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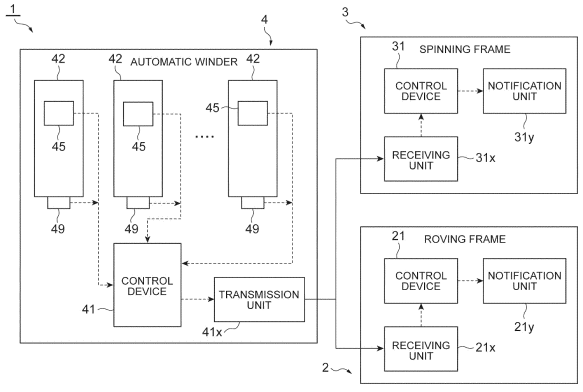
(54) YARN WINDING SYSTEM, AUTOMATIC WINDER, SPINNING FRAME AND YARN WINDING METHOD

(57) A yarn winding system 1 includes an automatic winder 4 configured to wind yarn from a yarn supply bobbin to form a package, and a roving frame 2 and a spinning frame 3 each configured to perform a spinning process at a previous step for the automatic winder 4. The automatic winder 4 includes a yarn monitoring unit 45 configured to detect a state of the yarn travelling and a transmission unit 41x configured to transmit information on a monitoring result of the yarn monitoring unit 45 to the roving frame 2 and the spinning frame 3. The roving frame 2 and the spinning frame 3 include a receiving unit 21x and 31x, respectively, configured to receive the information on the monitoring result of the yarn monitoring unit 45 from the automatic winder 4.

Fig.5



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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] Conventionally, 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 of the formed yarn supply bobbin to form a package has been known (see Patent Literature 1, for example). In a yarn winding system described in Patent Literature 1, a medium is provided to a tray on which a bobbin is mounted and that is conveyed so as to travel between a spinning frame and an automatic winder. Onto this medium, information on yarn processing of the winder is written by a writing device. This yarn processing information written on the medium is read by a reading device to be managed by a management computer.

Citation List

Patent Literature

[0003] [Patent Literature 1] Japanese Examined Patent Publication No. H6-76177

Summary of Invention

Technical Problem

[0004] In the yarn winding system described above, when abnormality has occurred in a previous step machine (e.g., a spinning frame and/or a roving frame) configured to perform a spinning process at a previous step for the automatic winder, it is desired to grasp this abnormality in the previous step machine in a timely manner, for example, in order to quickly improve the quality of the yarn.

[0005] Various aspects of the present invention have been made in view of the circumstance described above, and it is an object to enable abnormality, which has occurred in a previous step machine configured to perform a spinning process at a previous step for an automatic winder, to be grasped in the previous step machine in a timely manner.

Solution to Problem

[0006] A yarn winding system according to one aspect of the present invention includes: an automatic winder configured to wind yarn from a yarn supply bobbin to form a package; and one or a plurality of previous step machines each configured to perform a spinning process at a previous step for the automatic winder. The automatic winder includes a yarn monitoring unit configured to detect a state of the yarn travelling and a transmission unit configured to transmit information on a monitoring result of the yarn monitoring unit to the previous step machine(s). Each previous step machine includes a receiving unit configured to receive the information on the monitoring result of the yarn monitoring unit from the automatic winder.

[0007] In this yarn winding system, the information on the monitoring result of the yarn monitoring unit is transmitted from the automatic winder to the previous step machines each configured to perform the spinning process at a previous step for the automatic winder (hereinafter also simply called "previous step machines"). Thus, in each of the previous step machines, based on the received information, for example, a quality defect of yarn that has been spun by the previous step machine, and consequently abnormality in the previous step machine can be grasped. In other words, abnormality that has occurred in a previous step machine can be grasped in the previous step machine in a timely manner.

[0008] In the yarn winding system, the automatic winder may include a first abnormality information acquisition unit configured to acquire abnormality information on each of the previous step machines based on detection data detected by the yarn monitoring unit. The transmission unit may transmit the abnormality information as the information on the monitoring result. In this case, in the previous step machine, the abnormality that has occurred can be grasped in a timely manner by receiving the abnormality information.

[0009] In the yarn winding system, each of the previous step machines may include a spinning frame including a plurality of spinning units each configured to form the yarn supply bobbin. A tray configured to transfer the yarn supply bobbin may include a storage unit configured to store therein identification information for identifying each of the spinning units that has formed the corresponding yarn supply bobbin. The automatic winder may include a reading unit configured to read the identification information stored in the storage unit. The first abnormality information acquisition unit may identify the spinning unit in which abnormality has occurred, based on the detection data detected by the yarn monitoring unit and the identification information read by the reading unit, and may acquire information on the spinning unit identified as the abnormality information. By this configuration, in the spinning frame as a previous step machine, a spinning unit in which abnormality has occurred can be grasped in a timely manner.

[0010] In the yarn winding system, each of the previous step machines may include a spinning frame including a plurality of spinning units each configured to form the yarn supply bobbin. The first abnormality information acquisition unit may acquire information on abnormality that

is common to the spinning units as the abnormality information, based on the detection data detected by the yarn monitoring unit. By this configuration, in the spinning frame as a previous step machine, abnormality that is common to the spinning units, such as an abnormal stop of a blower, for example, can be grasped in a timely manner.

[0011] In the yarn winding system, the transmission unit may transmit the detection data detected by the yarn monitoring unit as the information on the monitoring result. Each previous step machine may include a second abnormality information acquisition unit configured to acquire abnormality information on the previous step machine based on the detection data received by the receiving unit. In this case, the previous step machine receives the detection data. In the previous step machine, abnormality that has occurred can be grasped in a timely manner by acquiring the abnormality information from the detection data.

[0012] In the yarn winding system, each of the previous step machines may include a spinning frame including a plurality of spinning units each configured to form the yarn supply bobbin. A tray configured to transfer the yarn supply bobbin may include a storage unit configured to store therein identification information for identifying each of the spinning units that has formed the corresponding yarn supply bobbin. The automatic winder may include a reading unit configured to read the identification information stored in the storage unit. The transmission unit may further transmit the identification information detected by the reading unit as the information on the monitoring result. The second abnormality information acquisition unit may identify the spinning unit in which abnormality has occurred, based on the detection data received by the receiving unit and the identification information, and may acquire information on the spinning unit identified as the abnormality information. By this configuration, in the spinning frame as a previous step machine, a spinning unit in which abnormality has occurred can be grasped in a timely manner.

[0013] In the yarn winding system, each of the previous step machines may include a spinning frame including a plurality of spinning units each configured to form the yarn supply bobbin. The second abnormality information acquisition unit may acquire information on abnormality that is common to the spinning units as the abnormality information, based on the detection data received by the receiving unit. By this configuration, in the spinning frame as a previous step machine, abnormality that is common to the spinning units, such as an abnormal stop of a blower, for example, can be grasped in a timely manner.

[0014] In the yarn winding system, each of the previous step machines may include a notification unit configured to provide notification of abnormality in the previous step machine according to the abnormality information. In this case, an operator can be notified of abnormality that has occurred in the previous step machine.

[0015] In the yarn winding system, the detection data may include yarn defect detection data on a detected yarn defect. In this case, based on the yarn defect detection data, the abnormality information is acquired. For example, when the yarn defect detection data includes a yarn defect that occurs repeatedly and continuously, it is determined that abnormality has occurred in the previous step machine, and the abnormality information can be acquired.

[0016] In the yarn winding system, each of the previous step machines may include a roving frame including a plurality of roving units each configured to form a roved yarn bobbin. In this case, in the roving frame as a previous step machine, abnormality that has occurred in the roving frame can be grasped in a timely manner.

[0017] An automatic winder according to one aspect of the present invention is an automatic winder configured to wind yarn from a yarn supply bobbin to form a package. The automatic winder includes: a yarn monitoring unit configured to detect a state of the yarn travelling; and a transmission unit configured to transmit information on a monitoring result of the yarn monitoring unit to one or a plurality of previous step machines each configured to perform a spinning process at a previous step for the automatic winder.

[0018] With this automatic winder, the information on the monitoring result of the yarn monitoring unit is transmitted to the previous step machine(s). Thus, in each of the previous step machines, based on the information on the monitoring result of the yarn monitoring unit, abnormality that has occurred can be grasped in a timely manner.

[0019] A spinning frame according to one aspect of the present invention is a spinning frame arranged for a previous step for an automatic winder configured to wind yarn from a yarn supply bobbin to form a package and including a plurality of spinning units each configured to form the yarn supply bobbin. The spinning frame includes a receiving unit configured to receive, from the automatic winder, information on a monitoring result of a yarn monitoring unit provided to the automatic winder and configured to detect a state of the yarn travelling.

[0020] The spinning frame receives the information on the monitoring result of the yarn monitoring unit from a previous step machine. Thus, in the spinning frame as a previous step machine, based on the received information, abnormality that has occurred can be grasped in a timely manner.

[0021] A yarn winding method according to one aspect of the present invention is a yarn winding method for forming a yarn supply bobbin by a spinning frame and winding yarn from the yarn supply bobbin by an automatic winder to form a package. The yarn winding method includes: a step of, by a yarn monitoring unit, detecting a state of the yarn travelling in the automatic winder; and a step of transmitting information on a monitoring result of the yarn monitoring unit from the automatic winder to the spinning frame.

[0022] In this yarn winding method, the information on

the monitoring result of the yarn monitoring unit is transmitted from the automatic winder to the spinning frame. Thus, in the spinning frame as a previous step machine, based on the information on the monitoring result of the yarn monitoring unit, abnormality that has occurred can be grasped in a timely manner.

Advantageous Effects of Invention

[0023] According to one aspect of the present invention, abnormality that has occurred in a previous step machine configured to perform a spinning process at a previous step for an automatic winder can be grasped in the previous step machine in a timely manner.

Brief Description of Drawings

[0024]

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 schematic block diagram illustrating main parts of the yarn winding system in FIG. 1; and
FIG 6 is a sequence diagram illustrating one example of processes performed by the yarn winding system in FIG. 1.

Description of Embodiments

[0025] One embodiment will now be described in detail with reference to the drawings. In the drawings, like or equivalent elements are designated by like numerals, and duplicate description is omitted.

[0026] 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.

[0027] 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 (storage unit) 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.

[0028] As depicted in FIG. 1, the roving frame 2 is one of previous step machines each configured to perform a spinning process (roving process) at a previous step for the automatic winder 4. 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 is a part for an operator to set operating conditions, for example, of each roving unit 22.

[0029] The spinning frame 3 is one of the previous step machines each configured to perform a spinning process (fine spinning process) at a previous step for the automatic winder 4. 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 and an operation unit 31b such as input keys. The display unit 31a displays, for example, an operating status of each of the spinning units 32. The operation unit 31b is a part for the operator to set operating conditions, for example, of each of the spinning unit 32.

[0030] As depicted in FIG. 3, the spinning unit 32 includes a drafting device 33 and a twisting device 34.

[0031] 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.

[0032] 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.

[0033] 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 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.

[0034] 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.

[0035] 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. The control device 41 includes a display unit 41a such as a display and an operation unit 41b such as input keys. The display unit 41a displays, for example, an operating status of each of the winder units 42. The operation unit 41b is a part for the operator to set operating conditions, for example, of each of the winder unit 42. The control device 41 also controls operation of the bobbin transfer device 5.

[0036] As depicted in FIG. 4, the winder unit 42 includes a winding device 43, a tension applying device 44, a yarn monitoring device (yarn monitoring unit) 45, an upper yarn catching device 46, a lower yarn catching device 47, and a splicing device 48.

[0037] The winding device 43 includes a cradle 43a and a winding drum 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 from a yarn supply bobbin 11 set at a predetermined position to form the package 15. 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.

[0038] The yarn monitoring device 45 monitors the travelling yarn 14 to detect the state of the yarn 14 including 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.

[0039] 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 (identification information) 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.

[0040] 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 (reading unit) 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.

[0041] The following describes main parts of the yarn winding system 1 in detail with reference to FIG. 5.

[0042] As depicted in FIG. 5, in each of the winder units 42, the corresponding yarn monitoring device 45 detects the state of travelling yarn 14, and outputs the detected detection data to the control device 41. The detection data includes yarn defect detection data on a yarn defect, foreign matter detection data on foreign matter, yarn color defect detection data on a yarn color defect, apparent thickness data on apparent yarn thickness indices, Super

Spectron data on Super Spectron, hairiness data, and apparent thickness variation coefficient data on CV% (coefficient of variation) of apparent yarn thickness. Examples of a yarn defect detected by the yarn monitoring device 50 include thickness abnormality of yarn 14 and mixing of foreign matter into yarn 14 as described above. The examples of a yarn defect detected by the yarn monitoring device 50 also include nep, slub, a yarn color defect, different yarn count abnormality, excessive hairiness yarn, weak yarn, and yarn physical property change. The specifications of the yarn monitoring device 45 is not limited to a particular one, and the yarn monitoring device may be an optical device or may be a capacitive device.

[0043] Each RF reader 49 reads, in a noncontact manner, at least unit identification information that is written on the RF tag 63 of the tray 6 by the RF writer 51 (see FIG. 1). The RF reader 49 outputs the read unit identification information to the control device 41. The unit identification information includes inspector information on the machine number of a spinning unit 32 that has formed a yarn supply bobbin 11 supported by the tray 6. The unit identification information herein is written on the RF tag 63 in a manner described below, for example. Specifically, yarn supply bobbins 11 that have been simultaneously doffed in the spinning frame 3 are set on trays 6, and then pass through the RF writer 51 in the same order as the order in which the spinning units 32 are aligned. Thus, the RF writer 51 identifies a spinning unit 32 that has formed a yarn supply bobbin 11 by counting the order of each of the yarn supply bobbins 11 passing therethrough, and writes, on the RF tag 63, unit identification information indicating by which spinning unit 32 the yarn supply bobbin has been formed.

[0044] The automatic winder 4 includes the control device 41 and a transmission unit 41x. The control device 41 is an electronic control unit having a central processing unit (CPU), a read only memory (ROM), and a random access memory (RAM), for example. The control device 41 loads a program stored in the ROM into the RAM, and causes the CPU to execute the program, thereby performing various controls. The control device 41 may include a plurality of electronic control units. The control device 41 outputs information on monitoring results of the yarn monitoring devices 45 to the transmission unit 41x.

[0045] The control device 41 is a first abnormality information acquisition unit configured to acquire abnormality information of the previous step machine. Based on the detection data output from each of the yarn monitoring devices 45 and/or the unit identification information output from the corresponding RF reader 49, the control device 41 conducts an abnormality check described below, and acquires the result as the abnormality information.

[0046] Specifically, the control device 41 checks and identifies a spinning unit 32 in which abnormality has occurred among the spinning units 32. For example, the control device 41 associates the unit identification information with the detection data of each of the yarn monitoring devices 45, and determines which spinning unit 32 has formed a yarn supply bobbin 11 the state of yarn of which is indicated by each of the detection data. Subsequently, for example, when the yarn defect detection data includes a yarn defect that occurs repeatedly and continuously (i.e., when a yarn defect occurring periodically, not a yarn defect occurring accidentally, is included), a spinning unit 32 associated with this yarn defect detection data (textile alarm) is identified as a spinning unit having abnormality. In this case, the control device 41 determines that the spinning frame 3 has abnormality, and acquires information indicating that the identified spinning unit 32 has abnormality as abnormality information.

[0047] When the same yarn defect has been detected from all pieces of detection data of the respective yarn monitoring devices 45, the control device 41 determines that abnormality that is common to the spinning units 32 (extensive abnormality in the spinning frame 3) has occurred. For example, when a yarn defect determined to be excessive hairiness yarn has been detected from all pieces of detection data of the respective yarn monitoring devices 45, the control device 41 determines that an abnormal stop of a blower has occurred in the spinning frame 3. In this case, the control device 41 determines that the spinning frame 3 has abnormality, and acquires, as abnormality information, information indicating that an abnormal stop has occurred in a negative-pressure generating device (blower) configured to supply negative pressure to a mechanism configured to reduce fuzz by using negative pressure of the spinning frame 3.

[0048] The control device 41 also checks abnormality of the roving frame 2. In most cases, when a malfunction has occurred in a certain roving unit 22, influence of this malfunction is exerted on a plurality of spinning units 32 to which this roving unit 22 supplies roved yarn bobbins. Thus, for example, when the control device 41 has identified a plurality of spinning units 32 in which abnormality has occurred, if yarn defects of yarns 14 spun by these spinning units 32 are the same and one or more roving units 22 supplying roved yarn bobbins to these spinning units 32 are the same, the control device determines that abnormality has occurred in the same one or more roving units 22. In this case, the control device 41 determines that the roving frame 2 has abnormality, and acquires, as abnormality information, information indicating that abnormality has occurred in the one or more roving units 22. The control device 41 outputs the acquired abnormality information to the transmission unit 41x.

[0049] The transmission unit 41x is a part configured to transmit information from the automatic winder 4 to the roving frame 2 and the spinning frame 3. The transmission unit 41x transmits the abnormality information output by the control device 41 to a later-described receiving unit 21x of the roving frame 2 and a later-described receiving unit 31x of the spinning frame 3 as in-

formation on monitoring results of the yarn monitoring devices 45. Transmission by the transmission unit 41x to the receiving unit 21x and the receiving unit 31x may be performed through wired communication using a cable, for example, or may be performed through wireless communication. When the transmission by the transmission unit 41x is performed through wireless communication, radio waves, infrared rays, or light may be used as conveyance media. In FIG. 5, the transmission unit 41x and the control device 41 are illustrated as separate elements. However, the transmission unit 41x may be included in the control device 41. In other words, the transmission unit 41x may be a communication function implemented in the control device 41.

[0050] The spinning frame 3 includes the receiving unit 31x, the control device 31, and a notification unit 31y. The receiving unit 31x receives the abnormality information transmitted from the transmission unit 41x of the automatic winder 4 as information on monitoring results of the yarn monitoring devices 45. The receiving unit 31x outputs the received abnormality information to the control device 31.

[0051] The control device 31 is an electronic control unit including a CPU, a ROM, and a RAM. The control device 31 loads a program stored in the ROM into the RAM, and causes the CPU to execute the program, thereby performing various controls. The control device 31 may include a plurality of electronic control units. According to the abnormality information output from the receiving unit 31x, the control device 31 controls operation of the notification unit 31y.

[0052] According to the abnormality information received, the notification unit 31y notifies the operator of abnormality in the spinning frame 3. The notification unit 31y notifies the operator of abnormality locations such as a spinning unit 32 having abnormality and/or extensive abnormality in the spinning frame 3 to warn and alert the operator. The notification unit 31y includes at least one of a display unit configured to display an alarm, a warning light, and a speaker. In FIG. 5, the receiving unit 31x and the notification unit 31y are illustrated as elements separate from the control device 31. However, at least one of the receiving unit 31x and the notification unit 31y may be included in the control device 31. In other words, the receiving unit 31x may be a communication function implemented in the control device 31, and the notification unit 31y may be a notification function implemented in the control device 31.

[0053] The roving frame 2 includes the receiving unit 21x, the control device 21, and a notification unit 21y. The receiving unit 21x receives the abnormality information transmitted from the transmission unit 41x of the automatic winder 4 as information on the monitoring result of the yarn monitoring device 45. The receiving unit 21x outputs the received abnormality information to the control device 21.

[0054] The control device 21 is an electronic control unit including a CPU, a ROM, and a RAM. The control device 21 loads a program stored in the ROM into the RAM, and causes the CPU to execute the program, thereby performing various controls. The control device 21 may include a plurality of electronic control units. According to the abnormality information output from the receiving unit 21x, the control device 21 controls operation of the notification unit 21y.

[0055] According to the abnormality information received, the notification unit 21y notifies the operator of abnormality in the roving frame 2. The notification unit 21y notifies the operator of abnormality locations such as a roving unit 22 having abnormality and/or extensive abnormality in the roving frame 2 to warn and alert the operator. The notification unit 21y includes at least one of a display unit configured to display an alarm, a warning light, and a speaker. In FIG. 5, the receiving unit 21x and the notification unit 21y are illustrated as elements separate from the control device 21. However, at least one of the receiving unit 21x and the notification unit 21y may be included in the control device 21. In other words, the receiving unit 21x may be a communication function implemented in the control device 21, and the notification unit 21y may be a notification function implemented in the control device 21.

[0056] The following describes a yarn winding method performed by the yarn winding system 1. In the following description, one example of processes performed in the yarn winding method related to communication between the transmission unit 41x and the receiving unit 21x and between the transmission unit and the receiving unit 31 x will be described with reference to a sequence diagram of FIG. 6.

[0057] As depicted in FIG. 6, in the automatic winder 4, each of the RF readers 49 reads and acquires unit identification information written on the RF tag 63 of the tray 6 by the RF writer 51 (S1). Each yarn monitoring device 45 detects the state of travelling yarn 14, and acquires detection data on at least part of yarn 14 wound by the corresponding yarn supply bobbin 11 (S2). Based on the detection data and/or the unit identification information, the control device 41 conducts the abnormality check described above (S3).

[0058] As a result of the abnormality check at S3 above, if it is determined that the spinning frame 3 has abnormality (Yes at S4), abnormality information is transmitted from the transmission unit 41x of the automatic winder 4 to the receiving unit 31x of the spinning frame 3 (S5). As a result of the abnormality check at S3 above, if it is determined that the roving frame 2 has abnormality (Yes at S6), abnormality information is transmitted from the transmission unit 41x of the automatic winder 4 to the receiving unit 21x of the roving frame 2 (S7). Subsequently, for example, every time a yarn supply bobbin 11 is newly transferred to the automatic winder 4, the respective processes described above are repeatedly performed.

[0059] In the spinning frame 3, when the receiving unit 31x has received the abnormality information transmitted

from the transmission unit 41x of the automatic winder 4, the notification unit 31y outputs an alarm display (S11, S12). In the roving frame 2, the receiving unit 21x has received the abnormality information transmitted from the transmission unit 41x of the automatic winder 4, the notification unit 21y outputs an alarm display (S21, S22). Subsequently, the alarm display of the notification unit 31y is cleared by the operator's operation of the control device 31. The alarm display of the notification unit 21y is cleared by the operator's operation of the control device 21.

[0060] As described in the foregoing, in the yarn winding system 1, information on the monitoring result of each of the yarn monitoring devices 45 is transmitted from the automatic winder 4 to the spinning frame 3 and/or the roving frame 2 as a previous step machine. Thus, in each of the previous step machines, based on the received information, for example, a quality defect of yarn 14 that has been spun by the previous step machine, and consequently abnormality in the previous step machine can be grasped. In other words, abnormality that has occurred in a previous step machine can be grasped in the previous step machine in a timely manner. Consequently, in the event of abnormality, maintenance and/or adjustment of the previous step machine can be automatically performed in a timely manner, and quality of yarn 14 can be improved immediately in the previous step machine.

[0061] In the yarn winding system 1, the control device 41 of the automatic winder 4 acquires abnormality information on each of the previous step machines based on detection data detected by the yarn monitoring devices 45. The abnormality information is transmitted to the corresponding previous step machine by the transmission unit 41x. Thus, in the previous step machine, the abnormality that has occurred can be grasped in a timely manner by receiving the abnormality information.

[0062] In the yarn winding system 1, the tray 6 includes the RF tag 63 configured to store therein unit identification information. In the automatic winder 4, the unit identification information of the RF tag 63 is read by the corresponding RF reader 49. In the control device 41, based on detection data detected by each of the yarn monitoring devices 45 and unit identification information read by each of the corresponding RF readers 49, a spinning unit 32 in which abnormality has occurred is identified. Subsequently, abnormality information on this spinning unit 32 is transmitted from the transmission unit 41x to the receiving unit 31x of the spinning frame 3. Thus, in the spinning frame 3, a spinning unit 32 in which abnormality has occurred can be grasped in a timely manner.

[0063] In the yarn winding system 1, the control device 41 of the automatic winder 4 acquires abnormality information on abnormality that is common to a plurality of spinning units 32, based on the detection data detected by the yarn monitoring devices 45. The abnormality information on abnormality that is common to the spinning units 32 is transmitted from the transmission unit 41x to the receiving unit 31x of the spinning frame 3. Thus, in the spinning frame 3, abnormality that is common to the spinning units 32, such as an abnormal stop of the blower, for example, can be grasped in a timely manner.

[0064] In the yarn winding system 1, the roving frame 2 includes the notification unit 21y, and the spinning frame 3 includes the notification unit 31y. Thus, the operator can be notified of abnormality that has occurred in the roving frame 2 and the spinning frame 3.

[0065] In the yarn winding system 1, the detection data includes yarn defect detection data on a detected yarn defect. Thus, for example, when the yarn defect detection data is data (textile alarm) including a yarn defect that occurs repeatedly and continuously, the control device 41 of the automatic winder 4 determines that abnormality has occurred in the previous step machine, and can acquire the abnormality information.

[0066] The yarn winding system 1 includes the roving frame 2 as a previous step machine. In this case, abnormality that has occurred in the roving frame 2 can be grasped in a timely manner in the roving frame 2 as a previous step machine.

[0067] The automatic winder 4 includes the yarn monitoring devices 45 and the transmission unit 41x configured to transmit information on monitoring results of the yarn monitoring devices 45 to the roving frame 2 and the spinning frame 3 as previous step machines. Thus, in the roving frame 2 and the spinning frame 3, based on the information on monitoring results of the yarn monitoring devices 45, abnormality that has occurred can be grasped in a timely manner.

[0068] The spinning frame 3 is arranged for a previous step for the automatic winder 4, and includes the receiving unit 31x configured to receive information on monitoring results of the yarn monitoring devices 45 of the automatic winder 4 from the automatic winder 4. In the spinning frame 3, based on the received information, abnormality that has occurred can be grasped in a timely manner.

[0069] The yarn winding method according to the present embodiment includes: the above-described S2 of, by the yarn monitoring devices 45, detecting the state of yarn 14 travelling in the automatic winder 4 to acquire detection data; and the above-described S5 of transmitting information on monitoring results of the yarn monitoring devices 45 from the automatic winder 4 to the spinning frame 3. By this yarn winding method, in the spinning frame 3, based on the information on monitoring results of the yarn monitoring devices 45, abnormality that has occurred can be grasped in a timely manner.

[0070] Although one embodiment has been described above, the present invention is not limited to the embodiment.

[0071] In the embodiment, the abnormality check conducted by the control device 41 of the automatic winder 4 may be conducted by at least one of the control device 21 of the roving frame 2 and the control device 31 of the spinning frame 3 as described below, for example.

[0072] Specifically, in the automatic winder 4, the con-

trol device 41 outputs detection data of the yarn monitoring devices 45 and unit identification information of the RF tags 63 to the transmission unit 41x. The transmission unit 41x transmits the detection data and the unit identification information to the receiving unit 21x of the roving frame 2 and/or the receiving unit 31x of the spinning frame 3.

[0073] In the roving frame 2, based on the detection data and/or the unit identification information received by the receiving unit 21x, the control device 21 conducts the abnormality check described above to acquire abnormality information. For example, based on the detection data and the unit identification information, a roving unit 22 in which abnormality has occurred is identified, and information on this roving unit 22 is acquired as the abnormality information. In some cases, based on the detection data, information on abnormality that is common to a plurality of roving units 22 is acquired as the abnormality information. In the spinning frame 3, based on the detection data and/or the unit identification information received by the receiving unit 31x, the control device 31 conducts the abnormality check described above to acquire abnormality information. For example, based on the detection data and the unit identification information, a spinning unit 32 in which abnormality has occurred is identified, and information on this spinning unit 32 is acquired as the abnormality information. In some cases, based on the detection data, information on abnormality that is common to a plurality of spinning units 32 is acquired as the abnormality information.

[0074] In this manner, previous step machines that are the roving frame 2 and the spinning frame 3 can receive detection data and unit identification information (what is called raw data), not as results of the abnormality check. In the previous step machines, by acquiring abnormality information from the detection data, abnormality that has occurred can be grasped in a timely manner. In particular, in the spinning frame 3, a spinning unit 32 in which abnormality has occurred can be grasped in a timely manner. In the spinning frame 3, abnormality that is common to a plurality of spinning units 32, such as an abnormal stop of the blower, can be grasped in a timely manner.

Industrial Applicability

[0075] According to one aspect of the present invention, abnormality that has occurred in a previous step machine configured to perform a spinning process at a previous step for an automatic winder can be grasped in the previous step machine in a timely manner.

Reference Signs List

[0076] 1... yarn winding system, 2... roving frame (previous step machine), 3... spinning frame (previous step machine), 4... automatic winder, 6... tray, 11... yarn supply bobbin, 14... yarn, 15... package, 21... control device (second abnormality information acquisition unit), 21x... receiving unit, 21y... notification unit, 31... control device (second abnormality information acquisition unit), 31x... receiving unit, 31y... notification unit, 32... spinning unit, 41... control device (first abnormality information acquisition unit), 41x... transmission unit, 45... yarn monitoring device (yarn monitoring unit), 49... RF reader (reading unit), 63... RF tag (storage unit)

Claims

1. A yarn winding system comprising:

an automatic winder configured to wind yarn from a yarn supply bobbin to form a package; and

one or a plurality of previous step machines each configured to perform a spinning process at a previous step for the automatic winder, wherein

the automatic winder includes a yarn monitoring unit configured to detect a state of the yarn travelling and a transmission unit configured to transmit information on a monitoring result of the yarn monitoring unit to the previous step machine(s), and

each of the previous step machines includes a receiving unit configured to receive the information on the monitoring result of the yarn monitoring unit from the automatic winder.

2. The yarn winding system according to claim 1, wherein

the automatic winder includes a first abnormality information acquisition unit configured to acquire abnormality information on each of the previous step machines based on detection data detected by the yarn monitoring unit, and

the transmission unit transmits the abnormality information as the information on the monitoring result.

3. The yarn winding system according to claim 2, wherein

each of the previous step machines includes a spinning frame including a plurality of spinning units each configured to form the yarn supply bobbin,

a tray configured to transfer the yarn supply bobbin includes a storage unit configured to store therein identification information for identifying each of the spinning units that has formed the corresponding yarn supply bobbin,

the automatic winder includes a reading unit configured to read the identification information stored in the storage unit, and

the first abnormality information acquisition unit identifies the spinning unit in which abnormality has occurred, based on the detection data detected by the yarn monitoring unit and the identification information read by the reading unit, and acquires informa-

tion on the spinning unit identified as the abnormality information.

4. The yarn winding system according to claim 2, wherein
each of the previous step machines includes a spinning frame including a plurality of spinning units each configured to form the yarn supply bobbin, and
the first abnormality information acquisition unit acquires information on abnormality that is common to the spinning units as the abnormality information, based on the detection data detected by the yarn monitoring unit.

5. The yarn winding system according to claim 1, wherein
the transmission unit transmits the detection data detected by the yarn monitoring unit as the information on the monitoring result, and
each of the previous step machines includes a second abnormality information acquisition unit configured to acquire abnormality information on the previous step machine based on the detection data received by the receiving unit.

6. The yarn winding system according to claim 5, wherein
each of the previous step machines includes a spinning frame including a plurality of spinning units each configured to form the yarn supply bobbin,
a tray configured to transfer the yarn supply bobbin includes a storage unit configured to store therein identification information for identifying each of the spinning units that has formed the corresponding yarn supply bobbin,
the automatic winder includes a reading unit configured to read the identification information stored in the storage unit,
the transmission unit further transmits the identification information detected by the reading unit as the information on the monitoring result, and
the second abnormality information acquisition unit identifies the spinning unit in which abnormality has occurred, based on the detection data received by the receiving unit and the identification information, and acquires information on the spinning unit identified as the abnormality information.

7. The yarn winding system according to claim 5, wherein each of the previous step machines includes a spinning frame including a plurality of spinning units each configured to form the yarn supply bobbin, and
the second abnormality information acquisition unit acquires information on abnormality that is common to the spinning units as the abnormality information, based on the detection data received by the receiving unit.

8. The yarn winding system according to any one of claims 2 to 7, wherein each of the previous step machines includes a notification unit configured to provide notification of abnormality in the previous step machine according to the abnormality information.

9. The yarn winding system according to any one of claims 2 to 8, wherein the detection data includes yarn defect detection data on a detected yarn defect.

10. The yarn winding system according to any one of claims 1 to 9, wherein each of the previous step machines includes a roving frame including a plurality of roving units each configured to form a roved yarn bobbin.

11. An automatic winder configured to wind yarn from a yarn supply bobbin to form a package, the automatic winder comprising:

a yarn monitoring unit configured to detect a state of the yarn travelling; and
a transmission unit configured to transmit information on a monitoring result of the yarn monitoring unit to one or a plurality of previous step machines each configured to perform a spinning process at a previous step for the automatic winder.

12. A spinning frame arranged for a previous step for an automatic winder configured to wind yarn from a yarn supply bobbin to form a package and including a plurality of spinning units each configured to form the yarn supply bobbin, the spinning frame comprising a receiving unit configured to receive, from the automatic winder, information on a monitoring result of a yarn monitoring unit provided to the automatic winder and configured to detect a state of the yarn travelling.

13. A yarn winding method for forming a yarn supply bobbin by a spinning frame and winding yarn from the yarn supply bobbin by an automatic winder to form a package, the yarn winding method comprising:

a step of, by a yarn monitoring unit, detecting a state of the yarn travelling in the automatic winder; and
a step of transmitting information on a monitoring result of the yarn monitoring unit from the automatic winder to the spinning frame.

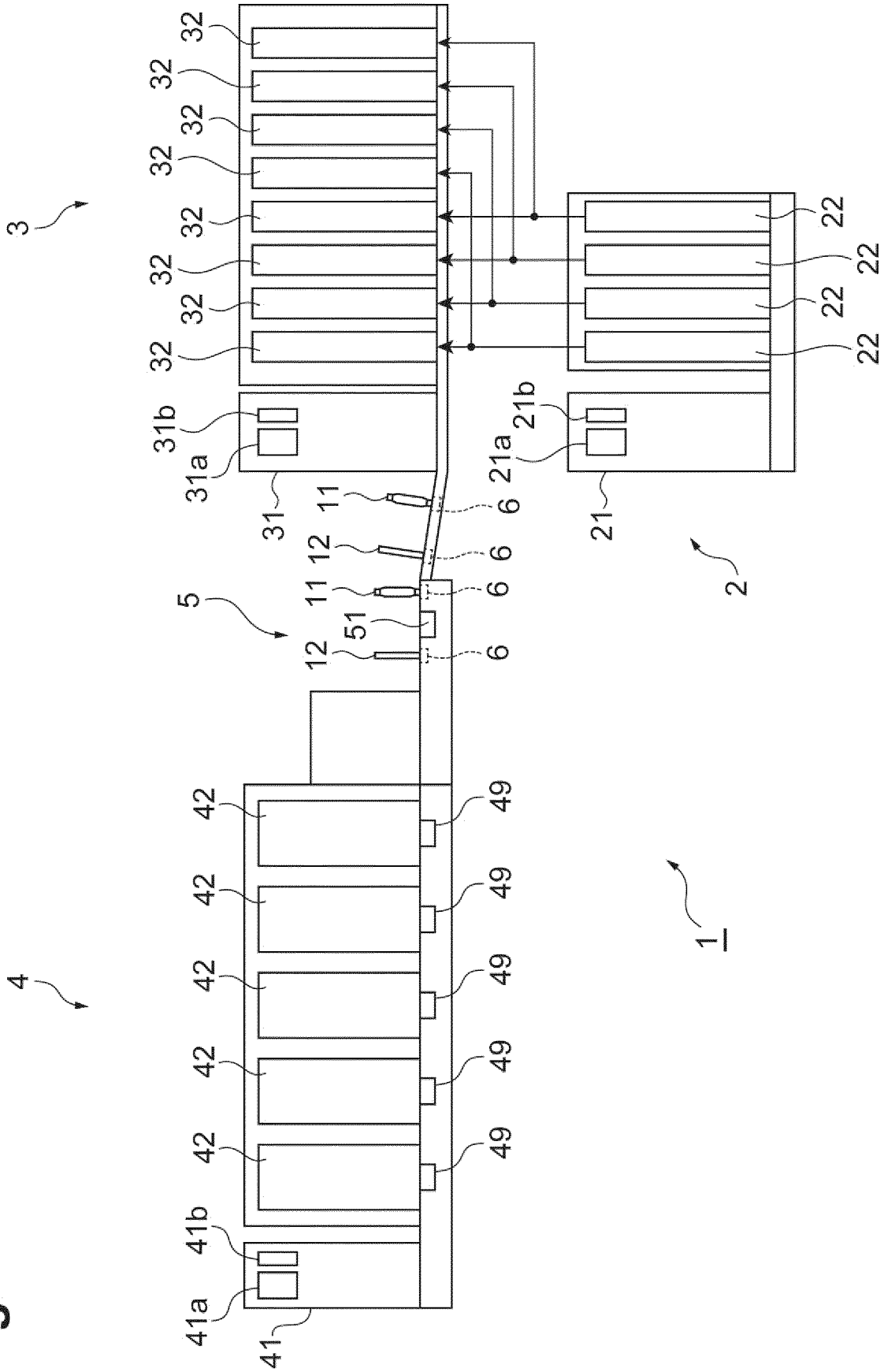


Fig.1

Fig.2

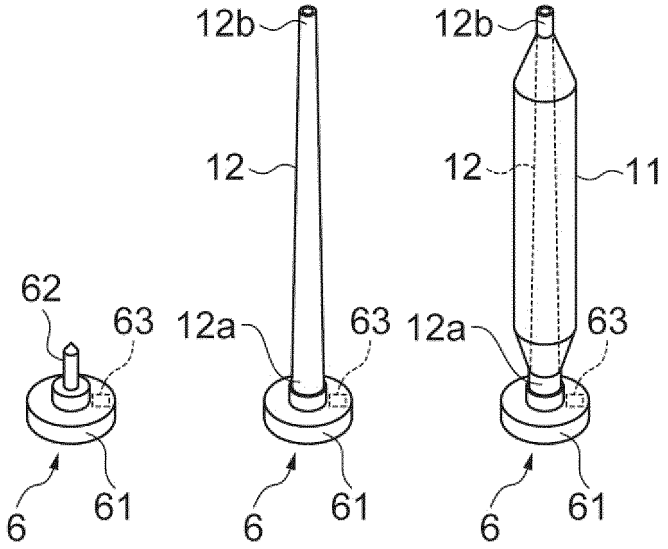


Fig.3

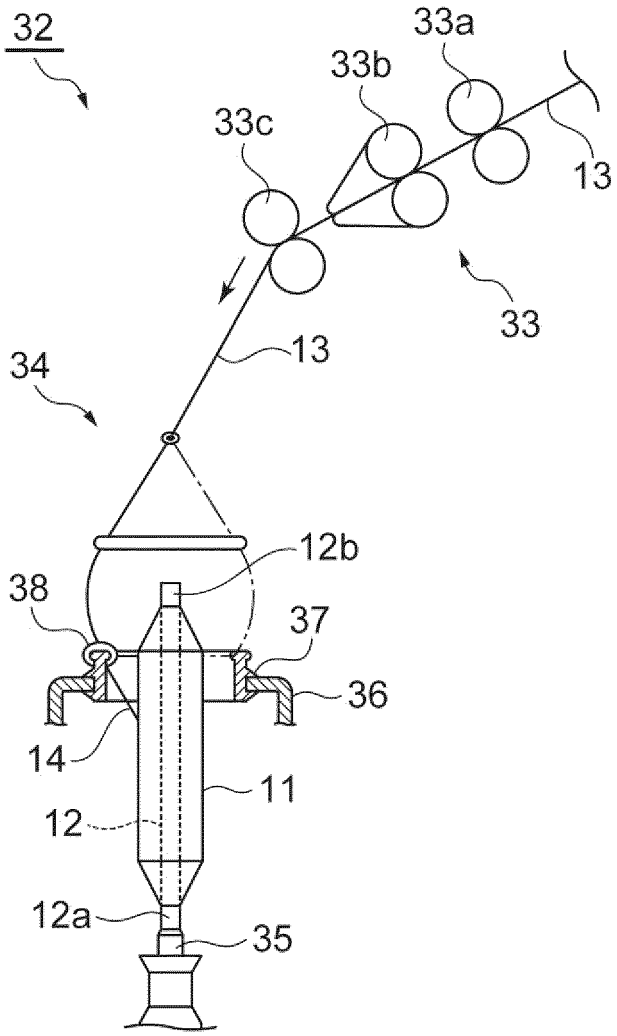


Fig.4

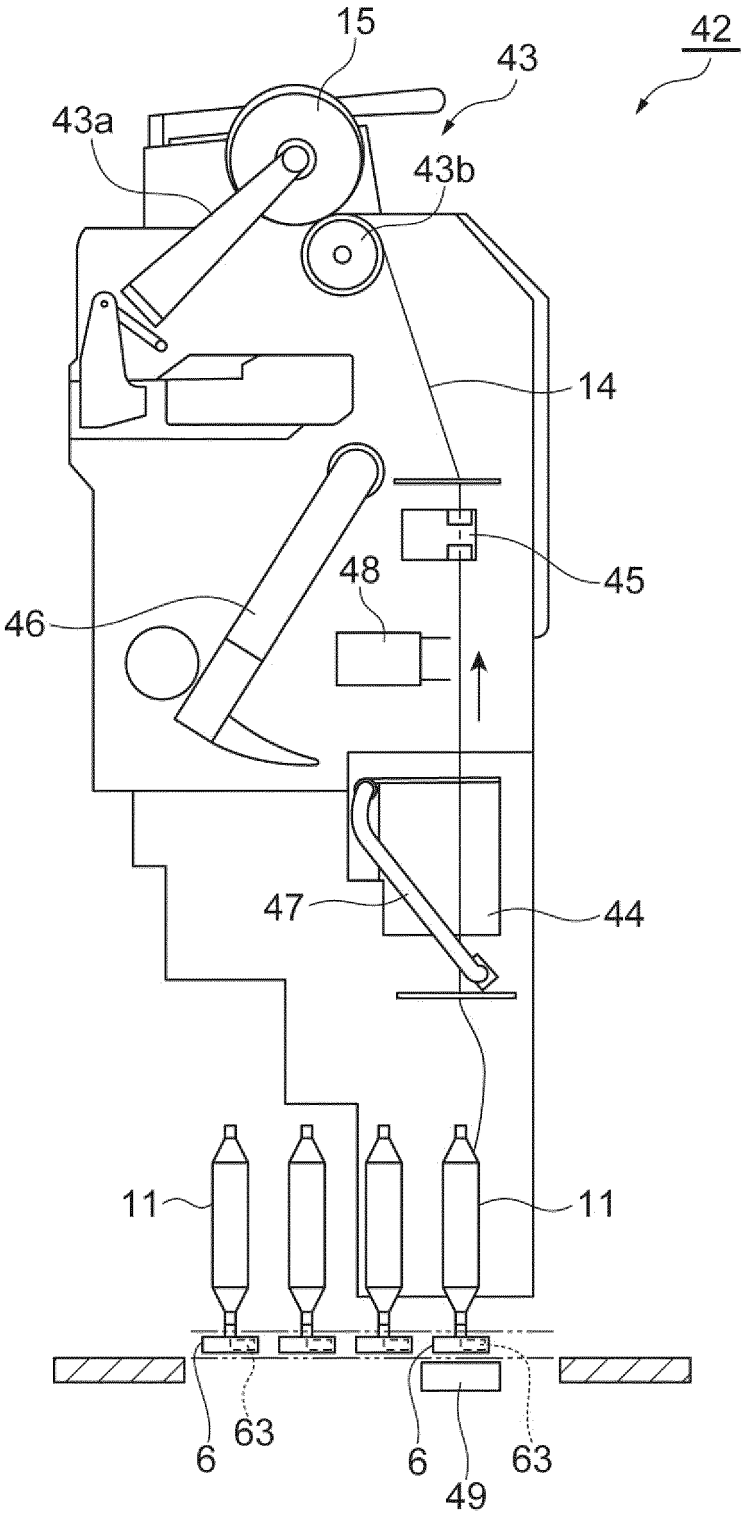


Fig.5

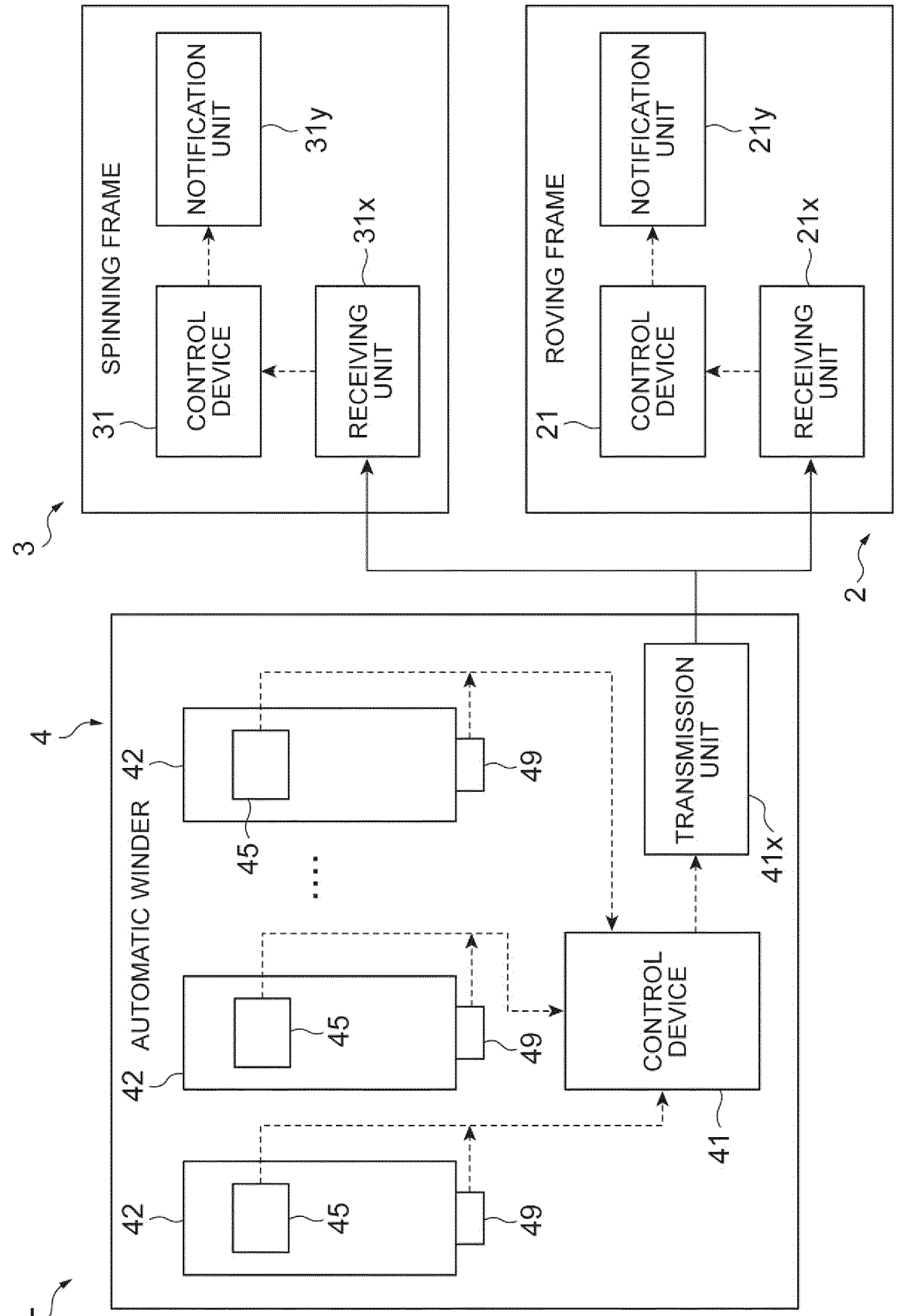
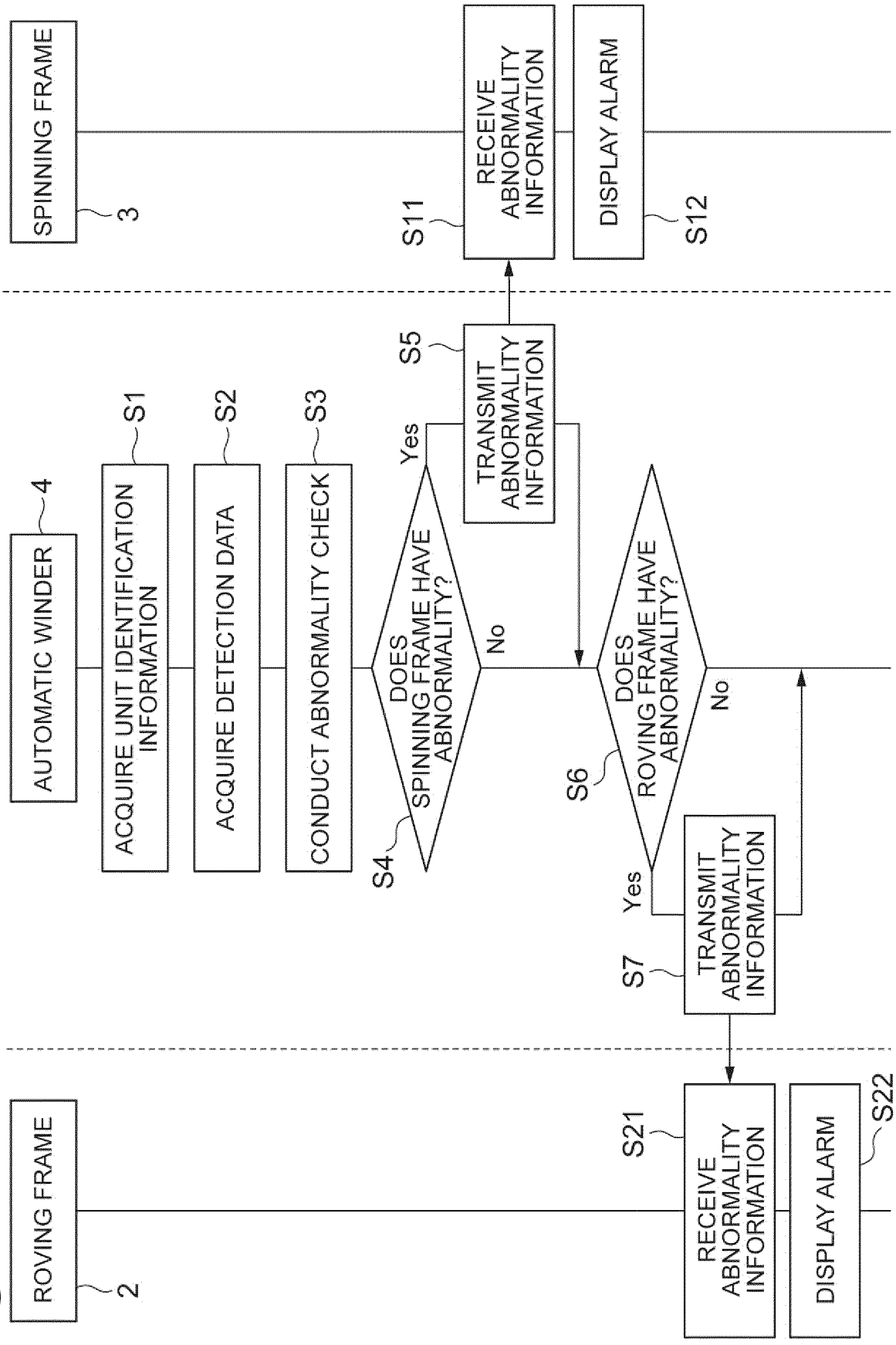

1
4
AUTOMATIC WINDER
42
45
49
41
CONTROL DEVICE
41x
TRANSMISSION UNIT
2
3
SPINNING FRAME
31
CONTROL DEVICE
RECEIVING UNIT
31x
NOTIFICATION UNIT
31y
ROVING FRAME
21
21x
21y

Fig.6


SPINNING FRAME
3
S11
RECEIVE ABNORMALITY INFORMATION
DISPLAY ALARM
S12
S5
TRANSMIT ABNORMALITY INFORMATION
Yes
AUTOMATIC WINDER
4
S1
ACQUIRE UNIT IDENTIFICATION INFORMATION
S2
ACQUIRE DETECTION DATA
S3
CONDUCT ABNORMALITY CHECK
DOES SPINNING FRAME HAVE ABNORMALITY?
S4
No
DOES ROVING FRAME HAVE ABNORMALITY?
S6
No
Yes
TRANSMIT ABNORMALITY INFORMATION
S7
ROVING FRAME
2
S21
RECEIVE ABNORMALITY INFORMATION
DISPLAY ALARM
S22

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/061783

A. CLASSIFICATION OF SUBJECT MATTER
B65H67/06(2006.01)i, *D01H9/18*(2006.01)i, *D01H13/14*(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, 67/06, D01H9/18, 13/14

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.
X Y	JP 2009-242029 A (Murata Machinery Ltd.), 22 October 2009 (22.10.2009), paragraphs [0031] to [0033], [0038], [0042], [0096] to [0097]; fig. 1 to 2 & EP 2108723 A2 paragraphs [0032] to [0034], [0039], [0043], [0097] to [0098]; fig. 1 to 2 & CN 101546193 A	1-2,5,9, 11-13 3-4,6-8,10
Y	JP 2011-20836 A (Murata Machinery Ltd.), 03 February 2011 (03.02.2011), paragraphs [0030], [0036], [0039], [0047], [0064], [0086], [0123] to [0129]; fig. 2 (Family: none)	3-4,6-10

☒ 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	Date of mailing of the international search report
09 June 2016 (09.06.16)	21 June 2016 (21.06.16)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/061783

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 61-178375 A (Murata Machinery Ltd.), 11 August 1986 (11.08.1986), page 5, lower right column, lines 3 to 11; fig. 1 & US 4660370 A column 6, lines 3 to 11; fig. 1 & DE 3603002 A1	8-10

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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