 of yarn in the yarn supply bobbin 11. As used herein the downward winding refers to a state in which yarn 14 is wound from the top portion 12b side to the bottom portion 12a side of the bobbin 12 in the yarn supply bobbin 11. The upward winding refers to a state in which yarn 14 is wound from the bottom portion 12a side to the top portion 12b side of the bobbin 12 in the yarn supply bobbin 11. In the yarn supply bobbin 11, the downward winding pitch P2 is usually set wider than the upward winding pitch P1.

[0035] The setting values also include a P value indicating the hardness (Shore hardness) of winding of yarn 14 in the yarn supply bobbin 11. The P value is rebound

hardness in the vicinity of the central portion of the yarn supply bobbin 11. The setting values also include a tension value indicating the yarn tension during winding of yarn 14 in the yarn supply bobbin 11.

[0036] The communication unit 31c transmits the winding information at a predetermined timing to the automatic winder 4. The predetermined timing may be when the setting values related to formation of the yarn supply bobbin 11 are input (when an instruction to change lots is given) or may be periodic. The predetermined timing may be when all the yarn supply bobbins 11 are simultaneously doffed or when a request for winding information is accepted from the automatic winder 4.

[0037] As depicted in FIG. 1, the automatic winder 4 includes a control device 41 configured to control operation of the automatic winder 4 and a plurality of winder units 42 each configured to form a package 15 (see FIG. 4). The control device 41 includes a display unit 41a such as a display, an operation unit 41b such as input keys, and a communication unit (acquisition unit) 41c (see FIG. 5). The display unit 41a displays, for example, an operating status of each of the winder units 42. The operation unit 41b allows the operator to set operating conditions, for example, of each of the winder unit 42. The communication unit 41c communicates with the spinning frame 3. The communication unit 41c is connected to be able to mutually communicate with the communication unit 31c. The control device 41 also controls the operation of the bobbin transfer device 5.

[0038] As depicted in FIG. 4, the winder unit 42 includes a winding device 43, a tension applying device 44, a yarn monitoring device 45, an upper yarn catching device 46, a lower yarn catching device 47, a splicing device 48, and a unit controlling unit (control unit) 52.

[0039] The winding device 43 includes a cradle 43a and a winding drum (winding unit) 43b. The cradle 43a supports a package 15. The winding drum 43b rotates the package 15 while traversing the yarn 14. Thus, the yarn 14 is wound (unwound) from a yarn supply bobbin 11 set at a predetermined position to form the package 15. The winding drum 43b is driven by a drive motor 43d (see FIG. 5). The operation of the drive motor 43d, that is, the winding drum 43b is controlled by the unit controlling unit 52. The tension applying device 44 applies a predetermined tension to the yarn 14 that is travelling from the yarn supply bobbin 11 to the package 15.

[0040] The yarn monitoring device 45 monitors the travelling yarn 14 to detect a yarn defect (thickness abnormality of yarn 14, mixing of foreign matter into yarn 14, etc.). When a yarn defect has been detected, the yarn 14 is cut by a cutter separately provided. When the yarn 14 has been cut, the upper yarn catching device 46 catches a yarn end of the yarn 14 on the package 15 side, and guides the yarn end to the splicing device 48. When the yarn 14 has been cut, the lower yarn catching device 47 catches a yarn end of the yarn 14 on the yarn supply bobbin 11 side, and guides the yarn end to the splicing device 48. The splicing device 48 splices the yarn ends

that have been guided by the upper yarn catching device 46 and the lower yarn catching device 47 to each other.

[0041] The unit controlling unit 52 centrally controls the operation of the winding device 43, the tension applying device 44, the yarn monitoring device 45, the upper yarn catching device 46, the lower yarn catching device 47, and the splicing device 48. The unit controlling unit 52 includes, for example, a central processing unit (CPU), a read only memory (ROM), a random access memory (RAM), and an input/output (I/O) port. The ROM has a program stored therein for controlling the configuration of a winding unit body 16. The parts in the winder unit 42 and the control device 41 are connected to the I/O port to communicate, for example, control information. Thus, the unit controlling unit 52 can control the operation of the parts in the winder unit 42.

[0042] The unit controlling unit 52 determines the winding speed of yarn in the winding drum 43b, based on the winding information received by the communication unit 41c. Specifically, the communication unit 41c receives and acquires the winding information transmitted from the communication unit 31c of the spinning frame 3. The communication unit 41c outputs the acquired winding information to the unit controlling unit 52 in each of the winder units 42. The unit controlling unit 52 receives the winding information output from the communication unit 41c and controls the drive motor 43d based on the setting values indicated by the winding information to determine the winding speed of yarn 14 in the winding drum 43b.

[0043] Specifically, for example, when the winding information indicates that the downward winding pitch P2 is equal to or greater than a predetermined reference pitch (first reference value), the unit controlling unit 52 sets the rotational speed of the drive motor 43d to a predetermined reference speed (first reference speed) or higher to increase the winding speed of yarn in the winding drum 43b, in unwinding from the yarn supply bobbin 11 to which the winding information is applied. Thus, in the winder unit 42, the unwinding speed of yarn 14 in the yarn supply bobbin 11 is increased.

[0044] For example, when the winding information indicates that the downward winding pitch P2 is less than a predetermined reference pitch, the unit controlling unit 52 sets the rotational speed of the drive motor 43d to less than a predetermined reference speed to decrease the winding speed of yarn in the winding drum 43b, in unwinding from the yarn supply bobbin 11 to which the winding information is applied. Thus, in the winder unit 42, the unwinding speed of yarn 14 in the yarn supply bobbin 11 is decreased. For the upward winding pitch P1, the unit controlling unit 52 also determines the winding speed of yarn 14 in the winding drum 43b based on a reference pitch.

[0045] The reference pitch and the reference speed are values set according to conditions such as yarn count and kind and set appropriately, for example, based on experiments. The unit controlling unit 52 may determine the rotational speed of the drive motor 43d according to

the difference of the value of the downward winding pitch P2 from the reference pitch. Alternatively, the unit controlling unit 52 may set a plurality of thresholds for the difference of the downward winding pitch P2 from the reference pitch to determine the rotational speed of the drive motor 43d in stages based on the thresholds.

[0046] For example, when the winding information indicates that the P value of the hardness of the yarn supply bobbin 11 is equal to or greater than a reference P value (second reference value) (the yarn 14 is wound relatively tightly), the unit controlling unit 52 sets the rotational speed of the drive motor 43d to a predetermined reference speed (second reference speed) or higher to increase the winding speed of yarn in the winding drum 43b, in unwinding from the yarn supply bobbin 11 to which the winding information is applied. Thus, in the winder unit 42, the unwinding speed of yarn 14 in the yarn supply bobbin 11 is increased.

[0047] For example, when the winding information indicates that the P value of the hardness of the yarn supply bobbin 11 is less than a reference P value (the yarn 14 is wound relatively loosely), the unit controlling unit 52 sets the rotational speed of the drive motor 43d to less than a predetermined reference speed to decrease the winding speed of yarn in the winding drum 43b, in unwinding from the yarn supply bobbin 11 to which the winding information is applied. Thus, in the winder unit 42, the unwinding speed of yarn 14 in the yarn supply bobbin 11 is decreased. The reference value is a value set according to conditions such as yarn count and kind and set appropriately, for example, based on experiments.

[0048] For example, when the winding information indicates that the tension value indicating the yarn tension during winding of yarn 14 in the yarn supply bobbin 11 is equal to or greater than a reference tension value (third reference value) (yarn 14 is wound relatively tightly), the unit controlling unit 52 sets the rotational speed of the drive motor 43d to a predetermined reference speed (third reference speed) or higher to increase the winding speed of yarn in the winding drum 43b, in the same manner as when the P value of the hardness of the yarn supply bobbin 11 is equal to or greater than a reference value. This is because when the tension value is higher than a reference value, the P value of the hardness of the yarn supply bobbin 11 is higher than a reference value.

[0049] As depicted in FIG. 1, the bobbin transfer device 5 includes an RF writer 51. When a yarn supply bobbin 11 is transferred from the spinning frame 3 to the automatic winder 4, the RF writer 51 writes information on the yarn supply bobbin 11 on the RF tag 63 of the tray 6 on which the yarn supply bobbin 11 is set. The information on the yarn supply bobbin 11 includes unit identification information for identifying a spinning unit 32 that has formed the yarn supply bobbin 11 and doffing information for identifying timing of simultaneous doffing. The RF writer 51 may be provided to an exit of the spinning frame 3 in the transfer direction of the yarn supply bobbin 11. Alternatively, the RF writer 51 may be provided to every

spinning unit 32.

[0050] When the yarn supply bobbin 11 has been set on the winder unit 42 of the automatic winder 4, the information written on the RF tag 63 by the RF writer 51 is read by an RF reader 49 provided to each of the winder units 42, and is transmitted to the control device 41 of the automatic winder 4. Based on this information, the control device 41 can identify the spinning unit 32 that has formed the yarn supply bobbin 11 and the timing of simultaneous doffing for the yarn supply bobbin 11 set on the winder unit 42.

[0051] As explained above, in the yarn winding system 1 according to the present embodiment, the spinning frame 3 includes the communication unit 31c configured to output winding information related to the winding state of yarn 14 in the yarn supply bobbin 11 formed in the spinning unit 32. The automatic winder 4 includes the communication unit 41c configured to acquire the winding information output from the communication unit 31c of the spinning frame 3. The automatic winder 4 determines the winding speed of yarn 14 in the winding drum 43b based on the acquired winding information. Because of this configuration, in the automatic winder 4, yarn 14 can be unwound from the yarn supply bobbin 11 according to the winding state of yarn 14 in the yarn supply bobbin 11. Accordingly, in the automatic winder 4, unwinding of yarn 14 suitable for the winding state of yarn 14 in the yarn supply bobbin 11 can be carried out. In other words, since unwinding of yarn 14 under a condition inappropriate for the winding state of yarn 14 can be avoided, reduction in work efficiency due to sloughing and reduction in efficiency resulting from the winding speed of yarn 14 can be suppressed. As a result, the work efficiency can be improved.

[0052] In the present embodiment, the winding information includes information indicating the pitch of winding of yarn in the yarn supply bobbin 11 (the upward winding pitch P1 and the downward winding pitch P2), information indicating the tightness of winding of yarn 14 in the yarn supply bobbin 11 (P value), and information indicating the yarn tension during winding of yarn in the yarn supply bobbin (tension value). Because of the inclusion of these pieces of information, the operation of the winding drum 43b can be controlled according to the pieces of information in the unit controlling unit 52. Thus, yarn 14 can be wound according to the winding state of yarn 14 in the yarn supply bobbin 11.

[0053] In the present embodiment, the unit controlling unit 52 of the automatic winder 4 sets the winding speed to a reference speed or higher when the downward winding pitch P2 of yarn 14 is equal to or greater than a reference pitch, and sets the winding speed to less than the reference speed when the downward winding pitch P2 of yarn 14 is less than the reference pitch. Thus, in the automatic winder 4, unwinding of yarn 14 can be carried out according to the pitch of winding of yarn 14 (the downward winding pitch P2 of yarn 14) in the yarn supply bobbin 11.

[0054] In the present embodiment, the unit controlling unit 52 of the automatic winder 4 sets the winding speed to a reference speed or higher when the P value of the hardness of the yarn supply bobbin 11 is equal to or greater than a reference P value, and sets the winding speed to less than the reference speed when the P value of the hardness of the yarn supply bobbin 11 is less than the reference P value. Thus, in the automatic winder 4, unwinding of yarn 14 can be carried out according to the tightness of winding of yarn 14 in the yarn supply bobbin 11 (the P value of the hardness of the yarn supply bobbin 11).

[0055] In the present embodiment, the unit controlling unit 52 of the automatic winder 4 sets the winding speed to a reference speed or higher when the tension value indicating the yarn tension during winding of yarn 14 in the yarn supply bobbin 11 is equal to or greater than a reference tension value. Thus, unwinding of yarn can be carried out according to the yarn tension during winding of yarn in the yarn supply bobbin.

[0056] In the present embodiment, winding information is directly transmitted from the communication unit 31c of the spinning frame 3 to the communication unit 41c of the automatic winder 4. Thus, the automatic winder 4 can acquire winding information accurately and promptly.

[0057] Although one embodiment of the present invention has been described above, the present invention is not limited to the embodiment. For example, in the foregoing embodiment, the manner in which the unit controlling unit 52 of the automatic winder 4 controls the drive motor 43d to determine the winding speed (unwinding speed) of the winding drum 43b has been illustrated by way of example. However, the automatic winder may include a yarn storing unit (winding unit) between the winding drum 43b and the yarn supply bobbin 11. In this configuration, the unit controlling unit 52 may control the rotational speed of a storage roller in the yarn storing unit to determine the unwinding speed of the yarn supply bobbin 11. In this configuration, a yarn unwinding assist device may be provided, which restricts a balloon formed when yarn 14 is unwound from the yarn supply bobbin 11.

[0058] In the foregoing embodiment, the manner in which the unit controlling unit 52 increases or decreases the rotational speed of the drive motor 43d from a predetermined reference speed based on the winding information has been illustrated by way of example. In this respect, the unit controlling unit 52 may control the operation of the drive motor 43d so as to attain a rotational speed corresponding to the value in each item indicated by the winding information. Specifically, the rotational speed of the drive motor 43d may be preset to correspond one-to-one to the value of each item indicated by the winding information, and the drive motor 43d may be controlled based on the values.

[0059] In the foregoing embodiment, the setting values related to formation of the yarn supply bobbin 11 have been described as the winding information by way of example. However, the winding information may be any

other information. For example, the winding information may be information indicating the state of the yarn supply bobbin 11 detected by a sensor installed in the spinning frame 3. The sensor detects and outputs the winding state of yarn 14 (for example, pitch) in the yarn supply bobbin 11. The sensor may be provided in each of the spinning units 32 or may be provided in one or a predetermined number of spinning units 32.

[0060] When a sensor is provided in each of the spinning units 32, the spinning unit 32 allows the winding information indicating the winding state output from the sensor to be written on the RF tag 63. The RF tag 63 is then read in the winder unit 42 of the automatic winder 4 whereby the winding information can be acquired. Alternatively, the spinning unit 32 allows identification information that can uniquely identify the formed yarn supply bobbin 11 to be written on the RF tag 63 and outputs the identification information linked to the winding information to the communication unit 31c. The communication unit 31c transmits the winding information output from each of the spinning units 32 to the automatic winder 4. In the automatic winder 4, the identification information is read from the RF tag 63 on the yarn supply bobbin 11 in the winder unit 42, and the corresponding winding information is acquired from among a plurality of winding information received by the communication unit 41c, based on the identification information.

[0061] When a sensor is provided in one or a predetermined number of spinning units 32, the winding information indicating the winding state detected by the sensor is transmitted from the communication unit 31c of the spinning frame 3 to the automatic winder 4. When a predetermined number of sensors are provided, a plurality of winding information output from the sensors are subjected to predetermined processing (for example, averaging) and output as a piece of winding information from the communication unit 31c.

[0062] In the foregoing embodiment, information indicating the pitch of winding of yarn 14 in the yarn supply bobbin 11, information indicating the tightness of winding of yarn 14 in the yarn supply bobbin 11, and information indicating the yarn tension during winding of yarn 14 in the yarn supply bobbin 11 have been described as the winding information by way of example. However, the winding information may not include these three pieces of information or may include information other than these three pieces of information.

[0063] In the foregoing embodiment, the manner in which the winding information is directly transmitted from the communication unit 31c of the spinning frame 3 to the communication unit 41c of the automatic winder 4 has been described by way of example. However, the method of acquiring the winding information in the automatic winder 4 is not limited to this manner. For example, the winding information output from the communication unit 31c may be acquired by the communication unit 41c through another device (for example, a server device).

[0064] In the foregoing embodiment, the manner in

which the winding information is acquired by the automatic winder 4 through communication between the communication unit 31c of the spinning frame 3 and the communication unit 41c of the automatic winder 4 has been described by way of example. However, the acquisition of the winding information is not limited to communication. For example, the winding information may be written on the RF tag 63 in the tray 6 in which the yarn supply bobbin 11 is set. In this configuration, the winding information is read by the RF reader 49 and transmitted to the unit controlling unit 52 of the automatic winder 4.

[0065] In the foregoing embodiment, the manner in which the control device 41 of the automatic winder 4 includes the communication unit 41c has been described by way of example. However, the unit controlling unit 52 may include a communication unit (acquisition unit). Although the manner in which the control device 31 of the spinning frame 3 includes the communication unit 31c has been described by way of example, the spinning unit 32 may include a communication unit (output unit).

Reference Signs List

[0066]

1 ... yarn winding system, 3 ... spinning frame, 4 ... automatic winder, 11 ... yarn supply bobbin, 14 ... yarn, 15 ... package, 31c ... communication unit (output unit), 41c ... communication unit (acquisition unit), 43b ... winding drum (winding unit), 52 ... unit controlling unit (control unit).

Claims

1. A yarn winding system comprising:

a spinning frame configured to form a yarn supply bobbin; and
an automatic winder configured to wind yarn from the yarn supply bobbin to form a package, wherein
the spinning frame includes an output unit configured to output winding information related to a winding state of the yarn in the formed yarn supply bobbin,
the automatic winder includes:

an acquisition unit configured to acquire the winding information from the spinning frame;
a winding unit configured to unwind the yarn from the yarn supply bobbin and wind the unwound yarn; and
a control unit configured to control winding operation of the winding unit, and

the control unit determines a winding speed of

the yarn in the winding unit, based on the winding information acquired by the acquisition unit.

2. The yarn winding system according to claim 1, wherein the winding information includes at least one of information indicating pitch of winding of the yarn in the yarn supply bobbin, information indicating tightness of winding of the yarn in the yarn supply bobbin, and information indicating yarn tension during winding of the yarn in the yarn supply bobbin.
3. The yarn winding system according to claim 1 or 2, wherein the output unit and the acquisition unit are connected to be able to communicate with each other, the output unit outputs the winding information to the acquisition unit, and the acquisition unit acquires the winding information output from the output unit.
4. An automatic winder configured to wind yarn of a yarn supply bobbin supplied from a spinning frame to form a package, the automatic winder comprising:
 - an acquisition unit configured to acquire winding information related to a winding state of the yarn in the yarn supply bobbin from the spinning frame;
 - a winding unit configured to unwind the yarn from the yarn supply bobbin and wind the unwound yarn; and
 - a control unit configured to control winding operation of the winding unit, wherein the control unit determines a winding speed of the yarn in the winding unit, based on the winding information acquired by the acquisition unit.
5. A spinning frame configured to form a yarn supply bobbin to be supplied to an automatic winder, the spinning frame comprising an output unit configured to output winding information related to a winding state of yarn in the yarn supply bobbin.
6. The spinning frame according to claim 5, wherein the output unit outputs the winding information to the automatic winder.
7. A yarn winding method performed in a yarn winding system including a spinning frame configured to form a yarn supply bobbin and an automatic winder configured to wind yarn from the yarn supply bobbin to form a package; the yarn winding method comprising:
 - outputting, by the spinning frame, winding information related to a winding state of the yarn in the formed yarn supply bobbin; and
 - acquiring, by the automatic winder, the winding

information output from the spinning frame to determine a winding speed of the yarn based on the winding information.

8. The yarn winding method according to claim 7, wherein the spinning frame outputs the winding information including information indicating pitch of winding of the yarn in the yarn supply bobbin, and the automatic winder sets the winding speed to a first reference speed or higher when pitch of winding of the yarn is equal to or greater than a first reference value, and sets the winding speed to less than the first reference speed when pitch of winding of the yarn is less than the first reference value.
9. The yarn winding method according to claim 7 or 8, wherein the spinning frame outputs the winding information including information indicating tightness of winding of the yarn in the yarn supply bobbin, and the automatic winder sets the winding speed to a second reference speed or higher when tightness of winding of the yarn is equal to or greater than a second reference value, and sets the winding speed to less than the second reference speed when tightness of winding of the yarn is less than the second reference value.
10. The yarn winding method according to any one of claims 7 to 9, wherein the spinning frame outputs the winding information including information indicating yarn tension during winding of the yarn in the yarn supply bobbin, and the automatic winder sets the winding speed to a third reference speed or higher when yarn tension is equal to or greater than a third reference value.

Fig.1

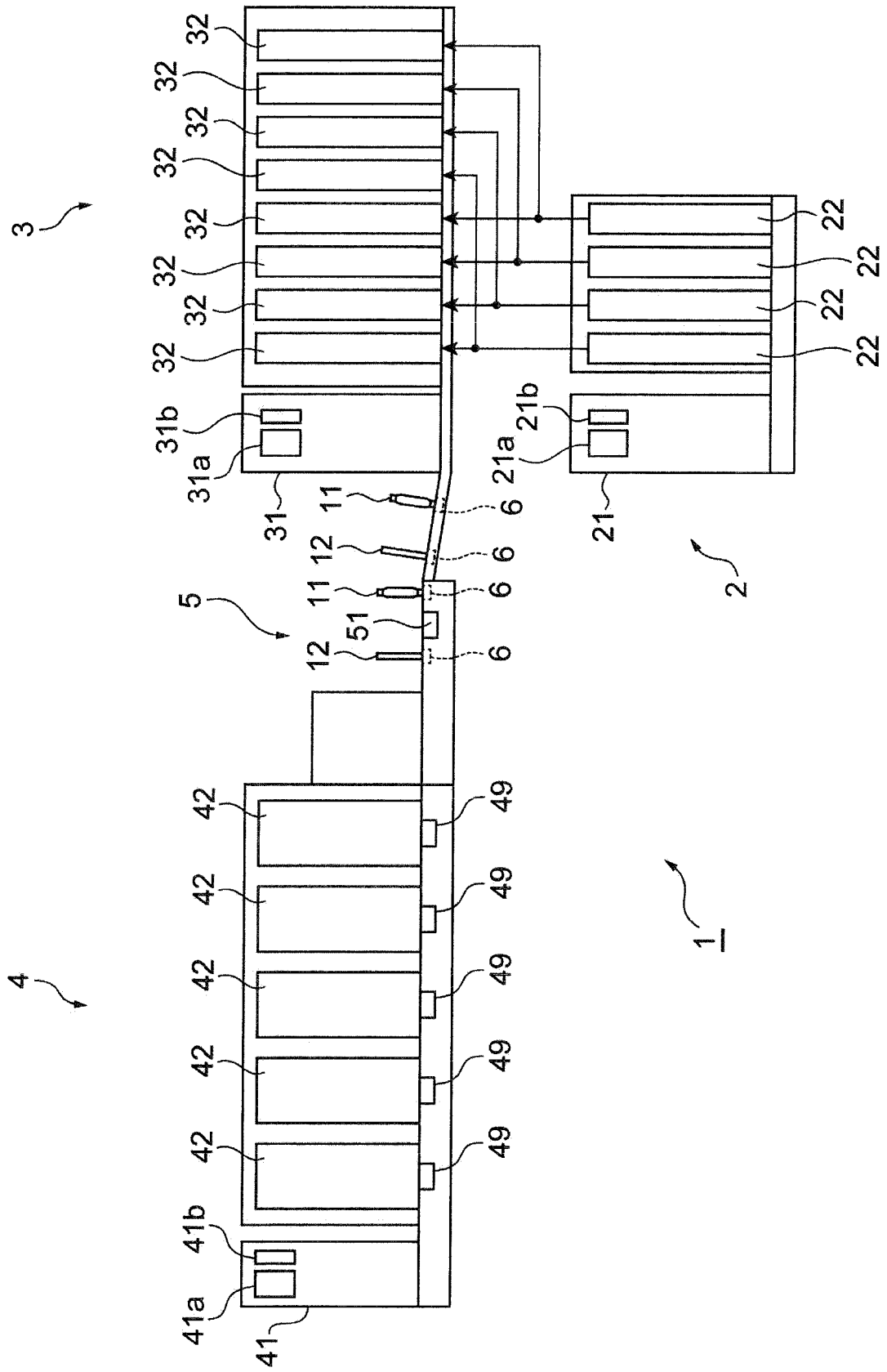


Fig.2

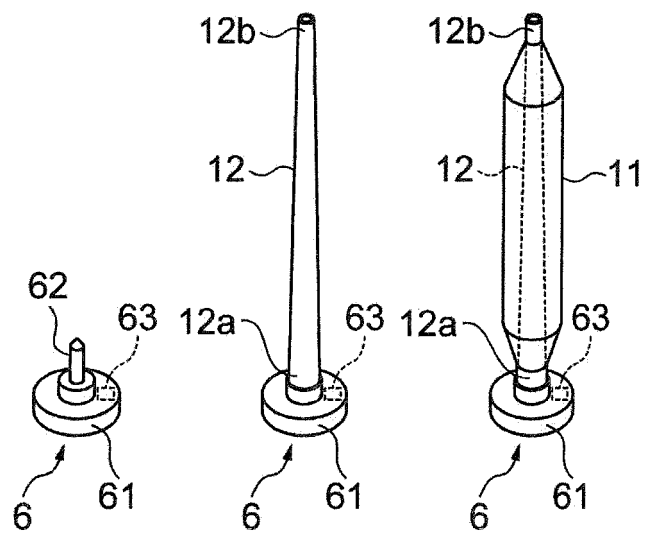


Fig.3

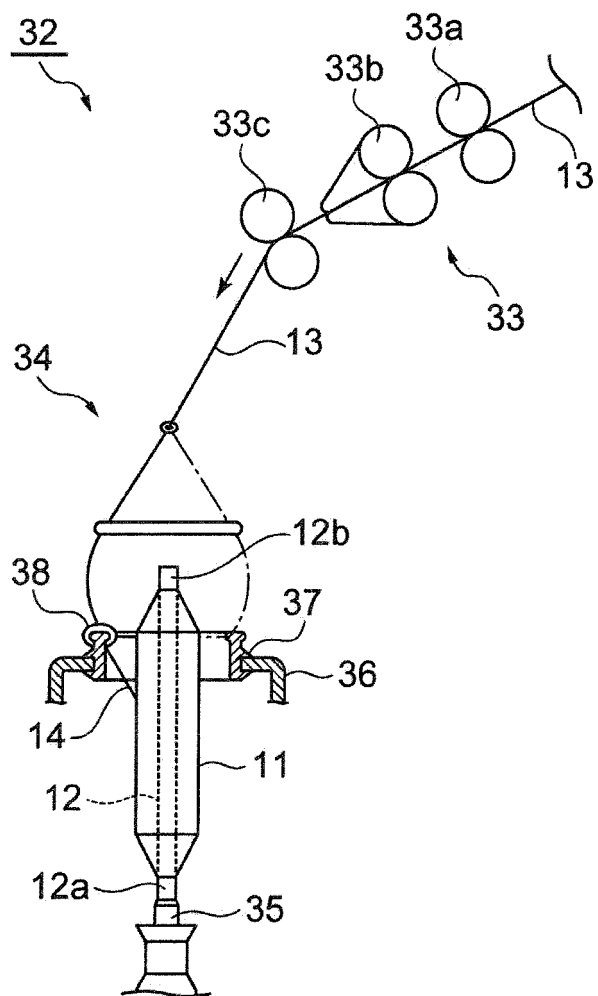


Fig.4

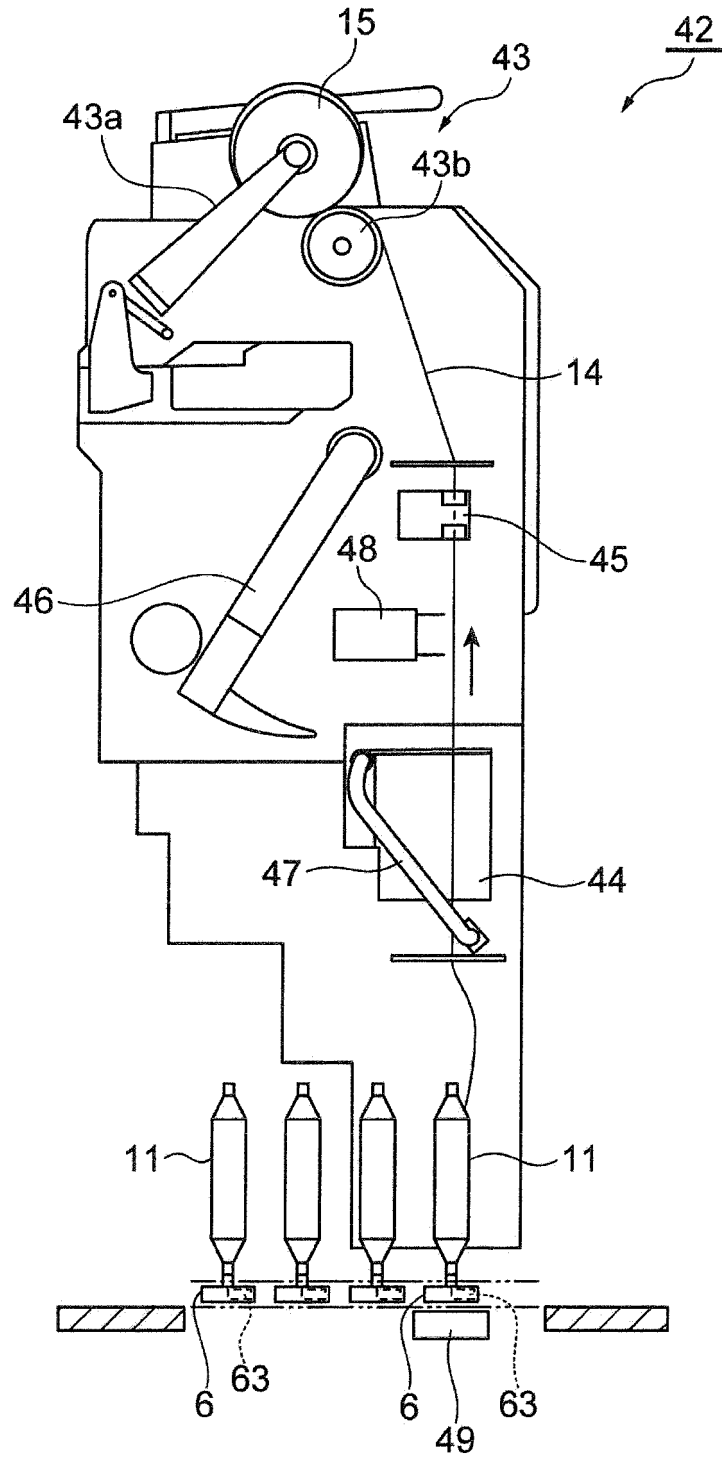


Fig.5

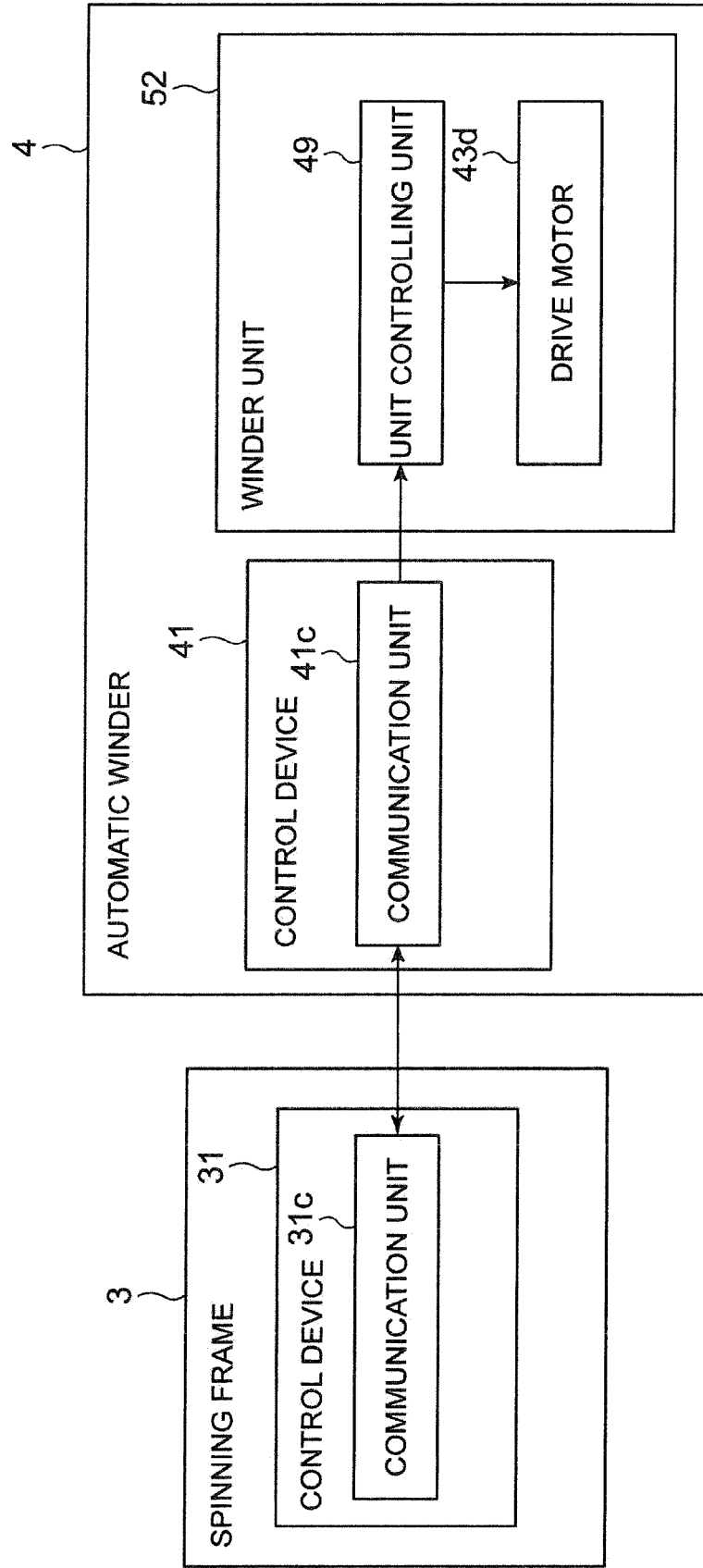
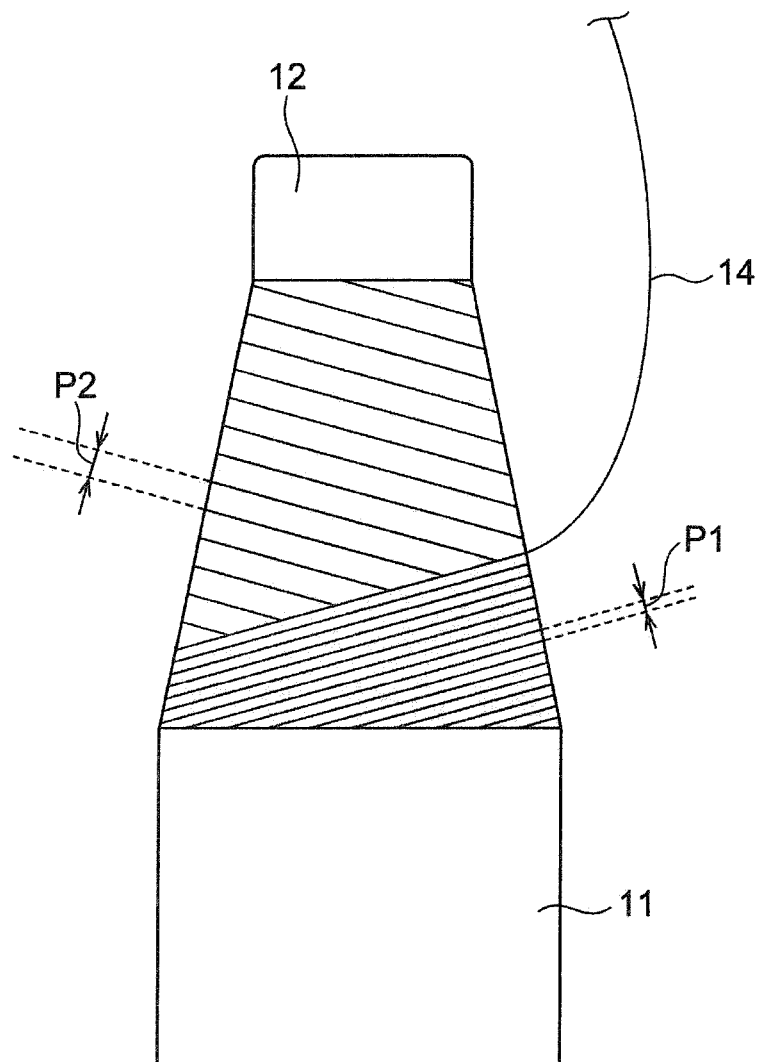


Fig.6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/061912

A. CLASSIFICATION OF SUBJECT MATTER

B65H67/06(2006.01)i, B65H54/02(2006.01)i, B65H54/70(2006.01)i, D01H13/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65H54/02, 54/70, 67/06, D01H9/18, 13/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2009-242029 A (Murata Machinery Ltd.), 22 October 2009 (22.10.2009), paragraphs [0031] to [0038], [0042], [0071], [0096] to [0097]; fig. 1 to 2 & EP 2108723 A2 paragraphs [0032] to [0039], [0043], [0072], [0097] to [0098]; fig. 1 to 2 & CN 101546193 A	1-10
Y	JP 2013-249189 A (Murata Machinery Ltd.), 12 December 2013 (12.12.2013), paragraph [0070]; fig. 1 to 2 & EP 2671983 A2 paragraph [0069]; fig. 1 to 2 & CN 103449257 A	1-10

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search
09 June 2016 (09.06.16)

Date of mailing of the international search report
21 June 2016 (21.06.16)

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/061912

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2006-151690 A (Toray Industries, Inc.), 15 June 2006 (15.06.2006), paragraphs [0014] to [0015]; fig. 3 (Family: none)	2-3, 8-10
A	JP 4-361953 A (Murata Machinery Ltd.), 15 December 1992 (15.12.1992), paragraphs [0015], [0019] to [0021]; fig. 1 & US 5269478 A column 3, lines 5 to 12; column 3, line 48 to column 4, line 16; fig. 1 & DE 4217059 A1	1, 4, 7

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2080825 A [0003]