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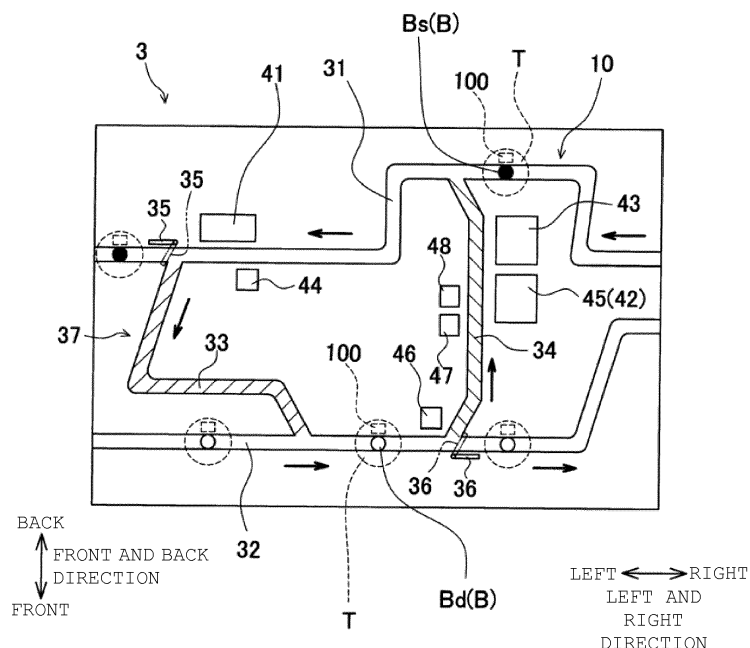
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(54) **YARN WINDING EQUIPMENT**

(57) A bobbin processing device (3) for a yarn winding system configured to receive bobbins from and transfer bobbins to a spinning machine (2) and/or a winding machine (4), comprises a transportation path (10) along which the bobbins can move through the bobbin processing device, optionally on a bobbin transport tray (T) a removing section (42) configured to remove a bobbin (B) from the transportation path, optionally from the bobbin transport tray; and a bobbin processing control section

(11) that is configured to control the removing section to remove a bobbin from the transportation path in dependence on at least one of quality information linked to the bobbin, yarn amount information linked to the bobbin and status information linked to the bobbin. Further described is a yarn winding/processing system optionally with the bobbin processing device and a bobbin processing method optionally using the bobbin processing device.

FIG. 4



Description**BACKGROUND OF THE INVENTION****1. Field of the Invention**

[0001] The present invention relates to yarn winding equipment.

2. Description of the Related Art

[0002] A spinning winder (yarn winding equipment) disclosed in Japanese Unexamined Patent Publication No. 2011-20837 includes a spinning unit, a winding unit, and an automatic bobbin supplying device (bobbin processing device). The spinning unit is adapted to spin the yarn and wind the yarn around an empty bobbin to form a yarn supplying bobbin. The winding unit is adapted to unwind the yarn from the yarn supplying bobbin and wind the yarn around a winding bobbin to form a package, and discharge the processed yarn supplying bobbin as a discharge bobbin. The bobbin processing device is adapted to perform supply of the yarn supplying bobbin to the winding unit side, predetermined processing on the yarn supplying bobbin and the discharge bobbin, return of the discharge bobbin that has become empty to the spinning unit side, and the like. The yarn supplying bobbin or the like is transported while being loaded on a tray.

[0003] Here, the discharge bobbin may include a "defective bobbin" discharged due to reasons such as a large number of yarn defects and the like. Specifically, the winding unit is configured to be able to determine whether or not the yarn supplying bobbin, from which the yarn is unwound, is a defective bobbin. When the yarn supplying bobbin is determined to be a defective bobbin, the winding unit stops the unwinding of the yarn from the yarn supplying bobbin and discharges the yarn supplying bobbin.

[0004] In addition, the bobbin processing device can have the tray on which the defective bobbin is loaded to temporarily wait in the defective bobbin waiting path. The defective bobbin accumulated on the defective bobbin waiting path is removed from the tray by an operator and replaced with an empty bobbin. Thereafter, the tray on which the empty bobbin is loaded is transported out of the defective bobbin waiting path and returned to the spinning unit.

[0005] As described in Japanese Unexamined Patent Publication No. 2011-20837, it is time-consuming to have the operator remove the defective bobbins waiting on the defective bobbin waiting path from the tray one by one. Furthermore, if the operator does not perform the above-described removing work for some reason such as troubleshooting, and the tray on the defective bobbin waiting path becomes full, the subsequent defective bobbins cannot enter the defective bobbin waiting path. In such a case, the operation of the bobbin processing device

may be stopped.

BRIEF SUMMARY OF THE INVENTION

[0006] An object of the present invention is to remove a defective bobbin from a transportation path or optionally a tray running on said transportation path without manual operation (automatically) when the yarn supplying bobbin, from which yarn is unwound by the winding unit, is determined to be a defective bobbin.

[0007] Said objective and more is achieved by the bobbin processing device according to the appended claims and as described below. Further core aspects of the present invention are a complete yarn winding system/equipment (= yarn processing system/equipment) and a bobbin processing method both also according to the appended claims and as described below.

[0008] As a first aspect of the present invention, a bobbin processing device for a yarn winding/processing system is configured to receive bobbins from and transfer bobbins to a spinning machine and/or a winding machine, wherein the bobbin processing device comprises: a transportation path along which the bobbins can move through the bobbin processing device, optionally on a bobbin transport tray; a removing section configured to remove a bobbin from the transportation path, optionally from the bobbin transport tray; and a bobbin processing control section that is configured to control the removing section to remove a bobbin from the transportation path in dependence on at least one of quality information linked to the bobbin, yarn amount information linked to the bobbin and status information linked to the bobbin.

[0009] In a further aspect of the bobbin processing device according to the present invention, the quality information linked to the bobbin is information obtained by a status information acquiring section included in the bobbin processing device and is information about a defective or non-defective state of the bobbin; the yarn amount information linked to the bobbin is information obtained by at least one yarn amount sensor included in the bobbin processing device and is information about the amount or residue of yarn wound on the bobbin; and the status information linked to the bobbin is information obtained by the status information acquiring section included in the bobbin processing device and is information about the number of times the bobbin has been circulated in the bobbin processing device.

[0010] The above bobbin processing device preferably further includes: a supplying path adapted to transport the bobbin transport tray on which the yarn supplying bobbin is loaded, a discharge path adapted to transport the bobbin transport tray on which the discharge bobbin is loaded, a yarn-end finding processing section adapted to execute a yarn-end finding processing to find a yarn end of the yarn supplying bobbin on the supplying path, a feeding path that diverges from a portion downstream of the yarn-end finding processing section of the supplying path in a transportation direction of the bobbin trans-

port tray and joins with the discharge path, a return path that diverges from a portion downstream of a point where the discharge path and the feeding path join, and joins with a portion upstream of the yarn-end finding processing section of the supplying path in the transportation direction, a number-of-times information assigning section adapted to assign number-of-times-information to a number-of-times assigned section, provided that the number-of-times information is information relating to a number of times the bobbin transport tray being transported around along an orbit path formed by the supplying path, the feeding path, the discharge path and the return path, and a number-of-times acquiring section adapted to acquire the number-of-times information assigned to the number-of-times information assigned section, wherein the bobbin processing control section is adapted to control the bobbin processing device when the yarn-end finding processing fails such that the bobbin transport tray on which the yarn supplying bobbin is loaded is transported along the orbit path and returned to the supplying path, and also to control the number-of-times information assigning section to assign the number-of-times information to the number-of-times assigned section, the status information acquiring section includes the number-of-times information acquiring section, and the status information includes the number-of-times information.

[0011] The bobbin processing device according to another aspect of the invention optionally further comprises a sorting section adapted to process such that a removed bobbin removed from the transportation path or bobbin transport tray by the removing section can be sorted, wherein the bobbin processing control section is adapted to control the sorting section in accordance with at least the quality information.

[0012] Preferably the sorting section further includes: a plurality of sorting passages, and a switching section adapted to be able to be switched to define to which one of the sorting passages the removed bobbin is to be moved.

[0013] Preferably, the plurality of the sorting passages includes a first sorting passage and a second sorting passage different from the first sorting passage, preferably only said two sorting passages or additional ones, and the switching section includes a guiding member adapted to be able to switch a position between a first position to guide the removed bobbin to the first sorting passage and a second position to guide the removed bobbin to the second sorting passage, and a driving section adapted to move the guiding member between the first position and the second position.

[0014] Yet preferably, the plurality of the sorting passages is configured to extend at least downward as towards a downstream side in a moving direction of the removed bobbin.

[0015] In the above bobbin processing device configurations, a storage section adapted to be able to store a plurality of the removed bobbins is optionally provided at

a downstream side in the sorting passage in a moving direction of the removed bobbin.

[0016] Further, in the above bobbin processing device configurations, the bobbin processing control section is adapted to control the sorting section in accordance with the status information in addition to the quality information.

[0017] Finally, the bobbin processing device configurations above may optionally further comprise an empty bobbin loading section adapted to load an empty bobbin on the bobbin transport tray from which a bobbin has been removed by the removing section; and a return path for returning the bobbin transport tray with the empty bobbin to the spinning machine; and/or a yarn supplying bobbin loading section adapted to load a yarn supplying bobbin on the bobbin transport tray from which a bobbin has been removed by the removing section.

[0018] A further core aspect of the present invention is a yarn winding equipment/system or yarn processing equipment/system respectively that comprises any one of the bobbin processing device configurations described above and described in the following; and further a winding machine and/or a spinning machine (2), wherein the bobbin processing device is spatially and/or procedurally so situated with respect to the winding machine and/or the spinning machine as to receive bobbins from and transfer bobbins to the winding machine and/or the spinning machine, optionally wherein the bobbin processing device is spatially and/or procedurally situated between the spinning machine and the winding machine so as to transfer bobbins from one machine to the other and vice versa.

[0019] The above yarn winding system has the winding machine that comprises a winding unit that a) is adapted to unwind a yarn from a yarn supplying bobbin optionally loaded on a bobbin transport tray and to wind the yarn around a winding bobbin, and adapted to discharge as a discharge bobbin, the yarn supplying bobbin that has been used; b) has a unit control section adapted to control a movement of the winding unit; c) has a monitoring section adapted to monitor the yarn that has been unwound from the yarn supplying bobbin and is running; and d) has a quality information assigning section adapted to assign quality information relating to a quality of a yarn wound around the yarn supplying bobbin to a quality information assigned section; wherein the quality information acquiring section of the bobbin processing device is adapted to acquire, from the quality information assigned section, the quality information of a bobbin optionally loaded on the bobbin transport tray on the transportation path. The yarn winding system optionally further comprises a determination section that is adapted to determine whether or not the yarn supplying bobbin is a defective bobbin in accordance with a monitor result of the monitoring section, and when the determination section determines that the yarn supplying bobbin is the defective bobbin, the unit control section stops unwinding of a yarn from the bobbin by the winding unit and discharges the

bobbin from the winding unit, and also controls the quality information assigning section to assign to the quality information assigned section, information indicating that the discharged bobbin is the defective bobbin, and the bobbin processing control device of the bobbin processing device controls the removing section in accordance with the quality information acquired by the quality information acquiring section, and when the discharged bobbin is the defective bobbin, controls the removing section to remove the bobbin from the transportation path, optionally from the bobbin transport tray on which the bobbin was loaded.

[0020] In the above yarn winding system configurations, the determination section is included in the monitoring section or is included in the unit control section and/or the quality information assigned section is provided on the bobbin transport tray, and the quality information acquiring section is adapted to read the quality information assigned to the bobbin transport tray.

[0021] According to a further aspect of the present invention, in the above yarn winding system configurations, the spinning machine includes a spinning unit adapted to form the yarn supplying bobbin by spinning a yarn and winding the yarn around an empty bobbin, the spinning machine being connected to the bobbin processing device.

[0022] A yet further core aspect of the present invention is a bobbin processing method, comprising the steps of: detecting at least one of quality information, yarn amount information and status information linked to a bobbin being conveyed along a transportation path of a bobbin processing device, preferably the bobbin processing device according to any one of the above configurations or the configurations described below; and removing the bobbin from the transportation path or optionally from the bobbin transport tray on which the bobbin is moving along the transportation path, if any one of the information satisfies a prescribed condition.

[0023] In the above method, the bobbin is removed from the transportation path or the bobbin transport tray and optionally a new, empty bobbin loaded to the transportation path or the bobbin transport tray, if it is detected - as the quality information - that the bobbin is a defective bobbin; if it is detected - as the yarn amount information - that the amount or residue of yarn wound on the bobbin is not greater than or equal to a predetermined amount of yarn and if it is detected - as the status information - that the number of circulations of the bobbin in the bobbin processing device is greater than or equal to a predetermined number of times.

[0024] According to a further aspect of the present invention, in the above methods, the removal of the bobbin is carried out automatically by a bobbin removing device of the bobbin processing device; and/or the loading of a new, empty bobbin is carried out automatically by a bobbin loading device of the bobbin processing device.

[0025] Finally, the above methods optionally further comprise a step of sorting the bobbins removed from the

transportation path, optionally wherein the sorting is carried out automatically by a bobbin sorting device of the bobbin processing device.

[0026] The following further items are also part of the present invention and disclosure and contribute to achieving the above objective. All effects and advantages mentioned below for the further items of the present invention also apply to the above described aspects of the invention and vice versa.

[0027] A yarn winding/processing equipment/system according to a first item of the present invention and disclosure relates to a yarn winding equipment including: a winding unit adapted to unwind a yarn from a yarn supplying bobbin loaded on a tray, preferably a bobbin transport tray, and to wind the yarn around a winding bobbin, and adapted to discharge as a discharge bobbin the yarn supplying bobbin that has been used; a unit control section adapted to control a movement of the winding unit; a monitoring section adapted to monitor the yarn that has been unwound from the yarn supplying bobbin and is running; a quality information assigning section adapted to assign quality information relating to a quality of a yarn wound around the yarn supplying bobbin to a quality information assigned section; a bobbin processing device in which a transportation path adapted to transport the tray is formed, the bobbin processing device being adapted to execute prescribed processing on the yarn supplying bobbin and the discharge bobbin; a quality information acquiring section adapted to acquire, from the quality information assigned section, the quality information of a bobbin loaded on the tray on the transportation path; and a bobbin processing control section, the yarn winding equipment characterized by further including a determination section is adapted to determine whether or not the yarn supplying bobbin is a defective bobbin in accordance with a monitor result of the monitoring section, where the bobbin processing device includes a removing section adapted to be able to remove a bobbin from the tray, when the determination section determines that the yarn supplying bobbin is the defective bobbin, the unit control section stops unwinding of a yarn from the bobbin by the winding unit and discharges the bobbin from the winding unit, and also controls the quality information assigning section to assign to the quality information assigned section, information indicating that the discharged bobbin is the defective bobbin, and the bobbin processing control section controls the removing section in accordance with the quality information acquired by the quality information acquiring section, and when the discharge bobbin is the defective bobbin, controls the removing section to remove the bobbin from the tray on which the bobbin is loaded.

[0028] In the present invention, the defective bobbin cannot be visually distinguished from the normal yarn supplying bobbin, but can be distinguished from the normal yarn supplying bobbin by monitoring, with the monitoring section, the yarn unwound from the yarn supplying bobbin and running and by determining with the deter-

mination section. For example, a yarn supplying bobbin on which a yarn having weak twist and prone to breakage is wound, a yarn supplying bobbin on which a yarn having many defects is wound, or the like corresponds to the defective bobbin here. The yarn supplying bobbin determined to be a defective bobbin is discontinued from use and discharged from the winding unit.

[0029] In the present invention, the quality information acquiring section can acquire the quality information of the bobbin transported on the transportation path of the bobbin processing device. Furthermore, since the removing section is controlled in accordance with the quality information, the defective bobbin can be removed from the tray by the removing section. Therefore, when the yarn supplying bobbin from which the yarn is unwound by the winding unit is determined to be a defective bobbin, the defective bobbin can be removed from the tray without manual operation.

[0030] Yarn winding equipment according to a second item relates to the first item, where the determination section is included in the monitoring section.

[0031] For example, a configuration of a part of the monitoring section may function as a determination section, or the unit control section may have a function as a determination section. In the present invention, the processing load of the unit control section can be alleviated compared to a case where the unit control section functions as a determination section.

[0032] Yarn winding equipment according to a third item relates to the first item, where the determination section is included in the unit control section.

[0033] In the present invention, even if the monitoring section cannot function as the determination section, the unit control section can determine whether the yarn supplying bobbin is a defective bobbin.

[0034] Yarn winding equipment according to a fourth item relates to any one of the first to third inventions, where the quality information assigned section is provided on the tray, and the quality information acquiring section is adapted to read the quality information assigned to the tray.

[0035] For example, the quality information assigning section may be configured to be communicable with the control section, and the control section may function as the quality information assigned section by storing data relating to quality information. However, in such a configuration, the data relating to the quality information is concentrated in the control section, and hence the data may be lost all at once, for example, when a trouble occurs in the control section. In the present invention, the quality information is assigned to each tray, so that the data relating to the quality information can be avoided from being concentrated in the control section. Therefore, the risk of loss of the data can be suppressed.

[0036] Yarn winding equipment according to a fifth item relates to any one of the first to fourth items, where the bobbin processing device includes a status information acquiring section adapted to acquire status information

relating to a status of a bobbin loaded on the tray in the transportation path, and the bobbin processing control section is adapted to control the removing section in accordance with the status information in addition to the quality information such that a bobbin is removed from the tray when the status information acquired by the status information acquiring section satisfies a prescribed condition.

[0037] In the present invention, bobbins other than the defective bobbin can also be removed without manual operation.

[0038] Yarn winding equipment according to a sixth item relates to the fifth item, and further includes a yarn amount detecting section adapted to detect an amount of a yarn wound around a bobbin loaded on the tray, where the status information acquiring section includes the yarn amount detecting section, and the status information includes yarn amount information relating to an amount of the yarn.

[0039] For example, a discharge bobbin, from which the yarn is normally unwound by the winding unit and a small amount of yarn remains thereon, may also be subject to removal. In the present invention, such a bobbin can also be removed by the removing section.

[0040] Yarn winding equipment according to a seventh item relates to the fifth or sixth item, where the bobbin processing device includes a supplying path adapted to transport the tray on which the yarn supplying bobbin is loaded, a discharge path adapted to transport the tray on which the discharge bobbin is loaded, a yarn-end finding processing section adapted to execute yarn-end finding processing to find a yarn end of the yarn supplying bobbin on the supplying path, a feeding path that diverges from a portion downstream of the yarn-end finding processing section of the supplying path in a transportation direction of the tray and joins with the discharge path, a return path that diverges from a portion downstream of a point where the discharge path and the feeding path join, and joins with a portion upstream of the yarn-end finding processing section of the supplying path in the transportation direction, a number-of-times information assigning section adapted to assign number-of-times-information to a number-of-times information assigned section, provided that the number-of-times information is information relating to a number of times the tray being transported around along an orbit path formed by the supplying path, the feeding path, the discharge path and the return path, and a number-of-times information acquiring section adapted to acquire the number-of-times information assigned to the number-of-times information assigned section; the bobbin processing control section is adapted to control the bobbin processing device when the yarn-end finding processing to the yarn supplying bobbin fails such that the tray on which the yarn supplying bobbin is loaded is transported along the orbit path and returned to the supplying path, and also to control the number-of-times information assigning section to assign the number-of-times information to the number-of-times

information assigned section, the status information acquiring section includes the number-of-times information acquiring section, and the status information includes the number-of-times information.

[0041] If the yarn supplying bobbin, which has repeatedly failed in the yarn-end finding processing, circulates on the orbit path many times, the tray on which the yarn supplying bobbin is loaded may accumulate on the orbit path and get in the way of other trays. In the present invention, such a bobbin can also be removed by the removing section.

[0042] Yarn winding equipment according to an eighth item relates to any one of the fifth to seventh inventions, and further includes a sorting section adapted to process such that a removed bobbin removed from the tray by the removing section can be sorted, where the bobbin processing control section is adapted to control the sorting section in accordance with at least the quality information.

[0043] In the configuration in which the defective bobbin and the other bobbins can be removed, the defective bobbin and the other bobbins are preferably be sorted as the contents of the processing to be performed after the removal may be different from each other. However, since the defective bobbin is not distinguishable from other bobbins in appearance, manual sorting is difficult. In the present invention, the sorting section can be controlled in accordance with at least the information as to whether or not the removed bobbin is a defective bobbin. Therefore, the defective bobbin and the other removed bobbin can be sorted.

[0044] Yarn winding equipment according to a ninth item relates to the eighth item, where the sorting section includes a plurality of sorting passages and a switching section adapted to be able to switch as to the removed bobbin be moved to which sorting passage among the plurality of sorting passages.

[0045] For example, in order to have the defective bobbin and the other bobbins sortable, a seal or the like may be attached to the defective bobbin, but for example, in a configuration where the defective bobbin and the other removed bobbins are transported to the same place, manual sorting is eventually required, which causes trouble. In the present invention, the defective bobbin and the other removed bobbins can be moved to different places. Therefore, the defective bobbin and the other removed bobbins can be easily and reliably sorted.

[0046] Yarn winding equipment according to a tenth item relates to the ninth item, where the plurality of the sorting passages includes a first sorting passage and a second sorting passage different from the first sorting passage, and the switching section includes a guiding member adapted to be able to switch a position between a first position to guide the removed bobbin to the first sorting passage and a second position to guide the removed bobbin to the second sorting passage, and a driving section adapted to move the guiding member between the first position and the second position.

[0047] In the present invention, the removed bobbins can be sorted by a simple operation of switching the position of the guiding member.

[0048] A yarn winding equipment according to an eleventh item relates to the ninth or tenth item, where the plurality of the sorting passages are configured to extend at least downward as toward a downstream side in a moving direction of the removed bobbin.

[0049] In the present invention, the removed bobbin can be moved along the sorting passage by the action of gravity. Therefore, cost can be reduced compared with the structure in which the removed bobbin is transported by a mechanism such as a belt conveyor.

[0050] Yarn winding equipment according to a twelfth item relates to any one of the ninth to eleventh inventions, where a storage section adapted to be able to store a plurality of the removed bobbins is provided at a downstream side in the sorting passage in a moving direction of the removed bobbin.

[0051] In the present invention, the plurality of removed bobbins that have been sorted and stored can be collected and collectively processed. Therefore, the trouble can be saved, for example, as compared to a case where the removed bobbins on the sorting passage are sequentially processed.

[0052] Yarn winding equipment according to a thirteenth item relates to any one of the eighth to twelfth inventions, where the bobbin processing control section is adapted to control the sorting section in accordance with the status information in addition to the quality information.

[0053] In some cases, situations may arise where it is desired to further sort the removed bobbins other than the defective bobbins. In the present invention, since the sorting section is controlled in accordance with the status information, the removed bobbins other than the defective bobbin can be further sorted.

[0054] Yarn winding equipment according to a fourteenth item relates to any one of the first to thirteenth items, and further includes a spinning machine including a spinning unit adapted to form the yarn supplying bobbin by spinning a yarn and winding the yarn around an empty bobbin, the spinning machine being connected to the bobbin processing device, where the bobbin processing device includes an empty bobbin loading section adapted to load an empty bobbin on the tray from which a bobbin has been removed by the removing section; and a return path for returning the tray on which the empty bobbin is loaded to the spinning machine.

[0055] In the present invention, in the yarn winding equipment in which the bobbin processing device and the spinning machine are connected, the work from removing the defective bobbin from the tray and loading the empty bobbin on the tray until returning the tray on which the empty bobbin is loaded to the spinning machine can be performed without manual operation.

[0056] Yarn winding equipment according to a fifteenth item relates to any one of the first to thirteenth inventions,

where the bobbin processing device includes a yarn supplying bobbin loading section adapted to load a yarn supplying bobbin on the tray from which a bobbin has been removed by the removing section.

[0057] In the present invention, in the yarn winding equipment in which a yarn supplying bobbin is loaded on an empty tray and again sent toward the winding unit, the work from removing the defective bobbin from the tray and loading the yarn supplying bobbin to the tray can be performed without manual operation.

[0058] Yarn winding equipment according to a sixteenth invention relates to the fifteenth item, and further includes a yarn amount detecting section adapted to detect an amount of a yarn wound around the bobbin, where the bobbin processing control section is adapted to control the removing section in accordance with yarn amount information relating to an amount of yarn in addition to the quality information to remove an empty bobbin from the tray.

[0059] In the present invention, both the removal of the defective bobbin and the removal of the empty bobbin can be performed by the removing section. Therefore, the manufacturing cost of the yarn winding equipment can be reduced as compared with the configuration in which these bobbins are removed separately.

ADVANTAGES AND TECHNICAL EFFECTS

[0060] The above and below detailed bobbin processing device in all its versatile configurations, the bobbin processing method optionally using the same and the yarn winding/processing equipment/system comprising said various bobbin processing device configurations realize a number of significant technical effects and advantages.

[0061] First and foremost, the bobbin processing device according to the present invention is able to detect and analyze a number of features and a state of bobbins that are transferred between a winding machine and a spinning machine of a yarn winding/processing equipment/system via the bobbin processing device for a significant number of process scenarios. Based on the analysis results obtained, the bobbin processing device can decide whether a particular bobbin currently transported by the bobbin processing device can remain in the transport/conveyance process or is to be removed and discarded and optionally replaced by a new bobbin that is then instead supplied to the transportation/conveyance process. As a further beneficial functionality, the bobbin processing device may preferably sort the discarded bobbins according to predetermined criteria, which significantly eases later handling of the discarded bobbins. The judgement and execution mentioned above is done automatically, preferably fully automatically, such that little to no manual work and interference by an operator is required and the yarn winding/processing equipment/system can operate largely user-independently with little to no malfunctions caused by bobbin problems.

This is achieved by the bobbin processing device being configured to provide each connected component of a yarn winding/processing equipment/system with bobbins in the state needed for optimal processing and functionality. On top of that, the bobbin processing device described here can basically decide, if a current bobbin state, albeit not pristine, is still suitable for further processing and can thus keep such bobbin in the transportation/conveyance process. This avoids excessive discard of non-pristine bobbins and improves bobbin usage efficiency and overall operational efficiency. In addition, bobbin analysis is made more efficient, since the bobbin processing device and not a or several different users make the judgement as to whether a bobbin is to be discarded and replaced or not. Hence, the judgment and processing become more objective.

BRIEF DESCRIPTION OF THE DRAWINGS

[0062]

FIG. 1 is a schematic plan view of yarn winding equipment according to the present embodiment;
 FIG. 2 is a block diagram illustrating an electrical configuration of the yarn winding equipment;
 FIG. 3 is a schematic front view of a winding unit;
 FIG. 4 is a plan view of the bobbin processing device;
 FIG. 5A is a perspective view of a bobbin removing device and a bobbin sorting device;
 FIG. 5B is a view illustrating an internal structure of the bobbin removing device;
 FIG. 5C is a view illustrating an internal structure of the bobbin sorting device;
 FIG. 6 is a flowchart illustrating a discharging process of a tray from the winding unit;
 FIG. 7 is a flowchart illustrating processing related to removal and discharge of the bobbin as well as returning of the tray;
 FIG. 8 is a flowchart illustrating processing from when the tray is transported to a yarn-end finding device side until the tray is again returned to the transportation path;
 FIG. 9A is an explanatory view related to a movement of the bobbin on the transportation path;
 FIG. 9B is an explanatory view related the movement of the bobbin on the transportation path;
 FIG. 9C is an explanatory view related the movement of the bobbin on the transportation path;
 FIG. 10A is an explanatory view related to the movement of the bobbin on the transportation path;
 FIG. 10B is an explanatory view related the movement of the bobbin on the transportation path;
 FIG. 10C is an explanatory view related the movement of the bobbin on the transportation path;
 FIG. 11A is an explanatory view related to an operation of the bobbin sorting device;
 FIG. 11B is an explanatory view related to the operation of the bobbin sorting device;

FIG. 12A is a view illustrating an internal structure of a bobbin removing device according to an alternative embodiment;

FIG. 12B is a view illustrating an internal structure of a bobbin removing device according to an alternative embodiment;

FIG. 12C is a perspective view of the bobbin removing device and the bobbin sorting device;

FIG. 13 is a flowchart illustrating processing related to removal and discharge of the bobbin as well as returning of the tray according to the alternative embodiment illustrated in FIG. 12;

FIG. 14 is a plan view of a bobbin processing device according to another alternative embodiment; and
FIG. 15 is a flowchart illustrating processing related to removal and discharge of a bobbin according to the alternative embodiment illustrated in FIG. 14.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0063] Next, an embodiment of the present invention will be described with reference to FIGS. 1 to 11. Directions illustrated in FIG. 1 are a front and back direction, and a left and right direction, for the sake of convenience of explanation. The direction (vertical direction) orthogonal to both the front and back direction and the left and right direction and in which gravity acts is an up and down direction.

(Schematic configuration of yarn winding equipment)

[0064] First, a schematic configuration of yarn winding equipment/system (= yarn processing equipment/system) 1 according to the present embodiment will be described with reference to FIGS. 1 and 2. FIG. 1 is a schematic plan view of the yarn winding equipment 1 according to the present embodiment. FIG. 2 is a block diagram illustrating an electrical configuration of the yarn winding equipment 1. As illustrated in FIG. 1, the yarn winding equipment 1 includes a spinning machine 2, a bobbin processing device 3, a winding machine 4, and a machine control device 5. The yarn winding equipment 1 is so-called link corner type equipment in which the spinning machine 2, the bobbin processing device 3, and the winding machine 4 are connected.

[0065] The spinning machine 2 includes a plurality of spinning units 6 arrayed in the left and right direction. Each spinning unit 6 performs spinning on a roved yarn (not illustrated) and winds a yarn around a tubular empty bobbin to form a yarn supplying bobbin Bs. The spinning machine 2 feeds a yarn supplying bobbin Bs formed by each spinning unit 6 to the bobbin processing device 3. The yarn supplying bobbin Bs is fed to the bobbin processing device 3 in a substantially upright state while being loaded on the tray T, which can optionally be referred to as bobbin transport tray, since being arranged and configured to retain a bobbin and to move or to be

moved along the bobbin processing device. On the tray T, an RF tag 100 (see FIGS. 3 and 4) capable of recording various information such as identification information of the tray T is provided.

[0066] The bobbin processing device 3 is configured to transport, to the winding machine 4 side, the tray T on which the yarn supplying bobbin Bs (see black circle in FIG. 1) formed by the spinning machine 2 is loaded, and transport, to the spinning machine 2 side, the tray T on which the discharge bobbin Bd (see white circle in FIG. 1) discharged from the winding machine 4 is loaded. Hereinafter, the yarn supplying bobbin Bs and the discharge bobbin Bd are also collectively referred to as a bobbin B. The bobbin processing device 3 is disposed on the left side of the spinning machine 2 and the right side of the winding machine 4. The bobbin processing device 3 has a transportation path 10 for transporting the bobbin directly or optionally on tray T, i.e., a bobbin transport tray on which the bobbin B is loaded. Furthermore, the bobbin processing device 3 performs predetermined processing on the bobbin B. The bobbin processing device 3 performs, for example, a yarn-end finding processing for easily catching the yarn end of the yarn supplying bobbin Bs by the winding unit 7 described later, a removal processing of the discharge bobbin Bd (details will be described later), and the like.

[0067] The winding machine 4 is disposed on the left side of the bobbin processing device 3. The winding machine 4 includes a plurality of winding units 7 arrayed in the left and right direction. Each winding unit 7 unwinds the yarn from the yarn supplying bobbin Bs and winds it around the winding bobbin Bw (see FIG. 3) to form a package P (see FIG. 3). Each winding unit 7 discharges the processed yarn supplying bobbin Bs as a discharge bobbin Bd. The discharge bobbin Bd includes an empty bobbin from which all the yarns have been unwound and a residual yarn bobbin on which the yarn remains (details will be described later). The winding machine 4 further includes a supplying path 101, a plurality of individual paths 102, and a discharge path 103. The supplying path 101 is a path disposed on the back side of each winding unit 7 and extending in the left and right direction for transporting the tray T on which the yarn supplying bobbin Bs is loaded. Each individual path 102 is a path diverged from the supplying path 101 and extending toward the front side for distributing the yarn supplying bobbin Bs to each winding unit 7. The discharge path 103 is a path joined with each individual path 102 and extending in the left and right direction for returning the tray T on which the discharge bobbin Bd is loaded, to the bobbin processing device 3. The tray T on each path is transported by a conveyor mechanism (not illustrated).

[0068] The machine control device 5 is disposed on the left side of the winding machine 4. As illustrated in FIG. 2, the machine control device 5 is electrically connected to a control section (not illustrated) of each spinning unit 6, a bobbin processing control section 11 of the bobbin processing device 3, and a unit control section

12 of each winding unit 7 to communicate with these control sections.

[0069] In the yarn winding equipment 1 having the above configuration, the yarn supplying bobbin Bs formed by the spinning machine 2 is supplied to each winding unit 7 of the winding machine 4 through the bobbin processing device 3. The yarn is unwound from the yarn supplying bobbin Bs by each winding unit 7. The processed yarn supplying bobbin Bs are discharged from each winding unit 7 as a discharge bobbin Bd, and returned to the spinning machine 2 through the bobbin processing device 3.

(Winding unit)

[0070] Next, a configuration of the winding unit 7 will be briefly described with reference to FIG. 3. FIG. 3 is a schematic front view of the winding unit 7.

[0071] The winding unit 7 is configured to unwind the yarn Y from the yarn supplying bobbin Bs disposed at the lower end portion, and wind the yarn Y around the winding bobbin Bw disposed at the upper end portion to form a package P. As illustrated in FIG. 3, the winding unit 7 includes a bobbin supporting portion 21, a yarn clearer 22, and a traverse drum 23 in order from the lower side. The winding unit 7 unwinds the yarn Y from the yarn supplying bobbin Bs supported by the bobbin supporting portion 21 and winds the yarn Y around the winding bobbin Bw rotating while making contact with the traverse drum 23 while monitoring the running yarn Y with the yarn clearer 22. The winding bobbin Bw is rotatably supported by a cradle 24.

[0072] The bobbin supporting portion 21 is configured to be able to support the tray T on which the yarn supplying bobbin Bs is loaded. The yarn clearer 22 is configured to be able to monitor the yarn Y unwound from the yarn supplying bobbin Bs and running and to be able to detect a defect included in the yarn Y. The traverse drum 23 makes contact with the surface of the winding bobbin Bw (package P), and is rotationally driven by a motor (not illustrated) to cause the winding bobbin Bw to rotate while making contact. The traverse drum 23 is formed with a groove for traversing the yarn Y. In this manner, the traverse drum 23 rotates the winding bobbin Bw while traversing the yarn Y, and winds the yarn Y around the winding bobbin Bw.

[0073] The yarn clearer 22 (monitoring section of the present invention) will be described in more detail. The yarn clearer 22 includes, for example, an optical sensor, and monitors the running yarn Y to detect a defect or the like of the yarn Y. The yarn clearer 22 includes a cutter (not illustrated) adapted to cut the running yarn Y when a defect or the like of the yarn Y is detected. Furthermore, the yarn clearer 22 includes a clearer control section 22a (determination section of the present invention) (see FIG. 2). The clearer control section 22a is configured to be able to count the number of defects of the yarn Y, the number of times the yarn Y is cut with a cutter, the number

of yarn breakages caused by causes other than the cutting of the yarn with the cutter, or the like. In the clearer control section 22a, for example, when the number of defects in the yarn Y or the number of yarn breakages becomes greater than or equal to a predetermined value, the yarn supplying bobbin Bs from which the yarn Y is unwound is determined as a defective bobbin around which the defective yarn is wound. The clearer control section 22a is electrically connected to the unit control section 12 (see FIG. 2) described above. When the yarn supplying bobbin Bs is determined to be a defective bobbin, the clearer control section 22a transmits a signal indicating that the yarn supplying bobbin Bs is a defective bobbin to the unit control section 12.

[0074] In a case where a yarn is cut with a cutter or a yarn breakage caused by other causes occurs, the winding unit 7 performs a yarn joining process of joining the yarn Y (lower yarn Y1) from the yarn supplying bobbin Bs and the yarn Y (upper yarn Y2) from the winding bobbin Bw. As a configuration for the yarn joining process, the winding unit 7 includes a yarn joining device 25, a lower yarn suction 26, and an upper yarn suction 27. The lower yarn suction 26 sucks and holds the lower yarn Y1 and guides the lower yarn Y1 to the yarn joining device 25. The upper yarn suction 27 sucks and holds the upper yarn Y2 and guides the upper yarn Y2 to the yarn joining device 25. The yarn joining device 25 performs the yarn joining process using, for example, compressed air. The yarn joining device 25 performs the yarn joining process by spraying the compressed air on the lower yarn Y1 and the upper yarn Y2 to once loosen both yarn ends, and then again spraying the compressed air on both yarn ends to entangle the yarn ends to each other.

[0075] Furthermore, a read/write section 28, a yarn presence/absence sensor 29, and an ejector 30 are disposed in the vicinity of the bobbin supporting portion 21. The read/write section 28 is electrically connected to the unit control section 12 (see FIG. 2). The read/write section 28 is configured to be able to write quality information on the quality of the yarn supplying bobbin Bs in an RF tag 100 (see FIG. 1) of the tray T. For example, when the yarn supplying bobbin Bs is determined to be a defective bobbin, the unit control section 12 controls the read/write section 28 and records the quality information indicating that the yarn supplying bobbin Bs is a defective bobbin, in the RF tag 100. That is, the RF tag 100 corresponds to the quality information assigned section of the present invention. The read/write section 28 corresponds to the quality information assigning section of the present invention. The yarn presence/absence sensor 29 detects whether or not the yarn supplying bobbin Bs is in a state where the yarn Y can be unwound. The ejector 30 is configured to be able to discharge the yarn supplying bobbin Bs from the winding unit 7. For example, when the yarn Y drawn from the yarn supplying bobbin Bs is not detected by the yarn presence/absence sensor 29, the winding unit 7 determines that the yarn of the yarn supplying bobbin Bs is not present (is empty) or the yarn

of the yarn supplying bobbin Bs cannot be caught, and operates the ejector 30 to discharge the yarn supplying bobbin Bs from the winding unit 7. Furthermore, when the yarn clearer 22 determines that the yarn supplying bobbin Bs is a defective bobbin, the unit control section 12 stops the unwinding of the yarn Y from the yarn supplying bobbin Bs and ejects the yarn supplying bobbin Bs from the winding unit 7 by the ejector 30. The discharged bobbin B (discharge bobbin Bd) is passed through the downstream side portion in the transportation direction of the individual path 102 and transported to the discharge path 103.

[0076] In addition, as described above, the winding unit 7 includes the unit control section 12. The unit control section 12 includes a CPU, a ROM, a RAM, and the like. The unit control section 12 controls each section of the winding unit 7 by the CPU according to a program stored in the ROM. Furthermore, the unit control section 12 communicates with the machine control device 5.

(Configuration of bobbin processing device)

[0077] Next, a more detailed configuration of the bobbin processing device 3 will be described with reference to FIG. 4 and FIGS. 5A to 5C. FIG. 4 is a plan view of the bobbin processing device 3. FIG. 5A is a perspective view of a bobbin removing device 42 and a bobbin sorting device 45, to be described later. FIG. 5B is a front view of the bobbin removing device 42. FIG. 5C is a front view of the bobbin sorting device 45.

[0078] The bobbin processing device 3 feeds the tray T on which the yarn supplying bobbin Bs is loaded from the spinning machine 2 to the winding machine 4 and returns the tray T on which the discharge bobbin Bd is loaded from the winding machine 4 to the spinning machine 2. Furthermore, the bobbin processing device 3 is configured to perform predetermined processing on the yarn supplying bobbin Bs and the discharge bobbin Bd.

[0079] As illustrated in FIG. 4, the bobbin processing device 3 has a substantially rectangular shape when viewed from above. The bobbin processing device 3 includes the transportation path 10 as described above. The transportation path 10 includes a supplying path 31, a discharge path 32, a feeding path 33, and a return path 34. The supplying path 31 is a path extending across the left and right ends of the bobbin processing device 3 for transporting the yarn supplying bobbin Bs to the winding machine 4 side. The left end portion of the supplying path 31 is connected to the right end portion of the supplying path 101 of the winding machine 4. Similarly to the supplying path 31, the discharge path 32 is a path extending across the left and right ends of the bobbin processing device 3 for transporting the discharge bobbin Bd to the spinning machine 2 side. The left end portion of the discharge path 32 is connected to the right end portion of the discharge path 103 of the winding machine 4.

[0080] The feeding path 33 (see the hatched portion on the left side in the plane of drawing of FIG. 3) is di-

verged from a portion on the downstream side of a yarn-end finding device 41 (described later) of the supplying path 31 in the transportation direction of the tray T (hereinafter simply referred to as transportation direction). Furthermore, the feeding path 33 joins with the discharge path 32. A destination switching section 35 capable of switching the destination of the tray T is provided at a diverging point of the supplying path 31 and the feeding path 33. The destination switching section 35 is electrically connected to the bobbin processing control section 11 (see FIG. 2). The return path 34 (see the hatched portion on the right side in the plane of drawing of FIG. 3) is diverged from a portion downstream of a point where the discharge path 32 joins with the feeding path 33 in the transportation direction. Furthermore, the return path 34 joins with a portion upstream of the yarn-end finding device 41 of the supplying path 31 in the transportation direction. A destination switching section 36 capable of switching the destination of the tray T is provided at a diverging point of the discharge path 32 and the return path 34. The destination switching section 36 is electrically connected to the bobbin processing control section 11 (see FIG. 2). A part of the supplying path 31, the feeding path 33, a part of the discharge path 32, and the return path 34 form an orbit path 37 on which the tray T can orbit. The trays T on the transportation path 10 are transported by the conveyor mechanism (not illustrated) in the direction indicated by the arrow in FIG. 3.

[0081] The bobbin processing device 3 is provided with a device for performing predetermined processing on the bobbin B on the transportation path 10. Specifically, the bobbin processing device 3 is provided with the yarn-end finding device 41 adapted to perform yarn-end finding processing on the yarn end of the yarn supplying bobbin Bs, a bobbin removing device 42 adapted to remove the discharge bobbin Bd from the tray T, a bobbin loading device 43 adapted to load the bobbin B on an empty tray T, and the like.

[0082] As illustrated in FIG. 4, the yarn-end finding device 41 (yarn-end finding processing section of the present invention) is disposed along the supplying path 31. The yarn-end finding device 41 is a device adapted to perform the yarn-end finding processing on the yarn end of the yarn supplying bobbin Bs transported on the supplying path 31. In the yarn-end finding processing, the distal end portion of the yarn wound around the yarn supplying bobbin Bs is pulled out, so that the yarn end of the yarn supplying bobbin Bs is in a state of being easily sucked and caught by the lower yarn suction 26 in the winding unit 7 (see FIG. 3). The yarn-end finding device 41 is electrically connected to the bobbin processing control section 11 (see FIG. 2). In the vicinity of the yarn-end finding device 41, a yarn amount sensor 44 adapted to detect the amount of yarn wound around the yarn supplying bobbin Bs is disposed. The yarn amount sensor 44 is electrically connected to the bobbin processing control section 11 (see FIG. 2).

[0083] When the amount of yarn detected by the yarn

amount sensor 44 is sufficiently large, the bobbin processing control section 11 controls the yarn-end finding device 41 to perform the yarn-end finding processing on the yarn supplying bobbin Bs around which the yarn is wound. When the yarn-end finding processing is successful, the tray T on which the yarn supplying bobbin Bs is loaded is fed toward the winding machine 4 through the supplying path 31. When the yarn-end finding processing fails or the yarn-end finding processing is not performed, the tray T is guided toward the feeding path 33 by the destination switching section 35 to pass through the orbit path 37 (further details will be described later).

[0084] The bobbin removing device 42 (removing section of the present invention) is disposed along the return path 34. The bobbin removing device 42 is a device mainly for removing the discharge bobbin Bd from the tray T. The bobbin removing device 42 is disposed so as to extend in the vertically (see FIG. 5A). A bobbin sorting device 45 is connected to the bobbin removing device 42 (see FIG. 5A). The details of the bobbin sorting device 45 will be described later.

[0085] As illustrated in FIG. 4, in the vicinity of a diverging point of the discharge path 32 and the return path 34, a residual yarn sensor 46 adapted to detect whether or not a yarn remains in the discharge bobbin Bd is disposed. The residual yarn sensor 46 is electrically connected to the bobbin processing control section 11 (see FIG. 2). For example, when no yarn is detected by the residual yarn sensor 46, the tray T is returned to the spinning machine 2 through the discharge path 32. When yarn is detected by the residual yarn sensor 46, the tray T is guided toward the return path 34 by the destination switching section 36.

[0086] A yarn amount sensor 47 adapted to detect the amount of yarn remaining on the discharge bobbin Bd is disposed in a portion between the bobbin removing device 42 and the residual yarn sensor 46 in the transportation direction. Different processing is performed in the bobbin removing device 42 in accordance with the detection result of the yarn amount sensor 47 (details will be described later).

[0087] Furthermore, in the vicinity of the yarn amount sensor 47, a read/write section 48 adapted to read information recorded in the RF tag 100 of the tray T and write information to the RF tag 100 is disposed. The read/write section 48 is electrically connected to the bobbin processing control section 11 (see FIG. 2).

[0088] The bobbin loading device 43 (empty bobbin loading section of the present invention) is disposed downstream of the bobbin removing device 42 in the transportation direction. The bobbin loading device 43 is configured to be able to load an empty bobbin B on a tray T from which the bobbin B is removed and emptied.

[0089] As described above, the bobbin processing device 3 includes the bobbin processing control section 11. The bobbin processing control section 11 includes a CPU, a ROM, a RAM, and the like. The bobbin processing control section 11 controls each section of the bobbin

processing device 3 by the CPU according to the program stored in the ROM. Furthermore, the bobbin processing control section 11 communicates with the machine control device 5.

[0090] Here, in the conventional bobbin processing device, the waiting path diverged from the discharge path 32 is formed, and the defective bobbin is made to wait on the waiting path. Furthermore, the defective bobbins waiting on the waiting path are removed one by one from the tray T by the operator and replaced with empty bobbins. It takes time and effort to carry out such work. Furthermore, if the operator does not carry out the above-described removing work for some reason such as troubleshooting, and the tray T on the waiting path becomes full, the subsequent defective bobbins cannot enter the waiting path. In such a case, the operation of the bobbin processing device 3 may be stopped. Therefore, in the present embodiment, the yarn winding equipment 1 has the following configuration so that when the yarn supplying bobbin Bs whose yarn is unwound by the winding unit 7 is determined to be a defective bobbin, the defective bobbin can be removed from the tray T without manual operation.

(Bobbin removing device)

[0091] First, the specific configuration of the bobbin removing device 42 will be described with reference to FIGS. 5A to 5C. As illustrated in FIG. 5B, the bobbin removing device 42 includes a conveyor mechanism 51, a pressing roller 52, and two guide members 53 arranged in an up and down direction. The number of guide members 53 is not limited thereto. The bobbin removing device 42 can also include three guide members 53 as in the embodiment described later. The conveyor mechanism 51 includes belt feed rollers 54 and 55 disposed so as to be spaced apart from each other in the up and down direction, and an endless belt 56 wound around the belt feed rollers 54 and 55. The belt feed roller 54 is rotationally driven by a motor 57. The endless belt 56 is thereby driven, and the belt feed roller 55 is driven and rotated. A portion on the left side (the side facing the return path 34) of the endless belt 56 travels upward.

[0092] The pressing roller 52 and the guide member 53 are adapted to remove the bobbin B from the tray T by pressing the bobbin B against the traveling endless belt 56. The pressing roller 52 and the guide member 53 (guide member 61) disposed at the lowermost side is supported through a link mechanism 65 by a supporting member 64 provided independently of the conveyor mechanism 51. The pressing roller 52 and the guide member 61 are movable between a first position (see solid line) and a second position (see two-dot chain line) by the link mechanism 65. The guide member 61 connected to the link mechanism 65 is moved and driven between the first position and the second position by, for example, an air cylinder 67. The air cylinder 67 is configured to be controllable by the bobbin processing con-

trol section 11. When the pressing roller 52 and the guide member 61 are located at the first position, the bobbin B is pressed against the endless belt 56 and removed from the tray T. When the pressing roller 52 and the guide member 61 are located at the second position, the bobbin B is not pressed against the endless belt 56 and thus the bobbin B is removed from the tray T.

[0093] The guide member 53 (guide member 62) disposed immediately above the guide member 61 is supported by the supporting member 64 through a link mechanism 66. The guide member 62 is configured to be movable by the link mechanism 66 so as to change the gap with the endless belt 56. The guide member 62 is closed by the biasing force of the spring 68 toward the right side through the link mechanism 66. Thus, the guide member 62 can sandwich the bobbin B with the endless belt 56. Furthermore, the gap between the guide member 62 and the endless belt 56 can be changed according to the thickness of the bobbin B (e.g., according to the presence or absence of a yarn). The bobbin B removed from the tray T and transported toward the upper side is transported to above the guide member 62. The bobbin B transported to above the guide member 62 is designed to drop obliquely downward toward the left side (see arrow in FIG. 5B). In the present embodiment, all the removed bobbins Bp removed by the bobbin removing device 42 move toward the bobbin sorting device 45.

(Bobbin sorting device)

[0094] Next, the bobbin sorting device 45 will be described. As illustrated in FIG. 5A, the bobbin sorting device 45 (sorting section of the present invention) is connected to the bobbin removing device 42. The bobbin sorting device 45 is a device adapted to process the removed bobbins B (hereinafter, also referred to as a removed bobbin Bp) so as to be sortable into a plurality of types. The bobbin sorting device 45 is disposed on the left side of the bobbin removing device 42 (the side on which the removed bobbin Bp drops from the bobbin removing device 42). As illustrated in FIG. 5C, the bobbin sorting device 45 includes a frame member 71 and a switching mechanism 72.

[0095] The frame member 71 is a member formed with an internal passage through which the removed bobbin Bp passes. As illustrated in FIG. 5C, the frame member 71 includes an input port 73 into which the removed bobbin Bp dropped from the bobbin sorting device 45 is input, a common passage 74, and a plurality of sorting passages 75 (first sorting passage 76 and second sorting passage 77). The common passage 74 is formed in the upper side portion of the frame member 71. The common passage 74 is extended obliquely downward to the left. The removed bobbin Bp can drop along the inclined portion of the common passage 74. The first sorting passage 76 and the second sorting passage 77 are disposed below the common passage 74 (downstream in the moving direction of the removed bobbin Bp). The first sorting pas-

sage 76 and the second sorting passage 77 are partitioned by a partition member 78. The first sorting passage 76 and the second sorting passage 77 extend obliquely downward while having the outlet portion curved (see FIG. 5A). That is, the first sorting passage 76 and the second sorting passage 77 extend at least downward as toward the downstream side in the moving direction of the removed bobbin Bp. A first discharge box 111 is disposed downstream of the first sorting passage 76 and a second discharge box 112 is disposed downstream of the second sorting passage 77 in the moving direction of the removed bobbin Bp. The first discharge box 111 and the second discharge box 112 are configured to be able to store a plurality of removed bobbins Bp. The first discharge box 111 and the second discharge box 112 correspond to a storage section of the present invention.

[0096] A switching mechanism 72 (switching section of the present invention) is adapted to switch to which sorting passage 75 to move the removed bobbin Bp from the common passage 74 or optionally adapted to be switched to define which one of the sorting passages 75 to move the removed bobbin Bp is to be moved from the common passage 74. As illustrated in FIG. 5C, the switching mechanism 72 includes, for example, a swing plate 81, a guiding plate 82 (guiding member of the present invention), and an air cylinder 83 (driving section of the present invention). The switching mechanism 72 is configured to switch the destination of the removed bobbin Bp by switching the position (angular position) of the guiding plate 82 fixed to the swingable swing plate with the air cylinder 83.

[0097] The swing plate 81 is provided on the upper side of the partition member 78 and is swingably supported by the frame member 71. For example, a protrusion 84 is provided on the end face of the swing plate 81. The distal end portion of a rod 85 of the air cylinder 83 is attached to the swing plate 81 through the protrusion. The guiding plate 82 is swingably provided integrally with the swing plate 81. The air cylinder 83 includes an extendable rod 85. The distal end portion of the rod 85 is attached to the protrusion 84 of the swing plate 81. The air cylinder 83 is configured to extend and contract the rod 85 by the supply and discharge of the compressed air. The position (angular position) of the guiding plate 82 is switched as the swing plate 81 is swung by the extension/contraction of the rod 85. Specifically, the guiding plate 82 can switch the position between a first position (see solid line in FIG. 5C) of guiding the removed bobbin Bp to the first sorting passage 76 and a second position (see two-dot chain line in FIG. 5C) of guiding the removed bobbin Bp to the second sorting passage 77. The air cylinder 83 is configured to be controllable by the bobbin processing control section 11.

(Control related to removal processing of bobbin)

[0098] Next, a removal processing of the bobbin B from the tray T transported on the transportation path 10 of

the bobbin processing device 3 will be described. In the present embodiment, as will be described below, the bobbin processing control section 11 controls each section of the bobbin processing device 3 to remove a plurality of types of bobbins B from the tray T by the bobbin removing device 42, and sort the removed bobbins Bp by the bobbin sorting device 45.

[0099] First, prior to the control of the bobbin processing device 3 by the bobbin processing control section 11, the discharging process of the tray T from the winding unit 7 by the unit control section 12 will be described using the flowchart illustrated in FIG. 6.

[0100] In the initial state, the yarn Y is unwound from the yarn supplying bobbin Bs in the winding unit 7. When the yarn supplying bobbin Bs is not determined to be a defective bobbin around which a defective yarn is wound, according to the detection result of the yarn clearer 22 (S101: No), the unit control section 12 (see FIG. 2) causes the winding unit 7 to continuously perform the unwinding of the yarn from the yarn supplying bobbin Bs. When the yarn supplying bobbin Bs is not empty (S102: No), the process returns to S101 and waits for a signal from the yarn clearer 22. When detected by the residual yarn sensor 46 that the yarn supplying bobbin Bs has become empty (S102: Yes), the unit control section 12 controls the ejector 30 (see FIG. 3) to discharge from the winding unit 7 the tray T on which the yarn supplying bobbin Bs, which has become empty, is loaded (S103). In addition, although many of the discharge bobbins Bd discharged normally in this way are empty bobbins with no yarn remaining, a part of the discharge bobbins Bd can be a small-amount-of-residual-yarn bobbins with a small amount of yarn remaining.

[0101] On the other hand, when the yarn supplying bobbin Bs is determined to be a defective bobbin according to the detection result of the yarn clearer 22 before the yarn supplying bobbin Bs becomes empty (S101: Yes), the unit control section 12 stops the unwinding process of the yarn Y from the yarn supplying bobbin Bs by the winding unit 7. Furthermore, the unit control section 12 controls the read/write section 28 (see FIG. 3) to record quality information indicating that the yarn supplying bobbin Bs is a defective bobbin to the RF tag 100 of the tray T (see FIG. 3) (S104). Moreover, the unit control section 12 controls the ejector 30 (see FIG. 3) to discharge the tray T on which the yarn supplying bobbin Bs (discharge bobbin Bd) that has become empty is loaded from the winding unit 7 (S103).

[0102] Thus, when the unwinding of the yarn Y from the yarn supplying bobbin Bs is completed normally, quality information indicating that the discharge bobbin Bd is a defective bobbin is not written in the RF tag 100 of the discharged tray T. On the other hand, when the yarn supplying bobbin Bs is a defective bobbin, quality information indicating that the discharge bobbin Bd is a defective bobbin is written in the RF tag of the discharged tray T.

[0103] Next, a control of the bobbin processing device

3 by the bobbin processing control section 11 will be described using FIGS. 7 to 11. In particular, FIG. 7 and the below description thereof embody the innovative core functionality of the present invention and the thereby achieved technical effects. Said figure illustrates that various different bobbin states are detected and analyzed and that is respectively acted thereon, preferably fully automatically thus achieving a user-independent, fast and efficient bobbin processing, handling and transportation. FIG. 7 is a flowchart illustrating processing related to the removal and discharge of the bobbin B, and the return of the tray T. In the following description, the tray T on which the yarn supplying bobbin Bs is loaded and the tray T on which the discharge bobbin Bd is loaded may coexist on the transportation path 10 of the bobbin processing device 3. Therefore, the yarn supplying bobbin Bs and the discharge bobbin Bd are collectively referred to as the bobbin B unless particularly necessary. FIG. 8 is a flowchart illustrating processing from when the tray T is transported to the yarn-end finding device 41 side until the tray is again returned to the transportation path 10 of the bobbin processing device 3. FIGS. 9A to 9C and FIGS. 10A to 10C are explanatory views illustrating the movement of the bobbin B on the transportation path 10. FIGS. 11A and 11B are explanatory views illustrating the operation of the bobbin sorting device 45.

[0104] As an initial state, the tray T on which a certain bobbin B is loaded is located in front of the residual yarn sensor 46 on the discharge path 32 (see FIG. 9A). Here, the bobbin B being transported on the discharge path 32 is one of the defective bobbin described above, the empty bobbin, the small-amount-of-residual-yarn bobbin, the yarn-end finding bobbin that requires the yarn-end finding processing again due to reasons such as failure of the yarn-end finding processing by the yarn-end finding device 41, and the like.

[0105] First, whether the yarn remains on the bobbin B is detected by the residual yarn sensor 46. If no yarn remains on the bobbin B (S201: No), the bobbin B is an empty bobbin and can be returned to the spinning machine 2. Therefore, the tray T on which the bobbin B is loaded is transported as it is on the discharge path 32 (return path of the present invention) (see FIG. 9B) and returned to the spinning machine 2 (S202). If even a small amount of yarn remains on the bobbin B (S201: Yes), the bobbin processing control section 11 controls the destination switching section 36 to move the tray T to the return path 34 (see FIG. 9C).

[0106] Next, an amount of yarn remaining on the bobbin B is detected by the yarn amount sensor 47 (yarn amount detecting section of the present invention). The yarn amount information related to the amount of yarn is transmitted from the yarn amount sensor 47 to the bobbin processing control section 11. When the residual yarn amount is not greater than or equal to a predetermined amount (S202: No), the bobbin B is a small-amount-of-residual-yarn bobbin. In this case, the bobbin processing control section 11 controls the bobbin removing device

42 to remove the bobbin B from the tray T. Furthermore, the bobbin processing control section 11 controls the bobbin sorting device 45 to locate the guiding plate 82 at the first position (see FIG. 11A), and moves the removed bobbin Bp to the first sorting passage (S204). Thus, the removed bobbin Bp moves along the first sorting passage 76 by the action of gravity and is discharged to the first discharge box 111. Furthermore, the bobbin processing control section 11 controls the bobbin loading device 43 (empty bobbin loading section of the present invention) to load the empty bobbin B around which the yarn is not wound on the tray T on which nothing is loaded (S205).

[0107] When the residual yarn amount is greater than or equal to a predetermined amount (S202: Yes), the quality information recorded in the RF tag 100 of the tray T is read by the read/write section 48 (quality information acquiring section of the present invention). The bobbin processing control section 11 determines whether quality information indicating that the bobbin B is a defective bobbin is recorded in the tray T (S206). When the quality information is recorded in the tray T (S206: Yes), the bobbin processing control section 11 controls the bobbin removing device 42 to remove the bobbin B from the tray T. Furthermore, the bobbin processing control section 11 controls the bobbin sorting device 45 to locate the guiding plate 82 at the second position (see FIG. 11B), and moves the removed bobbin Bp to the second sorting passage (S207). Thus, the removed bobbin Bp is discharged to the second discharge box 112. Furthermore, the bobbin processing control section 11 controls the bobbin loading device 43 to load an empty bobbin B on the empty tray T (S208).

[0108] On the other hand, when the quality information is not recorded in the tray T (S206: No), the bobbin B loaded on the tray T is not a defective bobbin but is a bobbin having a large amount of residual yarn. Furthermore, although there is no problem in yarn quality, the bobbin B which could not catch a yarn with the winding unit 7 when the yarn is cut is also discharged from the winding unit 7 and transported through the return path 34. Such a bobbin B is, for example, a yarn-end finding bobbin which failed in the yarn-end finding processing by the yarn-end finding device 41 and which is circulating on the orbit path 37. Therefore, instead of removing the bobbin B from the tray T, the bobbin processing control section 11 performs the following processing. That is, the bobbin processing control section 11 controls the read/write section 48 (number-of-times information assigning section and number-of-times information acquiring section of the present invention) to record the circulation information related to the number of times the tray T circulated, to the RF tag 100 (number-of-times information assigned section of the present invention) of the tray T. More specifically, when the number of circulations before recording is N, the bobbin processing control section 11 controls the read/write section 48 to write the number-of-times information indicating that the number

of circulations is N + 1 to the RF tag 100 (S209). Furthermore, when the number of circulations of the tray T at this time is greater than or equal to a predetermined number of times (e.g., three times) (S210: Yes), the bobbin processing control section 11 controls the bobbin removing device 42 to remove the bobbin B from the tray T. Furthermore, the bobbin processing control section 11 controls the bobbin sorting device 45 to locate the guiding plate 82 at the first position, and discharges the removed bobbin Bp to the first discharge box 111 (S211). Moreover, the bobbin processing control section 11 controls the bobbin loading device 43 to load an empty bobbin B on the empty tray T (S212).

[0109] Thus, the bobbin processing control section 11 controls the bobbin removing device 42 based on the quality information, the yarn amount information and the number-of-times information, and executes the removal processing of the bobbin B when the above information satisfies the prescribed condition. The yarn amount information and the number-of-times information correspond to the status information of the present invention. The yarn amount sensor 47 and the read/write section 48 correspond to the status information acquiring section of the present invention. Furthermore, the bobbin processing control section 11 controls the bobbin sorting device 45 based on at least the quality information. That is, the bobbin processing control section 11 discharges the removed bobbin Bp to the first discharge box 111 when the removed bobbin Bp is not a defective bobbin, and discharges the removed bobbin Bp to the second discharge box 112 when the removed bobbin Bp is a defective bobbin.

[0110] Thereafter, the bobbin processing control section 11 moves the tray T from the return path 34 to the supplying path 31 (see FIG. 10A). That is, the tray T is transported toward the yarn-end finding device 41 (S213). Thereafter, depending on the state of the bobbin B, the tray T is supplied to the winding unit 7 or returned again to the discharge path 32 through the orbit path 37. The specific processing will be described mainly with reference to FIG. 8.

[0111] First, the residual yarn amount of the bobbin B loaded on the tray T transported on the supplying path 31 is detected by the yarn amount sensor 44. The bobbin processing control section 11 determines whether the residual yarn amount of the bobbin B is greater than or equal to a predetermined amount (S301). Here, when the bobbin B is an empty bobbin loaded on the tray T by the above-described bobbin loading device 43, the residual yarn amount is always less than or equal to a predetermined amount (S301: No). In this case, the bobbin processing control section 11 controls the destination switching section 35 to move the tray T to the feeding path 33 (see FIG. 10B). Then, the tray T on which the empty bobbin B is loaded is transported to the discharge path 32 and returned to the spinning machine 2 as it is (see FIG. 9B).

[0112] On the other hand, when the residual yarn

amount of the bobbin B is greater than or equal to a predetermined amount (S301: Yes), that is, when the bobbin B is a yarn-end finding bobbin to be subjected to the yarn-end finding processing, the bobbin processing control section 11 controls the yarn-end finding device 41 and performs the yarn-end finding processing on the bobbin B (S303). When the yarn-end finding processing is successful (S304: Yes), the bobbin processing control section 11 moves the tray T toward the winding machine 4 as it is (S305; see FIG. 10C). When the yarn-end finding processing has failed (S304: No), the bobbin processing control section 11 controls the destination switching section 35 to move the tray T to the feeding path 33 (see FIG. 10B). The tray T moved to the feeding path 33 is transported again to the discharge path 32 (see FIG. 9A).

[0113] As described above, the read/write section 48 can acquire the quality information of the bobbin B transported on the transportation path 10 of the bobbin processing device 3. Furthermore, since the bobbin removing device 42 is controlled in accordance with the quality information, the defective bobbin can be removed from the tray T by the bobbin removing device 42. Therefore, when the yarn supplying bobbin Bs whose yarn is unwound by the winding unit 7 is determined to be a defective bobbin, the defective bobbin can be removed from the tray T without manual operation.

[0114] Further, whether the yarn supplying bobbin Bs is a defective bobbin is determined by the clearer control section 22a of the yarn clearer 22. Therefore, the processing load of the unit control section 12 can be alleviated as compared to a case where the unit control section 12 functions as the determination section of the present invention.

[0115] Furthermore, since the quality information is assigned for each tray T, concentration of data relating to the quality information in the bobbin processing control section 11 can be avoided. Therefore, the risk of loss of the data can be suppressed.

[0116] In addition to the quality information, the bobbin removing device 42 is also controlled in accordance with the status information. Therefore, the bobbins B other than the defective bobbin can also be removed without manual operation.

[0117] Moreover, the bobbin removing device 42 is controlled in accordance with the yarn amount information. Therefore, the discharge bobbin, from which the yarn is normally unwound by the winding unit 7 and a small amount of yarn remains thereon, can also be removed by the bobbin removing device 42.

[0118] The bobbin removing device 42 is also controlled in accordance with the number-of-times information in which the tray T circulated on the transportation path 10. Therefore, the bobbin in which failure of the yarn-end finding processing is repeated can also be removed by the bobbin removing device 42.

[0119] Furthermore, the bobbin sorting device 45 can be controlled in accordance with at least information on whether the removed bobbin Bp is a defective bobbin.

Therefore, the defective bobbin and the other removed bobbin Bp can be sorted.

[0120] Moreover, the defective bobbin and the other removed bobbin Bp can be moved to different places by the plurality of sorting passages 75. Therefore, the defective bobbin and the other removed bobbin Bp can be easily and reliably sorted.

[0121] In addition, the removed bobbins Bp can be sorted by a simple operation of switching the position of the guiding plate 82.

[0122] Furthermore, the removed bobbin Bp can be moved along the sorting passage 75 by the action of gravity. Therefore, the cost can be reduced as compared to a configuration in which the removed bobbin Bp is transported along the sorting passage 75 by a mechanism such as a belt conveyor.

[0123] Furthermore, the removed bobbin Bp is discharged to the first discharge box 111 or the second discharge box 112. The plurality of removed bobbins Bp which have been sorted and stored thus can be collected, and collectively processed. Therefore, the trouble can be saved as compared to a case where the removed bobbins Bp on the sorting passage 75 are sequentially processed.

[0124] Furthermore, in the yarn winding equipment 1 in which the bobbin processing device 3 and the spinning machine 2 are connected, the work from when the defective bobbin is removed from the tray T and an empty bobbin is loaded on the tray T until the tray T on which the empty bobbin is loaded is returned to the spinning machine 2 can be performed without any manual operation.

[0125] Next, an alternative embodiment in which change is made to the embodiments described above will be described. However, the same reference symbols are denoted on configurations similar to the embodiments described above, and the description thereof will be appropriately omitted.

(1) In the embodiments described above, all the removed bobbins Bp removed by the bobbin removing device 42 are moved to the bobbin sorting device 45 side, but this is not the sole case. Hereinafter, description will be made with reference to FIGS. 12A to 12C and FIG. 13.

As illustrated in FIGS. 12A and 12B, a guide member 91 may be provided on a further upper side of the guide member 62 of the bobbin removing device 42. The guide member 91 is supported by the supporting member 64 through the link mechanism 92. The guide member 91 connected to the link mechanism 92 is, for example, movable between the first position (see two-dot chain line in FIG. 12A) and the second position (see solid line in FIG. 12A) by the air cylinder 93. The air cylinder 93 is configured to be controllable by the bobbin processing control section 11. When the guide member 91 is located at the second position (see FIG. 12A), the removed bobbin Bp drops toward the bobbin sorting device 45 from a gap

formed between the guide member 62 and the guide member 91. On the other hand, when the guide member 91 is located at the first position (see FIG. 12B), the removed bobbin Bp is pressed against the endless belt 56 by the guide member 91. As a result, the removed bobbin Bp is moved by the endless belt 56 to the uppermost part of the bobbin removing device 42. In this case, the bobbin removing device 42 also functions as the sorting section of the present invention. That is, the passage of the removed bobbin Bp formed by the guide member 91 and the endless belt 56 also corresponds to the sorting passage of the present invention. Thus, the third sorting passage may be formed by the bobbin removing device 42. Furthermore, similarly to the switching mechanism 72, the guide member 91, the link mechanism 92, and the air cylinder 93 also correspond to the switching section of the present invention. Moreover, as illustrated in FIG. 12C, a third discharge box 113 may be attached to the upper side portion of the bobbin removing device 42. The third discharge box 113 is a discharge destination of the removed bobbin Bp that has reached the uppermost part of the bobbin removing device 42.

Furthermore, in the configuration as described above, the bobbin processing control section 11 may perform the following control, as illustrated in FIG. 13. That is, when the number of circulations of the tray T is greater than or equal to a predetermined number of times in S210 described above (S210: Yes), the bobbin processing control section 11 controls the bobbin removing device 42 to remove the bobbin B from the tray T. Furthermore, the bobbin processing control section 11 controls the bobbin removing device 42 to position the guide member 91 at the first position, and discharge the removed bobbin Bp to the third discharge box 113 (S214). That is, the bobbin processing control section 11 may control the sorting section based on the quality information and the status information. Thus, the removed bobbin Bp other than the defective bobbin can be further sorted.

(2) In the alternative embodiment of (1), although the third sorting passage is formed by the bobbin removing device 42, this is not the sole case. For example, the bobbin sorting device 45 may have three or more sorting passages, and a switching section capable of switching to which passage of the three or more sorting passages to move the removed bobbin Bp.

(3) The present invention may be applied to yarn winding equipment 1a including a bobbin processing device 3a illustrated in FIG. 14 instead of the yarn winding equipment 1 as the yarn winding equipment including the bobbin removing device 42 described in the alternative embodiment of (1) described above. The yarn winding equipment 1a is equipment with a so-called yarn supplying bobbin supplying device in which the bobbin processing device 3a and

the spinning machine 2 (see FIG. 1) are not connected. The transportation path 10a of the bobbin processing device 3a includes a supplying path 31a, a discharge path 32a, a feeding path 33a, and a return path 34a. An orbit path 37a is formed by the supplying path 31a, the discharge path 32a, the feeding path 33a, and the return path 34a. As a difference from the bobbin processing device 3 (see FIG. 4), the supplying path 31a and the return path 34a are not diverged from each other, and the discharge path 32a and the return path 34a are also not diverged from each other. That is, unlike the bobbin processing device 3, the bobbin processing device 3a has a configuration in which the tray T is not exchanged with the spinning machine 2. Furthermore, the bobbin loading device 43a (the yarn supplying bobbin loading section of the present invention) of the bobbin processing device 3a is configured to be able to load the fully wound yarn supplying bobbin Bs on the empty tray T instead of loading the empty bobbin B on the empty tray T.

Furthermore, in the configuration as described above, the bobbin processing control section 11 may perform the following control. That is, the bobbin processing control section 11 may cause the bobbin removing device 42 to remove the empty bobbin in addition to the above-described defective bobbin, the small-amount-of-residual-yarn bobbin, and the yarn-end finding bobbin. In this case, the yarn supplying bobbin Bs is loaded to the empty tray T. Hereinafter, this will be specifically described with reference to FIG. 15. If no yarn remains on the bobbin B in S201 described above (S201: No), that is, if the bobbin B is an empty bobbin, the bobbin processing control section 11 controls the bobbin removing device 42 to remove the bobbin B and discharge it to the third discharge box 113 (S215). Furthermore, the bobbin processing control section 11 controls the bobbin loading device 43a to load the yarn supplying bobbins Bs on the empty tray T (S216). Similarly, even when a small-amount-of-residual-yarn bobbin, defective bobbin and yarn-end finding bobbin are removed from the tray T, the bobbin processing control section 11 controls the bobbin loading device 43 to load the yarn supplying bobbin Bs on the empty tray T (S217, S218, S219, respectively). Thus, the work from removing the defective bobbin from the tray T until loading the yarn supplying bobbin Bs on the tray T can be carried out without manual operation. Moreover, both the removal of the defective bobbin and the removal of the empty bobbin can be performed by the bobbin removing device 42. Therefore, the manufacturing cost can be reduced as compared with the configuration in which such bobbins B are separately removed.

(4) In the embodiments described above, the first sorting passage 76 and the second sorting passage 77 are extended at least downward as toward the

downstream side in the moving direction of the removed bobbin Bp, but the invention is not limited thereto. For example, the first sorting passage 76 and the second sorting passage 77 may be extended in the horizontal direction, and the removed bobbins Bp on these passages may be transported by a conveyor mechanism or the like.

(5) In the embodiments described above, the discharge box is provided in correspondence with each sorting passage 75, but the present invention is not limited thereto. For example, each sorting passage 75 may be configured such that the operator can access the removed bobbin Bp, and the operator may sequentially process the removed bobbin Bp.

(6) In the embodiments described above, the quality information and the number-of-times information are recorded in the RF tag 100 of the tray T, but the present invention is not limited to thereto. For example, the winding unit 7 may be configured to be able to attach a seal with a barcode indicating that the bobbin B is a defective bobbin to the tray T or the bobbin B. In this case, the bobbin B also corresponds to the quality information assigned section of the present invention. Alternatively, identification information may be assigned in advance with a bar code or the like on all the bobbins B, and the winding unit 7 may be configured to correspond the identification information read from the bar code with the quality information and the number-of-times information, and transmit the same to the machine control device 5. The machine control device 5 may be configured to be able to store the quality information, the number-of-times information, and the identification information of the tray T in association with each other. In this case, the machine control device 5 corresponds to the quality information assigned section and the number-of-times information assigned section of the present invention.

(7) In the embodiments described above, the removed bobbin Bp is sorted by the sorting passage 75 and the switching mechanism 72, but the present invention is not limited thereto. For example, the bobbin sorting device 45 may be configured to be able to attach a seal or the like indicating that the removed bobbin Bp is a defective bobbin to the removed bobbin Bp. In this case, the bobbin sorting device 45 may discharge all the removed bobbins Bp into one discharge box, and then the operator may sort the bobbins by visual inspection.

(8) In the embodiments described above, the bobbin processing control section 11 removes the bobbins B other than the defective bobbin from the tray T by the bobbin removing device 42, but the present invention is not limited thereto. For example, the bobbin processing device 3 may include a residual yarn removing device (see Japanese Unexamined Patent Publication No. 2016-102004, etc.) capable of removing a small amount of residual yarn from a small-

amount-of-residual-yarn bobbin. Furthermore, the yarn-end finding bobbin may be circulated on the orbit path 37 until the yarn-end finding processing is successful. In these cases, the small-amount-of-residual-yarn bobbins and the yarn-end finding bobbins may not necessarily be removed from the tray T by the bobbin removing device 42. That is, the bobbin processing control section 11 may cause only the defective bobbin to be removed from the tray T by the bobbin removing device 42. In this case, the bobbin sorting device 45 may not necessarily be provided.

(9) In the embodiments described above, the yarn clearer 22 of the winding unit 7 performs monitoring of the yarn Y and determination regarding the quality of the yarn supplying bobbin Bs, but the present invention is not limited thereto. The monitoring section and the determination section may be provided separately. For example, the yarn clearer 22 may transmit the monitoring result of the yarn Y to the unit control section 12, and the unit control section 12 may make a determination regarding the quality of the yarn supplying bobbin Bs. In this case, the yarn clearer 22 functions only as a monitoring section of the present invention. The unit control section 12 functions as a determination section of the present invention. That is, the determination section of the present invention may be included in the unit control section 12. Accordingly, even with a configuration in which the yarn clearer 22 cannot function as the determination section of the present invention, the unit control section 12 can determine whether the yarn supplying bobbin Bs is a defective bobbin.

(10) In the embodiments described above, the bobbin processing control section 11 controls each section of the bobbin processing device 3, but the present invention is not limited thereto. For example, the machine control device 5 may control each section of the bobbin processing device 3. In this case, the machine control device 5 corresponds to the bobbin processing control section of the present invention.

Claims

1. A bobbin processing device (3) for a yarn winding system configured to receive bobbins from and transfer bobbins to a spinning machine (2) and/or a winding machine (4), the bobbin processing device comprising:

a transportation path (10) along which the bobbins can move through the bobbin processing device, optionally on a bobbin transport tray (T); a removing section (42) configured to remove a bobbin (B) from the transportation path, optionally from the bobbin transport tray; and

- a bobbin processing control section (11) that is configured to control the removing section to remove a bobbin from the transportation path in dependence on at least one of quality information linked to the bobbin, yarn amount information linked to the bobbin and status information linked to the bobbin.
2. The bobbin processing device according to claim 1, wherein
- the quality information linked to the bobbin is information obtained by a status information acquiring section (48) included in the bobbin processing device and is information about a defective or non-defective state of the bobbin;
- the yarn amount information linked to the bobbin is information obtained by at least one yarn amount sensor (44, 46, 47) included in the bobbin processing device and is information about the amount or residue of yarn wound on the bobbin; and
- the status information linked to the bobbin is information obtained by the status information acquiring section (48) included in the bobbin processing device and is information about the number of times the bobbin has been circulated in the bobbin processing device.
3. The bobbin processing device according to claim 1 or 2, further including:
- a supplying path (31) adapted to transport the bobbin transport tray (T) on which the yarn supplying bobbin (Bs) is loaded,
- a discharge path (32) adapted to transport the bobbin transport tray (T) on which the discharge bobbin (Bd) is loaded,
- a yarn-end finding processing section (41) adapted to execute a yarn-end finding processing to find a yarn end of the yarn supplying bobbin (Bs) on the supplying path (31),
- a feeding path (33) that diverges from a portion downstream of the yarn-end finding processing section (41) of the supplying path (31) in a transportation direction of the bobbin transport tray (T) and joins with the discharge path (32),
- a return path (34) that diverges from a portion downstream of a point where the discharge path (32) and the feeding path (33) join, and joins with a portion upstream of the yarn-end finding processing section (41) of the supplying path (31) in the transportation direction,
- a number-of-times information assigning section (48) adapted to assign number-of-times-information to a number-of-times assigned section (100), provided that the number-of-times information is information relating to a number of times the bobbin transport tray (T) being transported around along an orbit path (37) formed by the supplying path (31), the feeding path (33), the discharge path (32) and the return path (34), and
- a number-of-times acquiring section (48) adapted to acquire the number-of-times information assigned to the number-of-times information assigned section (100),
- wherein
- the bobbin processing control section (11) is adapted to control the bobbin processing device (3) when the yarn-end finding processing fails such that the bobbin transport tray (T) on which the yarn supplying bobbin (Bs) is loaded is transported along the orbit path (37) and returned to the supplying path (31), and also to control the number-of-times information assigning section (48) to assign the number-of-times information to the number-of-times assigned section (100), the status information acquiring section (48) includes the number-of-times information acquiring section (48), and
- the status information includes the number-of-times information.
4. The bobbin processing device according to any one of claims 1 to 3, comprising a sorting section (45) adapted to process such that a removed bobbin (Bp) removed from the transportation path (10) or the bobbin transport tray (T) by the removing section (42) can be sorted,
- wherein the bobbin processing control section (11) is adapted to control the sorting section (45) in accordance with at least the quality information.
5. The bobbin processing device according to claim 4, wherein the sorting section (45) includes:
- a plurality of sorting passages (75), and
- a switching section (72) adapted to be able to be switched to define to which one of the sorting passages (75) the removed bobbin (Bp) is to be moved.
6. The bobbin processing device according to claim 5, wherein
- the plurality of the sorting passages (75) include a first sorting passage (76) and a second sorting passage (77) different from the first sorting passage (76), and
- the switching section (72) includes:
- a guiding member (82) adapted to be able to switch a position between a first position to guide the removed bobbin (Bp) to the first sorting passage (76) and a second position to guide the removed bobbin (Bp) to the second sorting passage (76), and
- a driving section (83) adapted to move the guid-

ing member (82) between the first position and the second position.

7. The bobbin processing device according to claim 5 or 6, wherein the plurality of the sorting passages (75) is configured to extend at least downward as towards a downstream side in a moving direction of the removed bobbin (Bp). 5
8. The bobbin processing device according to any one of claims 5 to 7, wherein a storage section (111, 112) adapted to be able to store a plurality of the removed bobbins (Bp) is provided at a downstream side in the sorting passage (75) in a moving direction of the removed bobbin (Bp). 10
15
9. The bobbin processing device according to any one of claims 4 to 8, wherein the bobbin processing control section (11) is adapted to control the sorting section (45) in accordance with the status information in addition to the quality information. 20
10. The bobbin processing device according to any one of the preceding claims, further comprising: 25
 - an empty bobbin loading section (43) adapted to load an empty bobbin (B) on the bobbin transport tray (T) from which a bobbin (B) has been removed by the removing section (42); and
 - a return path (32) for returning the bobbin transport tray (T) with the empty bobbin (B) to the spinning machine (2); and/or
 - a yarn supplying bobbin loading section (43a) adapted to load a yarn supplying bobbin (Bs) on the bobbin transport tray T from which a bobbin (B) has been removed by the removing section (42) . 30
35
11. A yarn winding system (1), comprising
 - the bobbin processing device (3) according to any one of the preceding claims; and 40
 - a winding machine (4) and/or a spinning machine (2), wherein
 - the bobbin processing device is spatially and/or procedurally so situated with respect to the winding machine and/or the spinning machine as to receive bobbins from and transfer bobbins to the winding machine and/or the spinning machine, optionally wherein 45
 - the bobbin processing device is spatially and/or procedurally situated between the spinning machine and the winding machine so as to transfer bobbins from one machine to the other and vice versa. 50
12. The yarn winding system according to claim 11, wherein: 55
 - the winding machine comprises a winding unit

(7) that

is adapted to unwind a yarn (Y) from a yarn supplying bobbin (Bs) optionally loaded on a bobbin transport tray (T) and to wind the yarn (Y) around a winding bobbin (Bw), and adapted to discharge as a discharge bobbin (Bd), the yarn supplying bobbin (Bs) that has been used;

has a unit control section (12) adapted to control a movement of the winding unit (7);

has a monitoring section (22) adapted to monitor the yarn (Y) that has been unwound from the yarn supplying bobbin (Bs) and is running; and

has a quality information assigning section (28) adapted to assign quality information relating to a quality of a yarn (Y) wound around the yarn supplying bobbin (Bs) to a quality information assigned section (100); wherein

the quality information acquiring section (48) of the bobbin processing device is adapted to acquire, from the quality information assigned section (100), the quality information of a bobbin (B) optionally loaded on the bobbin transport tray (T) on the transportation path (10);

the yarn winding system (1) **characterized by** further comprising a determination section (22) that is adapted to determine whether or not the yarn supplying bobbin (Bs) is a defective bobbin in accordance with a monitor result of the monitoring section (22), and when the determination section (22) determines that the yarn supplying bobbin (Bs) is the defective bobbin, the unit control section (12) stops unwinding of a yarn (Y) from the bobbin (B) by the winding unit (7) and discharges the bobbin (B) from the winding unit (7), and also controls the quality information assigning section (28) to assign to the quality information assigned section (100), information indicating that the discharged bobbin (B) is the defective bobbin, and

the bobbin processing control device (11) of the bobbin processing device controls the removing section (42) in accordance with the quality information acquired by the quality information acquiring section (48), and when the discharged bobbin (Bd) is the defective bobbin, controls the removing section (42) to remove the bobbin (B) from the transportation path, optionally from the bobbin transport tray (T) on which the bobbin (B) was loaded.

13. The yarn winding system (1) according to claim 11 or 12, wherein the determination section (22) is included in the monitoring section (22) or is included

in the unit control section (12) and/or wherein the quality information assigned section (100) is provided on the bobbin transport tray (T), and the quality information acquiring section (48) is adapted to read the quality information assigned to the bobbin transport tray (T). 5

14. The yarn winding system (1) according to any one of claims 11 to 13, wherein the spinning machine (2) includes a spinning unit adapted to form the yarn supplying bobbin (Bs) by spinning a yarn (Y) and winding the yarn (Y) around an empty bobbin (B), the spinning machine (2) being connected to the bobbin processing device (3). 10

15. A bobbin processing method, comprising the steps of: 15

detecting at least one of quality information, yarn amount information and status information linked to a bobbin being conveyed along a transportation path of a bobbin processing device, preferably the bobbin processing device according to any one of claims 1 to 10; and removing the bobbin from the transportation path or optionally from the bobbin transport tray (T) on which the bobbin is moving along the transportation path, if any one of the information satisfies a prescribed condition. 20 25 30

16. The method according to claim 15, wherein the bobbin is removed from the transportation path or the bobbin transport tray and optionally a new, empty bobbin loaded to the transportation path or the bobbin transport tray, if 35

a) it is detected - as the quality information - that the bobbin is a defective bobbin;
b) it is detected - as the yarn amount information - that the amount or residue of yarn wound on the bobbin is not greater than or equal to a predetermined amount of yarn; and
c) it is detected - as the status information - that the number of circulations of the bobbin in the bobbin processing device is greater than or equal to a predetermined number of times. 40 45

17. The method according to claim 15 or 16, wherein the removal of the bobbin is carried out automatically by a bobbin removing device (42) of the bobbin processing device; and/or the loading of a new, empty bobbin is carried out automatically by a bobbin loading device (43) of the bobbin processing device. 50 55

18. The method according to any one of claims 15 to 17, further comprising a step of sorting the bobbins removed from the transportation

path, optionally wherein the sorting is carried out automatically by a bobbin sorting device (45) of the bobbin processing device.

FIG. 1

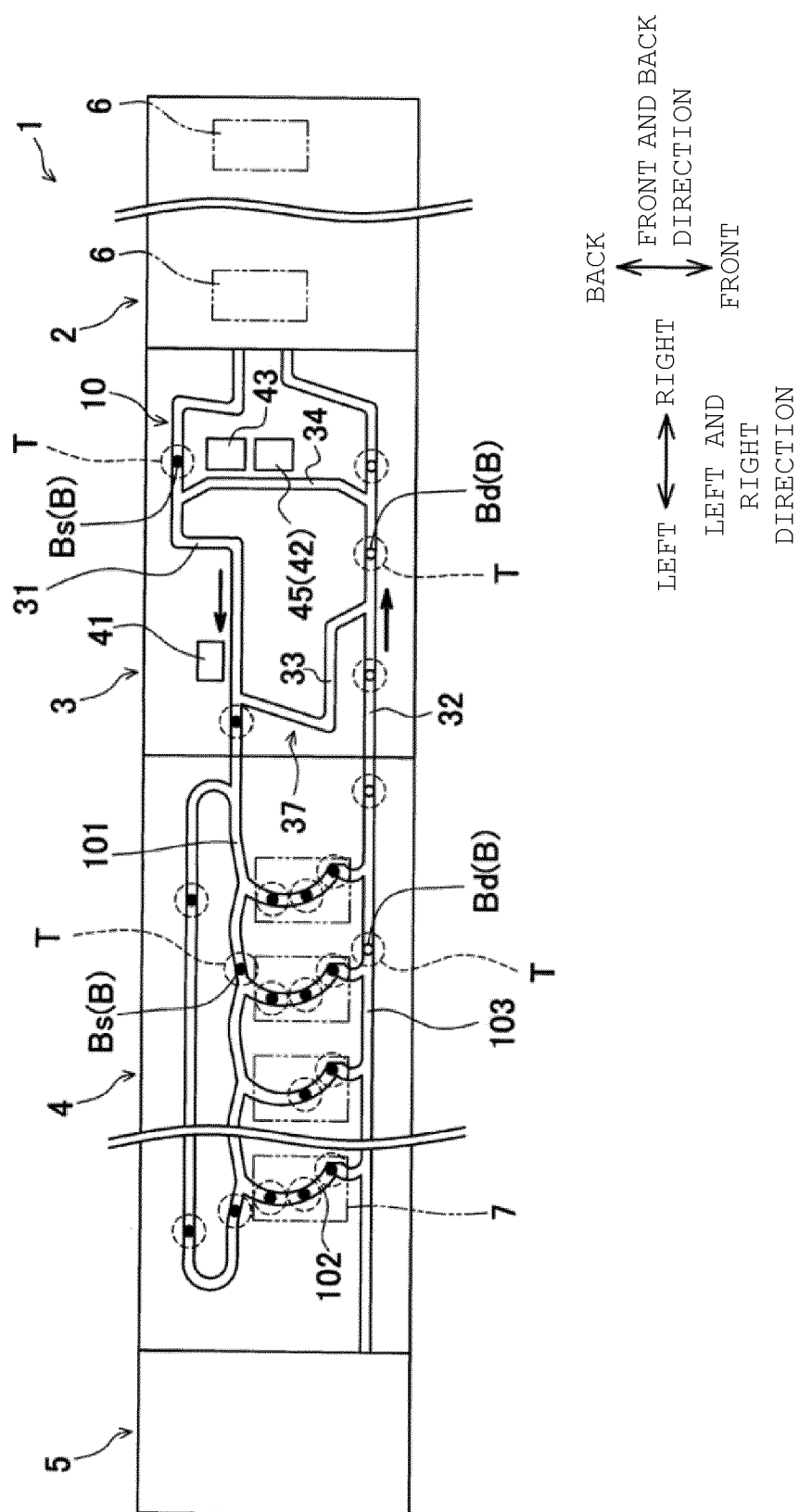


FIG. 2

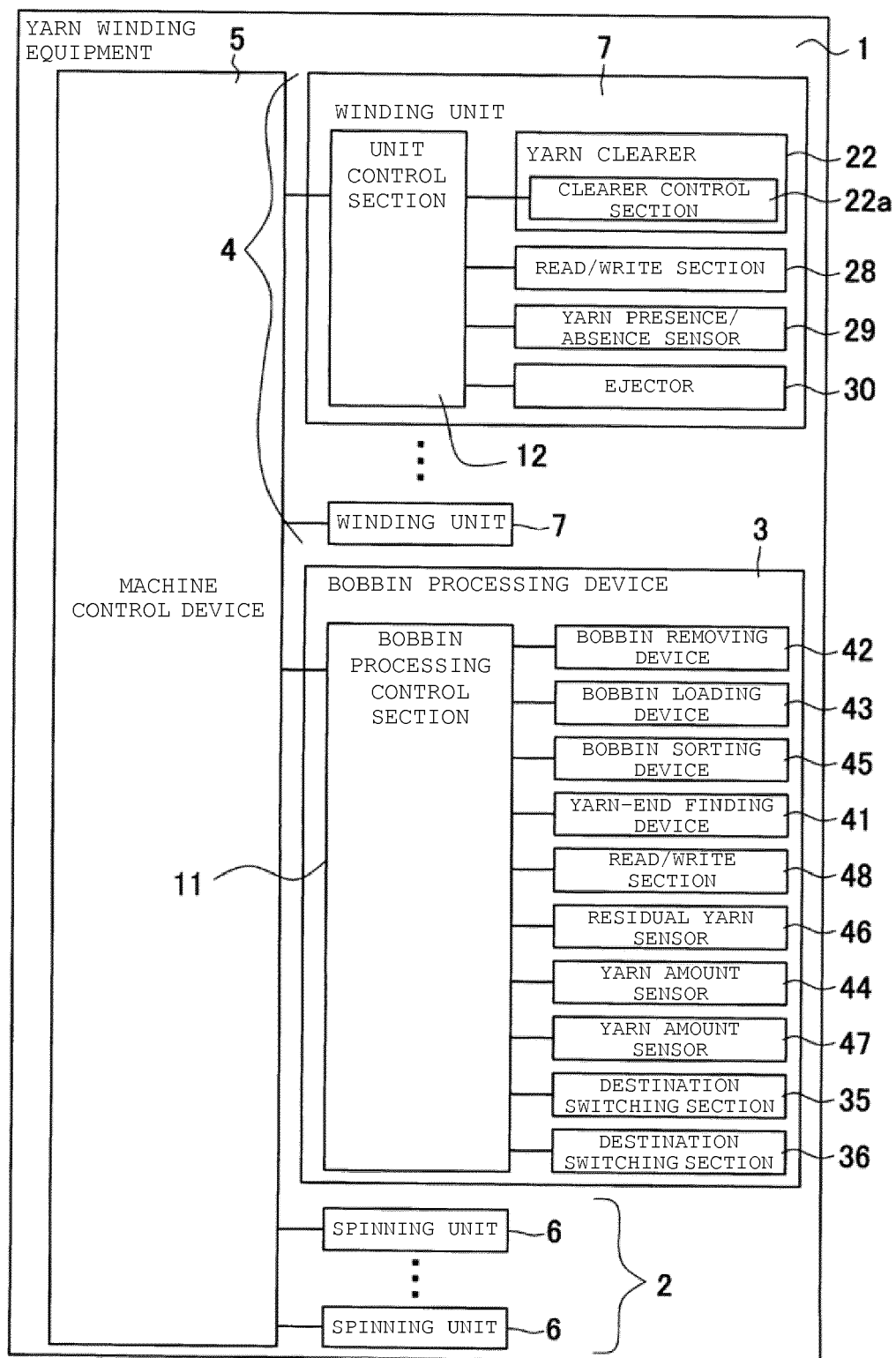


FIG. 3

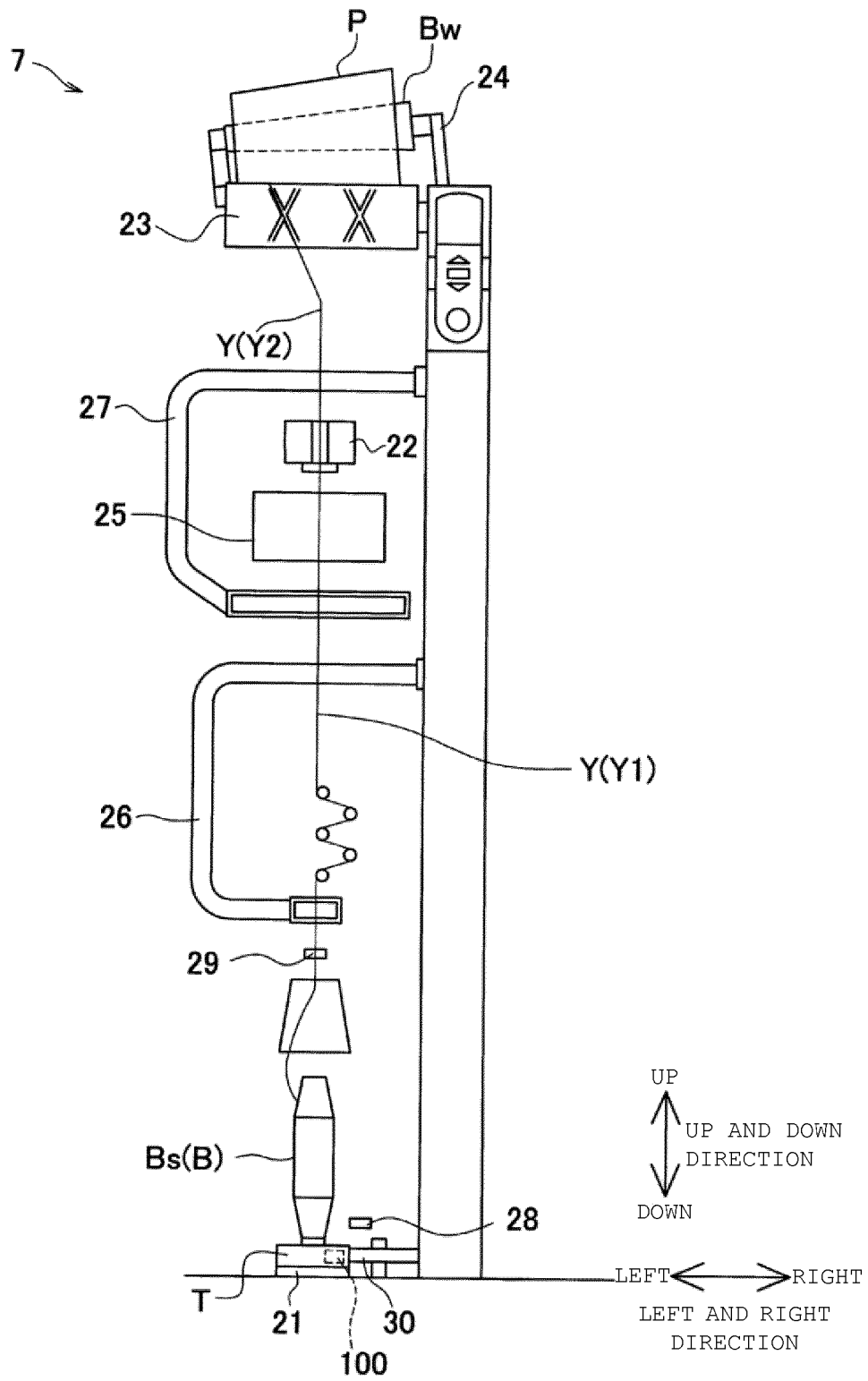


FIG. 4

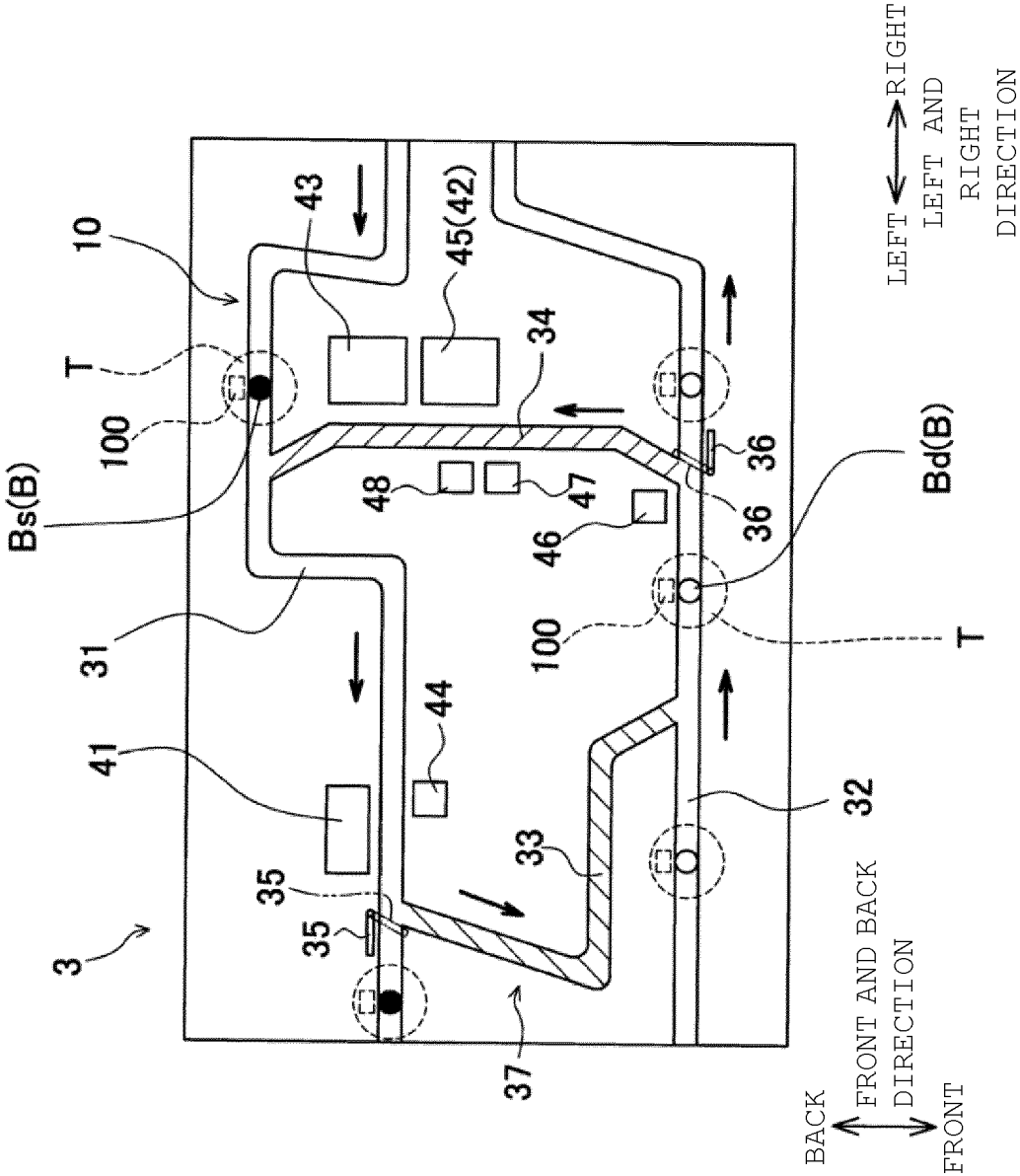


FIG. 5

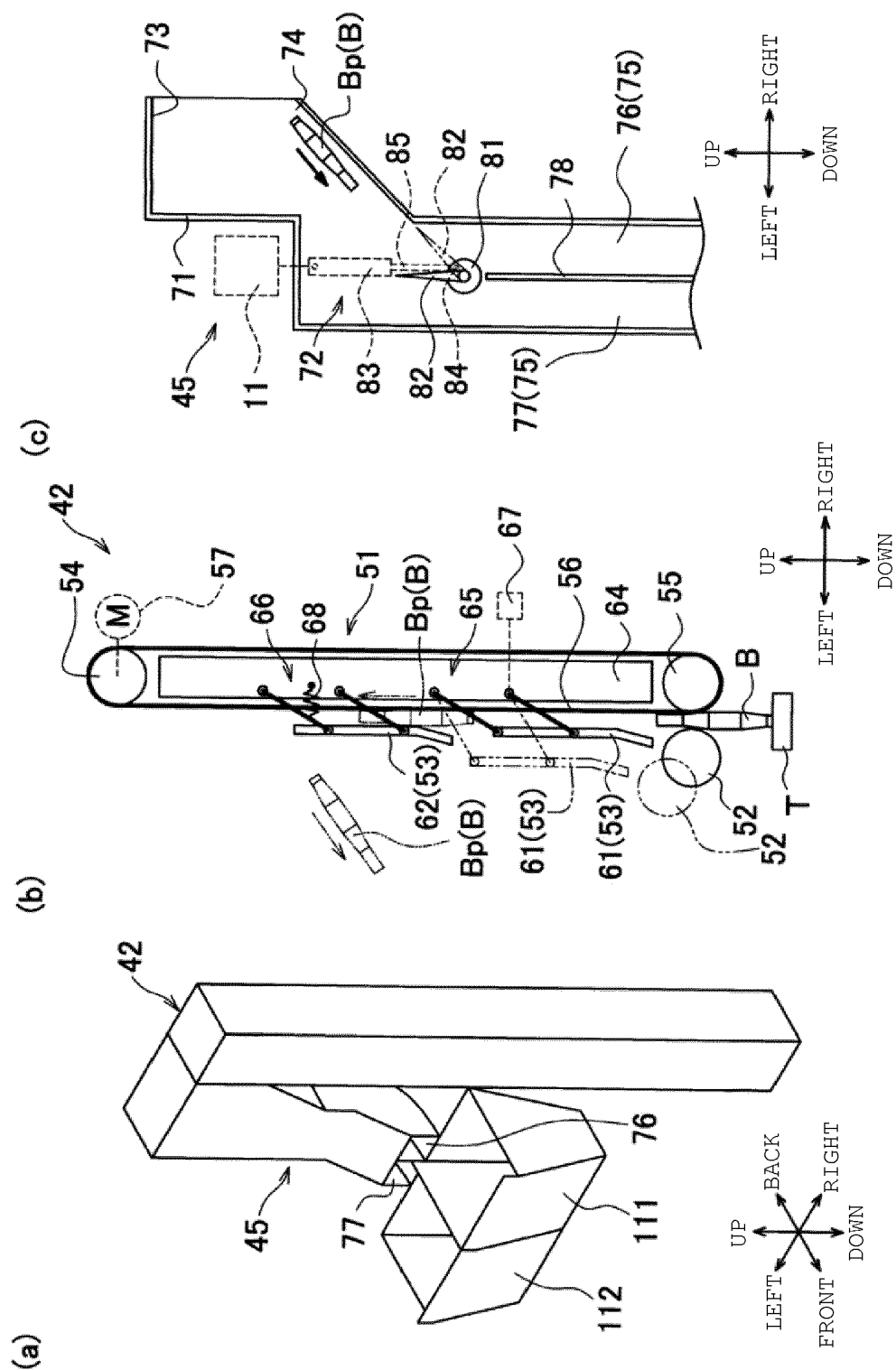


FIG. 6

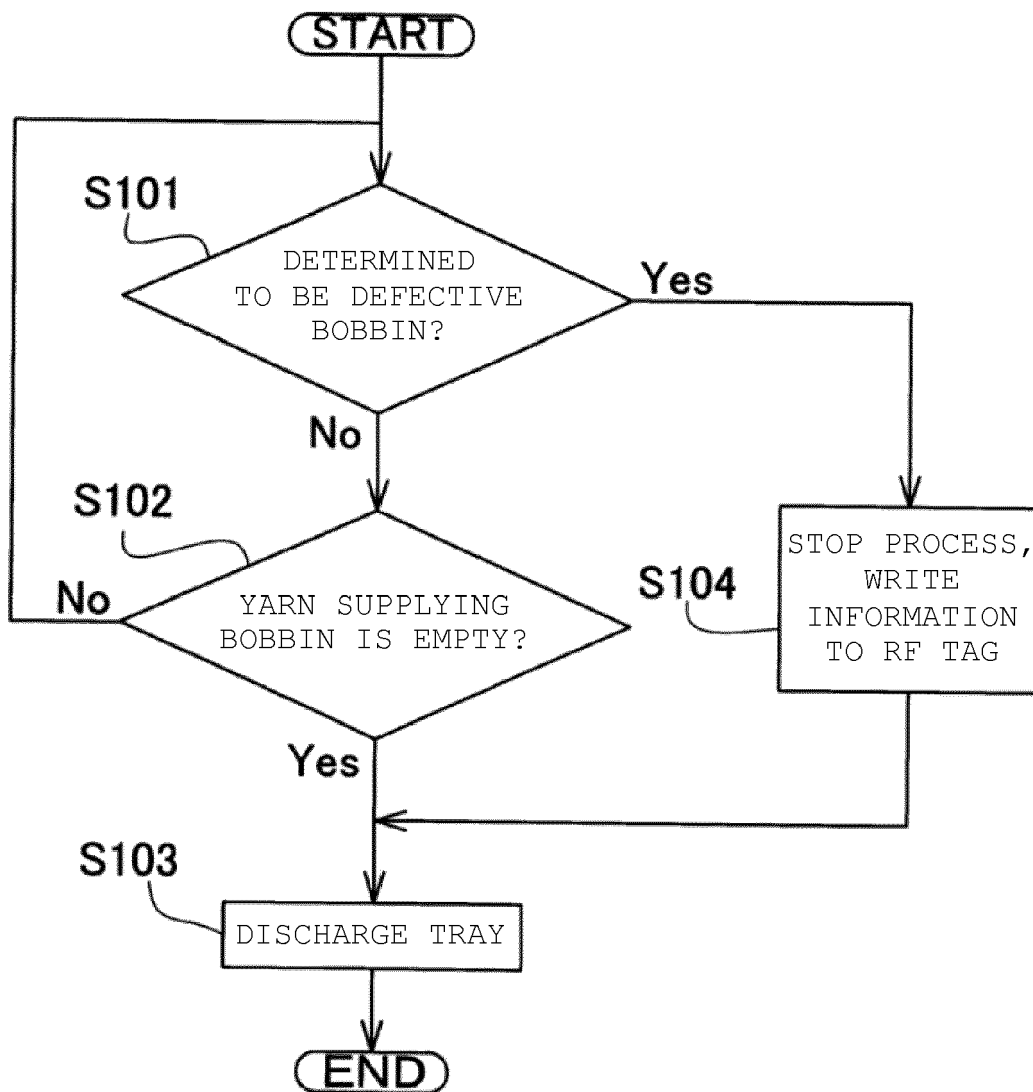


FIG. 7

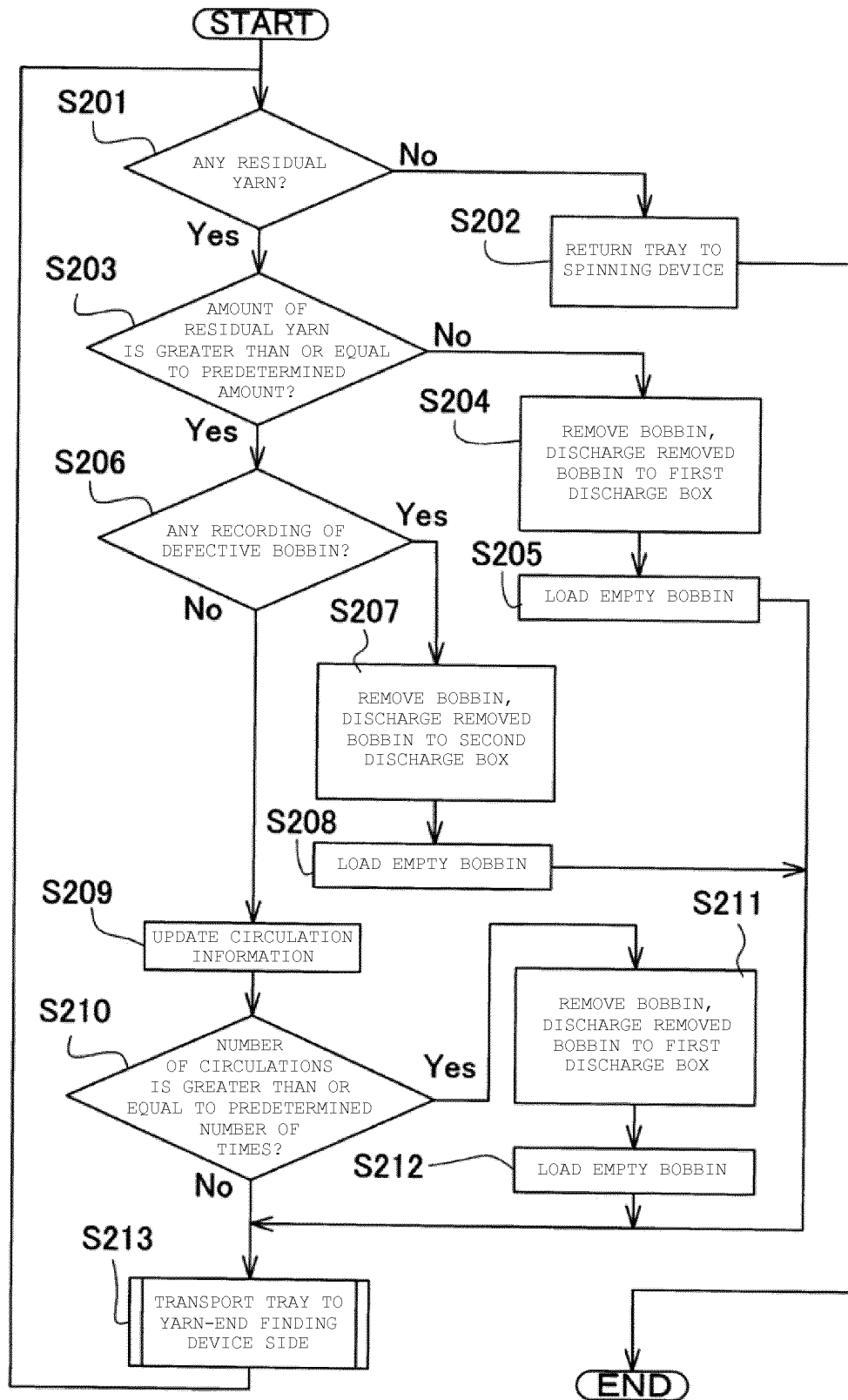


FIG. 8

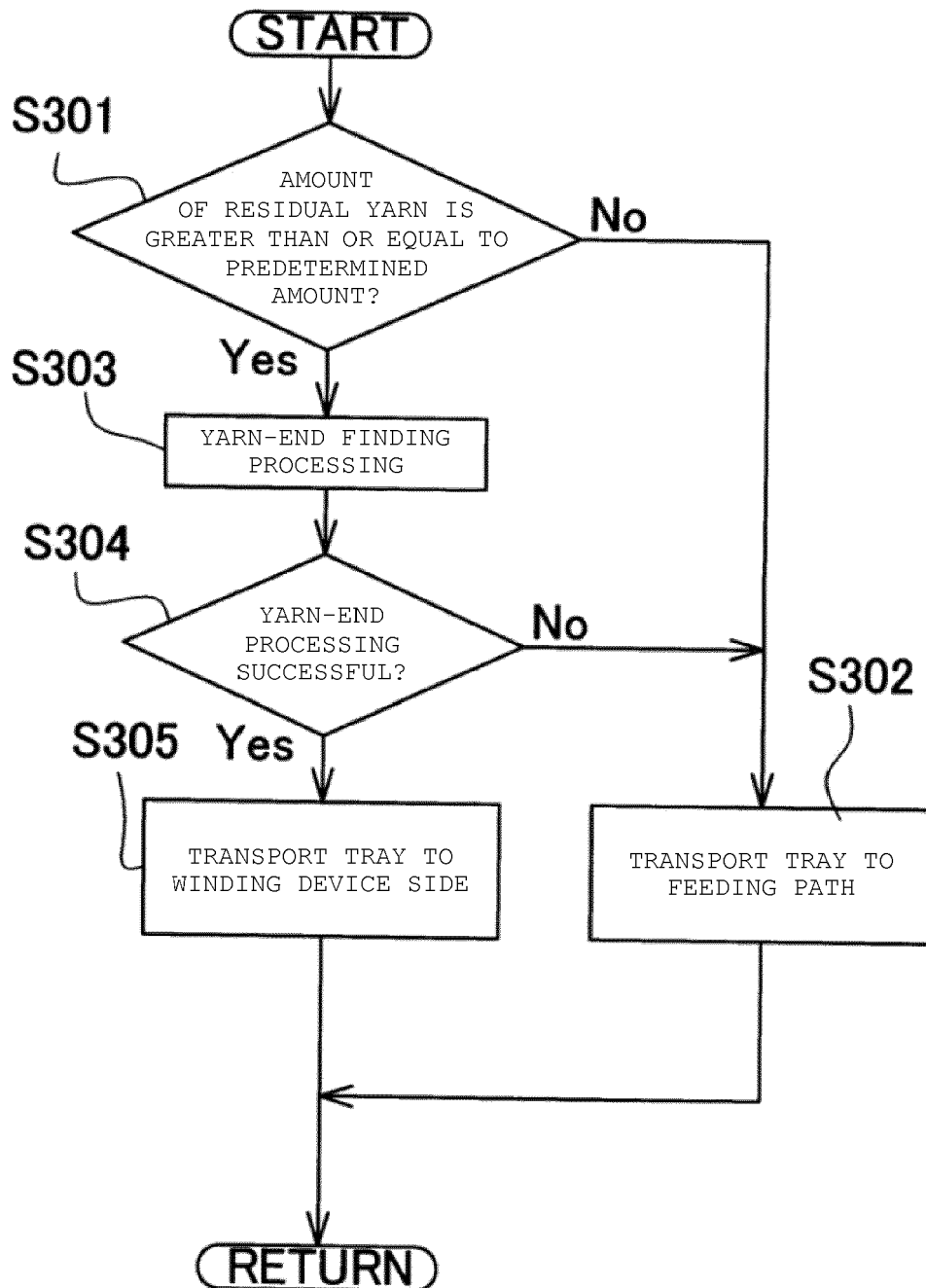


FIG. 9

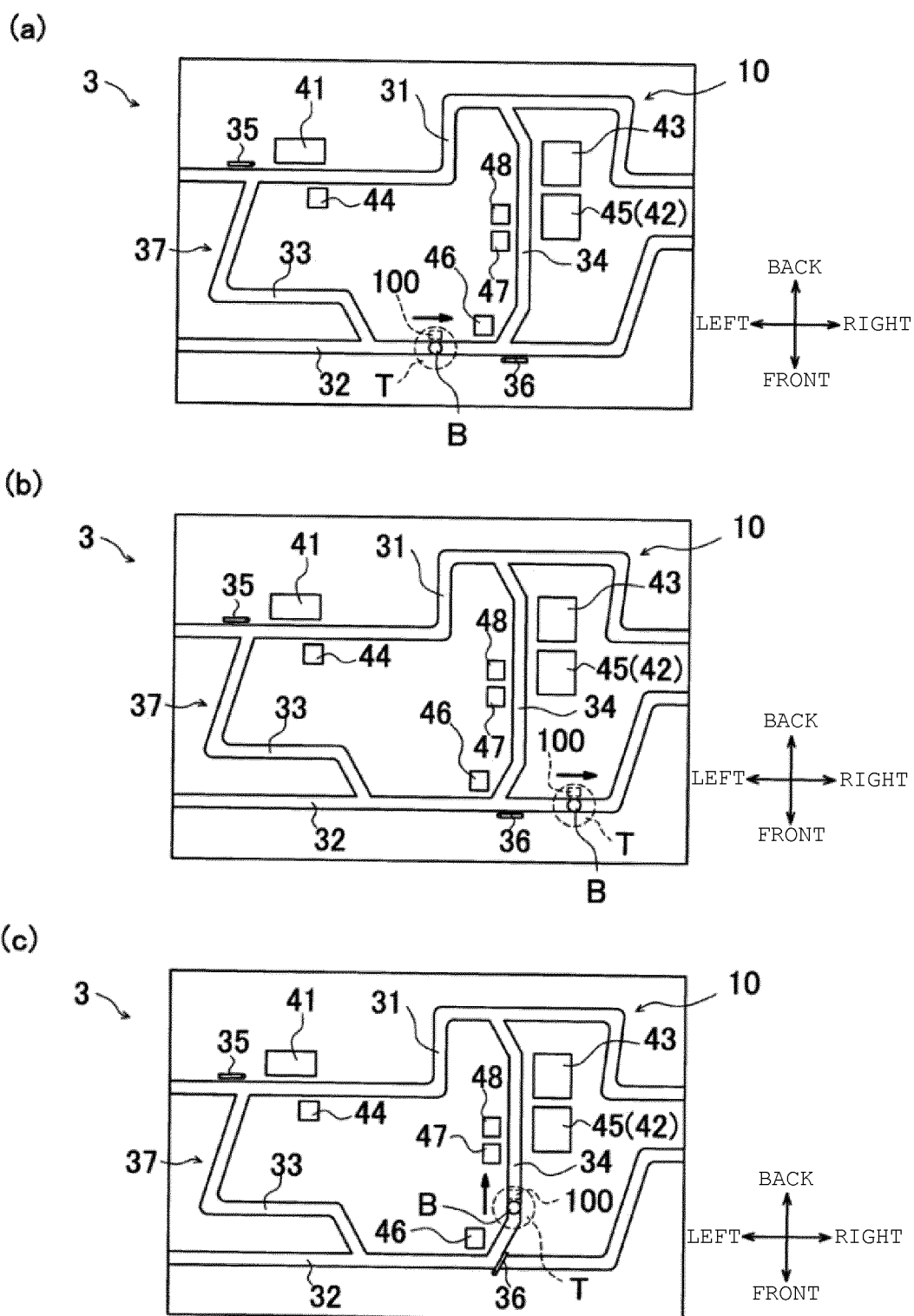


FIG. 10

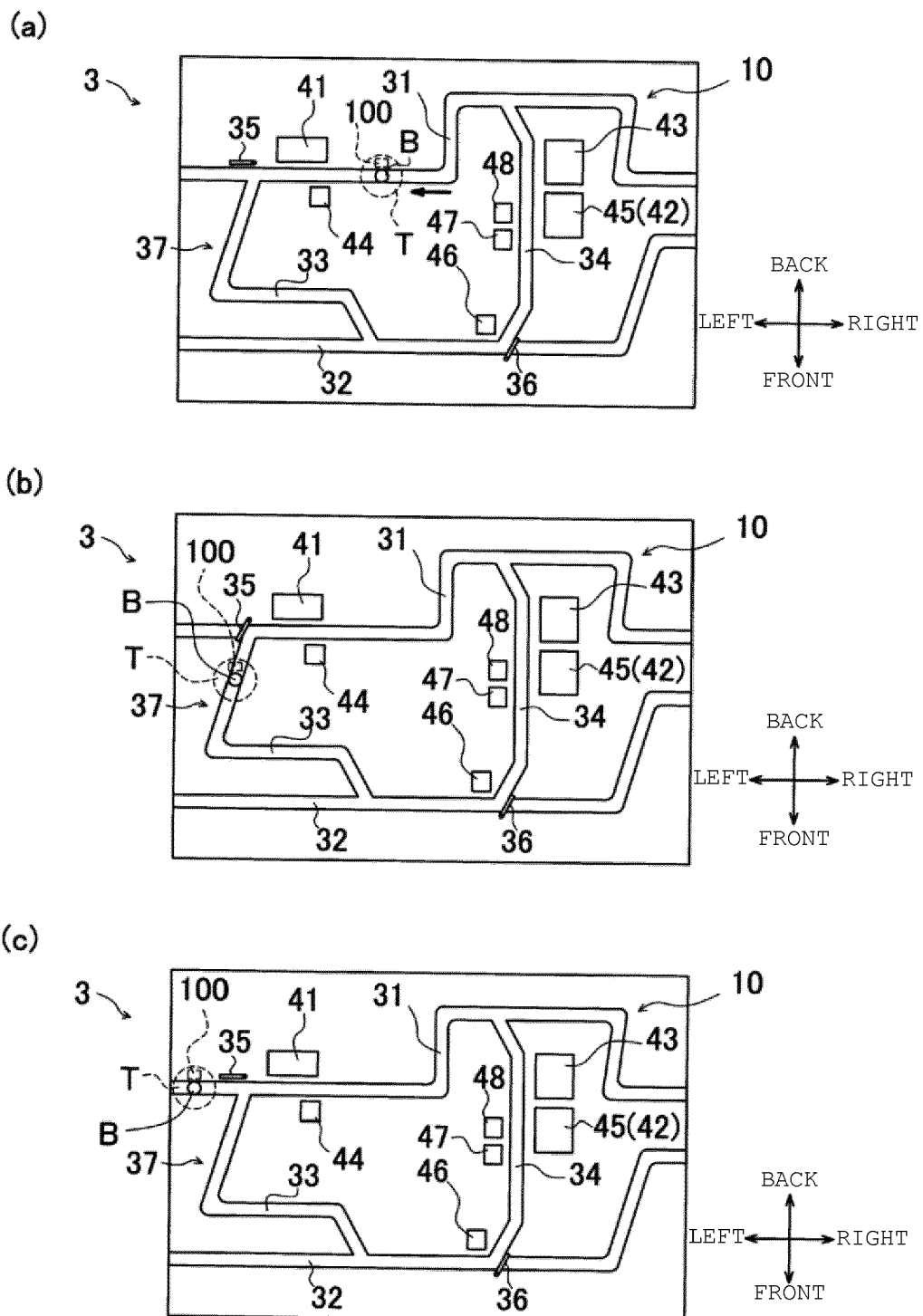


FIG. 11
(a) (b)

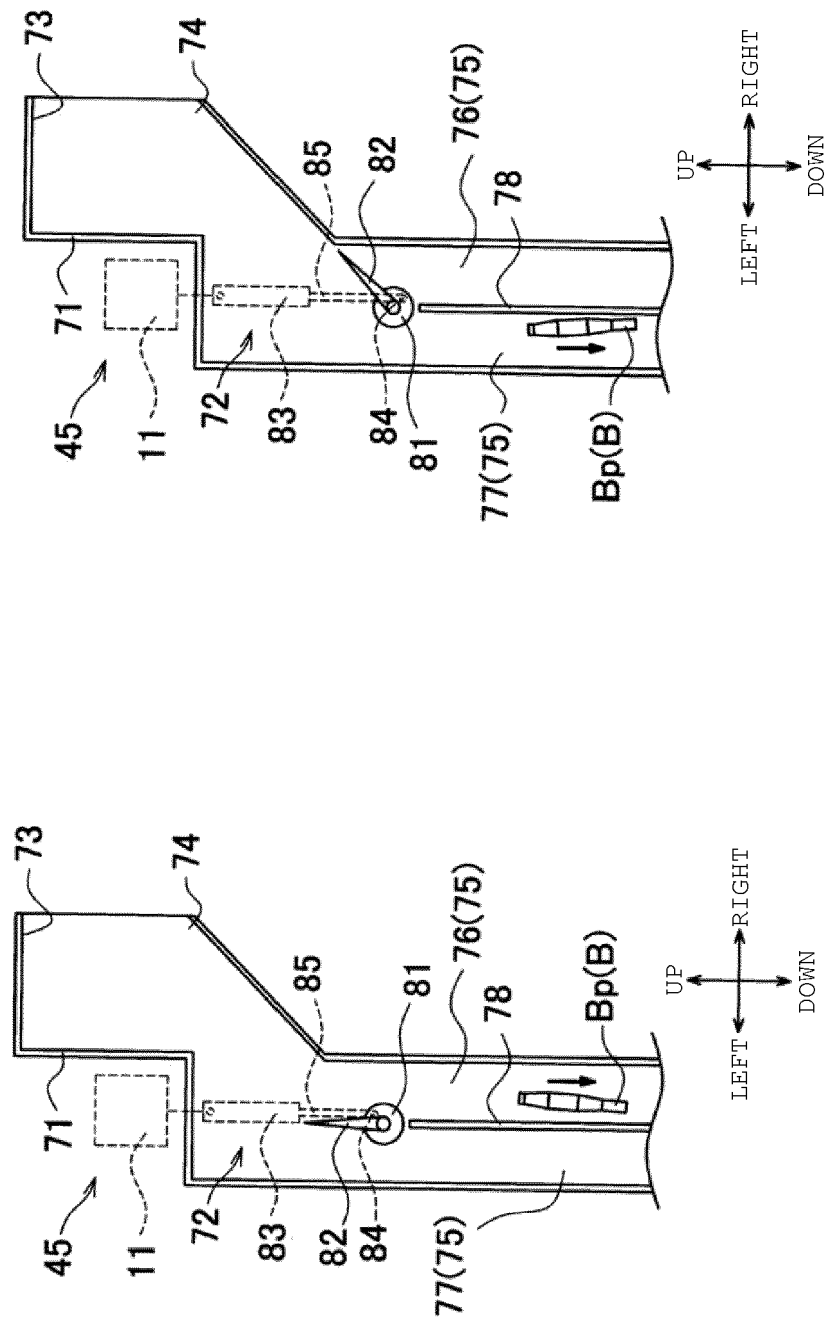


FIG. 12

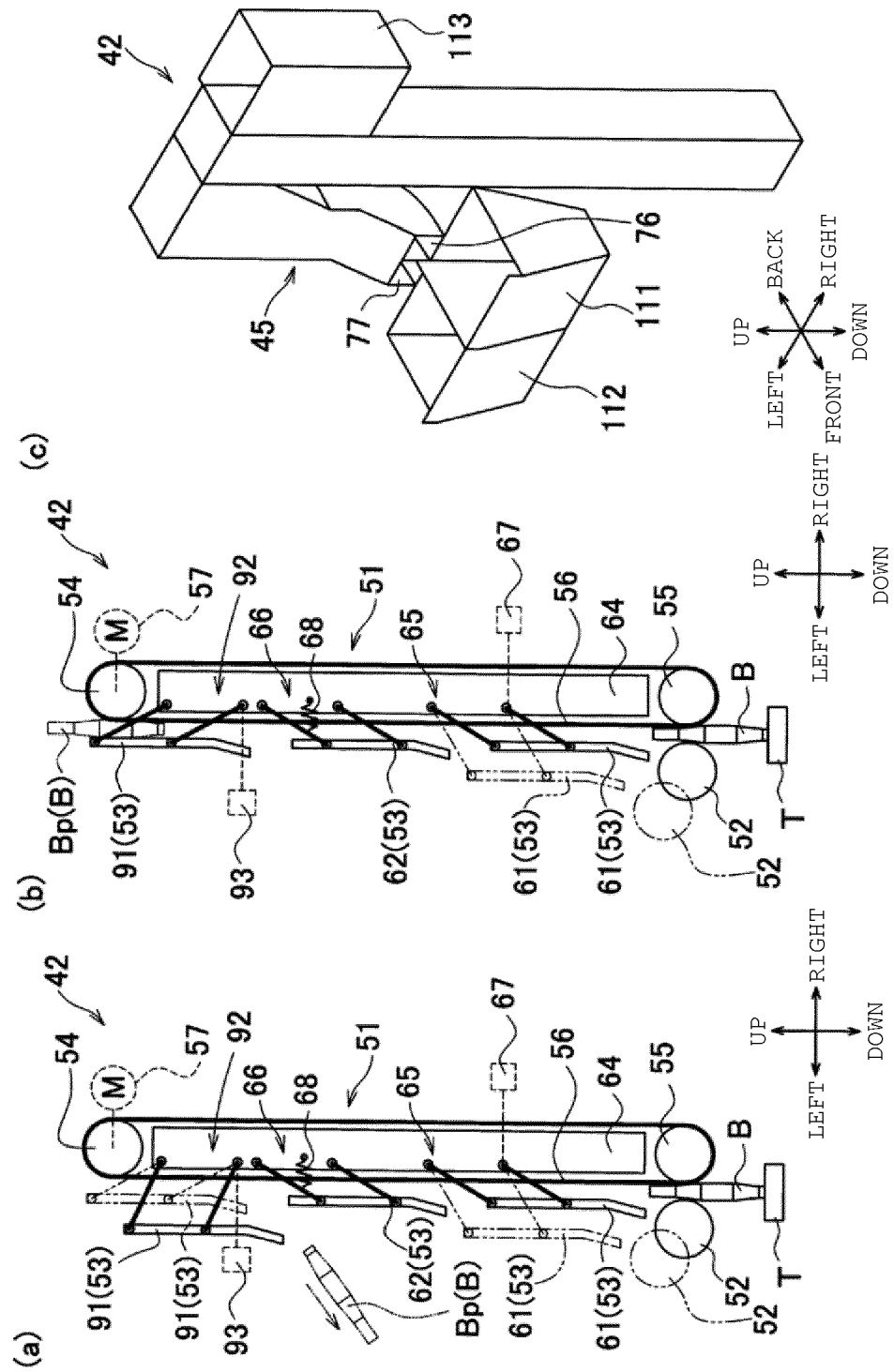


FIG. 13

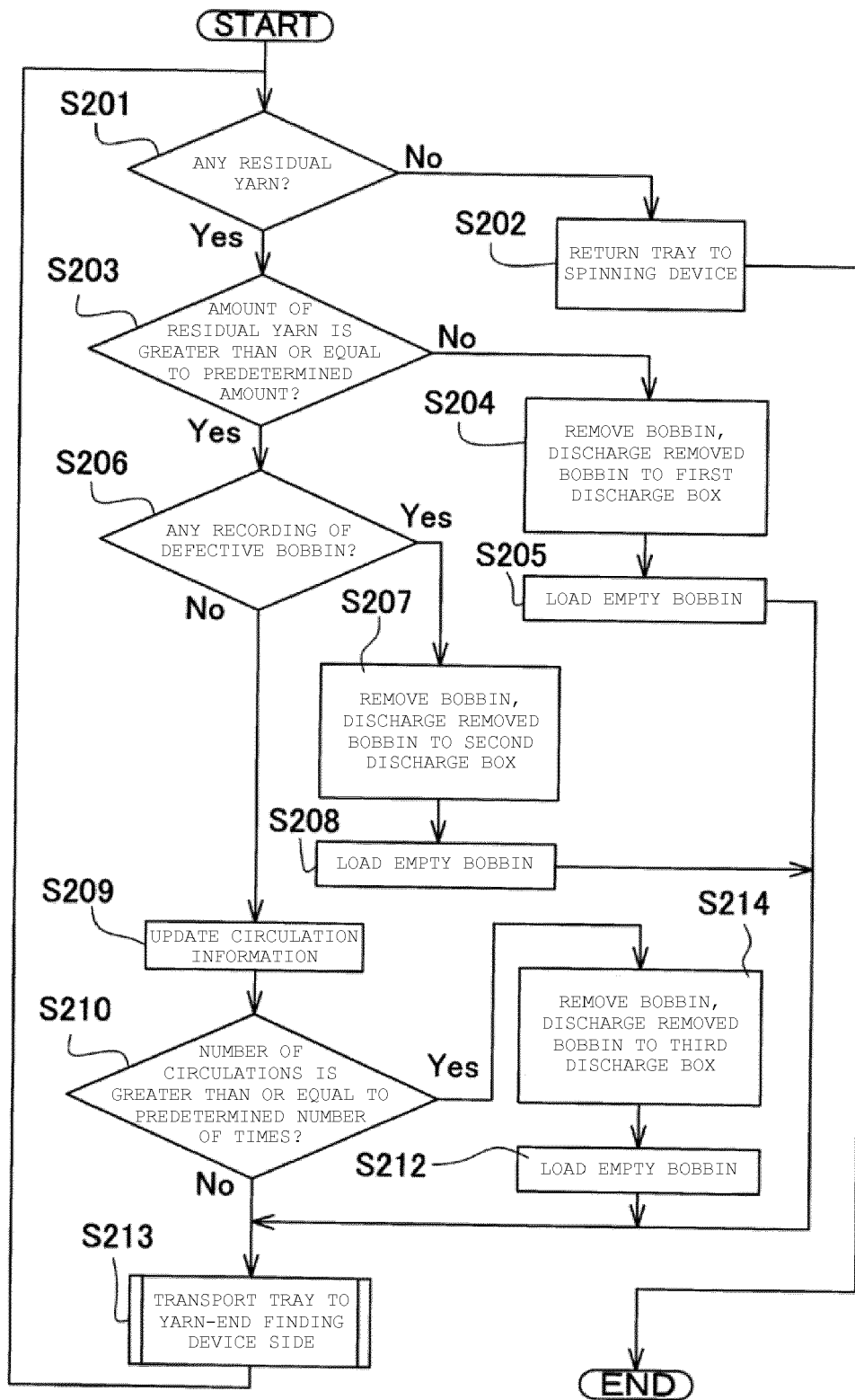


FIG. 14

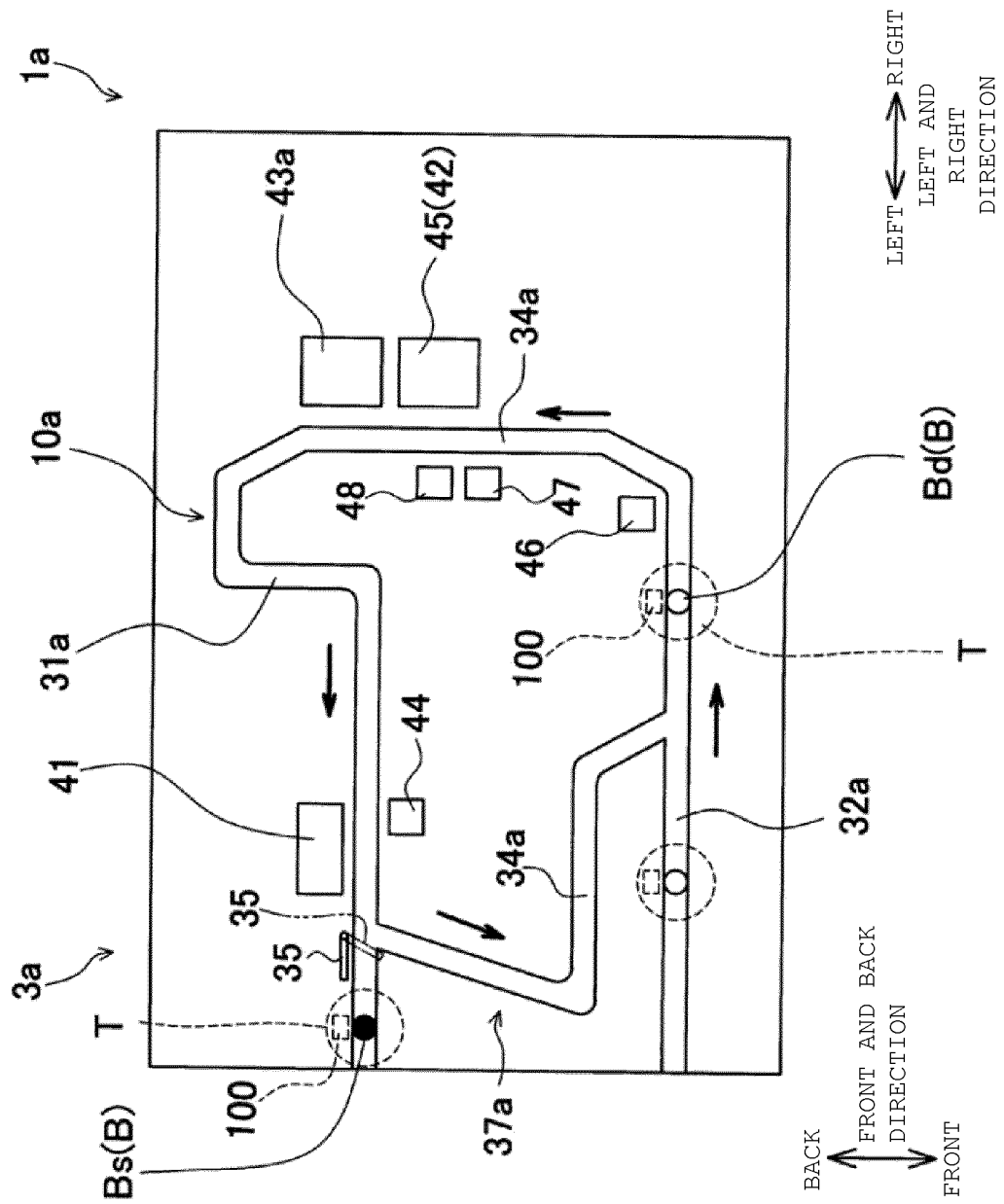
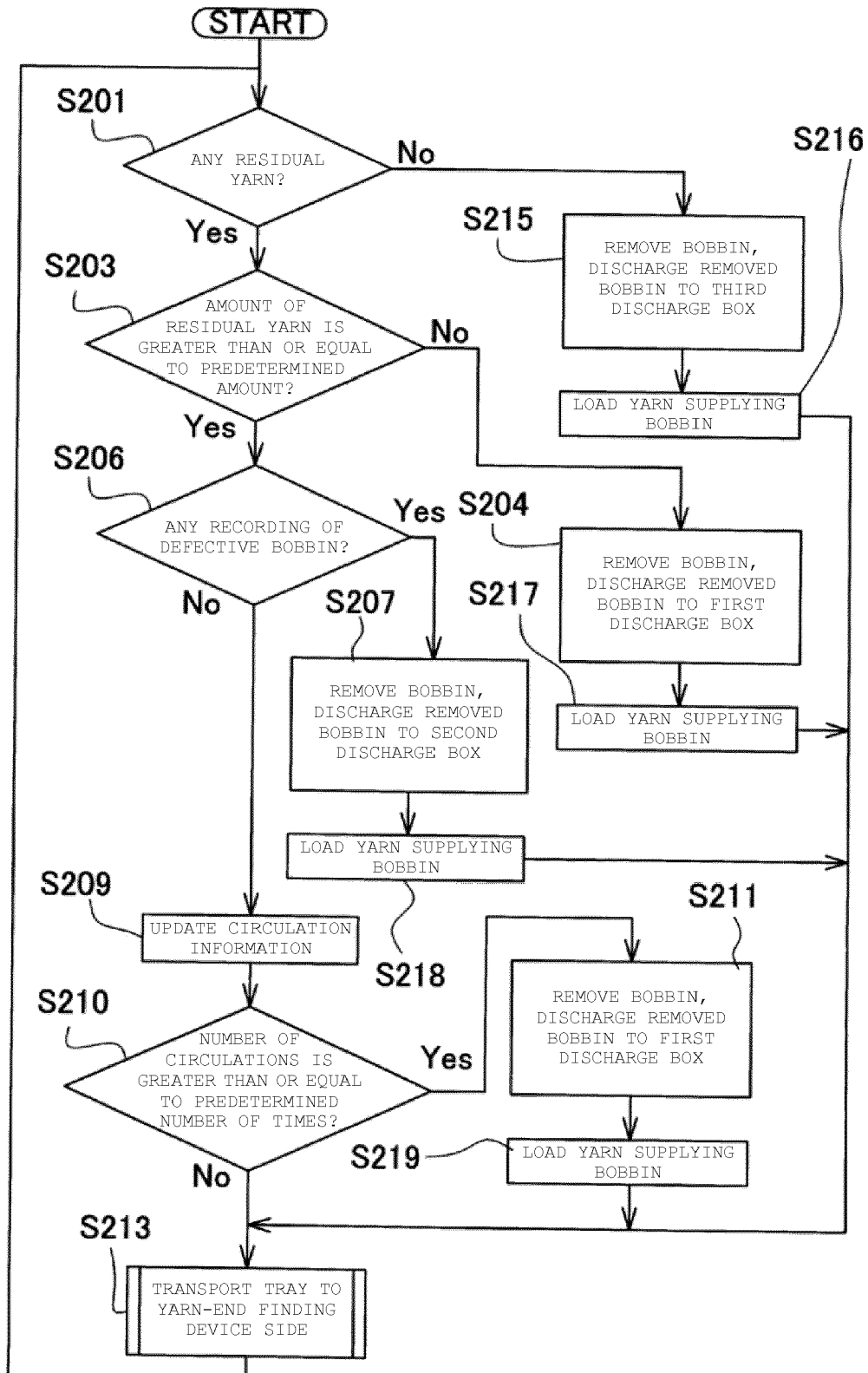


FIG. 15





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