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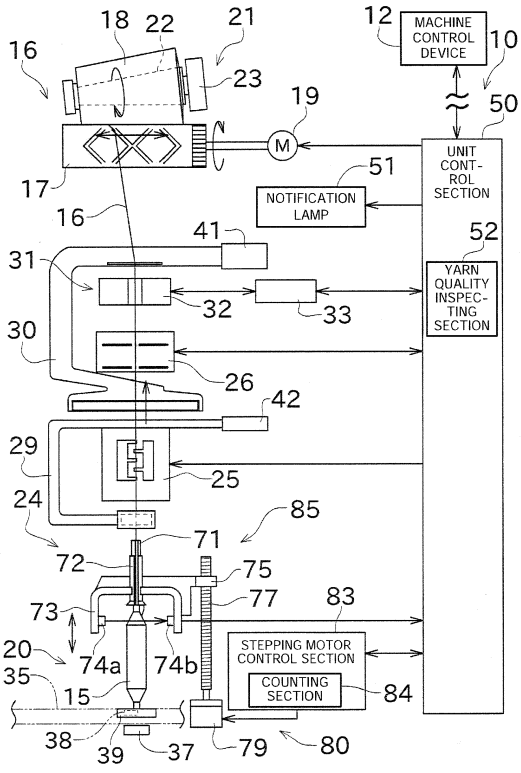
(54) Yarn winding machine

(57) An automatic winder (yarn winding machine) includes a transportation tray 39, a chase portion detecting sensor 74, a yarn quality measuring device, and a yarn quality inspecting section. A yarn supplying bobbin 15 is set in the transportation tray 39. The chase portion detecting sensor 74 detects an unwinding position of the yarn supplying bobbin 15 set in the transportation tray 39. The yarn quality measuring device measures quality of a yarn unwound from the yarn supplying bobbin 15. The yarn quality inspecting section manages the quality of the yarn in accordance with the unwinding position detected by the chase portion detecting sensor 74 and the quality of the yarn measured by the yarn quality measuring device.

FIG. 2



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention mainly relates to a yarn winding machine provided with a yarn quality measuring section.

2. Description of the Related Art

[0002] Conventionally, there is known a spinning winder including a spinning machine adapted to generate a yarn supplying bobbin by winding a spun yarn, an automatic winder adapted to form a package by unwinding the yarn from the yarn supplying bobbin, and a bobbin transport mechanism adapted to automatically transport the yarn supplying bobbin from a spinning unit of the spinning machine to a winding unit of the automatic winder. Japanese Unexamined Patent Application Publication No. 2011-20837 discloses a spinning winder of this kind.

[0003] An automatic winder provided in the spinning winder of Japanese Unexamined Patent Application Publication No. 2011-20837 includes in every winding unit a fluff detecting section adapted to detect the amount of fluff of the yarn. The automatic winder detects the length of an unwound yarn indicating how long the yarn has been unwound from the yarn supplying bobbin, based on the number of rotations of a winding drum, and the like.

[0004] It is known that the amount of fluff of the yarn unwound from the yarn supplying bobbin is likely to increase in accordance with the length of the unwound yarn (see FIG. 5 described later). In this respect, the automatic winder of Japanese Unexamined Patent Application Publication No. 2011-20837 associates the amount of fluff with the length of the unwound yarn. Therefore, it can be typically specified whether the amount of fluff is increased because the length of the unwound yarn is long or the amount of fluff is increased by another cause (e.g., humidity or damage in a member).

[0005] An automatic winder disclosed in Japanese Unexamined Patent Application Publication No. 2009-149404 includes an unwinding assisting device adapted to assist unwinding of the yarn from the yarn supplying bobbin. The unwinding assisting device includes an unwinding member, and a sensor adapted to detect a chase portion, which is a yarn layer end portion of the yarn supplying bobbin. By this configuration, the unwinding member can lower in accordance with a change in a position of the chase portion accompanying the yarn unwinding.

SUMMARY OF THE INVENTION

[0006] However, the yarn supplying bobbin to be supplied to the automatic winder is not always wound with the yarn sufficiently. For example, when the automatic winder discharges a yarn supplying bobbin, which is in the process of unwinding, and there is no problem in quality and the like of the yarn supplying bobbin, the yarn supplying bobbin may be supplied again.

[0007] In this case, since it cannot be specified in the configuration of Japanese Unexamined Patent Application Publication No. 2011-20837 that the amount of the remaining yarn of the yarn supplying bobbin is not sufficient, the yarn supplying bobbin is treated similarly to when a yarn supplying bobbin around which the yarn is sufficiently wound is supplied. Therefore, in the configuration of Japanese Unexamined Patent Application Publication No. 2011-20837, a situation may happen in which even when it is determined that there is a great amount of fluff, the length of the unwound yarn is merely long. In other words, conventionally, a cause of increase in the amount of fluff could not be accurately specified.

[0008] The present invention is made in consideration of the above-described circumstances, and its object is to provide a yarn winding machine adapted to accurately inspect the amount of fluff of the yarn supplying bobbin in consideration of the amount of the remaining yarn, which is estimated from an unwinding position of the yarn supplying bobbin.

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

[0010] According to an aspect of the present invention, a yarn winding machine having a configuration described below is provided. That is, the yarn winding machine includes a bobbin setting section, an unwinding position detecting section, a yarn quality measuring section, and a yarn quality inspecting section. A yarn supplying bobbin is set in the bobbin setting section. The unwinding position detecting section detects an unwinding position of the yarn supplying bobbin set in the bobbin setting section. The yarn quality measuring section measures quality of a yarn unwound from the yarn supplying bobbin. The yarn quality inspecting section manages the quality of the yarn in accordance with the unwinding position detected by the unwinding position detecting section and the quality of the yarn measured by the yarn quality measuring section.

[0011] Accordingly, even when the yarn supplying bobbin of which amount of a remaining yarn is not sufficient is supplied, the unwinding position of the yarn supplying bobbin at the time of measuring the quality of the yarn can be specified. Therefore, the quality of the yarn can be appropriately inspected in consideration of the unwinding position. Measuring the quality of the yarn outside a production line thus can be omitted.

[0012] In the above-described yarn winding machine, the unwinding position detecting section preferably includes a chase portion detecting sensor adapted to move following a change in a position of the chase portion,

which is a yarn layer end portion of the yarn supplying bobbin, at the time of unwinding operation, and to detect the chase portion.

[0013] Accordingly, since the chase portion detecting sensor serves as a part of the unwinding position detecting section, a new sensor and the like is not required to be provided as the unwinding position detecting section. Therefore, cost can be reduced by simplifying the configuration of the yarn winding machine.

[0014] In the above-described yarn winding machine, a notifying section adapted to notify an abnormality in the quality of the yarn in accordance with an inspection result of the yarn quality inspecting section, is preferably provided.

[0015] Accordingly, since an operator can grasp a winding unit in which the abnormality has occurred, an countermeasure according to a cause of degradation in the quality of the yarn can be taken at an early stage.

[0016] In the above-described yarn winding machine, a bobbin replacement instructing section adapted to instruct replacement of the yarn supplying bobbin in accordance with the inspection result of the yarn quality inspecting section, is preferably provided.

[0017] Accordingly, continuous winding of a yarn having low quality can be prevented.

[0018] In the above-described yarn winding machine, a configuration described below is preferably made. That is, the yarn winding machine includes an occurrence tendency calculating section adapted to obtain an occurrence tendency of the quality of the yarn in accordance with the inspection results of a plurality of the yarn quality inspecting sections. The yarn quality inspecting section inspects the quality of the yarn based on the occurrence tendency.

[0019] Accordingly, a determination can be made as to whether the quality of the yarn degrades in merely some of the winding units or in all of the winding units. Therefore, an occurrence cause of the degradation in the quality of the yarn can be easily found.

[0020] In the above-described yarn winding machine, a configuration described below is preferably made. That is, the yarn winding machine includes an unwinding assisting device adapted to assist unwinding of the yarn of the yarn supplying bobbin by moving an unwinding member according to the change in the position of the chase portion. The unwinding assisting device includes a stepping motor adapted to move the unwinding member, and a stepping motor control section adapted to control driving of the stepping motor. The stepping motor control section includes a counting section adapted to count the number of pulses transmitted to drive the stepping motor. The unwinding position detecting section is configured further including the stepping motor control section and the counting section.

[0021] Accordingly, the unwinding position can be detected based on the number of pulses transmitted until the chase portion detecting sensor detects the chase portion. Furthermore, since the unwinding position can be detected by merely counting the number of pulses, processing can be simplified.

[0022] In the above-described yarn winding machine, the unwinding position detecting section preferably includes remaining yarn amount sensors arranged in plurality in an unwinding direction and adapted to detect the unwinding position of the yarn supplying bobbin.

[0023] Accordingly, a position of the yarn layer end portion of the yarn supplying bobbin can be estimated in accordance with the number of the remaining yarn amount sensors that have detected a yarn layer of the yarn supplying bobbin, for example. Therefore, even in a configuration where the unwinding assisting device does not follow the change in the position of the chase portion, the unwinding position can be detected.

[0024] In the above-described yarn winding machine, a configuration described below is preferably made. That is, the yarn winding machine includes the unwinding assisting device adapted to assist the unwinding of the yarn of the yarn supplying bobbin by moving the unwinding member according to the change in the position of the chase portion, which is the yarn layer end portion of the yarn supplying bobbin. The remaining yarn amount sensor detects the unwinding position of the yarn supplying bobbin by detecting a position of the unwinding member or a member that moves in a unified manner with the unwinding member.

[0025] Accordingly, by detecting the position of the unwinding member or the member, which moves in a unified manner with the unwinding member, the unwinding position can be directly detected.

[0026] In the above-described yarn winding machine, a configuration described below is preferably made. That is, the yarn is wound around the yarn supplying bobbin by a spinning machine including a plurality of spinning units. The bobbin setting section is capable of moving along a transport path under a state in which the yarn supplying bobbin is set. The bobbin setting section includes a storage device adapted to store information for specifying the spinning unit that has wound the yarn around the yarn supplying bobbin.

[0027] Accordingly, since it can be detected that degradation in the quality of the yarn is caused by a specific spinning unit, a cause of the degradation in the quality of the yarn can be more accurately found.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028]

FIG. 1 is a front view illustrating an overall structure of an automatic winder provided with a winding unit according to one embodiment of the present invention.

FIG.2 is a front view illustrating a schematic structure of the winding unit.

FIG.3 is an enlarged perspective view illustrating a structure of an unwinding assisting device.

FIG.4A is a schematic side view illustrating a first state in which a rising and lowering member lowers following a chase portion of a yarn supplying bobbin.

FIG.4B is a schematic side view illustrating a second state in which the rising and lowering member lowers following the chase portion of the yarn supplying bobbin.

FIG.4C is a schematic side view illustrating a third state in which the rising and lowering member lowers following the chase portion of the yarn supplying bobbin.

FIG. 5 is a graph illustrating association of the amount of fluff and an unwinding position.

FIG.6A is a first schematic side view illustrating another structure of an unwinding position detecting section.

FIG.6B is a second schematic side view illustrating another structure of the unwinding position detecting section.

FIG.6C is a third schematic side view illustrating another structure of the unwinding position detecting section.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0029] Next, an automatic winder according to an embodiment of the present invention will be described with reference to the drawings. FIG. 1 is a front view illustrating a schematic structure of an automatic winder 10 of the present embodiment.

[0030] As illustrated in FIG. 1, the automatic winder (a yarn winding machine) 10 includes as main components, a plurality of winding units 11 arranged next to each other, a machine control device (occurrence tendency calculating section) 12, a yarn supplying bobbin supplying device 13, and a doffing device 14.

[0031] The machine control device 12 is configured capable of communicating with each of the winding units 11. An operator of the automatic winder 10 can manage the plurality of the winding units 11 in an integrated manner by appropriately operating the machine control device 12.

[0032] Each of the winding units 11 is configured to unwind a yarn from a yarn supplying bobbin 15 and wind an unwound yarn 16 around a winding bobbin 22 while traversing the yarn 16. A winding bobbin in a state where the yarn 16 is wound around is referred to as a package 18.

[0033] The yarn supplying bobbin 15 around which the yarn is wound by a spinning unit of a spinning machine (not illustrated) is supplied to the yarn supplying bobbin supplying device 13.

[0034] Between the yarn supplying bobbin supplying device 13 and each of the winding units 11, a yarn supplying bobbin transport path (transport path) 35, which is configured of a belt conveyer or the like, is arranged. The yarn supplying bobbin transport path 35 is capable of transporting a transportation tray (transport body) 39 having the yarn supplying bobbin 15 placed thereon, to each of the winding units 11.

[0035] The yarn supplying bobbin supplying device 13 is configured to feed the yarn supplying bobbin 15 to the yarn supplying bobbin transport path 35 after placing the yarn supplying bobbin 15 one by one on the transportation tray 39. By this configuration, the yarn supplying bobbin 15 can be supplied to each of the winding units 11.

[0036] The doffing device 14 is configured, when the package 18 becomes full (a state in which a prescribed amount of the yarn has been wound) in each winding unit 11, to travel to a position of the relevant winding unit 11 to remove the full package 18 and set an empty winding bobbin. The operation of the yarn supplying bobbin supplying device 13 and the doffing device 14 is controlled by the machine control device 12.

[0037] Next, a configuration of the winding unit 11 will be described with reference to FIG. 2. FIG. 2 is a front view illustrating a schematic structure of a winding unit.

[0038] Each winding unit 11 includes a yarn supplying section 20 and a winding section 21.

[0039] The yarn supplying section 20 is configured to hold in a prescribed position the yarn supplying bobbin 15 set on the transportation tray (a bobbin setting section) 39. Accordingly, the yarn 16 can be appropriately unwound from the yarn supplying bobbin 15.

[0040] An RF tag (storage device) 38 in which appropriate information can be written is embedded in the transportation tray 39. Information to be stored in the RF tag 38 may be information for specifying the spinning unit that has generated the yarn supplying bobbin 15 (e.g., a spindle number), doffing execution time, or the like. In a part below the yarn supplying bobbin transport path 35, an RF reader 37 is arranged in every winding unit 11. The RF reader 37 transmits information acquired from the RF tag 38 to the machine control device 12 via a unit control section (bobbin replacement instructing section) 50 (or directly).

[0041] The winding section 21 includes a cradle 23 and a winding drum 17.

[0042] The cradle 23 includes a pair of bearing holders, and is configured to rotatably support the winding bobbin 22 (or the package 18) by sandwiching the winding bobbin 22 with the bearing holders. The cradle 23 is configured so as to cause an outer periphery of the supported package 18 to make contact with an outer periphery of the winding drum 17.

[0043] The winding drum 17 traverses the yarn 16 on a surface of the package 18 and rotates the package 18. The winding drum 17 is rotated by a package drive motor 19. By rotating the winding drum 17 in a state where the outer periphery of the package 18 is in contact with the winding drum 17, the package 18 can be rotated. A spiral-shaped traverse groove (not illustrated) is formed on an outer peripheral surface of the winding drum 17. The yarn 16 unwound from the yarn supplying bobbin 15 is wound onto the surface of the package 18 while being

traversed by the traverse groove in a predetermined width. Accordingly, the package 18 having a predetermined winding width can be formed.

[0044] Each winding unit 11 includes a notification lamp (notifying section) 51 on a front surface of the winding unit 11. The notification lamp 51 can receive a signal from the unit control section 50 and the machine control device 12. When determining that there is an abnormality in the winding unit 11, the machine control device 12 or the unit control section 50 lights the notification lamp 51 in a color which is different from usual.

[0045] Each winding unit 11 has a configuration in which an unwinding assisting device 24, a tension applying device 25, a yarn joining device 26, and a yarn quality measuring device (yarn quality measuring section) 31 are arranged in this order from the yarn supplying section 20 in a yarn travelling path between the yarn supplying section 20 and the winding section 21. Upstream and downstream in a travelling direction of the yarn 16 may be simply referred to as "upstream" and "downstream" respectively in the following description.

[0046] The unwinding assisting device 24 includes a movable member (unwinding member) 72 that is capable of covering a core tube of the yarn supplying bobbin 15. The movable member 72 is configured to be substantially tubular and arranged so as to make contact with a balloon formed in an upper part of a yarn layer of the yarn supplying bobbin 15. The balloon is a portion, which is swung by centrifugal force, of the yarn 16 unwound from the yarn supplying bobbin 16. By causing the movable member 72 to make contact with the balloon, tension is applied on the yarn 16, which is a part of the balloon, and the yarn 16 is prevented from being swung excessively. Accordingly, the yarn 16 can be appropriately unwound from the yarn supplying bobbin 15. The unwinding assisting device 24 will be described in detail later.

[0047] The tension applying device 25 is adapted to apply a predetermined tension on the travelling yarn 16. In the present embodiment, the tension applying device 25 is configured of a gate-type in which movable comb teeth are arranged with respect to fixed comb teeth. The movable comb teeth are urged such that the comb teeth are engaged with each other. Since the yarn 16 bends and passes through the comb teeth that are in the state of being engaged with each other, adequate tension is applied on the yarn 16 and quality of the package 18 can be improved. However, the tension applying device 25 is not limited to the above-described gate-type and may be a disc-type, for example.

[0048] The yarn joining device 26 is adapted, when the yarn 16 between the yarn supplying bobbin 15 and the package 18 is separated by some reason, to join a lower yarn from the yarn supplying bobbin 15 and an upper yarn from the package 18. In the present embodiment, the yarn joining device 26 is configured as a splicer device for twisting yarn ends using whirling airflow generated by compressed air. However, the yarn joining device 26 is not limited to the above-described splicer device, and may be a mechanical knotter or the like, for example.

[0049] The yarn quality measuring device 31 is configured to measure quality of the yarn 16. Specifically, the yarn quality measuring device 31 includes a measuring section 32 and a processing section 33. The measuring section 32 is configured of one or a plurality of non-contact sensors. The processing section 33 is configured capable of measuring the quality of the yarn (e.g., the amount of fluff or the degree of yarn unevenness) by processing a signal from the measuring section 32. The processing section 33 transmits a detection result to the machine control device 12. For example, when detecting a yarn defect of which amount of fluff is a predetermined amount or greater than the predetermined amount, the processing section 33 transmits an instruction to a cutter (not illustrated) via the unit control section 50, and cuts the yarn 16.

[0050] When the yarn 16 is cut by the cutter, a lower yarn catching member 29 and an upper yarn catching member 30 catch the yarn 16, and the yarn joining device 26 carries out yarn joining.

[0051] Specifically, the upper yarn catching member 30 is connected to a negative pressure source and configured capable of rotating around an axis 41. Accordingly, a yarn end of the yarn 16 from the package 18 can be acquired, and the relevant yarn 16 can be introduced into the yarn joining device 26. Similarly, the lower yarn catching member 29 is connected to the negative pressure source and configured capable of rotating around an axis 42. Accordingly, the yarn from the yarn supplying bobbin 15 (the lower yarn) is caught and guided into the yarn joining device 26.

[0052] By driving the yarn joining device 26 under this state, the upper yarn and the lower yarn are joined, and the yarn 16 becomes connected between the yarn supplying bobbin 15 and the package 18. Accordingly, winding of the yarn 16 into the package 18 can be resumed.

[0053] As described above, the package 18 can be formed by winding the yarn 16 around the winding bobbin 22.

[0054] Next, the unwinding assisting device 24 will be described in detail. FIG. 3 is an enlarged perspective view illustrating a structure of the unwinding assisting device 24. FIG. 4A, FIG. 4B and FIG. 4C are schematic side views illustrating states in which a rising and lowering member 73 lowers following a chase portion 15a of the yarn supplying bobbin 15.

[0055] As illustrated in FIG. 3, the unwinding assisting device 24 includes a fixed member 71, a movable member 72, the rising and lowering member 73, and a chase portion detecting sensor 74.

[0056] The fixed member 71 is fixed to a unit frame 5 via an appropriate member. A narrow member (not illustrated) adapted to control the balloon is formed in a lower part of the fixed member 71. The movable member 72 is formed to be tubular and arranged so as to cover an outside of the fixed member 71. The rising and lowering member 73 is formed in a unified manner with the mov-

able member 72.

[0057] As illustrated in FIG. 2, the automatic winder 10, as a configuration to move the rising and lowering member 73, includes a stepping motor 79, a stepping motor control section 83, and a drive force conversion mechanism 85.

[0058] The stepping motor 79 is electrically connected to the stepping motor control section 83. The stepping motor control section 83 controls the stepping motor 79 by transmitting a pulse signal. The stepping motor control section 83 is connected to the unit control section 50. The stepping motor control section 83 includes a counting section 84. The counting section 84 counts the number of the pulses that have been transmitted by the stepping motor control section 83.

[0059] The drive force conversion mechanism 85 converts a force in a rotation direction of the stepping motor 79 into a force in a direction of a straight line, and includes a mounting member 75 and a screw shaft 77. The screw shaft 77 is arranged towards a vertical direction (axial direction of the yarn supplying bobbin 15) and rotatably supported.

[0060] The mounting member 75 is connected to the rising and lowering member 73. A screw hole is made in the mounting member 75, and since the screw shaft 77 is screwed into the screw hole, the mounting member 75 is mounted to the screw shaft 77. A motor shaft of the stepping motor 79 is connected to one end portion of the screw shaft 77. The movement of the mounting member 75 in a rotation direction is controlled by an appropriate measure such that the mounting member 75 does not rotate in a unified manner with the screw shaft 77.

[0061] By this configuration, when the stepping motor 79 is driven and the screw shaft 77 is rotated, the mounting member 75 and the rising and lowering member 73 moves in an upward direction or a downward direction along an axial line direction of the screw shaft 77.

[0062] In this manner, the rising and lowering member 73 is configured capable of moving vertically (in the axial direction of the yarn supplying bobbin 15). Since the movable member 72 is formed in a unified manner with the rising and lowering member 73, the movable member 72 and the rising and lowering member 73 move in a unified manner. As illustrated in FIG. 3, the rising and lowering member 73 includes the chase portion detecting sensor 74 adapted to detect the chase portion 15a of the yarn supplying bobbin 15. The chase portion 15a is a yarn layer end portion of the yarn supplying bobbin 15 following progress of winding operation. The chase portion detecting sensor 74 is configured as a transmissive photo sensor including a light projecting section 74a and a light receiving section 74b. A detection signal detected by the chase portion detecting sensor 74 is input in the unit control section 50.

[0063] By causing the rising and lowering member 73 to operate in accordance with the detection signal of the chase portion detecting sensor 74, the stepping motor control section 83 can position the movable member 72 in a predetermined distance from the chase portion 15a (see FIG. 4A). Even in a case where the yarn supplying bobbin 15 is unwound and a position of the chase portion 15a is lowered, the stepping motor control section 83 can always keep the distance between the chase portion 15a and the movable member 72 constant by lowering the rising and lowering member 73 in accordance with the detection signal of the chase portion detecting sensor 74 (see FIG. 4B and FIG. 4C).

[0064] Accordingly, the balloon that generates in a position where the yarn 16 is separated from the chase portion 15a when the yarn supplying bobbin 15 is unwound, can be appropriately controlled, and the winding operation can be carried out while keeping tension of the yarn 16 unwound from the yarn supplying bobbin 15 constant.

[0065] Since the chase portion detecting sensor 74 is mounted in the rising and lowering member 73, the chase portion 15a can be detected by the chase portion detecting sensor 74. An origin is set in the stepping motor 79 by an origin sensor, which is not illustrated, or the like. The counting section 84, from the origin position until the chase portion detecting sensor 74 detects the chase portion 15a, counts the number of pulses transmitted by the stepping motor control section 83 to move the rising and lowering member 73. In other words, the stepping motor control section 83 can grasp the movement amount of the rising and lowering member 73 based on the number of the pulses counted by the counting section 84. The stepping motor control section 83 can detect a position where the yarn supplying bobbin 15 is unwound (an unwinding position), based on the movement amount in which the rising and lowering member 73 has moved from the origin sensor. In this manner, in the present embodiment, since the unwinding position is detected by the chase portion detecting sensor 74, the stepping motor control section 83 and the counting section 84, an unwinding position detecting section 80 is configured of such members.

[0066] The stepping motor control section 83 transmits to the yarn quality inspecting section 52 the detected unwinding position of the yarn supplying bobbin 15. The yarn quality inspecting section 52 manages the quality of the yarn. The yarn quality inspecting section 52 inspects whether or not there is a great amount of fluff based on the unwinding position, and the detection result received from the processing section 33, for example.

[0067] A method of inspecting the amount of fluff will be described below with reference to FIG. 5. FIG. 5 is a graph illustrating association between the amount of fluff and an unwinding position.

[0068] As illustrated in FIG. 5, it is known that when the amount of the remaining yarn of the yarn supplying bobbin 15 becomes less and the unwinding position lowers (the length of the unwound yarn becomes longer), the amount of fluff is likely to increase (see FIG. 5). Therefore, when inspecting the amount of fluff, without setting a constant threshold value, the threshold value is pref-

erably set low in a case where there is a great amount of the remaining yarn (the length of the unwound yarn is short), and the threshold value is preferably set high in a case where there is a small amount of the remaining yarn and the rising and lowering member 73 has lowered (the length of the unwound yarn is long).

[0069] However, as described above, a yarn supplying bobbin 15 of which amount of the remaining yarn is not sufficient may be supplied. For example, when a yarn supplying bobbin 15 of which length of the unwound yarn is B in FIG. 5 is newly supplied, a conventional automatic winder performs the same control as in a case where a yarn supplying bobbin 15 of which length of the unwound yarn is A is supplied. In other words, a determination is made using a threshold value of when the length of the unwound yarn is A. As a result, it may be determined that there is a great amount of fluff despite that the amount of fluff is within a normal range.

[0070] In this respect, in the present embodiment, when the yarn supplying bobbin 15 of which length of the unwound yarn is B is newly supplied, the unwinding assisting device 24 lowers the rising and lowering member 73 until the chase portion detecting sensor 74 detects the chase portion 15a. Then, the stepping motor control section 83 detects the unwinding position of the yarn supplying bobbin 15 based on the number of the pulses transmitted until the chase portion 15a is detected (the number of the pulses counted by the counting section 84). That is, in the configuration of the present embodiment, even when the yarn supplying bobbin 15 of which length of the unwound yarn is B is newly supplied, the unwinding position can be accurately detected.

[0071] Therefore, from immediately after the yarn supplying bobbin 15 is supplied, the yarn quality inspecting section 52 can determine the amount of fluff using the threshold value corresponding to when the length of the unwound yarn is B. Therefore, an inspection can be accurately made as to whether or not there is a great amount of fluff.

[0072] When the detected amount of fluff exceeds the threshold value, the yarn quality inspecting section 52 notifies to the unit control section 50 and the machine control device 12 accordingly.

[0073] The unit control section 50 notifies that an abnormality has occurred, by changing a lighting color of the notification lamp 51. Since the notifying means is any, the abnormality may be notified by an alarm sound, or a spindle number of the relevant winding unit 11, and the like may be displayed on a display section of the machine control device 12. Accordingly, an operator specifies and deals with an occurrence cause of the abnormality. When the abnormality in the amount of fluff is notified from the yarn quality inspecting section 52, the unit control section 50 instructs discharge of the yarn supplying bobbin 15 instead of or in addition to notifying the abnormality.

[0074] When the abnormality in the amount of fluff is notified from the yarn quality inspecting section 52, the machine control device 12 specifies the relevant winding unit 11. Then, the machine control device 12, based on a value of the RF tag 38 in the transportation tray 39 for the yarn supplying bobbin 15 to which the winding unit 11 is/was carrying out winding, specifies and stores the spinning unit that generated the yarn supplying bobbin 15.

[0075] The machine control device 12 refers to the stored contents and, when the abnormality in the amount of fluff is frequently occurs in the yarn supplying bobbin 15 generated by the specified spinning unit, determines that there is an abnormality in the relevant spinning unit. Then the machine control device 12 notifies to the operator in an appropriate manner accordingly.

[0076] The yarn quality inspecting section 52 may transmit the detected amount of fluff to the machine control device 12. In this configuration, the machine control device 12 calculates an overall occurrence tendency of the amount of fluff based on the amount of fluff received from a plurality of the yarn quality inspecting sections 52. The above-described threshold value may be determined based on this occurrence tendency. In this configuration, since the amount of fluff can be compared among the winding units 11, whether a great amount of fluff occurs by the winding unit 11 or by a cause which is in common with the entire automatic winder 10 (e.g., humidity) can be specified.

[0077] As described above, the automatic winder 10 of the present embodiment includes the transportation tray 39, the chase portion detecting sensor 74, the yarn quality measuring device 31, and the yarn quality inspecting section 52. The yarn supplying bobbin 15 is set in the transportation tray 39. The chase portion detecting sensor 74 detects the unwinding position of the yarn supplying bobbin 15 set in the transportation tray 39. The yarn quality measuring device 31 measures the quality of the yarn 16 unwound from the yarn supplying bobbin 15. The yarn quality inspecting section 52 manages the quality of the yarn in accordance with the unwinding position detected by the chase portion detecting sensor 74 and the quality of the yarn measured by the yarn quality measuring device 31.

[0078] Accordingly, even when the yarn supplying bobbin 15 of which amount of the remaining yarn is not sufficient is supplied, the unwinding position of the yarn supplying bobbin 15 at the time of measuring the quality of the yarn can be specified. Therefore, the quality of the yarn can be appropriately inspected in consideration of the unwinding position.

[0079] The automatic winder 10 of the present embodiment includes the unwinding assisting device 24 adapted to assist unwinding of the yarn of the yarn supplying bobbin 15 by moving the movable member 72 according to the change in the position of the chase portion 15a, which is the yarn layer end portion of the yarn supplying bobbin 15. The chase portion detecting sensor 74 does not only detects the unwinding position, but also functions as a sensor adapted to move with the movable member 72 at the time of the unwinding operation and to detect

the chase portion 15a.

[0080] Accordingly, since the chase portion detecting sensor 74 serves as an unwinding position detecting section and an unwinding assistance, the number of the sensors can be reduced. Furthermore, the unwinding position can be detected without adding new equipment to the existing configuration.

[0081] The automatic winder 10 of the present embodiment includes the machine control device 12 adapted to obtain the occurrence tendency of the quality of the yarn, based on the inspection result of the plurality of the yarn quality inspecting sections 52.

[0082] Accordingly, a determination can be easily made as to whether the quality of the yarn degrades in merely some of the winding units 11 or in all of the winding units 11. Therefore, an occurrence cause of the degradation in the quality of the yarn can be easily found.

[0083] Next, an alternative embodiment will be described. FIG. 6A, FIG. 6B, and FIG. 6C are schematic side views illustrating another structure of the unwinding position detecting section. In the present alternative embodiment, the same or similar members as in the above-described embodiment receive the same reference numerals of the embodiment in the drawings and element names to omit description thereof in some cases.

[0084] The unwinding position detecting section 80 of the above-described embodiment has a configuration in which the unwinding position of the yarn supplying bobbin 15 is detected by the chase portion detecting sensor 74, the stepping motor control section 83, and the counting section 84. On the contrary, an unwinding position detecting section 80 of the present alternative embodiment detects the unwinding position of the yarn supplying bobbin 15 by a plurality of remaining yarn amount sensors 91, 92, 93, which are optical sensors.

[0085] As illustrated in FIG. 6A, FIG. 6B, and FIG. 6C, the remaining yarn amount sensors 91, 92, 93 are vertically (in the axial direction and an unwinding direction of the yarn supplying bobbin 15) arranged next to each other. The remaining yarn amount sensors 91, 92, 93 are arranged so as to detect a yarn layer portion of the yarn supplying bobbin 15, but not a core tube portion of the yarn supplying bobbin 15. Therefore, the unwinding position of the yarn supplying bobbin 15 can be detected in accordance with a detection signal of the remaining yarn amount sensors 91, 92, 93.

[0086] For example, in a state illustrated in FIG. 6A, all of the remaining yarn amount sensors 91, 92, 93 detect a yarn layer. Accordingly, it can be known that the unwinding position of the yarn supplying bobbin 15 is relatively high. In a state illustrated in FIG. 6B, the remaining yarn amount sensors 92, 93 detect the yarn layer. Accordingly, it can be known that the unwinding position of the yarn supplying bobbin 15 has lowered. In a state illustrated in FIG. 6C, only the remaining yarn amount sensor 93 detects the yarn layer. Accordingly, it can be known that the unwinding position of the yarn supplying bobbin 15 has further lowered.

[0087] In the present alternative embodiment, the above-described threshold value can be changed according to a case in which all the three of the remaining yarn amount sensors 91, 92, 93 detect the yarn layer, a case in which only two of the remaining yarn amount sensors 91, 92, 93 detect the yarn layer, and a case in which only one of the remaining yarn amount sensors 91, 92, 93 detects the yarn layer, for example. Accordingly, even when the yarn supplying bobbin 15 of which amount of the remaining yarn is small is supplied, the amount of fluff can be determined based on the unwinding position.

[0088] In the alternative embodiment, the yarn layer of the yarn supplying bobbin 15 is detected, but a configuration may be made in which a position of the movable member 72 of the unwinding assisting device 24 or a member adapted to move in a unified manner with the movable member 72 (e.g., the rising and lowering member 73 and the mounting member 75) can be detected by an equivalent sensor.

[0089] A configuration also may be made in which only the remaining yarn amount sensor 92 is provided, and the amount of fluff is measured when the remaining yarn amount sensor 92 no longer detects the yarn layer. Accordingly, since the amount of fluff of the yarn supplying bobbins 15 of which unwinding positions are the same can be measured, a determination can be accurately made as to whether or not the amount of fluff is abnormal.

[0090] Preferred embodiments are described above, but the above-described configuration may be changed as below, for example.

[0091] The configuration in which the unwinding position of the yarn supplying bobbin 15 is detected is not limited to the optical sensor as described above. The unwinding position may be detected by taking an image by a camera and the like, and by processing the image, for example.

[0092] In the above-described embodiments, processing devices such as the processing section 33, the yarn quality inspecting section 52, the unit control section 50, the machine control device 12, or the like are described, but which processing device performs which processing is not limited to the examples described in the embodiments above. For example, the amount of fluff may be determined by the machine control device 12, not by the yarn quality inspecting section 52. Furthermore, the yarn quality inspecting section 52 is not limited to a configuration in which the yarn quality inspecting section 52 is arranged in the unit control section 50, but may be independently arranged.

[0093] In the above-described embodiments, the unwinding assisting device 24 is moved by the stepping motor 79, the drive force conversion mechanism 85, or the like, but the unwinding assisting device 24 can be moved using an air cylinder. Even in this case, by detecting the yarn layer of the yarn supplying bobbin 15 by a plurality of optical sensors similar to the above description or by detecting the movable member 72 or the mem-

ber that moves in a unified manner with the movable member 72 (including a member that constitutes the air cylinder), the unwinding position can be detected.

[0094] In the above-described embodiments, the winding section 21 is adapted to traverse the yarn 16 by the winding drum 17, but may be adapted to traverse the yarn 16 by an arm-type traverse mechanism.

[0095] The configuration in which the yarn supplying bobbin 15 is supplied to the automatic winder 10 is not limited to the tray-type, and a magazine-type bobbin supplying device may be arranged in every winding unit 11.

[0096] The present invention, in a configuration where the quality of the yarn wound around the yarn supplying bobbin is measured, may be applied to another yarn winding machine without being limited to the automatic winder 10.

Claims

1. A yarn winding machine (10) comprising:

a bobbin setting section (39) in which a yarn supplying bobbin is set;
an unwinding position detecting section (80) adapted to detect an unwinding position of the yarn supplying bobbin set in the bobbin setting section (39);
a yarn quality measuring section (31) adapted to measure quality of a yarn unwound from the yarn supplying bobbin; and
a yarn quality inspecting section (52) adapted to manage the quality of the yarn in accordance with the unwinding position detected by the unwinding position detecting section (80) and the quality of the yarn measured by the yarn quality measuring section (31).

2. The yarn winding machine (10) according to claim 1, wherein the unwinding position detecting section (80) includes a chase portion detecting sensor (74) adapted to move following a change in a position of a chase portion, which is a yarn layer end portion of the yarn supplying bobbin, at the time of unwinding operation, and to detect the chase portion.

3. The yarn winding machine (10) according to claim 1 or claim 2, comprising a notifying section (51) adapted to notify an abnormality in the quality of the yarn in accordance with an inspection result of the yarn quality inspecting section (52).

4. The yarn winding machine (10) according to any one of claim 1 through claim 3, comprising a bobbin replacement instructing section (50) adapted to instruct replacement of the yarn supplying bobbin in accordance with the inspection result of the yarn quality inspecting section (52).

5. The yarn winding machine (10) according to any one of claim 1 through claim 4, comprising an occurrence tendency calculating section (12) adapted to obtain an occurrence tendency of the quality of the yarn in accordance with the inspection result of the yarn quality inspecting section (52);
wherein the yarn quality inspecting section (52) inspects the quality of the yarn based on the occurrence tendency.

6. The yarn winding machine (10) according to any one of claim 2 through claim 5, comprising an unwinding assisting device (24) adapted to assist unwinding of the yarn of the yarn supplying bobbin by moving an unwinding member (72) according to the change in the position of the chase portion;
wherein the unwinding assisting device (24) includes a stepping motor (79) adapted to move the unwinding member (72), and a stepping motor control section (83) adapted to control driving of the stepping motor (79);
the stepping motor control section (83) includes a counting section (84) adapted to count the number of pulses transmitted to drive the stepping motor (79); and
the unwinding position detecting section (80) is configured further including the stepping motor control section (83) and the counting section (84).

7. The yarn winding machine (10) according to claim 1, wherein the unwinding position detecting section (80) includes remaining yarn amount sensors (91, 92, 93) arranged in plurality in an unwinding direction and adapted to detect the unwinding position of the yarn supplying bobbin.

8. The yarn winding machine (10) according to claim 7, comprising the unwinding assisting device (24) adapted to assist the unwinding of the yarn of the yarn supplying bobbin by moving the unwinding member (72) according to the change in the position of the chase portion, which is the yarn layer end portion of the yarn supplying bobbin;
wherein the remaining yarn amount sensors (91, 92, 93) detect the unwinding position of the yarn supplying bobbin by detecting a position of the unwinding member (72) or a member that moves in a unified manner with the unwinding member (72).

9. The yarn winding machine (10) according to any one of claim 1 through claim 8, wherein a yarn is wound around the yarn supplying bobbin by a spinning machine including a plurality of spinning units;
the bobbin setting section (39) is capable of moving along a transport path under a state in which the yarn supplying bobbin is set; and
the bobbin setting section (39) includes a storage device (38) adapted to store information for specify-

ing the spinning unit that has wound the yarn around the yarn supplying bobbin.

FIG. 1

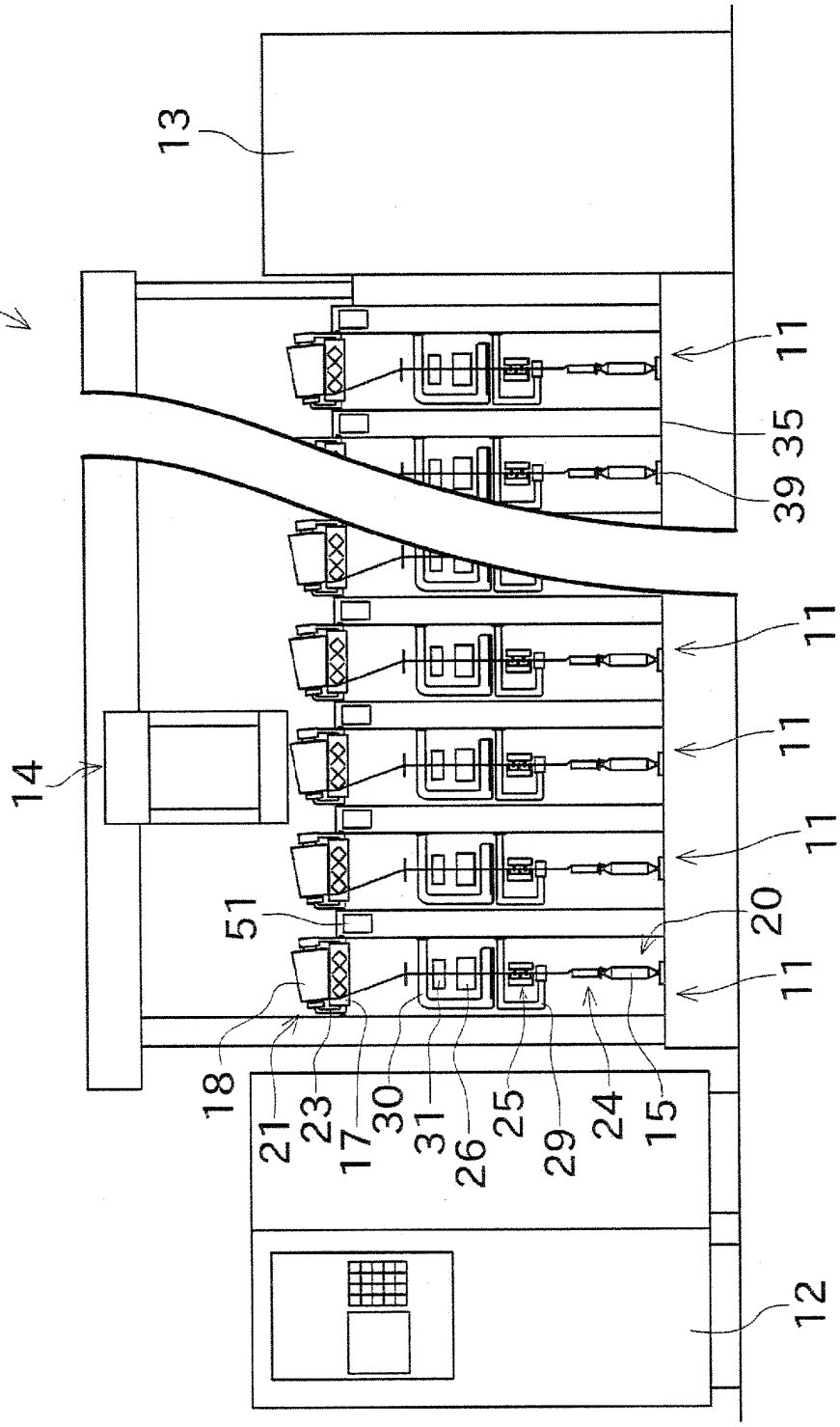


FIG. 2

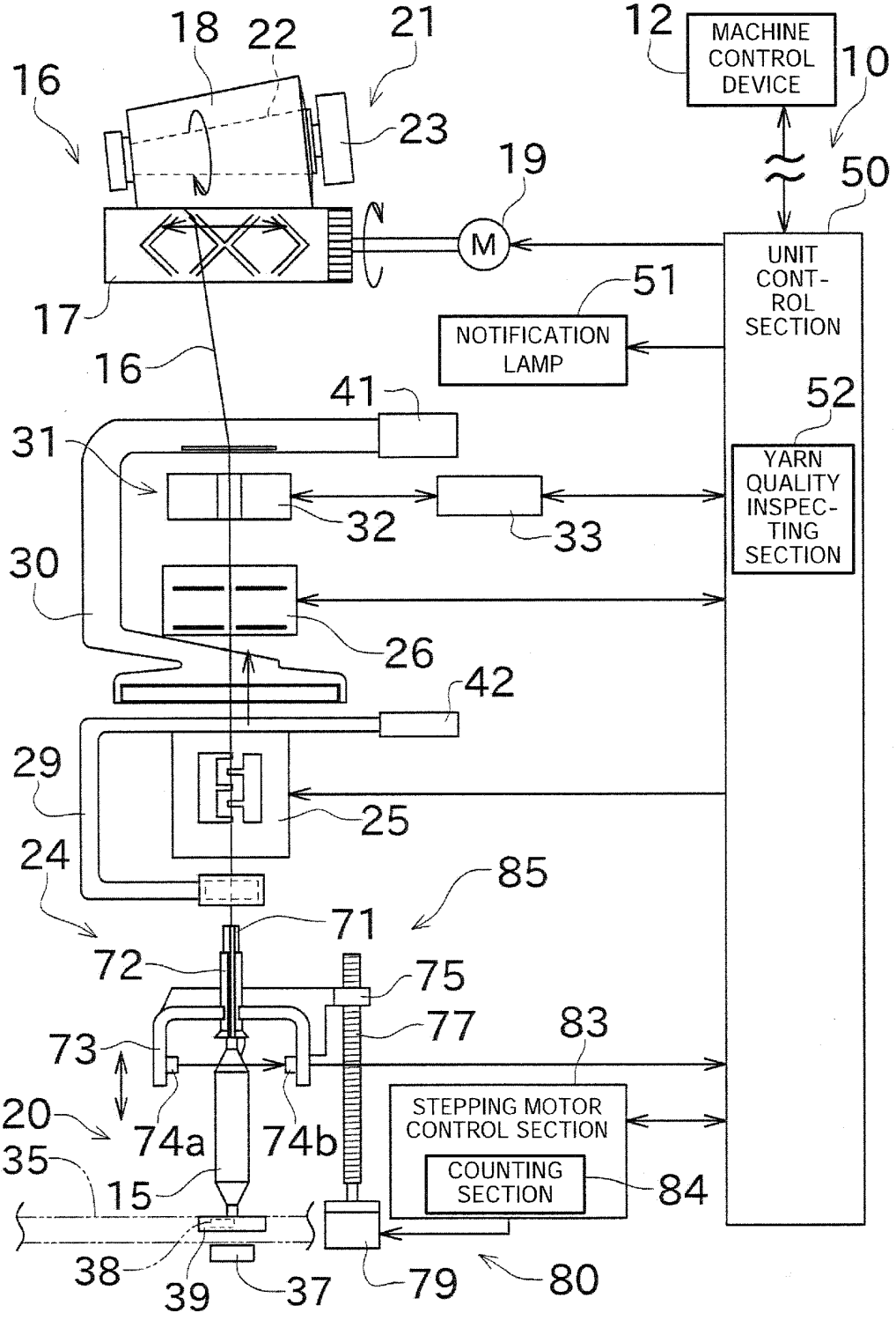

18
22
21
12
MACHINE CONTROL DEVICE
10
16
23
19
50
M
UNIT CONT-ROL SECTION
51
NOTIFICATION LAMP
17
16
41
52
31
YARN QUALITY INSPEC-TING SECTION
32
33
30
26
42
29
25
24
85
71
72
75
77
83
73
STEPPING MOTOR CONTROL SECTION
20
74a
74b
COUNTING SECTION
84
35
15
38
39
37
79
80

FIG. 3

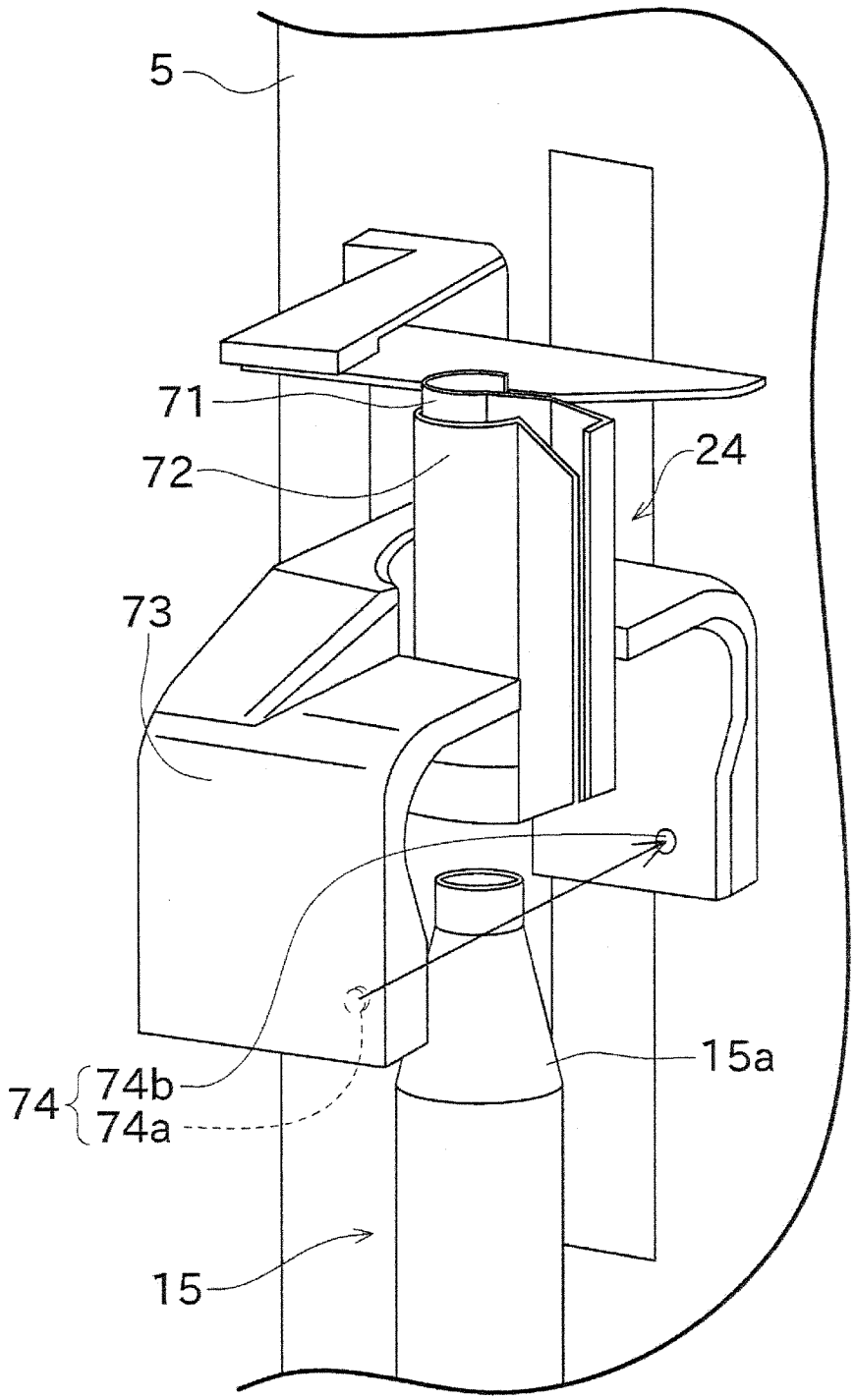


FIG. 4A

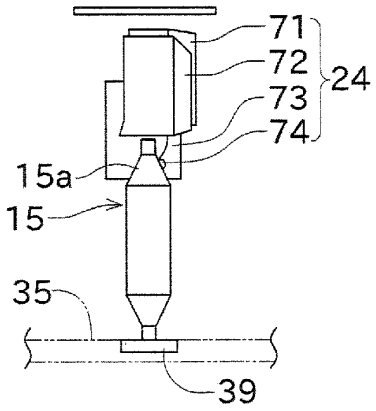


FIG. 4B

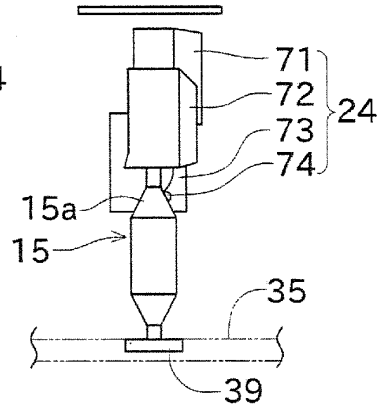


FIG. 4C

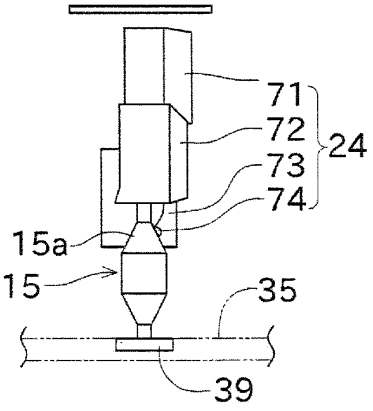


FIG. 5

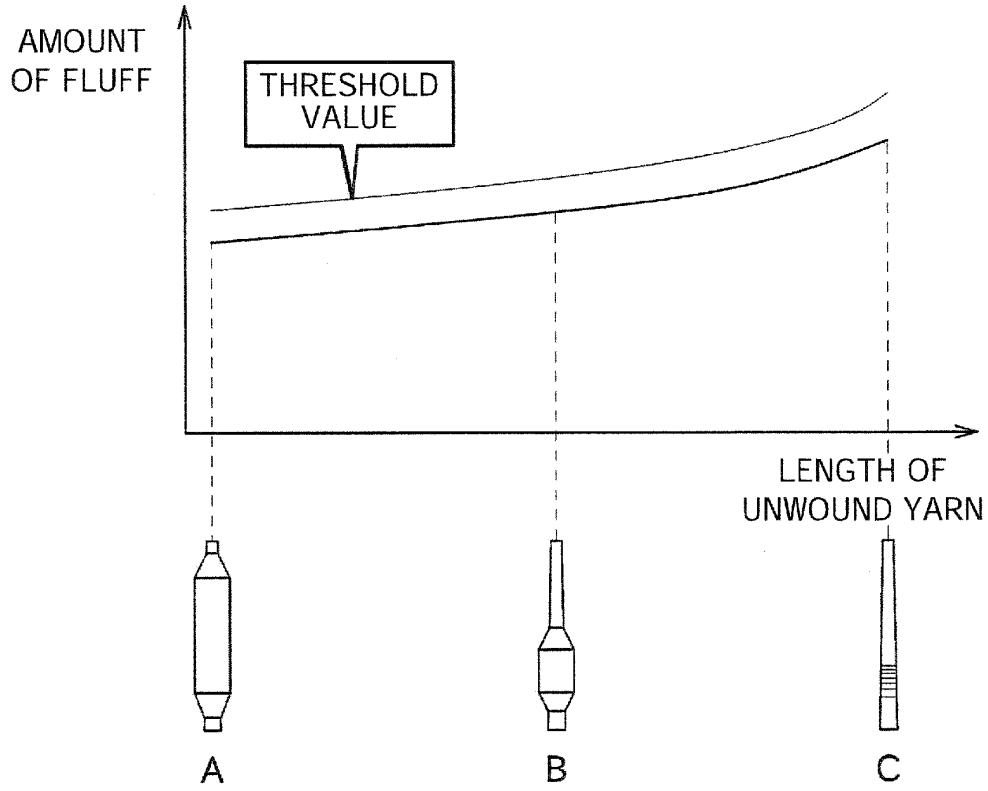


FIG. 6C

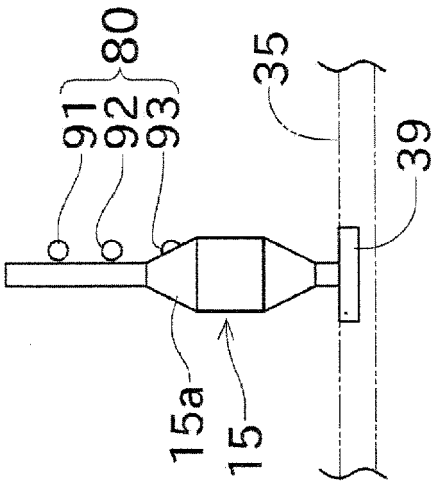


FIG. 6B

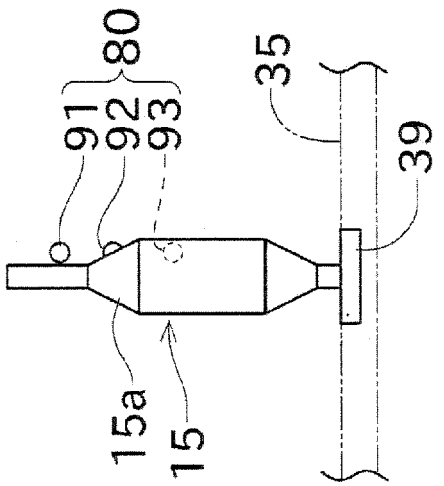
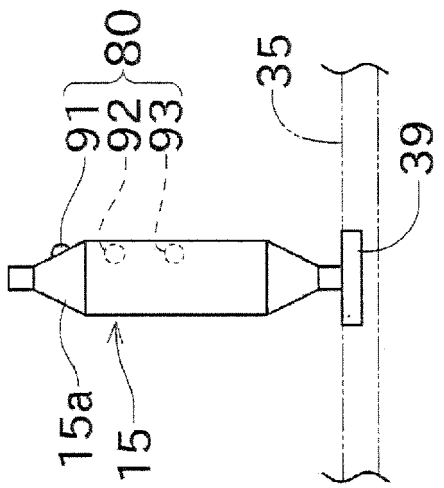


FIG. 6A



REFERENCES CITED IN THE DESCRIPTION

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- JP 2011020837 A **[0002] [0003] [0004] [0007]**
- JP 2009149404 A **[0005]**