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(54) **MANAGEMENT SYSTEM FOR FINE SPINNING WINDER AND FINE SPINNING WINDER**

VERWALTUNGSSYSTEM FÜR EINEN FEINDRAHTWICKLER UND FEINDRAHTWICKLER

SYSTEME DE GESTION POUR ENROULEUR DE FILAGE FIN ET ENROULEUR DE FILAGE FIN

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(73) Proprietor: **Murata Machinery, Ltd.**
Minami-ku
Kyoto-shi
Kyoto 601-8326 (JP)

(72) Inventor: **FUKUHARA, Shuichi**
Kyoto-shi
Kyoto 612-8686 (JP)

(74) Representative: **Zimmermann, Tankred Klaus et al**
Schoppe, Zimmermann, Stöckeler
Zinkler, Schenk & Partner mbB
Patentanwälte
Radlkoferstrasse 2
81373 München (DE)

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Description

TECHNICAL FIELD

[0001] The present invention relates to a management system applied to a fine spinning winder.

BACKGROUND ART

[0002] Conventionally known is a fine spinning winder including a spinning frame for spinning a yarn and winding the yarn on a bobbin, an automatic winder for unwinding the spun yarn from the bobbin to form a package having a predetermined length, and a bobbin transport mechanism for automatically transporting the bobbin by a tray from a fine spinning unit of the spinning frame to a rewinding unit of the automatic winder. In this type of fine spinning winder, a textile machine management system is sometimes applied, whereby recording means for recording information is attached to the tray and bobbin information is managed based on the information recorded on the recording means. By using such a management system, in a case where, for example, a yarn of lower quality than a set level is detected, a fine spinning unit having wound the yarn on the bobbin can be promptly identified based on the information recorded on the recording means. A fine spinning winder using such a fine spinning winder management system is disclosed in, for example, Patent Documents 1 and 2.

PRIOR-ART DOCUMENTS

PATENT DOCUMENTS

[0003]

Patent Document 1: Japanese Patent Application Laid-Open No. 2003-176081
Patent Document 2: Japanese Patent Application Laid-Open No. 62-41329 (1987)

[0004] WO 03/057610-A. WO 99/63139 A1 discloses the preamble of claim 1.

SUMMARY OF INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005] In the above-described fine spinning winder, there is sometimes a desire to know how fluff is occurring in a spun yarn on a unit basis of the bobbin, in order to use it as a reference for recognizing an operating situation of the fine spinning unit. It is therefore conceivable to use a fluff detection function of a clearer that is provided in the rewinding unit of the automatic winder.

[0006] Here, fluffing (the amount of fluff) in the spun yarn that is unwound from the bobbin has a certain variation tendency relative to the length of the unwound yarn, such as being small immediately after the start of the unwinding but gradually increasing as the amount of remaining yarn approaches zero. However, in a case of detecting the fluff by the clearer, the above-mentioned variation cannot be considered. Therefore, the amount of occurrence of fluff cannot be properly analyzed on a unit basis of the bobbin.

[0007] Therefore, a conventional fine spinning winder adopts a method in which one of the bobbins wound with the yarns by the fine spinning units of the spinning frame is picked up as a sample, and the yarn is unwound up to a certain length that is predefined, and then the amount of fluff is measured by an analyzer that is provided independently of the fine spinning winder. As a result, data concerning the amount of fluff in the yarn capable of being compared with another bobbin can be obtained. Therefore, a tendency of each bobbin can be grasped, such as a tendency that a certain bobbin has a larger amount of fluff than other bobbins. However, the spinning frame often includes a large number of fine spinning units, and it is quite troublesome to pick up a sample and analyze the sample by the analyzer for all of the fine spinning units. On the other hand, if an interval at which the sample is picked up for a quality inspection is increased, detection of a failure of the fine spinning unit may be delayed depending on a timing of picking up the sample, which undesirably causes decrease in production efficiency.

[0008] The present invention is made in view of the circumstances described above, and an object of the present invention is to provide a management system for a fine spinning winder, which enables a tendency of occurrence of fluff in a yarn spun by a fine spinning unit to be automatically analyzed on a unit basis of a bobbin.

MEANS FOR SOLVING THE PROBLEMS AND EFFECTS THEREOF

[0009] The problem to be solved by the present invention is as described above, and next, means for solving the problem and effects thereof will be described.

[0010] According to the invention as defined in claim 1, in a management system for managing a fine spinning winder including a spinning frame, an automatic winder, and a bobbin transport mechanism, the following configuration is provided. The spinning frame includes a plurality of fine spinning units for winding spun yarns on bobbins. The automatic winder includes a rewinding unit for unwinding the yarn from the bobbin to form a package. The bobbin transport mechanism transports, to the rewinding unit, a transporter on which the bobbin wound with the yarn by the spinning frame is set. The transporter has a data recording section configured to record information for identifying the fine spinning unit that has wound the yarn on the bobbin set on this transporter. The rewinding unit includes a fluff detection part, a yarn length calculation section, and a data reading part. The fluff detection part detects the amount of fluff in the yarn. The yarn length calculation section calculates the length of

the unwound yarn indicating the length of the yarn unwound from the bobbin. The data reading part reads the information from the data recording section corresponding to the bobbin on which a rewinding operation is performed. The automatic winder includes a quality inspection section for recording the amount of fluff together with the length of the unwound yarn obtained when the fluff detection part detected this amount of fluff, and performing a quality inspection, on a unit basis of the bobbin, on the yarn spun by the fine spinning unit.

[0011] Accordingly, the fine spinning unit having performed the spinning can be identified based on the information in the data recording section. Therefore, the quality of the yarn produced by the fine spinning unit can be examined on a unit basis of the bobbin. Additionally, the quality inspection can be automatically performed concurrently with the rewinding operation in a production line. This provides laborsaving for the quality inspection operation. Moreover, since the amount of fluff is recorded in association with the yarn length, a tendency of occurrence of fluff that indicates a portion of the yarn where a large amount of fluff occurs can be accurately recognized, which enables the fluff to be detected and handled efficiently.

[0012] In the management system, it is preferable that the fine spinning unit is configured as a ring spinning unit having a traveler.

[0013] Accordingly, since the tendency of occurrence of fluff can be accurately recognized on a unit basis of the bobbin, increase in the amount of fluff throughout the yarn, which is caused by degradation of the traveler due to abrasion, can also be detected easily.

[0014] According to the invention, the fine spinning winder includes notification means configured to identify the fine spinning unit requiring maintenance, and to make notification. The management system monitors, on a unit basis of the bobbin, a tendency of occurrence of fluff in the yarn produced by the same fine spinning unit, and if the tendency of occurrence of fluff exhibits a change that satisfies a determination condition as compared with a previous tendency of occurrence of fluff, the notification means makes notification.

[0015] Accordingly, since a change in the tendency of occurrence of fluff is monitored on a unit basis of the bobbin, a change in the amount of fluff caused by a failure of the fine spinning unit while a system is running can be detected on a unit basis of the bobbin, and an operator can be notified of the fine spinning unit requiring maintenance. This allows the operator to promptly handle the failure of the fine spinning unit, thus effectively suppressing deterioration in quality of the yarn rewound into the package. Moreover, a component part is replaced at a timing when the component part actually reaches the end of its lifetime and causes a failure. Therefore, the replacement of only the minimum number of component parts is required, and thus costs can be reduced efficiently.

[0016] It is preferable that the management system for the fine spinning winder is configured as follows. That is, if the rewinding operation is interrupted halfway, the management system records unwound yarn length information indicating the length of the unwound yarn obtained at a time when the interruption occurs. Additionally, when performing the rewinding operation again using the bobbin on which the rewinding operation has been interrupted halfway, the management system refers to the unwound yarn length information corresponding to this bobbin, and records the amount of fluff in association with the length of the unwound yarn including consideration for this unwound yarn length information.

[0017] Accordingly, even when the bobbin on which the rewinding operation has been interrupted is transported again to the rewinding unit, the amount of fluff is recorded based on the length of the unwound yarn including consideration for the length of the already unwound yarn. Therefore, a portion where the fluff is detected can be accurately identified.

[0018] In the management system, it is preferable that the rewinding unit includes a fluff suppression device that is controlled based on a tendency of occurrence of fluff on a unit basis of the bobbin.

[0019] Accordingly, fluff is suppressed in accordance with the tendency of occurrence thereof, and therefore the quality of the yarn rewound into the package can be kept more uniform.

[0020] In a second aspect of the present invention, a fine spinning winder to which the management system is applied is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

FIG. 1 is a schematic plan view showing a tray transport path provided in a fine spinning winder according to one embodiment of the present invention, as seen from the top side thereof.

FIG. 2 contains a schematic front elevational view and a block diagram showing a fine spinning winder.

FIG. 3 is a perspective view showing external appearances of a bobbin and a tray.

FIG. 4 is a side view showing a configuration of a fine spinning unit.

FIG. 5 is a side view showing a configuration of a rewinding unit.

FIG. 6 is an explanatory diagram for explaining trend data used for a quality inspection.

FIG. 7 is a side view showing a configuration of a rewinding unit according to a modification.

EMBODIMENT FOR CARRYING OUT THE INVENTION

[0022] Next, an embodiment of the invention will be described. FIG. 1 is a schematic plan view showing a fine spinning winder 1 according to one embodiment of the present invention, as seen from the top side thereof. FIG. 2 contains a schematic front elevational view and a

block diagram showing the fine spinning winder 1.

[0023] As shown in FIG. 1, the fine spinning winder 1 has a tray transport path 90 for transporting a tray (transporter) 50 on which a bobbin 23 is set. A spinning frame 2, a winder 3, and an automatic bobbin feed system (bobbin transport mechanism) 6 are arranged in the tray transport path 90. The tray transport path 90 connects the spinning frame 2 and the winder 3 to each other, and is configured as a loop, so that the bobbin 23 (tray 50) circulates through the tray transport path 90. Although FIG. 1 shows only one bobbin 23 and one tray 50, actually a plurality of trays 50 are transported along the tray transport path 90.

[0024] In the following description, regarding a flow of the tray 50 through the tray transport path 90, an upstream side and a downstream side with respect to a direction of transport of the tray 50 may be simply referred to as "upstream side" and "downstream side", respectively.

[0025] Firstly, configurations of the tray 50 and the bobbin 23 transported in the tray transport path 90 will be briefly described with reference to FIG. 3. FIG. 3 is a perspective view showing external appearances of the tray 50 and the bobbin 23 used in the fine spinning winder 1 of this embodiment.

[0026] As shown in the left part of FIG. 3, the tray 50 includes a base portion 50a having a substantially circular disc shape, and a bobbin insertion portion 50b having a rod-like shape and protruding from the base portion 50a in a vertical direction. The tray 50 moves along the tray transport path 90 while a side of the tray 50 at which the insertion portion 50b protrudes faces upward.

[0027] As shown in the middle part of FIG. 3, the bobbin 23 is shaped into a long and thin cylinder, and allows the insertion portion 50b to be inserted therein. Thereby, the bobbin 23 is set on the tray 50 with a longitudinal direction of the bobbin 23 extending in the vertical direction, and can be transported along the tray transport path 90.

[0028] In the following description, a bobbin (bobbin shown in the right part of FIG. 3) on which a yarn is wound will be sometimes referred to as "actual bobbin". A bobbin in a state where no yarn is wound thereon (in a state shown in the middle part of FIG. 3) will be sometimes referred to as "empty bobbin" or "bobbin that is empty" for the purpose of especially emphasizing such a state.

[0029] In the fine spinning winder 1 of this embodiment, a management system (textile machine management system) is applied which manages information of the bobbin 23 set on the tray 50 by using a technique of RFID (Radio Frequency IDentification: individual identification based on a radio wave). More specifically, in each tray 50, an RF tag (data recording section) 60 in which appropriate information can be written is arranged within the base portion 50a. By writing information concerning the bobbin 23 into the RF tag 60 (of each tray 50), a status of the bobbin 23 is managed.

[0030] Next, each configuration of the fine spinning winder 1 will be described along the tray transport path 90. The tray transport path 90 includes an actual bobbin introduction path 91, an actual bobbin transport path 92, a returned bobbin transport path 93, a bobbin waiting loop 94, a bobbin supply path 95, an empty bobbin transport path 96, an empty bobbin return path 97, a defective bobbin waiting path 98, and a replaced bobbin return path 99.

[0031] The actual bobbin introduction path 91 connects the spinning frame 2 and the automatic bobbin feed system 6 to each other, and transports the tray 50 having the bobbin 23 placed thereon from the spinning frame 2 to the automatic bobbin feed system 6. Hereinafter, the spinning frame 2 will be described.

[0032] As shown in FIG. 2, the spinning frame 2 includes a large number of fine spinning units 32 arranged in parallel with one another, and a controller 19 configured to collectively control the large number of fine spinning units 32. The spinning frame 2 also includes a doffing device (not shown) for doffing the bobbin 23 (actual bobbin) on which the yarn has been wound by the fine spinning unit 32.

[0033] Next, a detailed description will be given to the fine spinning unit 32 with reference to FIG. 4. As shown in FIG. 4, the fine spinning unit 32 of this embodiment is for spinning a sliver or a rove having been generated in a prior step by imparting twist thereto. More specifically, the spinning frame 2 is configured as a ring spinning frame, and the fine spinning unit 32 is configured as a ring spinning unit including a drafting mechanism 101 and a twist imparting mechanism 102.

[0034] The drafting mechanism 101 has a plurality of drafting rollers, and the drafting rollers include top rollers 103 and bottom rollers 104. The top rollers 103 have three drafting rollers, namely, a back roller 103a, a middle roller 103b having an apron belt 105 mounted thereon, and a front roller 103c. On the other hand, the bottom rollers 104 have three drafting rollers, namely, a back bottom roller 104a, a middle bottom roller 104b having an apron belt 105 mounted thereon, and a front bottom roller 104c. As shown in FIG. 4, the top roller 103 and the bottom roller 104 are arranged so as to be opposed to each other across a path of travel of the sliver or the rove, and are configured to nip the sliver or the rove with predetermined pressure. An output shaft of a driving source (not shown) is connected to each of the bottom rollers 104, so that the bottom rollers 104 can be driven at different speeds. By the driving of the bottom rollers 104, the sliver or the rove is, while being drawn, fed to the twist imparting mechanism 102.

[0035] The twist imparting mechanism 102 includes a spindle shaft 111, a ring rail 112, a ring 113, and a traveler 114. The spindle shaft 111 is for rotating the bobbin 23 that is set on the spindle shaft 111. The ring rail 112 is connected to a driver (not shown), and movable in the longitudinal direction of the bobbin 23. The ring 113 is fixed to the ring rail 112, and has a flange portion for the traveler 114 to be mounted thereon. The traveler 114 is supported on the flange portion of the ring 113, and mov-

able in a circumferential direction of the ring 113.

[0036] To perform the fine spinning in the fine spinning unit 32 configured as described above, firstly, the yarn (sliver or rove having been drawn) fed from the drafting mechanism 101 is inserted into a gap between the traveler 114 and the ring 113, and an end portion of the yarn is fixed to the empty bobbin 23 by an appropriate method. In this state, the spindle shaft 111 rotates the bobbin 23, and thereby the yarn being wound on the bobbin 23 drags the traveler 114, so that the traveler 114 moves in the circumferential direction. As a result, the rotation of the traveler 114 is delayed behind the rotation of the bobbin 23, and twist is imparted to the yarn due to a difference in the number of rotations thus caused. The twisted yarn is sequentially wound on the bobbin 23. When a preset length of the yarn is wound on the bobbin 23, the rotation of the spindle shaft 111 is stopped, to terminate the winding.

[0037] The spinning frame 2 of this embodiment is of so-called simultaneous doffing type. In the spinning frame 2 of this type, a large number of bobbins 23 transported from the automatic bobbin feed system 6 through the empty bobbin return path 97 which will be described later are stocked while being arranged in a line, and when a predetermined timing comes, the large number of bobbins 23 are simultaneously set on the spindle shafts 111 of the fine spinning units 32, and yarns are simultaneously wound thereon. When the winding of the yarns is completed, the doffing device simultaneously doffs all the bobbins 23 (actual bobbins). Then, bobbins 23 that are empty are pulled away from the trays 50. having the empty bobbins 23 placed thereon, which are waiting in appropriate positions. Then, the bobbins 23 (actual bobbins) are inserted into the trays 50. Then, the pulled bobbins 23 that are empty are set on the spindle shafts 111, and the spinning frame 2 winds yarns thereon. The bobbins 23 doffed by the spinning frame 2 and placed on the trays. 50 are transported through the actual bobbin introduction path 91, and thereby introduced into the automatic bobbin feed system 6.

[0038] The automatic bobbin feed system 6 receives the trays 50 having the bobbins 23 (actual bobbins) placed thereon from the spinning frame 2, and then writes appropriate information into the RF tags 60 of the trays 50. A pick finding device 7 finds pick of the bobbins 23, and then the trays 50 are supplied to the winder 3 side. Hereinafter, a detailed description will be given.

[0039] As shown in FIG. 1, an RF writer (data writing part) 4 is arranged at the downstream side of the spinning frame 2 in the actual bobbin introduction path 91. The RF writer 4 writes, for example, information identifying the fine spinning unit 32 that has spun the yarn on the bobbin 23, into the RF tag 60. When the tray 50 transported in the actual bobbin introduction path 91 passes through a writing position of the RF writer 4, the information identifying the fine spinning unit 32 that has wound the yarn on the bobbin 23 placed on this tray 50 is recorded on the RF tag 60 by the RF writer 4.

[0040] The fine spinning units 32 are arranged side by side in a longitudinal direction of the spinning frame 2. The bobbins 23 doffed by the simultaneous doffing are mounted on the trays 50, and then transported in the actual bobbin introduction path 91 in the same order as the order in which the fine spinning units 32 are arranged. Accordingly, by counting the order in which the bobbins 23 are introduced into the actual bobbin introduction path 91, the fine spinning unit 32 that has spun the yarn on the bobbin 23 can be identified. For example, in the first tray 50 that has passed through a reading position of the RF writer 4 after the simultaneous doffing was performed, a station number No.1 of the fine spinning unit 32 arranged most downstream is stored in the RF tag 60. In the next transported tray 50, the station number No. 2 of the fine spinning unit 32 adjacent upstream to the fine spinning unit 32 having the station number No. 1 is stored in the RF tag 60. In the subsequent trays newly transported, in the same manner, the station numbers No. 3, No. 4, ... are sequentially stored in the RF tags 60. As a result, the information (station number) identifying the fine spinning unit 32 that has wound the yarn on the bobbin 23 placed on the tray 50 is stored in the RF tag 60 of this tray 50 passing through the writing position of the RF writer 4.

[0041] The RF writer 4 of this embodiment is configured to write doffing information as well as the station number described above. Here, the doffing information means information indicating a timing of performing the doffing, such as time when the simultaneous doffing was performed or how many number of times the doffing was.

[0042] The reason why the doffing information (such as clock time when the doffing was performed) as well as the station number is recorded on the RF tag 60 is as follows. That is, in the automatic bobbin feed system 6 and the winder 3 (the downstream side of the spinning frame 2), there may be the trays 50 in which the same station number is stored in the RF tags 60. For example, this occurs in a case where, before a rewinding operation on the bobbin 23 that has been fed to the winder 3 side in the previous doffing is not completed, the next doffing is performed so that a new group of bobbins 23 are introduced into the automatic bobbin feed system 6. In such a case, if the doffing information mentioned above is stored in the RF tag 60, the doffing information is referred to so that the bobbins 23 having the same station number can be distinctively recognized as different bobbins 23. The RF writer 4 of this embodiment can also store, in the RF tag 60, not only the above-described information but also a lot number, a number of the spinning frame 2 (a number given to each spinning frame 2 in a case where a plurality of spinning frames 2 are provided), and the like. In the following description, the information (the station number and the doffing information) identifying the bobbin 23 which is stored in the RF tag 60 may be referred to as bobbin information.

[0043] A downstream end portion of the actual bobbin introduction path 91 is connected to an upstream end

portion of the actual bobbin transport path 92. The actual bobbin transport path 92 connects the automatic bobbin feed system 6 and the winder 3 to each other. The tray 50 in which predetermined information is written in the RF tag 60 thereof by the RF writer 4 is transported to the winder 3 along the actual bobbin transport path 92.

[0044] The automatic bobbin feed system 6 includes the pick finding device 7. The pick finding device 7 is arranged on the above-described actual bobbin transport path 92 and at the upstream side of the winder 3. The pick finding device 7 finds pick of the bobbin 23 in order to make it easy for the winder 3 to catch the yarn of the bobbin 23. A brief description will be given. The pick finding device 7 applies a suction flow to the bobbin 23 placed on the tray 50 transported in the actual bobbin transport path 92, and thereby unwinds the yarn from a surface of the bobbin 23. An end of the unwound yarn is inserted into the inside of the bobbin 23 having the cylindrical shape. This makes it easy that the end of the yarn of the bobbin 23 is caught by the winder 3 arranged at the downstream side of the pick finding device 7.

[0045] The pick finding device 7 does not always succeed in the pick-finding, and may sometimes fail. In this case, the tray 50 having placed thereon the bobbin 23 for which the pick-finding has been failed is sent out to the returned bobbin transport path 93. The returned bobbin transport path 93 diverges from the actual bobbin transport path 92 immediately downstream of the pick finding device 7, and is curved in a loop so as to be connected to the upstream end portion of the actual bobbin transport path 92. Such a configuration enables the bobbin 23 for which the pick-finding has been failed to be transported along the returned bobbin transport path 93 and thereby returned to the upstream side of the pick finding device 7 again. Thus, even if the pick-finding has been failed, a pick-finding process by the pick finding device 7 is automatically performed again. Therefore, it is not necessary that each time an error in the pick-finding occurs, an operator deals with it.

[0046] Next, the winder 3 will be described. As shown in FIGS. 1 and 2, the winder 3 includes a plurality of rewinding units 31, RF readers (data reading part) 5 arranged in the respective rewinding units 31, and a machine controller 11 serving as a controller. The winder 3 also includes a clearer control box (CCB) 12 to which a clearer (fluff detection part) 15 of the rewinding unit 31 which will be described later is connected.

[0047] As shown in FIG. 1, in the winder 3, a plurality of bobbin supply paths 95 diverging from the actual bobbin transport path 92 are provided. The plurality of bobbin supply paths 95 are provided corresponding to the plurality of rewinding units 31 of the winder 3. The plurality of bobbin supply paths 95 allow the bobbins 23 transported in the actual bobbin transport path 92 to be distributed to the rewinding units 31. A specific description will be given as follows.

[0048] Each bobbin supply path 95 has a predetermined length, and is configured such that a plurality of bobbins 23 can be arranged and stocked in the bobbin supply path 95. A guide member (not shown) or the like is arranged at an upstream end portion of each bobbin supply path 95, so that the bobbin 23 transported in the actual bobbin transport path 92 can be introduced into the bobbin supply path 95 by the guide member in the course of nature. If there is not a space in the bobbin supply path 95 for introduction of the bobbin 23 (if a maximum number of bobbins 23 are stocked), introduction of the new bobbin 23 into the bobbin supply path 95 is blocked by the bobbins existing in this bobbin supply path 95. At this time, the bobbin 23 blocked from being introduced into the bobbin supply path 95 is transported to the downstream side in the actual bobbin transport path 92, and introduced into another bobbin supply path 95 having a space. In this manner, the bobbins 23 fed from the spinning frame 2 can be distributed to the rewinding units 31.

[0049] On the other hand, if there is no bobbin supply path 95 having a space that allows the bobbin 23 to be introduced therein, the bobbin 23 is introduced into the bobbin waiting loop 94, and transported in the bobbin waiting loop 94. The bobbin waiting loop 94 diverges from a most downstream portion of the actual bobbin transport path 92, and is connected to a portion of the actual bobbin transport path 92 located at the upstream side of a position where the most upstream bobbin supply path 95 is diverged from the actual bobbin transport path 92. Accordingly, the bobbin 23 keeps circulating through a loop path made up of the bobbin waiting loop 94 and the actual bobbin transport path 92, until a space that allows a bobbin to be stocked therein is made in any bobbin supply path 95.

[0050] Next, a configuration of the rewinding unit 31 will be described in detail with reference to FIG. 5. As shown in FIG. 5, the rewinding unit 31 is for rewinding the yarn from the actual bobbin onto a rewinding bobbin 22 to thereby form a package 30. The rewinding unit 31 includes a rewinding drum (traverse drum) 24 for traversing the yarn and for driving the rewinding bobbin 22. In the rewinding unit 31 of this embodiment, in a path of travel of the yarn between the rewinding drum 24 and the bobbin 23 set in an appropriate position for an unwinding operation to be performed thereon, a tension applying device 13, a yarn piecing device 14, and a clearer (yarn quality measuring instrument) 15 are arranged in the mentioned order from the bobbin 23 side.

[0051] The tension applying device 13 applies a predetermined tension to the traveling yarn. As the tension applying device 13, a gate type one is adopted in which a movable comb is arranged relative to a fixed comb. The movable comb is rotatable by a rotary solenoid such that the combs can be brought into an engaged state or a disengaged state. The tension of the yarn to be rewound is controlled by the tension applying device 13, and thereby the quality of the package 30 can be improved.

[0052] For example, at a time of yarn cutting that is

performed by the clearer 15 upon detection of a yarn defect, or at a time of yarn breakage during unwinding of the yarn from the bobbin 23, the yarn piecing device 14 pieces a lower yarn of the bobbin 23 to an upper yarn of the package 30. Examples of the yarn piecing device 14 include a mechanical one, and one using a fluid such as a compressed air. A lower yarn guide pipe 25 for guiding the lower yarn of the bobbin 23 by sucking and catching the lower yarn and an upper yarn guide pipe 26 for guiding the upper yarn of the package 30 by sucking and catching the upper yarn are provided at the lower and upper sides of the yarn piecing device 14, respectively.

[0053] The clearer 15 is for detecting a defect and the amount of fluff in the yarn by detecting a diameter of the yarn using an appropriate sensor. The clearer 15 can also function as a sensor for simply detecting presence or absence of the yarn. Cutting means is provided near the clearer 15, so that if the clearer 15 detects a defect in the yarn, the defect can be removed.

[0054] The yarn unwound from the bobbin 23 is rewound on the rewinding bobbin 22 that is arranged at the downstream side of the yarn piecing device 14. The rewinding bobbin 22 is driven by rotational driving of the rewinding drum 24 that is opposed to the rewinding bobbin 22. A rotation sensor (not shown) is mounted to the rewinding drum 24. Each time the rewinding drum 24 is rotated through a predetermined angle, the rotation sensor outputs a rotation pulse signal to a unit control section (yarn length calculation section) 10. The rewinding unit 31 of this embodiment measures the number of pulses per a time period, thereby calculating a speed of rotation of the rewinding drum 24.

[0055] In the above-described configuration, the bobbin 23 transported in the bobbin supply path 95 is set in an appropriate position (rewinding position) in the rewinding unit 31, and then the rewinding drum 24 is driven, so that the yarn unwound from the bobbin 23 is rewound on the rewinding bobbin 22, to form the package 30 having a predetermined length.

[0056] An RF reader 5 is arranged in the bobbin supply path 95 so as to read the RF tag 60 of the tray 50 on which the bobbin 23 whose yarn is rewound by the rewinding unit 31 is placed. Information read by the RF reader 5 is transmitted to the machine controller 11.

[0057] As shown in FIG. 2, the machine controller 11 includes a display (notification means) 16 serving as display means, and input keys 17 serving as operation means. The display 16 is for displaying a status of each rewinding unit 31. The input keys 17 allow the operator to set rewinding conditions and the like.

[0058] As described above, the bobbin information (the station number and the doffing information) read by the RF reader is inputted into the machine controller 11. Therefore, which of the fine spinning units 32 has wound the yarn on the bobbin 23 whose yarn is currently rewound by the rewinding unit 31 can be identified.

[0059] The CCB 12 performs a determination process for determining, for example, whether or not a yarn defect is occurring, based on information transmitted from the clearer 15. As shown in FIG. 2, the CCB 12 has a display 18 serving as display means, so that various information, such as information concerning a yarn defect and information generated based on a yarn defect, can be displayed on the display 18. The CCB 12 is electrically connected to the machine controller 11, and communicates various information with the machine controller 11.

[0060] As shown in FIG. 5, the bobbin supply path 95 is laid under the rewinding unit 31. The bobbin 23 supplied to the rewinding unit 31 is transported to the above-mentioned rewinding position by this bobbin supply path 95. During the rewinding of the yarn, the bobbin 23 is stopped in the rewinding position, and therefore the transport of the tray 50 by the bobbin supply path 95 is temporarily stopped.

[0061] As described above, the bobbin supply path 95 is configured such that a plurality of bobbins 23 can be stocked therein. As shown in FIG. 5, the stocked bobbins 23 are arranged in a line on the bobbin supply path 95. The most downstream one of the bobbins 23 in the bobbin supply path 95 is an object of yarn rewinding performed by the rewinding unit 31. In FIG. 5, the position of the rightmost one of the plurality of bobbins is the above-mentioned rewinding position.

[0062] The unwinding of the yarn from the bobbin 23 is performed with the bobbin 23 being placed on the tray 50, as shown in FIG. 5. If the yarn of the bobbin 23 runs out and the bobbin 23 becomes empty, the bobbin supply path 95 transports the tray 50. Thereby, the bobbin 23 that is empty is fed to the downstream side while being placed on the tray 50, and discharged into the empty bobbin transport path 96 (which will be described later).

[0063] Along with the bobbin 23 that is empty and placed in the rewinding position being fed to the downstream side, each bobbin 23 stocked in the bobbin supply path 95 is also fed to the downstream side. As a result, a new bobbin 23 is set in the rewinding position, and the yarn is unwound from the new bobbin 23. Thus, the rewinding can be restarted. By discharging the empty bobbin 23 from the bobbin supply path 95, a new space allowing the bobbin 23 to be stocked therein is made in the bobbin supply path 95. Thus, the bobbin supply path 95 is replenished with the bobbin 23 transported in the actual bobbin transport path 92.

[0064] As shown in FIG. 1, a downstream end portion of each of the plurality of bobbin supply paths 95 joins the empty bobbin transport path 96. The empty bobbin transport path 96 connects the winder 3 and the automatic bobbin feed system 6 to each other. The empty bobbin 23 discharged from each rewinding unit 31 is transported through the empty bobbin transport path 96, and thereby returned to the automatic bobbin feed system 6.

[0065] In the automatic bobbin feed system 6, the empty bobbin transport path 96 is connected to a middle of the returned bobbin transport path 93. In the returned bobbin transport path 93, the empty bobbin return path

97 diverges therefrom at a position downstream of a position where the empty bobbin transport path 96 is connected to the returned bobbin transport path 93. The empty bobbin returned to the automatic bobbin feed system 6 through the empty bobbin transport path 96 passes through a part of the returned bobbin transport path 93, and then is introduced into the empty bobbin return path 97 by a path switching mechanism (not shown) which will be described later. The empty bobbin return path 97 connects the automatic bobbin feed system 6 and the spinning frame 2 to each other. In the automatic bobbin feed system 6, the bobbin 23 that is empty is transported in the empty bobbin return path 97, and thereby the bobbin 23 that is empty is returned to the spinning frame 2.

[0066] As described above, due to the loop-shaped tray transport path 90 that connects the spinning frame 2 and the winder 3 to each other, the bobbin 23 can circulate between the spinning frame 2 and the winder 3.

[0067] Actually, bobbins transported in the empty bobbin transport path 96 include not only the empty bobbins, but the actual bobbins and defective bobbins are randomly mixed therein. Therefore, a configuration is required that sorts and appropriately processes the empty bobbin, the actual bobbin, and the defective bobbin that are mixed in transport. In the following, this point will be described in detail.

[0068] Firstly, a description will be given to a case where the actual bobbin (bobbin on which the yarn remains) is transported in the empty bobbin transport path 96. For example, if yarn breakage occurs during rewinding of the yarn in the rewinding unit 31, the yarn piecing device 14 performs yarn piecing. At this time, the rewinding unit 31 causes a suction flow to occur in a distal end portion of the lower yarn guide pipe 25, thereby sucking and catching an end of the yarn of the bobbin 23, then guiding the end of the yarn to the yarn piecing device 14. Then, the yarn piecing device 14 pieces the yarn to the upper yarn.

[0069] However, in a case where the end of the yarn of the bobbin 23 cannot be sucked and caught by the lower yarn guide pipe 25, for example, in a case where the end of the yarn is wrapped around the bobbin 23 or in a case where the yarn is broken at a position near the bobbin 23, the lower yarn guide pipe 25 cannot catch the end of the yarn, and therefore the yarn piecing device 14 cannot perform the yarn piecing. In such a case, the rewinding unit 31 abandons catching the end of the yarn of the bobbin 23, and discharges the bobbin 23 whose yarn end could not be caught, to the empty bobbin transport path 96. Simultaneously with this, the stocked bobbin 23 is transported in the bobbin supply path 95 toward the downstream side, and set in the rewinding position. Since this new bobbin 23 has been subjected to the pick-finding in the pick finding device 7, an end of the yarn can be easily caught, so that the yarn piecing can be performed. In this manner, even if the end of the yarn cannot be caught at the time of yarn breakage, the bobbin 23 whose yarn end could not be caught is discharged, and instead, a new bobbin 23 can be set, thereby enabling the yarn piecing and restarting the rewinding.

[0070] On the other hand, the bobbin 23 whose yarn end could not be caught is transported in the empty bobbin transport path 96. In the empty bobbin transport path 96, as described above, the empty bobbins sent out from the other rewinding units 31 are also transported. Accordingly, the bobbin 23 whose yarn end could not be caught is transported together with the empty bobbins in the empty bobbin transport path 96, and then introduced into the returned bobbin transport path 93.

[0071] As shown in FIG. 1, in the returned bobbin transport path 93, an empty bobbin determination device 8 is provided at a position upstream of the position where the empty bobbin return path 97 diverges from the returned bobbin transport path 93. The empty bobbin determination device 8 inspects whether or not the bobbin 23 being transported in the returned bobbin transport path 93 is an empty bobbin, by using an appropriate sensor. Additionally, a path switching mechanism (not shown) is provided at the position where the empty bobbin return path 97 diverges from the returned bobbin transport path 93. The path switching mechanism sends out a bobbin 23 to the empty bobbin return path 97 side if the empty bobbin determination device 8 determines that the bobbin 23 is an empty bobbin, and keeps a bobbin 23 transported in the returned bobbin transport path 93 if the empty bobbin determination device 8 determines that the bobbin 23 is not an empty bobbin.

[0072] In the above-described configuration, only the empty bobbin can be returned to the spinning frame 2. The bobbin 23 (bobbin on which the yarn remains) determined to be not an empty bobbin by the empty bobbin determination device 8 is transported in the returned bobbin transport path 93. Then, a remaining yarn amount detection device (not shown) measures the amount of remaining yarn. In the bobbin 23 for which it is determined that the amount of remaining yarn is extremely small, the extremely small amount of remaining yarn is removed by a remaining yarn processing device (not shown). The bobbin 23 having a sufficient amount of remaining yarn is subjected to the pick-finding process in the pick finding device 7. In this manner, even if the end of the yarn of the bobbin 23 could not be caught in the rewinding unit 31, the bobbin 23 is subjected to the pick-finding in the pick finding device 7, and thereby the rewinding unit 31 can perform unwinding again.

[0073] Next, a description will be given to a case where a defective bobbin (bobbin from which a defective yarn is rewound) is transported in the empty bobbin transport path 96.

[0074] In the fine spinning unit 32, if damage, abrasion, or the like, occurs in the apron belt 105 for example, the yarn manufactured by the fine spinning unit 32 may have a non-uniform diameter. Additionally, there is a tendency that the amount of fluff in the yarn increases as the traveler 114 is abraded away. In a description given below, it is considered that a yarn having a non-uniform diameter

and a yarn having a large amount of fluff is a defective yarn of low commercial value, and a bobbin 23 having such a defective yarn wound thereon may be referred to as "defective bobbin". It is desired that the rewinding unit 31 automatically detects and removes the defective bobbin, in order to prevent the defective yarn to be mixed into the package 30.

[0075] In this embodiment, therefore, the diameter and the fluff of the yarn unwound from the bobbin 23 are detected by the clearer 15, as described above. In this embodiment, if the magnitude of variation in the yarn diameter or the amount of fluff, which is detected by the clearer 15 of the rewinding unit 31, is beyond a predetermined allowable range, it is determined that the bobbin on which the rewinding unit 31 currently performs rewinding is a defective bobbin.

[0076] If a defective bobbin is detected, the rewinding unit 31 does not unwind the yarn any longer, and discharges the defective bobbin as it is (with the yarn left thereon) to the empty bobbin transport path 96, and then starts unwinding the yarn from another bobbin 23 stocked in the bobbin supply path 95. This can prevent the yarn having a non-uniform diameter or the yarn having a large amount of fluff from being mixed into the package 30.

[0077] Here, if the defective bobbin sent out from the rewinding unit 31 into the empty bobbin transport path 96 was introduced into the returned bobbin transport path 93, the empty bobbin determination device 8 would determine that this defective bobbin is not an empty bobbin (because the yarn remains on this defective bobbin), and this defective bobbin would be supplied through the pick finding device 7 to the winder 3 again. Therefore, the automatic bobbin feed system 6 is configured such that when the defective bobbin is transported in the empty bobbin transport path 96, the defective bobbin is not introduced into the returned bobbin transport path 93 and escaped into the defective bobbin waiting path 98.

[0078] A specific description is as follows. If a defective bobbin is detected in a certain rewinding unit 31, the machine controller 11 stores information indicating the detection of the defective bobbin in the certain rewinding unit 31. As described above, while the yarn is rewound from the bobbin 23 in the rewinding unit 31, the information (including the information for identifying the bobbin 23) recorded on the RF tag 60 of the tray 50 having this bobbin 23 mounted thereon is read by the RF reader 5, and the information is inputted to the machine controller 11. If a defective bobbin is detected in the rewinding unit 31; the machine controller 11 stores the information indicating the detection in association with the bobbin information of the bobbin 23 (the defective bobbin described above) on which the rewinding unit 31 currently performs rewinding. As a result, information indicating which bobbin 23 is a defective bobbin is stored in the machine controller 11.

[0079] On the other hand, as shown in FIG. 1, the defective bobbin waiting path 98 diverges from the empty bobbin transport path 96 at a position upstream of the position where the empty bobbin transport path 96 joins the returned bobbin transport path 93. Additionally, in the empty bobbin transport path 96, an RF reader 9 is arranged at a position upstream of the position where the defective bobbin waiting path 98 diverges from the empty bobbin transport path 96. The RF reader 9 reads a storage content of the RF tag 60 of the tray 50 that is transported in the empty bobbin transport path 96, and transmits the storage content to the machine controller 11. Moreover, a path switching mechanism (not shown) is provided at the position where the defective bobbin waiting path 98 diverges from the empty bobbin transport path 96. The path switching mechanism is controllable by the machine controller 11.

[0080] The machine controller 11 checks the information transmitted from the RF reader 9 against the information stored in the machine controller 11 itself (the information indicating which bobbin 23 is a defective bobbin), and thereby determines whether or not the bobbin 23 placed on the tray 50 that is passing through the position of the RF reader 9 is a defective bobbin. This path switching mechanism sends out a bobbin 23 to the defective bobbin waiting path 98 side if the machine controller 11 determines that the bobbin 23 is a defective bobbin, and keeps a bobbin 23 transported in the empty bobbin transport path 96 if the machine controller 11 determines that the bobbin 23 is not a defective bobbin.

[0081] The defective bobbin waiting path 98 has a certain length, and a downstream end portion of the defective bobbin waiting path 98 is a closed end. Therefore, a plurality of trays 50 having defective bobbins placed thereon can wait in the defective bobbin waiting path 98.

[0082] When the trays 50 having the defective bobbins placed thereon are reserved to a certain extent in the defective bobbin waiting path 98, the operator removes the defective bobbins from the trays 50, and replaces them with empty bobbins. Then, the operator performs an appropriate operation, to thereby drive the defective bobbin waiting path 98 in reverse. As a result, the trays 50 reserved in the defective bobbin waiting path 98, on which the replacing empty bobbins are placed, are introduced into the replaced bobbin return path 99.

[0083] As shown in FIG. 1, the replaced bobbin return path 99 diverges from a middle of the defective bobbin waiting path 98, and is connected to the empty bobbin return path 97. The tray 50 on which the defective bobbin has been replaced with the empty bobbin is introduced through the replaced bobbin return path 99 into the empty bobbin return path 97, and then returned to the spinning frame 2.

[0084] As described above, in the fine spinning winder 1 of this embodiment, even if the empty bobbin, the actual bobbin, and the defective bobbin are mixed, the bobbin 23 can be appropriately transferred between the spinning frame 2 and the winder 3 without stopping the transport of the tray 50.

[0085] Next, a quality inspection function of a management system applied to the fine spinning winder 1 will be

described with reference to FIG. 6. FIG. 6 is an explanatory diagram for explaining trend data that is used for a quality inspection. The upper part of FIG. 6 shows graphs of the trend data. The lower part of FIG. 6 is a schematic diagram of the bobbin 23, expressing decrease in the amount of remaining yarn corresponding to the length of the unwound yarn in the trend data. The quality inspection function of this embodiment is a function for examining whether or not the quality of the yarn wound on the actual bobbin is maintained within a certain quality-assured range. The quality-assured range herein means such a range that the amount of fluff throughout the yarn wound on one bobbin is equal to or less than a predetermined value. A likelihood of departing from the quality-assured range means a likelihood that the amount of fluff would be equal to or more than the predetermined value. This predetermined value is set to be a value smaller than the value of the amount of fluff that serves as a reference when the clearer 15 determines the defective bobbin.

[0086] In this embodiment, the quality inspection is performed by chronologically comparing trend data that indicates a tendency of occurrence of an amount of fluff in the yarn wound on the actual bobbin. As shown in FIG. 6, the trend data is data indicating the relationship between an amount of fluff and the length of the unwound yarn obtained when this amount of fluff was detected. Here, the length of the unwound yarn is the length of the yarn unwound from the actual bobbin (the length of the yarn rewound from the actual bobbin into the package 30). The length of the unwound yarn is calculated based on the number of rotations of the rewinding drum. A method for calculating the length of the unwound yarn will be described later.

[0087] For each rewinding unit 31, information indicating the length of the unwound yarn is transmitted and inputted from the unit control section 10 to the machine controller 11. Additionally, for each rewinding unit 31, information indicating the amount of fluff is inputted from the clearer 15 to the CCB 12 at appropriate intervals. The machine controller 11 and the CCB 12 exchange the information indicating the length of the unwound yarn and the information indicating the amount of fluff, and thus generate the trend data on a unit basis of the bobbin. That is, a process of making correspondence between the information indicating the amount of fluff and the information indicating the length of the unwound yarn obtained when this amount of fluff was detected is sequentially performed from the start to the end of unwinding for the bobbin 23. Thereby, the trend data for one bobbin is generated. The generated trend data is stored in the machine controller 11 in chronological order with respect to each fine spinning unit 32 (according to the station number) identified based on the bobbin information in the RF tag 60.

[0088] In the machine controller 11, a determination condition is preliminarily set. Based on this determination condition, whether or not there is a likelihood that the newly stored trend data would depart from the quality-assured range is determined. To be more specific, when newly stored trend data is stored, the machine controller 11 compares the trend data with previous trend data, and if the new trend data exhibits a change that satisfies the determination condition, determines that there is a likelihood of departing from the quality-assured range. The determination condition is appropriately set in accordance with the number of yarn and the type of yarn. In this embodiment, operator can change the determination condition by operating the input keys 17 of the machine controller 11.

[0089] Here, the traveler 114 provided in the fine spinning unit 32 is a component part requiring periodic replacement, because degradation is caused by abrasion. If the traveler 114 is not replaced at an appropriate timing, as shown in FIG. 6, the amount of fluff may increase throughout the yarn due to degradation caused by abrasion of the traveler 114 (current trend data as compared with previous trend data). Conventionally, it has been difficult that such a change in which the fluff gradually increases over a long period is detected solely by the clearer 15. However, in the configuration of this embodiment, a tendency of increase of fluff over a long period as described above can be detected, by setting the above-mentioned determination condition so as to detect a change in which the amount of fluff throughout the yarn increases in the current trend data as compared with the previous trend data.

[0090] The determination condition may be set in consideration of a portion of the bobbin 23 where the yarn is wound based on the length of the unwound yarn. For example, as shown in FIG. 6, the amount of fluff in the yarn wound on the bobbin 23 exhibits a relatively high value in the vicinity of the end of the unwinding operation of the bobbin 23. Considering this, the determination condition may be set such that, for example, if the amount of fluff rapidly increases at a timing near the end of the unwinding operation, it is determined that there is a likelihood of departing from the quality-assured range even though an amount of change in the other portions is small.

[0091] If the newly generated trend data exhibits a change that satisfies the determination condition, the machine controller 11 displays on the display 16 information (for example, the station number mentioned above) that allows identification of the fine spinning unit 32 requiring maintenance. Alternatively, this display can be made on the display 18 of the CCB 12. The machine controller 11 of this embodiment can cause the trend data stored in the machine controller 11 to be displayed on the display 16 in the form of a graph, for example, with respect to each fine spinning unit 32. This configuration allows the operator to intuitively recognize a change in the tendency of occurrence of fluff by the visual sense.

[0092] Processes of generating and storing the trend data are performed by a quality inspection section provided in the winder 3. Either of the machine controller 11 and the CCB 12 functions as the quality inspection section. A configuration of the quality inspection section can

be appropriately changed depending on circumstances.

[0093] Next, a method for calculating the length of the unwound yarn will be described. As described above, the rotation sensor mounted to the rewinding drum 24 inputs the rotation pulse signal to the unit control section 10 (see FIG. 5). The unit control section 10 counts the rotation pulse signal, and based on a count value, calculates the length of the unwound yarn. This count value is reset at a timing when a new actual bobbin on which the rewinding operation is not yet performed is transported or at a timing when the yarn is entirely unwound from the actual bobbin, and the counting is started based on a timing of unwinding the yarn from a new actual bobbin. In this embodiment, the length of the yarn wound on the bobbin 23 by the fine spinning unit 32 is preliminarily stored as a set yarn length, and this information is used for various determination processes.

[0094] Next, a description will be given to calculation of the length of the unwound yarn in a case where the rewinding operation is interrupted. As described above, the bobbin 23 whose yarn could not be sucked and caught by the lower yarn guide pipe 25 due to occurrence of yarn breakage during the rewinding operation is once discharged from the rewinding position into the empty bobbin transport path 96. At this time, the machine controller 11 stores unwound yarn length information indicating the length of the unwound yarn obtained at a time when the rewinding operation is stopped, in association with the bobbin information of the bobbin 23 that has performed this unwinding operation.

[0095] The machine controller 11 obtains the bobbin information of the bobbin 23 newly transported to the rewinding unit 31, and then refers to the stored bobbin information to determine whether or not the bobbin 23 is a bobbin on which the rewinding operation has been interrupted. If the bobbin 23 is the bobbin 23 on which the rewinding operation has been interrupted, the unwound yarn length information stored in association with this bobbin 23 is referred to. Then, a value obtained based on the unwound yarn length information is added to the count value, to calculate the length of the unwound yarn. The length of the unwound yarn calculated in this manner includes consideration for the length of the already unwound yarn, and therefore is substantially coincident with the length of the yarn actually unwound from the bobbin 23. Thus, the trend data can be accurately generated.

[0096] In the above-described configuration, the spun yarn wound on the bobbin 23 in the fine spinning unit 32 is unwound in the rewinding unit 31, and with it, the trend data is generated. The generated trend data is distinguished according to the station number of each fine spinning unit that is identified based on the bobbin information stored in the RF tag 60, and is chronologically stored. If, as a result of the comparison between the newly generated trend data and the previous trend data of the same fine spinning unit 32, the newly generated trend data exhibits a change that satisfies the determination condition, the machine controller 11 determines that there is a likelihood that the quality of the actual bobbin would depart from the quality-assured range. Then, the information identifying the fine spinning unit 32 having produced the actual bobbin that is likely to depart from the quality-assured range is displayed on the display 16 of the machine controller 11, to notify the operator of the necessity of maintenance of this fine spinning unit 32.

[0097] As described above, the fine spinning winder 1 of this embodiment includes the spinning frame 2, the winder 3, and the automatic bobbin feed system 6. The spinning frame 2 includes the plurality of fine spinning units 32 that wind the spun yarns on the bobbins 23. The winder 3 includes the plurality of rewinding units 31 that unwind the yarns from the bobbins 23 to form the packages 30. The automatic bobbin feed system 6 transports, to the rewinding unit 31, the tray 50 on which the bobbin 23 wound with the yarn by the spinning frame 2 is set. The tray 50 has the RF tag 60 capable of recording thereon the information for identifying the fine spinning unit 32 that has wound the yarn on the bobbin 23 set on this tray 50. The rewinding unit 31 includes the clearer 15, the unit control section 10, and the RF reader 5. The clearer 15 detects the amount of fluff in the yarn. The unit control section 10 calculates the unwound yarn length that indicates the length of the yarn unwound from the bobbin 23. The RF reader 5 reads the information from the RF tag 60 corresponding to the bobbin 23 on which the rewinding operation is being performed. The winder 3 includes the quality inspection section (the machine controller 11 or the CCB 12) for recording the amount of fluff together with the unwound yarn length obtained when the clearer 15 detected this amount of fluff, and performing the quality inspection, on a unit basis of the bobbin 23, on the yarn spun by the fine spinning unit 32.

[0098] Accordingly, the fine spinning unit 32 having performed the spinning can be identified based on the information in the RF tag 60. Therefore, the quality of the yarn produced by the fine spinning unit 32 can be examined on a unit basis of the bobbin 23. Additionally, the quality inspection can be automatically performed concurrently with the rewinding operation in a production line. This provides laborsaving for the quality inspection operation. Moreover, since the amount of fluff is recorded in association with the yarn length, the tendency of occurrence of fluff that indicates a portion of the yarn where a large amount of fluff occurs can be accurately recognized, which enables the fluff to be detected and handled efficiently.

[0099] In the fine spinning winder 1 of this embodiment, the fine spinning unit 32 is configured as a ring spinning unit having the traveler 114.

[0100] Accordingly, since the tendency of occurrence of fluff can be accurately recognized on a unit basis of the bobbin 23, increase in the amount of fluff throughout the yarn, which is caused by degradation of the traveler 114 due to abrasion, can also be detected easily.

[0101] The fine spinning winder 1 is configured as follows. That is, the fine spinning winder 1 includes the dis-

play 16 of the machine controller 11, and the display 16 is configured to make notification about the fine spinning unit 32 that has been identified as the one requiring maintenance. The management system monitors, on a unit basis of the bobbin 23, the tendency of occurrence of fluff in the yarn produced by the same fine spinning unit 32. If the tendency of occurrence of fluff exhibits a change that satisfies the determination condition as compared with the previous tendency of occurrence of fluff, the management system causes the display 16 to display the information identifying the fine spinning unit 32, for the notification to the operator.

[0102] Accordingly, since a change in the tendency of occurrence of fluff is monitored on a unit basis of the bobbin 23, a change in the amount of fluff caused by a failure of the fine spinning unit 32 while a system is running can be detected on a unit basis of the bobbin, and the operator can be notified of the fine spinning unit 32 requiring maintenance. This allows the operator to promptly handle the failure of the fine spinning unit 32, thus effectively suppressing deterioration in quality of the yarn rewound into the package. Moreover, a component part is replaced at a timing when the component part actually reaches the end of its lifetime and causes a failure. Therefore, the replacement of only the minimum number of component parts is required, and thus costs can be reduced efficiently. Furthermore, by analyzing the tendency of occurrence of fluff (trend data) in each fine spinning unit 32, it is also possible to recognize time for simultaneous replacement of the travelers 114.

[0103] The management system applied to the fine spinning winder 1 of this embodiment is configured as follows. That is, if the rewinding operation is interrupted halfway, the management system records the unwound yarn length information indicating the length of the unwound yarn obtained at a time when the interruption occurs. When performing the rewinding operation again using the bobbin 23 on which the rewinding operation has been interrupted halfway, the management system refers to the aforementioned unwound yarn length information corresponding to the bobbin 23, and records the amount of fluff in association with the length of the unwound yarn including consideration for this unwound yarn length information.

[0104] Accordingly, even when the bobbin 23 on which the rewinding operation has been interrupted is transported again to the rewinding unit 31, the amount of fluff is recorded based on the length of the unwound yarn including consideration for the length of the already rewound yarn. Therefore, a portion where the fluff is detected can be accurately identified.

[0105] While the fine spinning winder 1 according to one embodiment of the present invention has been described above, the configuration of the fine spinning winder 1 can be appropriately modified depending on circumstances, as long as the management system of the present invention is applied thereto. In a possible modification, for example, the rewinding unit 31 of the winder 3 may include a fluff suppression device. Next, a modification in which a rewinding unit 231 includes a fluff suppression device 201 will be described with reference to FIG. 7. FIG. 7 is a side view showing a configuration of the rewinding unit 231 according to the modification. Since the modification which will be described below is identical to the above-described embodiment except that a rewinding unit includes a fluff suppression device, the identical parts will not be described.

[0106] As shown in FIG. 7, in the rewinding unit 231, the fluff suppression device 201 is provided above the tension applying device 13 (downstream thereof in a yarn travel direction). The fluff suppression device 201 of this modification includes swirling flow generation means (not shown in the drawing) for generating a swirling flow. The swirling flow generated by the swirling flow generation means serves to suppress fluff. As shown in FIG. 7, the yarn unwound from the bobbin 23 goes through the swirling flow, and then is rewound into the package 30.

[0107] The fluff suppression device 201 of this modification is configured to adjust the flow rate of the swirling flow and also to control a timing of generation of the swirling flow. The fluff suppression device 201 is controlled so as to apply the swirling flow in accordance with the trend data. To be specific, the intensity of the swirling flow generated by the fluff suppression device 201 varies based on the trend data. A control is made such that an enhanced fluff suppression effect can be exerted to a portion having a large amount of fluff. A method for controlling the fluff suppression device 201 may be appropriately modified depending on circumstances. For example, in consideration of the fact that the amount of fluff increases immediately before the amount of remaining yarn reaches zero after a progress of the unwinding, the control may be made so as to operate the fluff suppression device 201 at such a timing.

[0108] As shown above, in the management system according to the modification, the rewinding unit 231 includes the fluff suppression device 201 that is controlled based on the tendency of occurrence of fluff on a unit basis of the bobbin 23.

[0109] Accordingly, fluff is suppressed in accordance with the tendency of occurrence thereof, and therefore the quality of the yarn rewound into the package 30 can be kept more uniform.

[0110] Although the embodiment of the present invention has been described above, the above-described configuration may be modified as follows.

[0111] Although in the embodiment described above, the station number and the doffing information are stored in the RF tag 60 so that the fine spinning unit is identified, this configuration may be appropriately modified depending on circumstances. For example, a unique identification number may be given to the tray 50, so that the bobbin 23 is identified based on the identification number.

[0112] In a possible configuration, the rewinding unit 31 according to the embodiment described above may further include an RF writer (data writing part), so that

when the rewinding operation is interrupted, this RF writer stores the unwound yarn length information in the RF tag 60. In this case, the RF reader 5 reads the RF tag 60 of the tray 50 transported again, and the length of the unwound yarn is calculated with reference to the unwound yarn length information stored therein.

[0113] The notification means for notifying the operator of the necessity of maintenance may be appropriately modified. For example, in a possible configuration, a warning light serving as the notification means may be arranged for each fine spinning unit 32, and if the quality inspection function determines that maintenance is necessary, the warning light is operated (turned on) to thereby give notification to the operator.

[0114] Although the modification adopts the fluff suppression device that utilizes the swirling flow, this configuration may be appropriately modified depending on circumstances. For example, adoptable is a fluff suppression device having a configuration in which a plurality of friction discs are rotated to thereby impart temporary twist to a spun yarn traveling between the discs, so that fluff is drawn into fibers, thus implementing a fluff laying process.

DESCRIPTION OF THE REFERENCE NUMERALS

[0115]

1	fine spinning winder
2	spinning frame
3	winder (automatic winder)
4	RF writer
5	RF reader (data reading part)
6	automatic bobbin feed system (bobbin transport mechanism)
11	machine controller
15	clearer (fluff detection part)
16	display (notification means)
23	bobbin
31	rewinding unit
32	fine spinning unit
50	tray (transporter)
60	RF tag (data recording section)

Claims

1. A management system for managing a fine spinning winder (1) comprising:

a spinning frame (2) including a plurality of fine spinning units (32) for winding spun yarns on bobbins (23),
an automatic winder including a rewinding unit (31) for unwinding the yarn from the bobbin (23) to form a package; and
a bobbin transport mechanism for transporting, to the rewinding unit (31), a transporter (50) on which the bobbin (23) wound with the yarn by the spinning frame is set;
wherein
the transporter (50) has a data recording section (60) configured to record information for identifying the fine spinning unit (32) that has wound the yarn on the bobbin set on said transporter,
the rewinding unit includes:

a fluff detection part for detecting the amount of fluff in the yarn;
a yarn length calculation section for calculating the length of the unwound yarn indicating the length of the yarn unwound from the bobbin;
a data reading part for reading the information from the data recording section corresponding to the bobbin on which a rewinding operation is performed,

the automatic winder includes a quality inspection section for recording the amount of fluff together with the length of the unwound yarn obtained when the fluff detection part detected said amount of fluff, and performing a quality inspection, on a unit basis of the bobbin, on the yarn spun by the fine spinning unit;
the fine spinning winder includes notification means configured to identify the fine spinning unit requiring maintenance, and to make notification;
characterized in that
the management system monitors, on a unit basis of the bobbin, a tendency of occurrence of fluff in the yarn produced by the same fine spinning unit, and if the tendency of occurrence of fluff exhibits a change that satisfies a determination condition as compared with a previous tendency of occurrence of fluff, the notification means makes notification.

2. The management system for managing the fine spinning winder according to claim 1, wherein
the fine spinning unit is configured as a ring spinning unit having a traveler.

3. A fine spinning winder to which the management system according to claim 1 is applied.

Patentansprüche

1. Ein Verwaltungssystem zum Verwalten einer Feinspinnwickelmaschine (1), das folgende Merkmale aufweist:

eine Spinnmaschine (2), die eine Mehrzahl von Feinspinneinheiten (32) zum Aufwickeln ge-

sponnener Garne auf Spulen (23) umfasst,
eine automatische Wickelmaschine, die eine Umspuleinheit (31) zum Umspulen des Garns von der Spule (23), um ein Paket zu bilden, umfasst; und
einen Spulentransportmechanismus zum Transportieren eines Transportierers (50), auf dem die mittels der Spinnmaschine mit dem Garn gewickelte Spule (23) platziert ist, zu der Umspuleinheit (31);
wobei
der Transportierer (50) einen Datenaufzeichnungsabschnitt (60) aufweist, der dazu konfiguriert ist, Informationen zum Identifizieren der Feinspinneinheit (32) aufzuzeichnen, die das Garn auf die auf dem Transportierer platzierte Spule gewickelt hat,
die Umspuleinheit folgende Merkmale umfasst:

einen Flusenerfassungsteil zum Erfassen der Menge an Flusen in dem Garn;
einen Garnlängenberechnungsabschnitt zum Berechnen der Länge des abgewickelten Garns, was die Länge des von der Spule abgewickelten Garns angibt;
einen Datenleseteil zum Lesen der Informationen aus dem Datenaufzeichnungsabschnitt, der der Spule entspricht, auf der ein Umspulvorgang durchgeführt wird,

die automatische Wickelmaschine einen Qualitätsprüfungsabschnitt zum Aufzeichnen der Menge an Flusen zusammen mit der Länge des abgewickelten Garns, die erhalten wird, wenn der Flusenerfassungsteil die Menge an Flusen erfasste, und zum Durchführen, auf der Basis einer Einheit der Spule, einer Qualitätsprüfung an dem durch die Feinspinneinheit gesponnenen Garn, umfasst;
die Feinspinnwickelmaschine eine Benachrichtigungseinrichtung umfasst, die dazu konfiguriert ist, die Feinspinneinheit, die einer Wartung bedarf, zu identifizieren und eine Benachrichtigung vorzunehmen,
dadurch gekennzeichnet, dass
das Verwaltungssystem auf der Basis einer Einheit der Spule eine Tendenz eines Auftretens von Flusen in dem durch dieselbe Feinspinneinheit erzeugten Garn überwacht, und falls die Tendenz eines Auftretens von Flusen eine Veränderung aufweist, die im Vergleich zu einer früheren Tendenz eines Auftretens von Flusen eine Bestimmungsbedingung erfüllt, nimmt die Benachrichtigungseinrichtung eine Benachrichtigung vor.

2. Das Verwaltungssystem zum Verwalten der Feinspinnwickelmaschine gemäß Anspruch 1, bei dem die Feinspinneinheit als Ringspinneinheit konfiguriert ist, die einen Läufer aufweist.

3. Eine Feinspinnwickelmaschine, auf die das Verwaltungssystem gemäß Anspruch 1 angewendet wird.

Revendications

1. Système de gestion pour la gestion d'un enrouleur de filage fin (1), comprenant:

un métier à filer (2) comportant une pluralité d'unités de filage fin (32) destinées à enrouler des fils filés sur des bobines (23);
un enrouleur automatique comportant une unité de rembobinage (31) destinée à dérouler le fil de la bobine (23), pour former un paquet; et
un mécanisme de transport de bobine destiné à transporter vers l'unité de rembobinage (31) un transporteur (50) sur lequel est placée la bobine (23) enroulée avec le fil par le métier à filer;
dans lequel
le transporteur (50) présente un segment d'enregistrement de données (60) configuré pour enregistrer des informations pour identifier l'unité de filage fin (32) qui a enroulé le fil sur la bobine placée sur ledit transporteur,
l'unité de rembobinage comprend:

une partie de détection de peluches destinée à détecter la quantité de peluches dans le fil;
un segment de calcul de longueur de fil destiné à calculer la longueur du fil déroulé indiquant la longueur du fil déroulé de la bobine;
une partie de lecture de données destinée à lire les informations du segment d'enregistrement de données correspondant à la bobine sur laquelle est réalisée une opération de rembobinage,

l'enrouleur automatique comporte un segment d'inspection de qualité destinée à enregistreur la quantité de peluches ensemble avec la longueur du fil déroulé obtenue lorsque la partie de détection de peluches a détecté ladite quantité de peluches, et à réaliser une inspection de la qualité, par unité de bobine, sur le fil filé par l'unité de filage fin;
l'enrouleur de filage fin comporte un moyen de notification configuré pour identifier l'unité de filage fin qui requiert un entretien, et pour effectuer une notification;
caractérisé par le fait que
le système de gestion surveille, par unité de bobine, une tendance de production de peluches

dans le fil produit par cette unité de filage fin et, si la tendance de production de peluches présente une variation qui remplit une condition de détermination par rapport à une tendance de production de peluches précédente, le moyen de notification effectue une notification.

2. Système de gestion pour la gestion de l'enrouleur de filage fin selon la revendication 1, dans lequel l'unité de filage fin est configurée comme unité de filage à anneaux ayant un moyen de déplacement.

3. Enrouleur de filage fin auquel est appliqué le système de gestion selon la revendication 1.

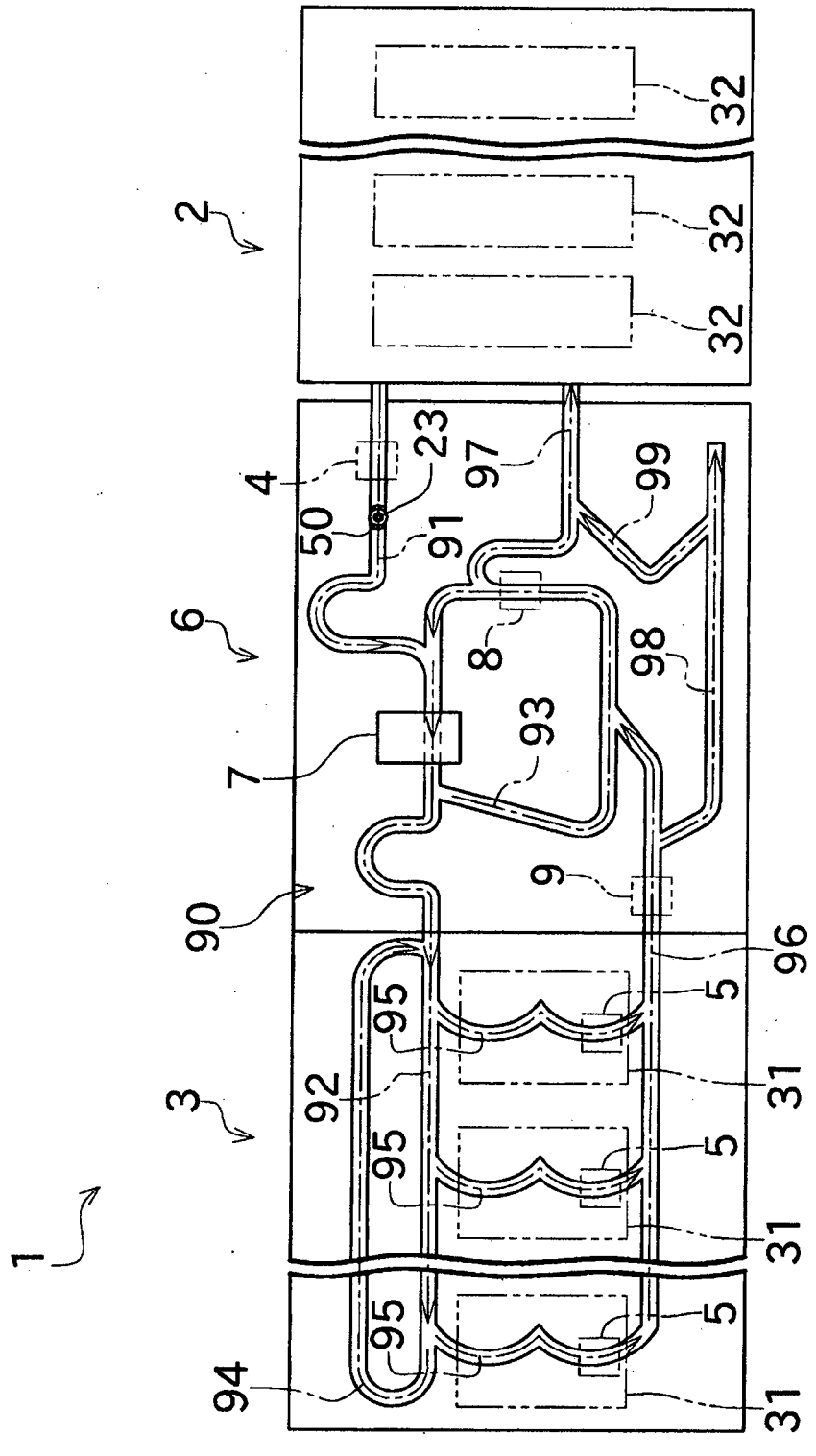


FIG.1

FIG.2

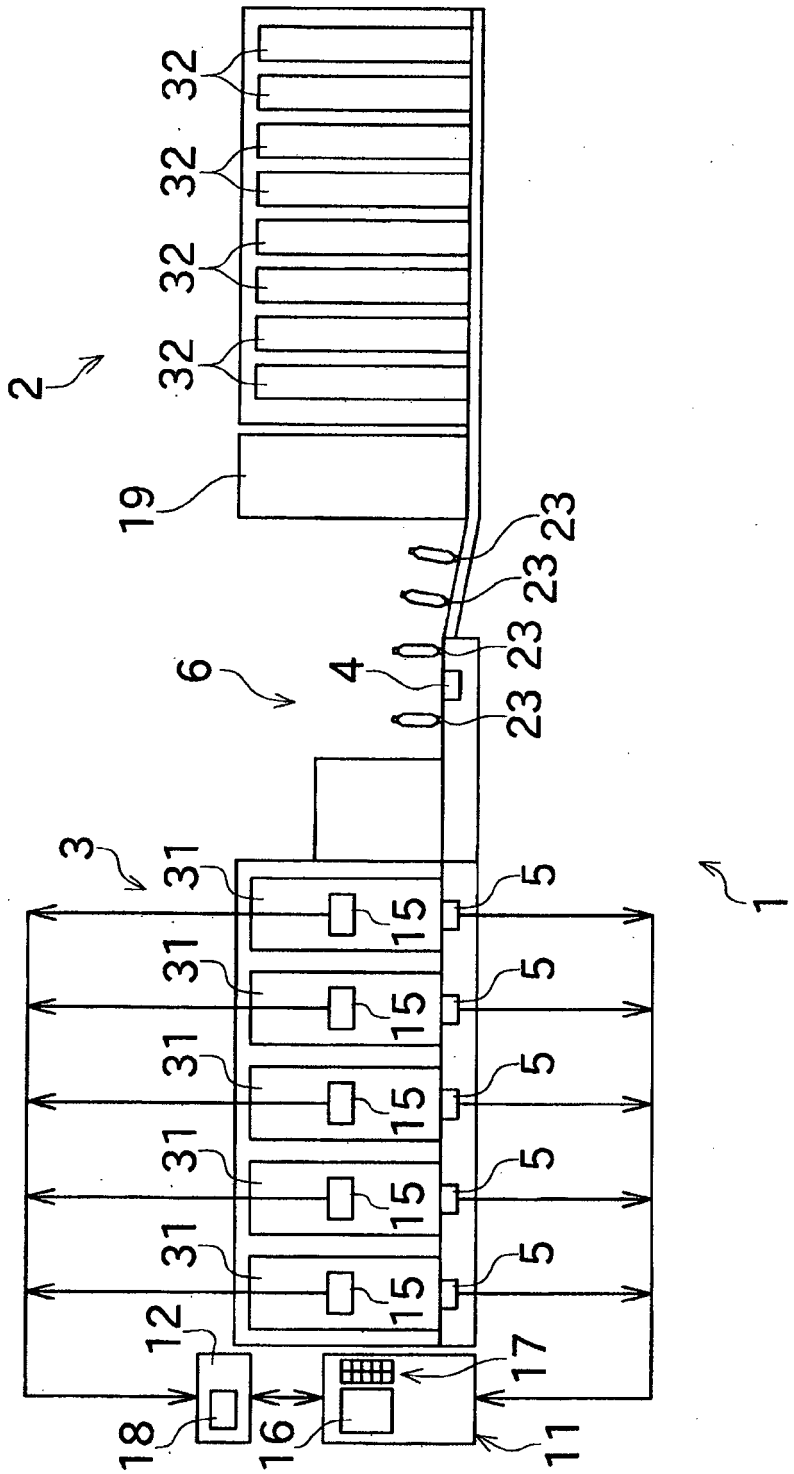


FIG.3

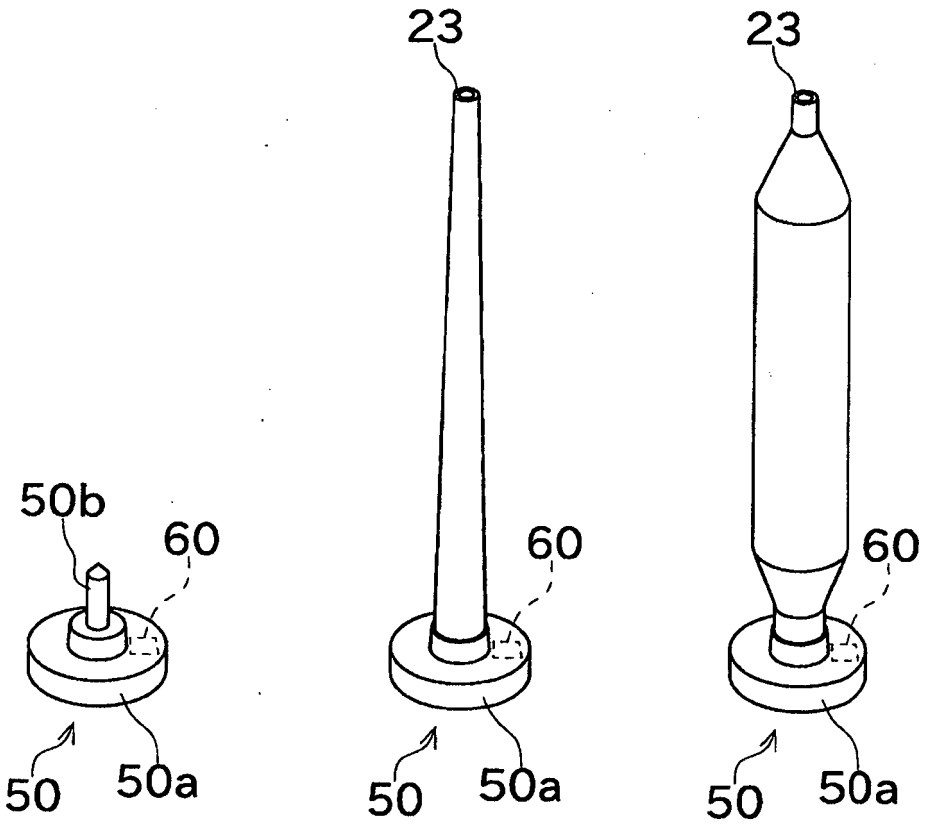


FIG.4

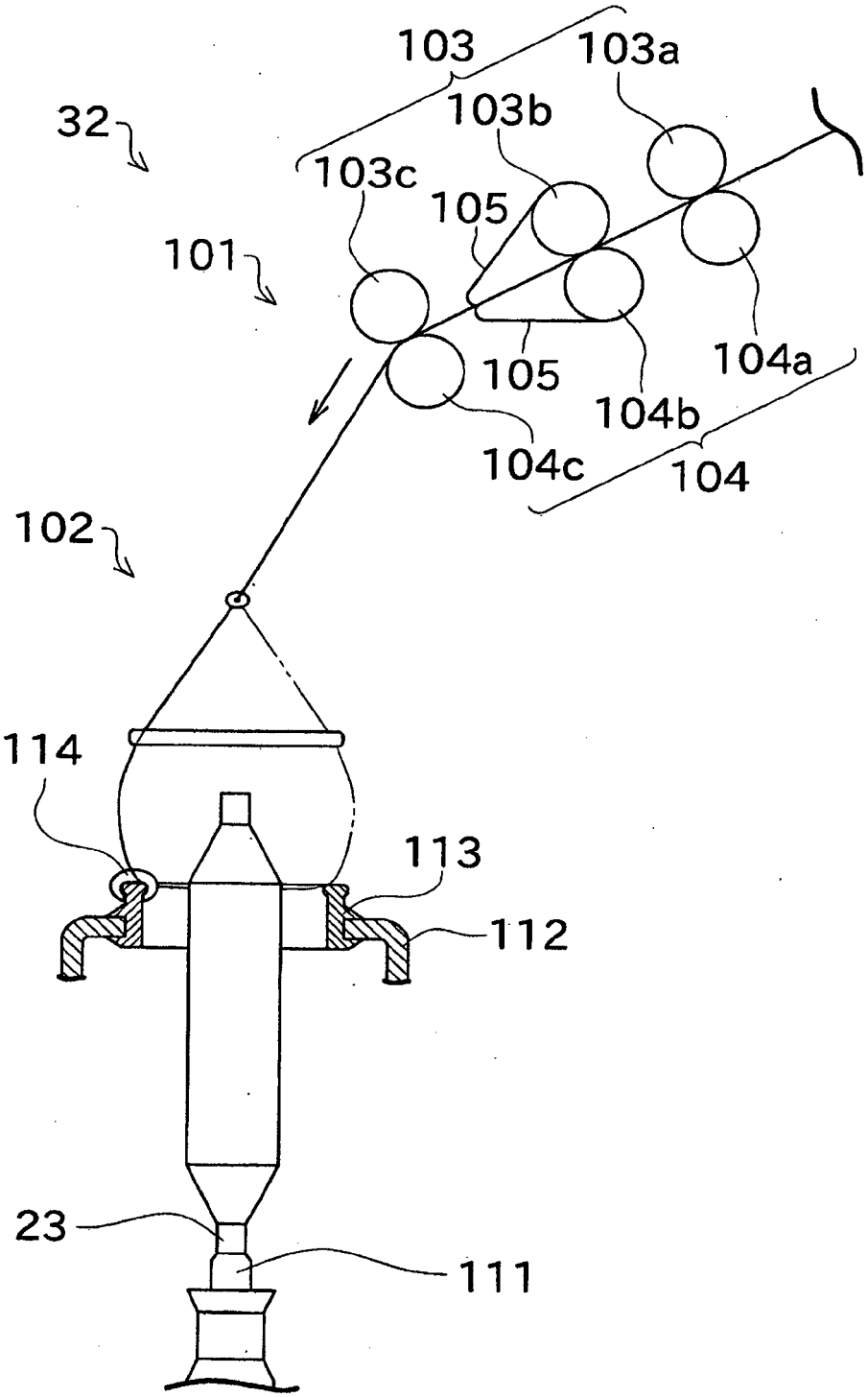

103
103a
32
103b
103c
105
101
105
104a
104b
104c
104
102
114
113
112
23
111

FIG.5

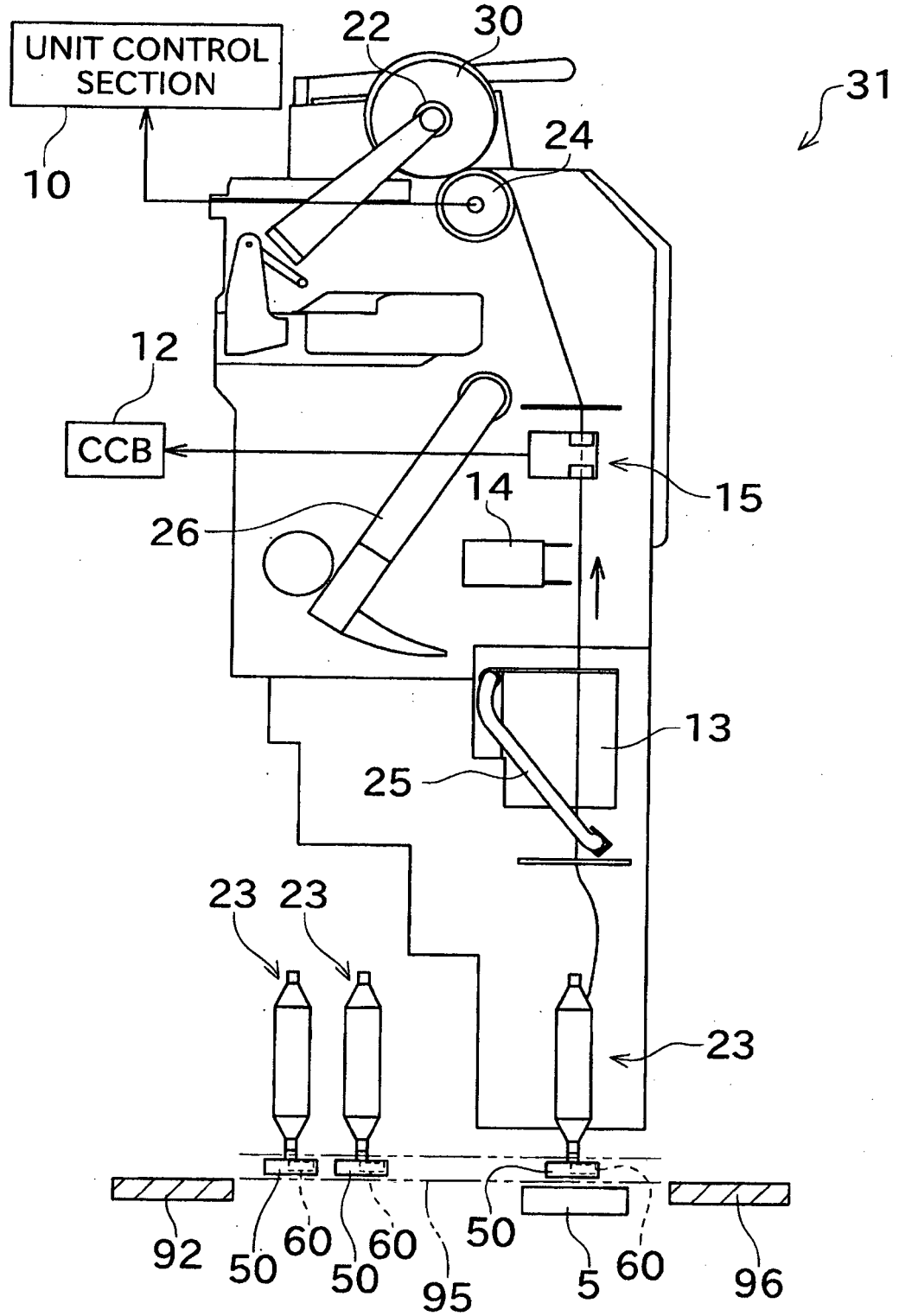

UNIT CONTROL SECTION
10
22
30
31
24
12
CCB
15
14
26
13
25
23
23
23
92
50
60
50
60
95
50
5
60
96

FIG.6

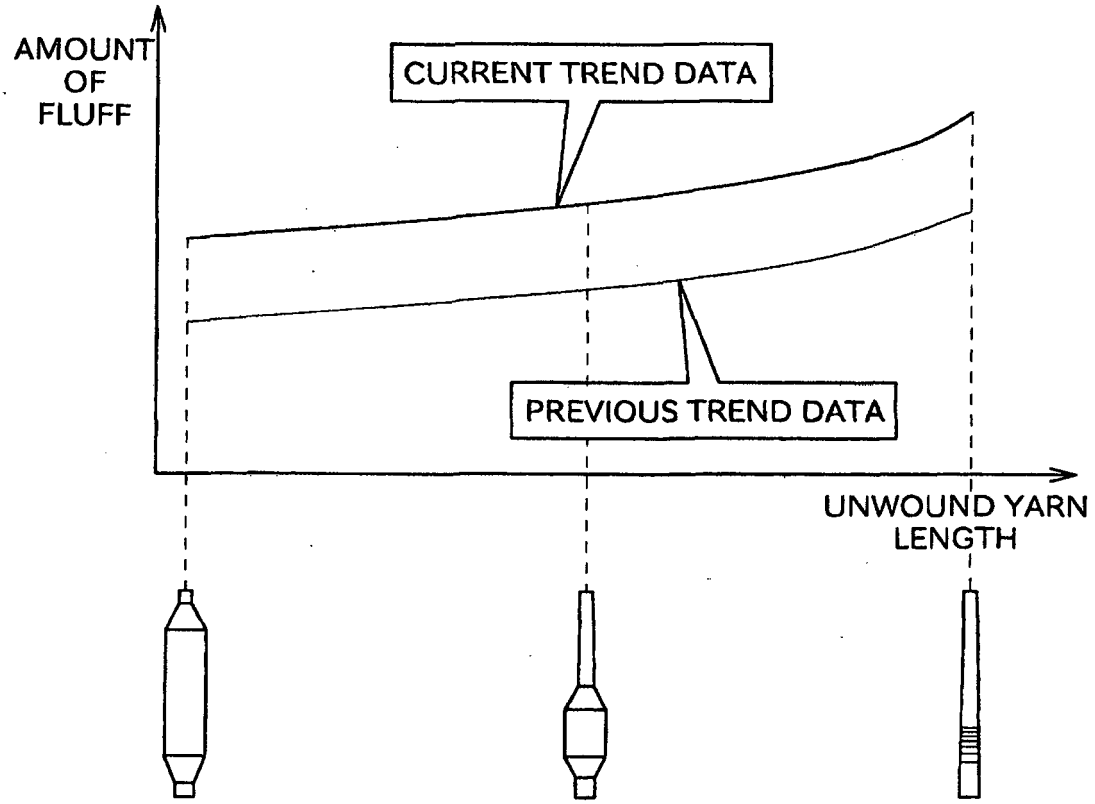
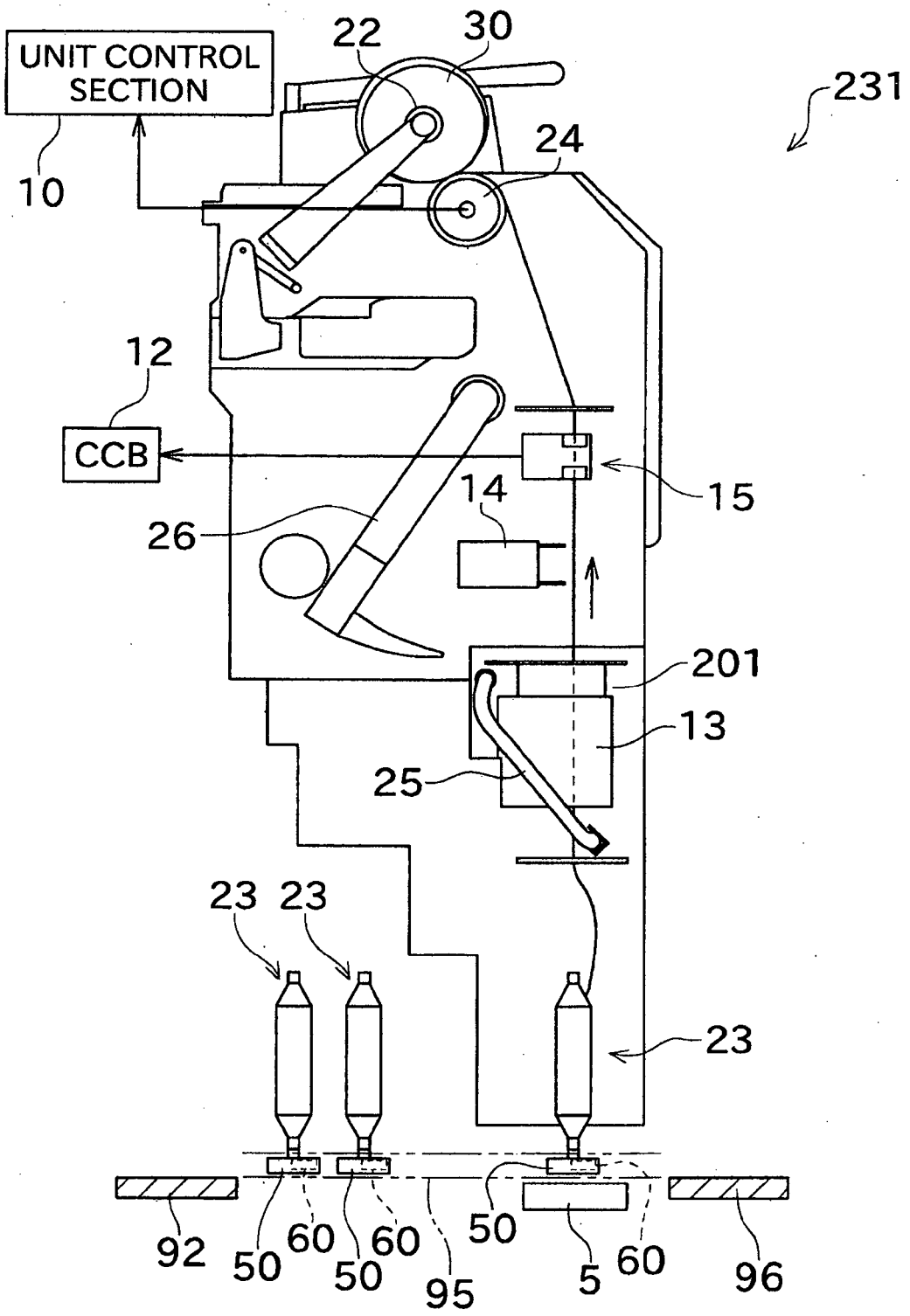

AMOUNT OF FLUFF
CURRENT TREND DATA
PREVIOUS TREND DATA
UNWOUND YARN LENGTH

FIG.7


UNIT CONTROL SECTION
10
22
30
231
24
12
CCB
15
14
26
201
13
25
23
23
23
92
50
60
50
60
95
50
5
60
96

REFERENCES CITED IN THE DESCRIPTION

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