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(54) **DOFFING DEVICE, DOFFING CONTROL METHOD AND DOFFING CONTROL APPARATUS**

(57) Embodiments of this disclosure provide a single doffing device and a single doffing control method and control apparatus. The device includes: a spinning machine workstation (100) having a spinning mechanism (101) and a winding mechanism (102), wherein the winding mechanism (102) is provided with a replaceable tube (1021); a control apparatus (12) configured to, when a yarn is wound into a yarn bobbin (1022) of a predetermined size around the replaceable tube (1021) on the winding mechanism (102), transmit control information for instructing to replace the yarn bobbin (1022) on the winding mechanism (102); and a tube replacement apparatus (202) storing one or more tube(s) (1021) therein and configured to replace the yarn bobbin (1022) on the winding mechanism (102) by using one of the stored tubes upon receipt of the control information. Hence, the yarn bobbin (1022) is replaced with an empty tube (1021) automatically after the yarn winding is completed, thereby eliminating or avoiding artificial intervene, lowering maintenance cost, and improving security and operational efficiency.

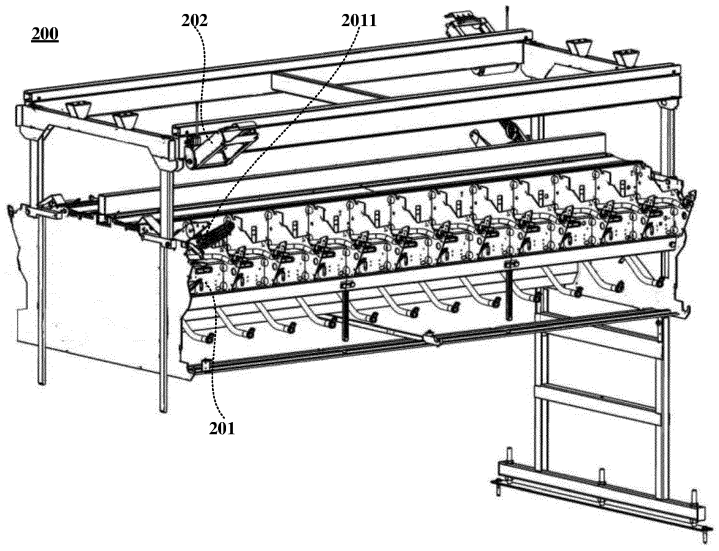

FIG. 2

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Description

Technical Field

[0001] This disclosure relates to the field of textile machinery and, in particular to a single doffing device and a single doffing control method and control apparatus.

Background

[0002] A semi-automatic rotor spinning machine generally includes multiple spinning machine workstations. The spinning machine workstation may include a spinning mechanism and a winding mechanism, the spinning mechanism being used to produce yarns, and the winding mechanism winding the yarns; a yarn take-off device may also be arranged between the spinning mechanism and the winding mechanism, and it may guide the yarns by using a yarn take-off roller and a pressure roller, so that the winding mechanism may wind the yarns efficiently. The winding mechanism generally cross-winds the yarns around a tube to form a bobbin or package of a certain size.

[0003] It should be noted that the above description of the background is merely provided for clear and complete explanation of this disclosure and for easy understanding by those skilled in the art. And it should not be understood that the above technical solution is known to those skilled in the art as it is described in the background of this disclosure.

Summary

[0004] However, it was found by the inventors that artificial intervene is still needed in existing semi-automatic rotor spinning machines, for example, tubes need to be artificially replaced after a yarn bobbin is completed. Hence, maintenance cost is still relatively high, security is relative low, and operational efficiency is not high.

[0005] In order to solve at least one of the above problems or other similar problems, embodiments of this disclosure provide a single doffing device and a single doffing control method and control apparatus, with an expectation of eliminating or avoiding artificial intervene, lowering maintenance cost, and improving security and operational efficiency.

[0006] According to an aspect of the embodiments of this disclosure, there is provided a single doffing device, including:

a spinning machine workstation having a spinning mechanism for producing a yarn and a winding mechanism for winding the yarn, wherein the winding mechanism is provided with a replaceable tube around which the yarns are wound;

a control apparatus configured to, when the yarn is wound into a yarn bobbin of a predetermined size on a replaceable tube on the winding mechanism, transmit control information for instructing to replace the yarn bobbin on the winding mechanism; and

a tube replacement apparatus storing one or more tube(s) therein and configured to replace the yarn bobbin on the winding mechanism by using one of the stored tubes upon receipt of the control information.

[0007] Hence, the yarn bobbin is replaced with an empty tube automatically after the yarn winding is completed by replacing the yarn bobbin on the winding mechanism with the tube stored in the tube replacement apparatus, thereby eliminating or avoiding artificial intervene, lowering maintenance cost, and improving security and operational efficiency.

[0008] In some embodiments, the control apparatus transmits the control information to the tube replacement apparatus in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

[0009] Hence, a time for replacement may further be controlled exactly by the control apparatus, and operational efficiency may be improved.

[0010] In some embodiments, the control apparatus transmits a control instruction to stop winding to the spinning machine workstation and causes the yarn bobbin to be ejected from the winding mechanism to a conveyor belt in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

[0011] Hence, the time for replacement may further be controlled exactly by the control apparatus, and operational efficiency may be improved.

[0012] In some embodiments, the tube replacement apparatus pushes out the one of stored tubes at an introduction position and configures the tubes on the winding mechanism after the yarn bobbin on the winding mechanism is ejected.

[0013] Hence, instructed by the control apparatus, the tube replacement apparatus and the winding mechanism operate in parallel, the time for replacement may further be controlled exactly by the control apparatus, and operational efficiency may be improved.

[0014] In some embodiments, the tube replacement apparatus is moved from a loading position to an introduction position upon receiving a control instruction, or, the tube replacement apparatus is moved from a loading position to an introduction position during spinning, or, the tube replacement apparatus is moved from a loading position to an introduction position after storing the tube(s), and remains at the introduction position when the tube(s) exist(s) in the tube replacement apparatus.

[0015] Hence, the tube replacement apparatus may reach the introduction position (standby position) before the spinning process is suspended, thereby saving time for replacing the tubes, further controlling exactly the time for replacing the tubes, and improving operational efficiency.

[0016] In some embodiments, the control apparatus detects whether the winding mechanism is configured with the tube, and transmits a control instruction for starting producing and winding the yarn to the spinning machine workstation in a case where the tube is correctly configured on the winding mechanism.

[0017] Hence, with the detection by the control apparatus, the time for operation again of the winding mechanism may be exactly determined, and security and operational efficiency may further be improved.

[0018] In some embodiments, in the case where the tube is correctly configured on the winding mechanism, the control apparatus further transmits a control instruction to the tube replacement apparatus to cause the tube replacement apparatus to be moved from the introduction position back to a loading position or a standby position.

[0019] Hence, with the detection by the control apparatus, the time for standby and introduction of the tube replacement apparatus may be exactly determined, and security and operational efficiency may further be improved. Moreover, after the tube replacement apparatus is moved back to the loading position or the standby position, maintenance and loading of the tubes may be better conducted.

[0020] According to another second aspect of the embodiments of this disclosure, there is provided a single doffing control method, including:

> when a yarn is wound into a yarn bobbin of a predetermined size on a replaceable tube on a winding mechanism in a spinning machine workstation, transmitting, by a control apparatus, control information for instructing to replace the yarn bobbin on the winding mechanism; and
> replacing the yarn bobbin on the winding mechanism by using one of stored tubes when a tube replacement apparatus receives the control information.

[0021] Hence, the yarn bobbin may be replaced with an empty tube automatically after the yarn winding is completed by replacing the yarn bobbin on the winding mechanism with the tube stored in the tube replacement apparatus, thereby eliminating or avoiding artificial intervene, lowering maintenance cost, and improving security and operational efficiency.

[0022] In some embodiments, the control apparatus transmits the control information to the tube replacement apparatus in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

[0023] Hence, a time for replacement may further be controlled exactly by the control apparatus, and operational efficiency may be improved.

[0024] In some embodiments, the method further includes:

transmitting, by the control apparatus, a control instruction to stop winding to the spinning machine workstation and causing the yarn bobbin to be ejected from the winding mechanism to a conveyor belt in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

[0025] Hence, the time for replacement may further be controlled exactly by the control apparatus, and operational efficiency may be improved.

[0026] In some embodiments, the method further includes:

pushing out the one of the stored tubes by the tube replacement apparatus at an introduction position and configuring the tube on the winding mechanism after the yarn bobbin on the winding mechanism is ejected.

[0027] Hence, instructed by the control apparatus, the tube replacement apparatus and the winding mechanism operate in parallel, the time for replacement may further be controlled exactly by the control apparatus, and operational efficiency may be improved.

[0028] In some embodiments, the method further includes:

moving the tube replacement apparatus from a loading position to the introduction position when the tube replacement apparatus receives a control instruction, or, moving the tube replacement apparatus from a loading position to an introduction position during spinning, or, moving the tube replacement apparatus from a loading position to an introduction position after the tube replacement apparatus stores the tube(s), and holding the tube replacement apparatus at the introduction position when the tube(s) exist(s) in the tube replacement apparatus.

[0029] Hence, the tube replacement apparatus may reach the introduction position (standby position) before the spinning process is suspended, thereby saving time for replacing the tubes, further controlling exactly the time for replacing the tubes, and improving operational efficiency.

[0030] In some embodiments, the method further includes:

detecting by the control apparatus whether the winding mechanism is configured with the tube, and transmitting a control instruction for starting producing and winding a yarn to the spinning machine workstation in a case where the tube is correctly configured on the winding mechanism.

[0031] Hence, with the detection by the control apparatus, the time for operation again of the winding mechanism may be exactly determined, and security and op-

erational efficiency may further be improved.

[0032] In some embodiments, the method further includes:

in the case where the tube is correctly configured on the winding mechanism, further transmitting a control instruction by the control apparatus to the tube replacement apparatus to cause the tube replacement apparatus to be moved from the introduction position back to a standby position or a loading position.

[0033] Hence, with the detection by the control apparatus, the time for standby and introduction of the tube replacement apparatus may be exactly determined, and security and operational efficiency may further be improved. Moreover, after the tube replacement apparatus is moved back to the loading position or the standby position, maintenance and loading of the tubes may be better conducted.

[0034] According to a further aspect of the embodiments of this disclosure, there is provided a single doffing control apparatus, including a memory and a processor, the memory storing a computer program, and the processor being configured to execute the computer program to implement the following operations:

when a yarn is wound into a yarn bobbin of a predetermined size on a replaceable tube on a winding mechanism in a spinning machine workstation, transmitting control information for instructing to replace the yarn bobbin on the winding mechanism, to enable a tube replacement apparatus to replace the yarn bobbin on the winding mechanism by using one of stored tubes.

[0035] An advantage of the embodiments of this disclosure exists in that the yarn bobbin may be replaced with an empty tube automatically after the yarn winding is completed, thereby eliminating or avoiding artificial intervene, lowering maintenance cost, and improving security and operational efficiency.

[0036] With reference to the following description and drawings, the particular embodiments of this disclosure are disclosed in detail, and the principle of this disclosure and the manners of use are indicated. It should be understood that the scope of the embodiments of this disclosure is not limited thereto. The embodiments of this disclosure contain many alternations, modifications and equivalents within the scope of the terms of the appended claims.

[0037] Features that are described and/or illustrated with respect to one embodiment may be used in the same way or in a similar way in one or more other embodiments and/or in combination with or instead of the features of the other embodiments.

[0038] It should be emphasized that the term "comprise/contain/have" when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

Brief Description of the Drawings

[0039] These and further aspects and features of this disclosure will be apparent with reference to the following description and attached drawings. In the drawings:

FIG 1 is a schematic diagram of a spinning machine workstation of an embodiment of this disclosure;

FIG 2 is the schematic diagram of a single doffing device of an embodiment of this disclosure;

FIG. 3 is a partial schematic diagram of the single doffing device of FIG. 2;

FIG. 4 is another schematic diagram of the single doffing device of FIG. 2;

FIG. 5 is a schematic diagram of a single doffing control method of an embodiment of this disclosure;

FIG. 6 is another schematic diagram of the single doffing control method of the embodiment of this disclosure; and

FIG. 7 is a schematic diagram of a single doffing control apparatus of an embodiment of this disclosure.

Detailed Description

[0040] These and further aspects and features of this disclosure will be apparent with reference to the following description and attached drawings. In the description and drawings, particular embodiments of the invention have been disclosed in detail as being indicative of some of the ways in which the principles of the invention may be employed, but it is understood that the invention is not limited correspondingly in scope. Rather, the invention includes all changes, modifications and equivalents coming within the terms of the appended claims.

[0041] In the embodiments of this disclosure, terms "and/or" include any one and all combinations of one or more relevantly listed terms. Terms "contain", "include" and "have" refer to existence of stated features, elements, components, or assemblies, but do not exclude existence or addition of one or more other features, elements, components, or assemblies.

[0042] In the embodiments of this disclosure, single forms "a", and "the", etc., include plural forms, and should be understood as "a kind of' or "a type of' in a broad sense, but should not defined as a meaning of "one"; and the term "the" should be understood as including both a single form and a plural form, except specified otherwise. Furthermore, the term "according to" should be understood as "at least partially according to", the term "based on" should be understood as "at least partially based on", except specified otherwise.

[0043] Implementations of the embodiments of this disclosure shall be described below with reference to the accompanying drawings.

[0044] An embodiment of this disclosure provides a single doffing device, including a spinning machine workstation, a control apparatus and a tube replacement ap-

paratus.

[0045] FIG. 1 is a schematic diagram of the spinning machine workstation of the embodiment of this disclosure. As shown in FIG. 1, the spinning machine workstation 100 includes a spinning mechanism 101 and a winding mechanism 102. The spinning machine workstation 100 is used for producing a yarn 11, and the winding mechanism 102 is used for winding the yarn 11. As shown in FIG. 1, a yarn take-off device 103 may be provided between the spinning mechanism 101 and the winding mechanism 102.

[0046] As shown in FIG. 1, the winding mechanism 102 may be configured with a tube 1021. The yarn 11 may be cross-wound on the tube 1021to form a bobbin 1022. The winding mechanism 102 may be separately driven by a driver, and may include a conveyor belt for conveying the bobbin 1022, and reference may be made to related techniques for detailed contents of the winding mechanism 102.

[0047] As shown in FIG. 1, the spinning machine workstation 100 may be controlled by a computer workstation 12, and the computer workstation 12 may control actions of components of one or more spinning machine workstations 100. The control apparatus in the embodiment of this disclosure may be implemented by, for example, the computer workstation 12 shown in FIG. 1; however, this disclosure is not limited thereto, for example, the control apparatus may also be one or some control circuits configured in the spinning machine workstation 100 or other devices.

[0048] It should be noted that the spinning machine workstation of this disclosure is only schematically described in FIG. 1; however, this disclosure is not limited thereto. For example, other components or devices may also be provided, and reference may be made to related techniques for details, which shall not be described herein any further. And reference may be made to related techniques for those parts or elements (such as a control line, and a connection element) that are not specified in FIG. 1, which are not limited in this disclosure.

[0049] FIG. 2 is the schematic diagram of the single doffing device of the embodiment of this disclosure, in which the control apparatus is omitted. FIG. 3 is a partial schematic diagram of the single doffing device of FIG. 2, showing a case of a winding mechanism of one spinning machine workstation and one tube replacement apparatus. And FIG. 4 is another schematic diagram of the single doffing device of FIG. 2, showing a case viewed from a side.

[0050] As shown in FIGs. 2-4, the single doffing device 200 may include a spinning machine workstation 201 and a tube replacement apparatus 202, and reference may be made to FIG. 1 for a structure of the spinning machine workstation 201. In FIGs. 2-4, for the sake of simplicity, reference number 201 is shown by taking one spinning machine workstation as an example.

[0051] The spinning machine workstation 201 has a spinning mechanism (not shown in FIG. 2) for producing a yarn and a winding mechanism 2011 for winding the yarn, wherein the winding mechanism 2011 is provided with a replaceable tube (as shown by 1021 in FIG. 1, not shown in FIG. 2) around which the yarn is wound.

[0052] When a yarn is wound into a yarn bobbin (as shown by 1022 in FIG. 1, not shown in FIG. 2) of a predetermined size around the replaceable tube on the winding mechanism 2011, the control apparatus (not shown in FIG. 2) transmits control information for instructing to replace the yarn bobbin on the winding mechanism 2011.

[0053] The tube replacement apparatus 202 stores one or more tube(s) therein, and replaces the yarn bobbin on the winding mechanism 2011 by using one of the stored tubes upon receipt of the control information.

[0054] In some embodiments, as shown in FIG. 2, for example, multiple spinning machine workstations 201 (for example, 12 spinning machine workstations configured at the front side are shown in FIG. 2), and one tube replacement apparatus 202 may be configured for each spinning machine workstation 201 (one tube replacement apparatus configured at the front side is only exemplarily shown in FIG. 2). One or more tube(s) may be stored in the tube replacement apparatus 202 (for example, 6 tubes may be stored in parallel). What described above are some examples of this disclosure only; however, this disclosure in not limited thereto.

[0055] Hence, the yarn bobbin may be replaced with an empty tube automatically after the yarn winding is completed by replacing the yarn bobbin on the winding mechanism with the tube stored in the tube replacement apparatus, thereby eliminating or avoiding artificial intervene, lowering maintenance cost, and improving security and operational efficiency.

[0056] It should be noted that the single doffing device of this disclosure is only schematically described in FIGs. 2-4; however, this disclosure is not limited thereto. For example, other components or devices may also be provided, and reference may be made to related techniques for details, which shall not be described herein any further. And reference may be made to related techniques for those parts or elements (such as a control line) that are not specified in FIGs. 2-4, which are not limited in this disclosure.

[0057] In some embodiments, the control apparatus transmits the control information to the tube replacement apparatus 202 in a case where a yarn length of the yarn bobbin (a total length of a yarn wound around the tube) reaches a predetermined length (a first length), or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin (a length of the yarn bobbin itself) reaches a predetermined length (a second length).

[0058] For example, assuming that the diameter of the yarn bobbin 1022 shown in FIG. 1 reaches a pre-required diameter threshold, the yarn bobbin 1022 needs to be replaced. For example, the yarn length may be detected by a sensor of the spinning mechanism, and the diame-

ter/length/weight of the yarn bobbin may be detected by the sensor of the winding mechanism, etc., and reference may be made to related techniques for specific detection components. This disclosure is not limited thereto, and the parameters as doffing conditions may also be, for example, a volume of the yarn bobbin, etc. In addition, the above doffing conditions may be used separately, or may be used by combining two or more of them.

[0059] Hence, a time for replacement may further be controlled exactly by the control apparatus, and operational efficiency may be improved.

[0060] In some embodiments, the control apparatus transmits a control instruction to stop winding to the spinning machine workstation 201 and causes the yarn bobbin to be ejected from the winding mechanism 2011 to a conveyor belt in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

[0061] For example, after the spinning machine workstation 201 receives the control instruction, it may deem that the winding of the yarn bobbin is completed, and hence production and winding of the spinning machine workstation 201 may be stopped, and replacement of the yarn bobbin may be prepared. For other spinning machine workstations 201, yarn production and winding may still be performed independently and are not affected by the control instruction.

[0062] Hence, the time for replacement may further be controlled exactly by the control apparatus, and operational efficiency may be improved.

[0063] In some embodiments, the tube replacement apparatus 202 pushes out one of the stored tubes at an introduction position and configures the tube on the winding mechanism after the yarn bobbin on the winding mechanism is ejected.

[0064] Hence, instructed by the control apparatus, the tube replacement apparatus and the winding mechanism operate in parallel (for example, the yarn bobbin is ejected, while the stored empty tube is introduced), the time for replacement may further be controlled exactly by the control apparatus, and operational efficiency may be improved.

[0065] In some embodiments, the introduction position refers to, for example, a position where an empty tube in the tube replacement apparatus may be inserted into a bobbin rack of the winding mechanism from a tube magazine, and the standby position refers to, for example, a position where the tube replacement apparatus waits for a tube replacement operation. The introduction position and the standby position may be in the vicinity of the winding mechanism and have predetermined distances from the winding mechanism.

[0066] The introduction position may be identical to the standby position, for example, the tube replacement apparatus may be standby at a first predetermined position near the winding mechanism and perform tube replacement at the first predetermined position; and the introduction position and the standby position may also be different, for example, the tube replacement may be standby at a second predetermined position near the winding mechanism, and may perform tube replacement at a third predetermined position.

[0067] In some embodiments, the loading position refers to, for example, a position where a tube is loaded (or stored) into the tube magazine of the tube replacement apparatus, which may be remote from the induction or standby position. For example, the tube magazine may be made more upright in the loading position, so that a tube to be loaded (stored) may automatically slide into the tube magazine due to the gravity, thereby simplifying operations of storing tubes by the tube magazine.

[0068] In addition, one or more of the introduction position, the standby position and the loading position may be set as actually demanded. For example, only the introduction position and the loading position may be set, or only the introduction position and the standby position may be set, or the introduction position, the standby position and the loading position may be set, and more positions may be set, etc., and this disclosure is not limited thereto.

[0069] In some embodiments, the tube replacement apparatus is moved from the loading position to the introduction position upon receiving a control instruction, or, the tube replacement apparatus is moved from the loading position to the introduction position during spinning, or, the tube replacement apparatus is moved from the loading position to the introduction position after storing the tubes, and remains at the introduction position when the tube(s) exist(s) in the tube replacement apparatus.

[0070] Hence, the tube replacement apparatus may reach the introduction position (standby position) before the spinning process is suspended, thereby saving time for replacing the tubes, further controlling exactly the time for replacing the tubes, and improving operational efficiency.

[0071] For example, at any suitable moment during the spinning process, the tube replacement apparatus may be moved to the introduction position, waiting for the spinning process to be suspended, so as to insert the tube into the bobbin rack of the winding mechanism immediately after the yarn bobbin is ejected. This may further save time as the tube magazine does not need to be moved from the loading position to the introduction position after the spinning process is suspended.

[0072] For another example, as shown in FIG. 3, it is assumed that the tube replacement apparatus 202 is currently at the loading position. In a case where the control information is received, the tube replacement apparatus 202 is moved from the loading position (such as being rotated or translated, and rotation is taken as an example in FIG. 3) to an introduction position with a predetermined distance from the winding mechanism 2011 (such as be-

ing rotated downwards as shown by the arrow in FIG. 3). In this introduction position, the tube replacement apparatus 202 is abutted with a guide rail of the winding mechanism 2011 capable of guiding an empty tube.

[0073] For a further example, after the yarn bobbin on the winding mechanism 2011 is ejected (such as being transferred to the conveyor belt), the tube replacement apparatus 202 pushes out the stored tube (such as pushing out a foremost tube by a pressure mechanism, and reference may be made to relevant techniques for details), and configures (such as introducing via the guide rail) the tube onto the winding mechanism 2011. Reference may be made to relevant techniques for implementing such actions as ejecting, transferring, pushing out, configuring, and introducing, which shall not be repeated herein any further.

[0074] In some embodiments, the control apparatus detects whether the winding mechanism 2011 is configured with the tube, and transmits a control instruction for starting producing and winding a yarn to the spinning machine workstation 201 in a case where the tube is correctly configured on the winding mechanism 2011.

[0075] For example, whether the tube is configured, or whether the tube is configured at a correct position, etc., may be detected by a detector. In the case where the tube is correctly configured on the winding mechanism 2011, subsequent yarn production and winding are proceeded; in a case where the tube is not correctly configured on the winding mechanism 2011, introduction of the tube may be awaited; and in a case where the tube are not properly configured after a predetermined time, an alert may be issued to notify relevant personnel.

[0076] Hence, with the detection by the control apparatus, the time for operation again of the winding mechanism may be exactly determined, and security and operational efficiency may further be improved.

[0077] In some embodiments, in the case where the tubes are correctly configured on the winding mechanism 2011, the control apparatus further transmits a control instruction to the tube replacement apparatus 202 to cause the tube replacement apparatus 202 to be moved from the introduction position back to the loading position or a standby position.

[0078] Hence, with the detection by the control apparatus, the time for standby and introduction of the tube replacement apparatus may be exactly determined, and security and operational efficiency may further be improved. Moreover, after the tube replacement apparatus is moved back to the loading position or the standby position, maintenance and loading of the tubes may be better conducted.

[0079] The above implementations only illustrate the embodiment of this disclosure. However, this disclosure is not limited thereto, and appropriate variants may be made on the basis of these implementations. For example, the above implementations may be executed separately, or one or more of them may be executed in a combined manner.

[0080] In addition, the devices or components are illustrated above only. However, this disclosure is not limited thereto, and reference may be made to related techniques for detailed contents of the devices or components; and furthermore, devices or components not shown in FIGs. 1-4 may be added, or one or more of the devices or components in FIGs. 1-4 may be reduced.

[0081] It should be noted that the embodiments of this disclosure are only illustratively described above. However, the embodiments of this disclosure are not limited thereto, and appropriate variants may be made on the basis of the above implementations. In addition, the components are illustrated above only. However, the embodiments of this disclosure are not limited thereto, and reference may be made to related techniques for detailed contents of the components. Moreover, components not shown in the drawings may be added, or one or more components in the drawings may be reduced.

[0082] The embodiment of this disclosure further provides a single doffing control method.

[0083] FIG. 5 is a schematic diagram of the single doffing control method of the embodiment of this disclosure. As shown in FIG. 5, the method includes:

501: when a yarn is wound into a yarn bobbin of a predetermined size around a replaceable tube on a winding mechanism in a spinning machine workstation, a control apparatus transmits control information for instructing to replace the yarn bobbin on the winding mechanism; and

502: a tube replacement apparatus replaces the yarn bobbin on the winding mechanism by using one of stored tubes when receiving the control information.

[0084] Hence, the yarn bobbin may be replaced with an empty tube automatically after the yarn winding is completed by replacing the yarn bobbin on the winding mechanism with the tube stored in the tube replacement apparatus, thereby eliminating or avoiding artificial intervene, lowering maintenance cost, and improving security and operational efficiency.

[0085] FIG. 6 is another schematic diagram of the single doffing control method of the embodiment of this disclosure.

[0086] 601: a spinning machine workstation produces a yarn, and winds the yarn by using tubes; and

[0087] 602: a control apparatus determines that the yarn is wound into a yarn bobbin of a predetermined size around a tube;

for example, a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length; and the above doffing conditions may be used separately, or may be used by combining two or more of them;

[0088] 603: the control apparatus transmits control in-

formation for replacing the yarn bobbing to the tube replacement apparatus;

in some embodiments, in a case where the control information is received, the tube replacement apparatus is moved from the loading position to an introduction position with a predetermined distance from the winding mechanism; for example, after the tube replacement apparatus reaches the introduction position, a further instruction may be awaited, and preparation for replacement may be started; however, this disclosure is not limited thereto, for example, the tube replacement apparatus may reach the introduction position at any appropriate time;

[0089] 604: the control apparatus transmits a control instruction to stop winding to the spinning machine workstation, and causes the yarn bobbin to be ejected from the winding mechanism to a conveyor belt;

for example, after receiving the control instruction, the spinning machine workstation may cut off the yarn, and transfers the yarn bobbing to the conveyor belt for performing subsequent processes; and furthermore, the control apparatus may further transmit an instruction to the tube replacement apparatus, so as to cause the tube replacement apparatus to start replacement of the tubes;

[0090] 605: the tube replacement apparatus pushes out one of the stored tubes after the yarn bobbing on the winding mechanism is ejected, and configures the tube on the winding mechanism.

[0091] As shown in FIG. 6, the method may further include:

606: the control apparatus detects whether the tube is correctly configured on the winding mechanism, and transmits a control instruction for starting producing and winding a yarn to the spinning machine workstation in a case where the tube is correctly configured on the winding mechanism, to enable the spinning machine workstation to proceed with 601, and the control apparatus may further transmit a control instruction to the tube replacement apparatus, to enable the tube replacement apparatus to execute 607, and 608 is executed in a case where the tube is not correctly configured onto the winding mechanism;

607: the tube replacement apparatus moves back to the loading position to the standby position; and

608: the tube replacement apparatus continues to wait or issues alert information.

[0092] It should be noted that FIG. 5 or FIG. 6 only schematically illustrates the embodiment of this disclosure; however, this disclosure is not limited thereto. For example, an order of execution of the steps may be appropriately adjusted, and furthermore, some other steps may be added, or some steps therein may be reduced. And appropriate variants may be made by those skilled in the art according to the above contents, without being limited to what is contained in FIG. 5 or FIG. 6.

[0093] The embodiment of this disclosure further provides a single doffing control apparatus. The control apparatus may be, for example, a computer, a server, a workstation, a lap-top computer, and a smart mobile phone, etc.; however, this disclosure is not limited thereto, and it may also be some circuits or some software programs in these devices.

[0094] FIG. 7 is a schematic diagram of the single doffing control apparatus of the embodiment of this disclosure. As shown in FIG. 7, the control apparatus 700 may include a processor 710 (such as a central processing unit) and a memory 720, the memory 720 being coupled to the processor 710. The memory 720 may store various data, and furthermore, it may store a program 721 for information processing, and execute the program 721 under control of the processor 710.

[0095] In some embodiments, the processor 710 is configured to carry out the single doffing control method as described above.

[0096] For example, the processor 710 is configured to perform the following control: when a yarn is wound into a yarn bobbin of a predetermined size around a tube on a winding mechanism in a spinning machine workstation, transmitting control information for instructing to replace the yarn bobbin on the winding mechanism, to enable a tube replacement apparatus to replace the yarn bobbin on the winding mechanism by using one of stored tubes.

[0097] For another example, the processor 710 is configured to perform the following control: transmitting the control information to the tube replacement apparatus in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

[0098] For a further example, the processor 710 is configured to perform the following control: transmitting a control instruction to stop winding by the control apparatus to the spinning machine workstation and causing the yarn bobbin to be ejected from the winding mechanism to a conveyor belt in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

[0099] For still another example, the processor 710 is configured to perform the following control: pushing out one of the stored tubes by the tube replacement apparatus at an introduction position and configuring the tube on the winding mechanism after the yarn bobbin on the winding mechanism is ejected.

[0100] For yet another example, the processor 710 is configured to perform the following control: moving the tube replacement apparatus from a loading position to the introduction position when the tube replacement ap-

paratus receives a control instruction, or, moving the tube replacement apparatus from a loading position to an introduction position during spinning, or, moving the tube replacement apparatus from a loading position to an introduction position after the tube replacement apparatus stores the tube(s), and holding the tube replacement apparatus at the introduction position when the tube(s) exist(s) in the tube replacement apparatus.

[0101] For yet further example, the processor 710 is configured to perform the following control: detecting whether the winding mechanism is configured with the tube, and transmitting a control instruction for starting producing and winding a yarn to the spinning machine workstation in a case where the tube is correctly configured on the winding mechanism.

[0102] For yet still another example, the processor 710 is configured to perform the following control: in the case where the tube is correctly configured on the winding mechanism, further transmitting a control instruction by the control apparatus to the tube replacement apparatus to cause the tube replacement apparatus to be moved from the introduction position back to a standby position or a loading position.

[0103] Furthermore, as shown in FIG. 7, the control apparatus 700 may include an input/output (I/O) device 730, and a display 740, etc.; wherein, functions of the above components are similar to those in the prior art, and shall not be described herein any further. It should be noted that the control apparatus 700 does not necessarily include all the parts shown in FIG. 7, and furthermore, the control apparatus 700 may include parts not shown in FIG. 7, and the related art may be referred to.

[0104] An embodiment of this disclosure provides a computer readable program, which, when executed in a control apparatus, will cause a computer to carry out the single doffing control method described above in the control apparatus.

[0105] An embodiment of this disclosure provides a computer storage medium, including a computer readable program, which will cause a computer to carry out the single doffing control method described above in a control apparatus.

[0106] The above apparatuses and methods of this disclosure may be implemented by hardware, or by hardware in combination with software. This disclosure relates to such a computer-readable program that when the program is executed by a logic device, the logic device is enabled to carry out the apparatus or components as described above, or to carry out the methods or steps as described above. The present invention also relates to a storage medium for storing the above program, such as a hard disk, a floppy disk, a CD, a DVD, and a flash memory, etc.

[0107] The methods/apparatuses described with reference to the embodiments of this disclosure may be directly embodied as hardware, software modules executed by a processor, or a combination thereof. For example, one or more functional block diagrams and/or one or more combinations of the functional block diagrams shown in the drawings may either correspond to software modules of procedures of a computer program, or correspond to hardware modules. Such software modules may respectively correspond to the steps shown in the drawings. And the hardware module, for example, may be carried out by firming the soft modules by using a field programmable gate array (FPGA).

[0108] The soft modules may be located in an RAM, a flash memory, an ROM, an EPROM, and EEPROM, a register, a hard disc, a floppy disc, a CD-ROM, or any memory medium in other forms known in the art. A memory medium may be coupled to a processor, so that the processor may be able to read information from the memory medium, and write information into the memory medium; or the memory medium may be a component of the processor. The processor and the memory medium may be located in an ASIC. The soft modules may be stored in a memory of a mobile terminal, and may also be stored in a memory card of a pluggable mobile terminal. For example, if equipment (such as a mobile terminal) employs an MEGA-SIM card of a relatively large capacity or a flash memory device of a large capacity, the soft modules may be stored in the MEGA-SIM card or the flash memory device of a large capacity.

[0109] One or more functional blocks and/or one or more combinations of the functional blocks in the drawings may be realized as a universal processor, a digital signal processor (DSP), an application-specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic devices, discrete gate or transistor logic devices, discrete hardware component or any appropriate combinations thereof carrying out the functions described in this application. And the one or more functional block diagrams and/or one or more combinations of the functional block diagrams in the drawings may also be realized as a combination of computing equipment, such as a combination of a DSP and a microprocessor, multiple processors, one or more microprocessors in communication combination with a DSP, or any other such configuration.

[0110] This disclosure is described above with reference to particular embodiments. However, it should be understood by those skilled in the art that such a description is illustrative only, and not intended to limit the protection scope of the present invention. Various variants and modifications may be made by those skilled in the art according to the principle of the present invention, and such variants and modifications fall within the scope of the present invention.

Claims

1. A single doffing device, **characterized in that** the device comprises:

   a spinning machine workstation having a spin-

ning mechanism for producing a yarn and a winding mechanism for winding the yarn, wherein the winding mechanism is provided with a replaceable tube around which the yarn is wound;
a control apparatus configured to, when the yarn is wound into a yarn bobbin of a predetermined size around the replaceable tube on the winding mechanism, transmit control information for instructing to replace the yarn bobbin on the winding mechanism; and
a tube replacement apparatus storing one or more tube(s) therein and configured to replace the yarn bobbin on the winding mechanism by using one of the stored tubes upon receipt of the control information.

2. The device according to claim 1, **characterized in that** the control apparatus transmits the control information to the tube replacement apparatus in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

3. The device according to claim 1, **characterized in that** the control apparatus transmits a control instruction to stop winding to the spinning machine workstation and causes the yarn bobbin to be ejected from the winding mechanism to a conveyor belt in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

4. The device according to claim 1, **characterized in that** the tube replacement apparatus pushes out the one of the stored tubes at an introduction position and configures the tube on the winding mechanism after the yarn bobbin on the winding mechanism is ejected.

5. The device according to claim 1, **characterized in that** the tube replacement apparatus is moved from a loading position to an introduction position upon receiving a control instruction, or, the tube replacement apparatus is moved from a loading position to an introduction position during spinning, or, the tube replacement apparatus is moved from a loading position to an introduction position after storing the tube(s), and remains at the introduction position when the tube(s) exist(s) in the tube replacement apparatus.

6. The device according to claim 4, **characterized in that** the control apparatus detects whether the winding mechanism is configured with the tube, and transmits a control instruction for starting producing and winding yarns to the spinning machine workstation in a case where the tube is correctly configured on the winding mechanism.

7. The device according to claim 6, **characterized in that** in the case where the tube is correctly configured on the winding mechanism, the control apparatus further transmits a control instruction to the tube replacement apparatus to cause the tube replacement apparatus to be moved from the introduction position back to a standby position or a loading position.

8. A single doffing control method, **characterized in that** the method comprises:

when a yarn is wound into a yarn bobbin of a predetermined size on a replaceable tube on a winding mechanism in a spinning machine workstation, transmitting, by a control apparatus, control information for instructing to replace the yarn bobbin on the winding mechanism; and
replacing the yarn bobbin on the winding mechanism by using one of stored tubes when a tube replacement apparatus receives the control information.

9. The method according to claim 8, **characterized in that** the control apparatus transmits the control information to the tube replacement apparatus in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

10. The method according to claim 8, **characterized in that** the method further comprises:
transmitting, by the control apparatus, a control instruction to stop winding to the spinning machine workstation and causing the yarn bobbin to be ejected from the winding mechanism to a conveyor belt in a case where a yarn length of the yarn bobbin reaches a predetermined length, or a weight of the yarn bobbin reaches a predetermined weight, or a diameter of the yarn bobbin reaches a predetermined diameter, or a length of the yarn bobbin reaches a predetermined length.

11. The method according to claim 8, **characterized in that** the method further comprises:
pushing out the one of the stored tubes by the tube replacement apparatus at an introduction position and configuring the tube on the winding mechanism

after the yarn bobbin on the winding mechanism is ejected.

12. The method according to claim 8, **characterized in that** the method further comprises:
moving the tube replacement apparatus from a loading position to the introduction position when the tube replacement apparatus receives a control instruction, or, moving the tube replacement apparatus from a loading position to an introduction position during spinning, or, moving the tube replacement apparatus from a loading position to an introduction position after the tube replacement apparatus stores the tube(s), and holding the tube replacement apparatus at the introduction position when the tube(s) exist(s) in the tube replacement apparatus.

13. The method according to claim 11, **characterized in that** the method further comprises:
detecting by the control apparatus whether the winding mechanism is configured with the tube, and transmitting a control instruction for starting producing and winding the yarn to the spinning machine workstation in a case where the tube is correctly configured on the winding mechanism.

14. The method according to claim 13, **characterized in that** the method further comprises:
in the case where the tube is correctly configured on the winding mechanism, further transmitting a control instruction by the control apparatus to the tube replacement apparatus to cause the tube replacement apparatus to be moved from the introduction position back to a standby position or a loading position.

15. A single doffing control apparatus, comprising a memory and a processor, the memory storing a computer program, and the processor being configured to execute the computer program to implement the following operations:
when a yarn is wound into a yarn bobbin of a predetermined size on a replaceable tube on a winding mechanism in a spinning machine workstation, transmitting control information for instructing to replace the yarn bobbin on the winding mechanism, to enable a tube replacement apparatus to replace the yarn bobbin on the winding mechanism by using one of stored tubes.

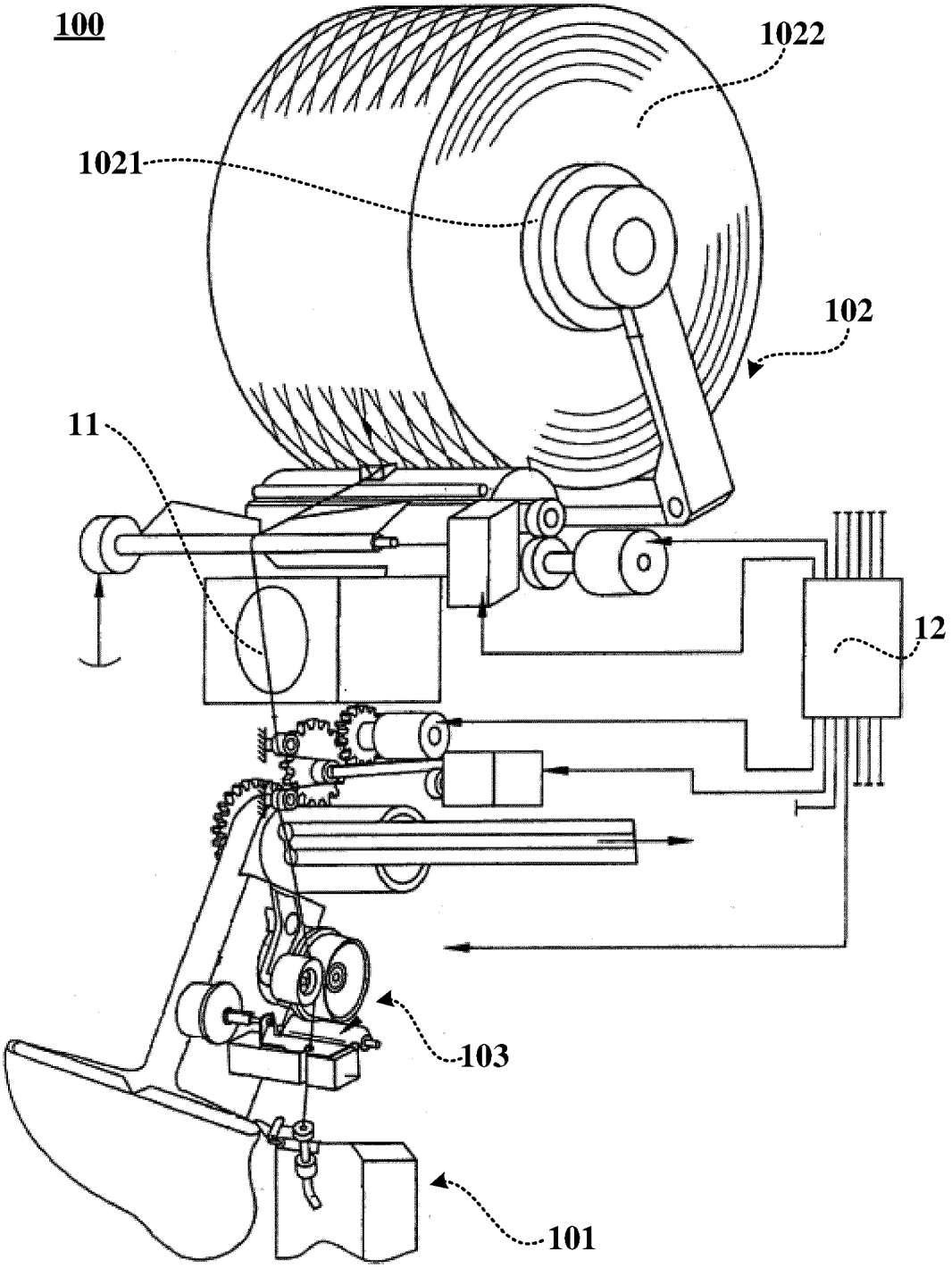

FIG. 1

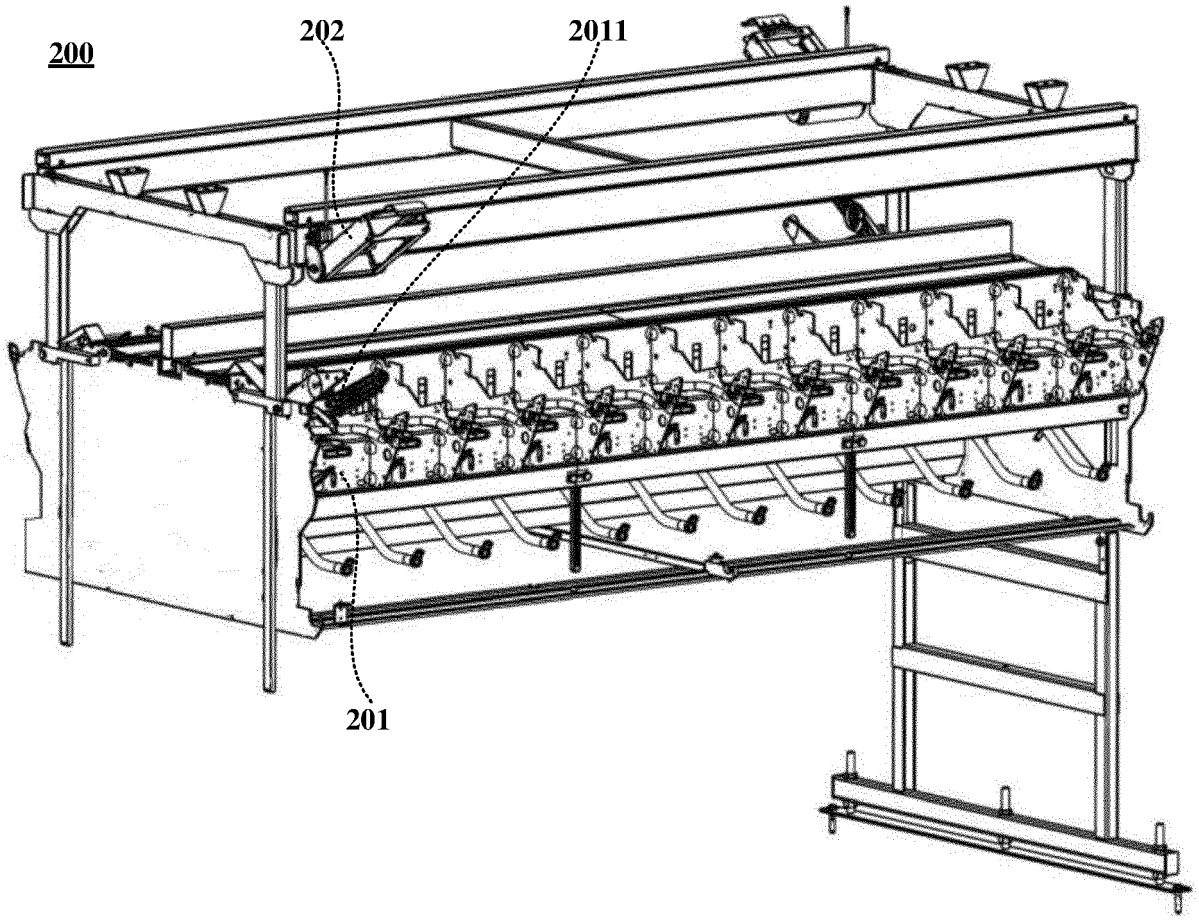

FIG. 2

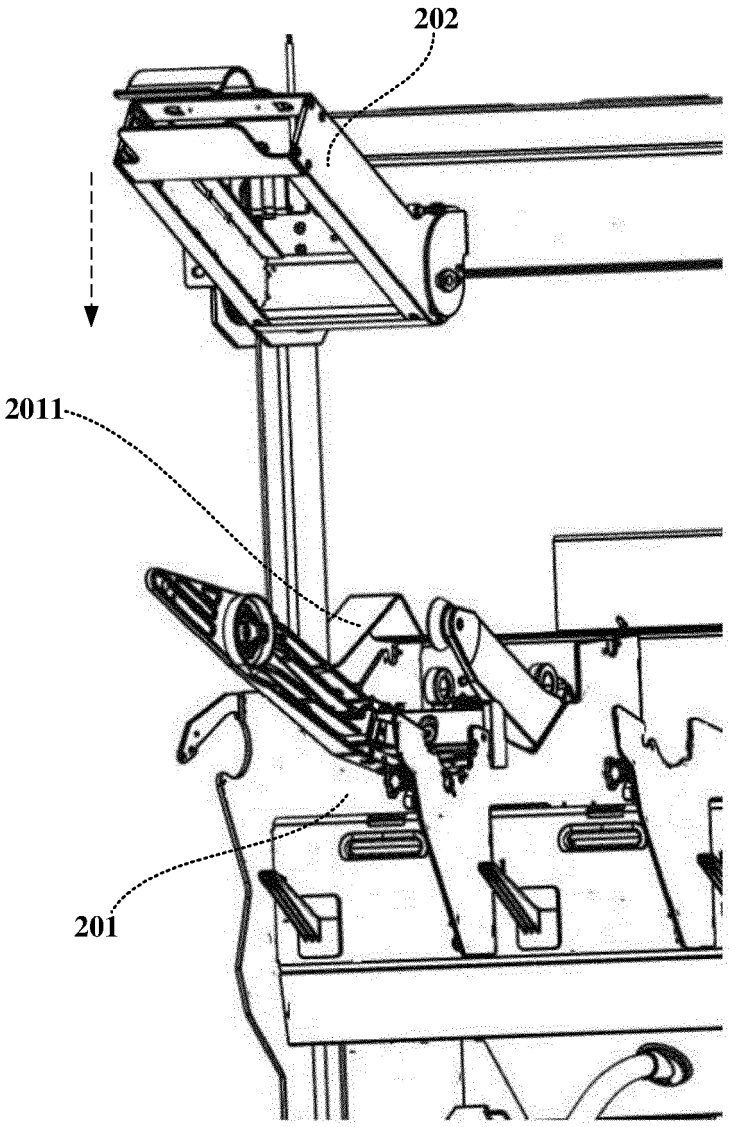

FIG. 3

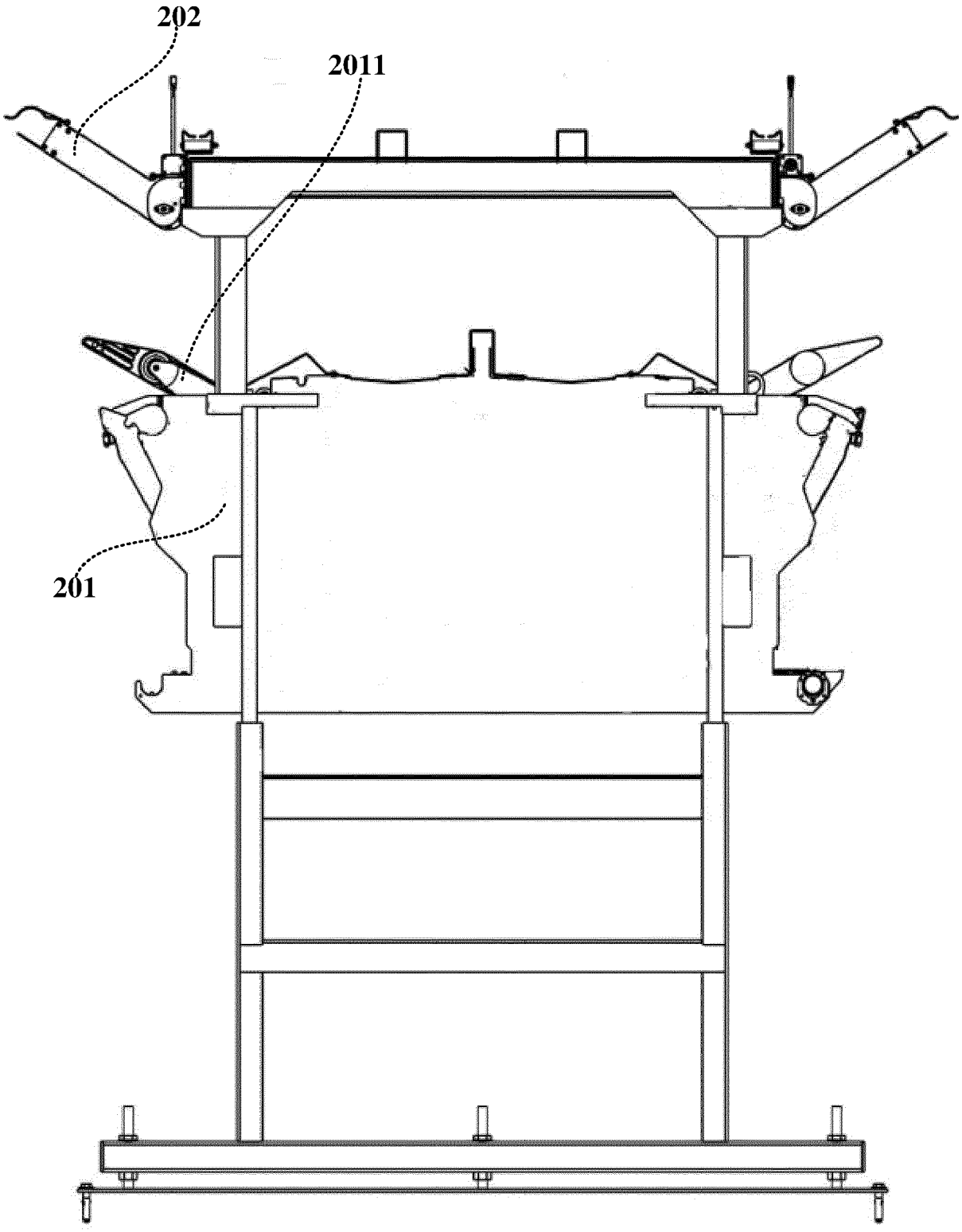

FIG. 4

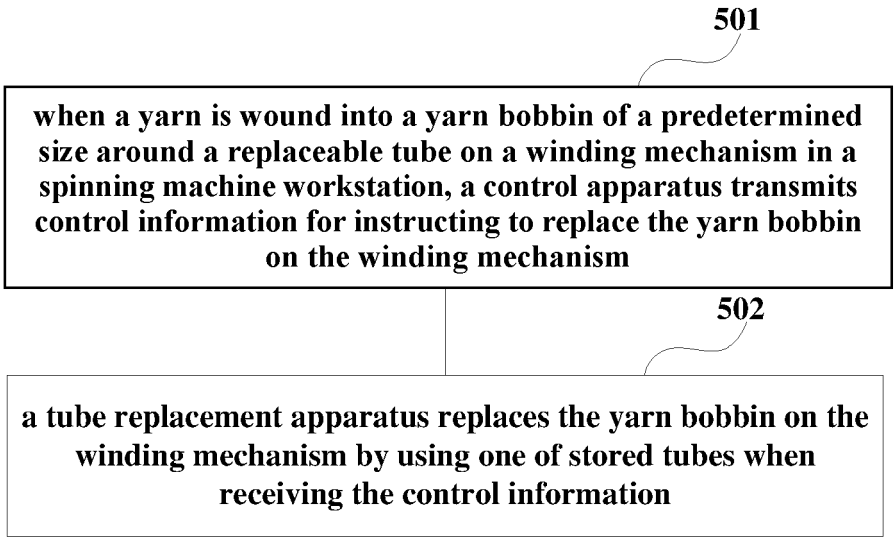
501
when a yarn is wound into a yarn bobbin of a predetermined size around a replaceable tube on a winding mechanism in a spinning machine workstation, a control apparatus transmits control information for instructing to replace the yarn bobbin on the winding mechanism
502
a tube replacement apparatus replaces the yarn bobbin on the winding mechanism by using one of stored tubes when receiving the control information

FIG. 5

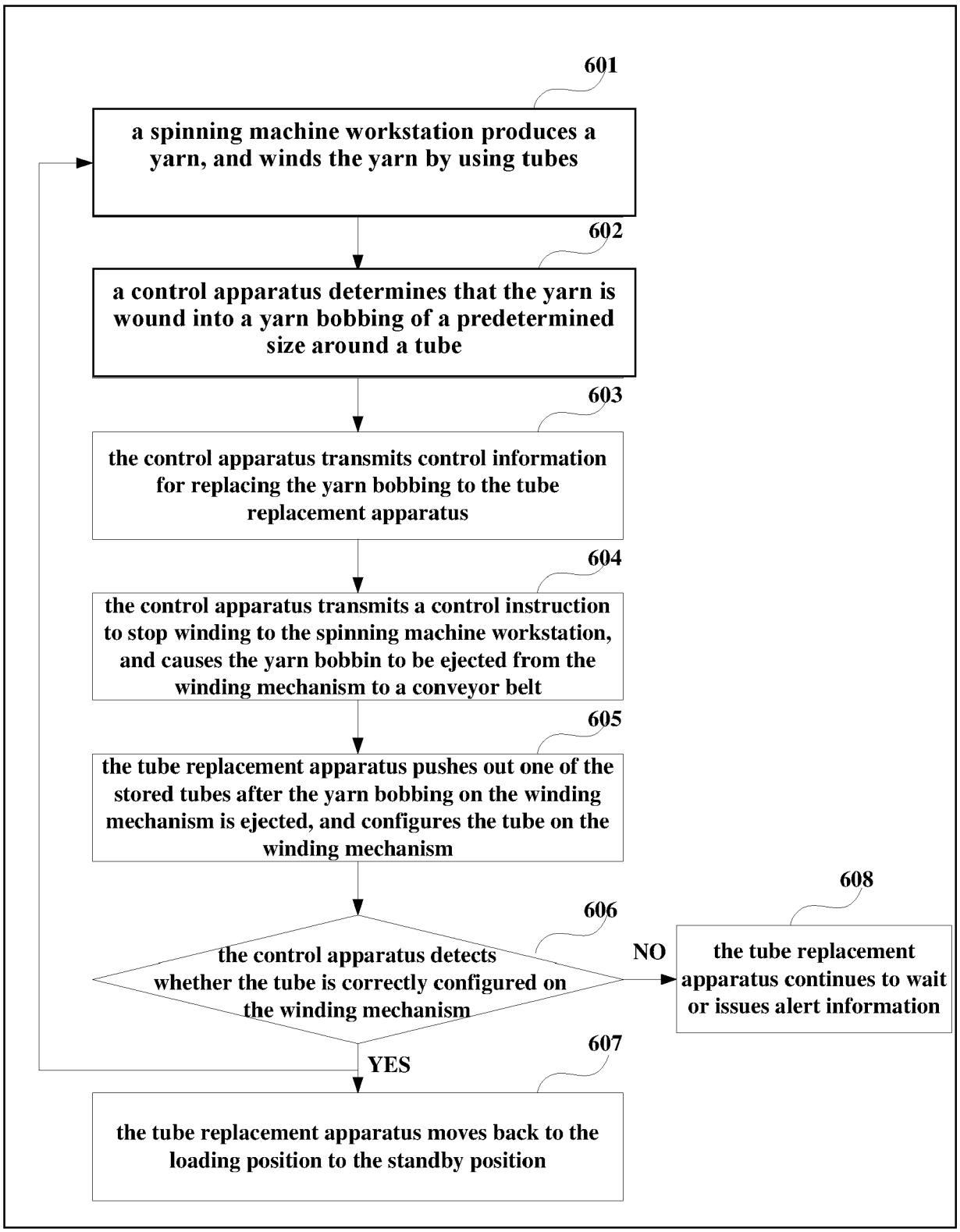
601
a spinning machine workstation produces a yarn, and winds the yarn by using tubes
602
a control apparatus determines that the yarn is wound into a yarn bobbing of a predetermined size around a tube
603
the control apparatus transmits control information for replacing the yarn bobbing to the tube replacement apparatus
604
the control apparatus transmits a control instruction to stop winding to the spinning machine workstation, and causes the yarn bobbin to be ejected from the winding mechanism to a conveyor belt
605
the tube replacement apparatus pushes out one of the stored tubes after the yarn bobbing on the winding mechanism is ejected, and configures the tube on the winding mechanism
606
the control apparatus detects whether the tube is correctly configured on the winding mechanism
NO
608
the tube replacement apparatus continues to wait or issues alert information
YES
607
the tube replacement apparatus moves back to the loading position to the standby position

FIG. 6

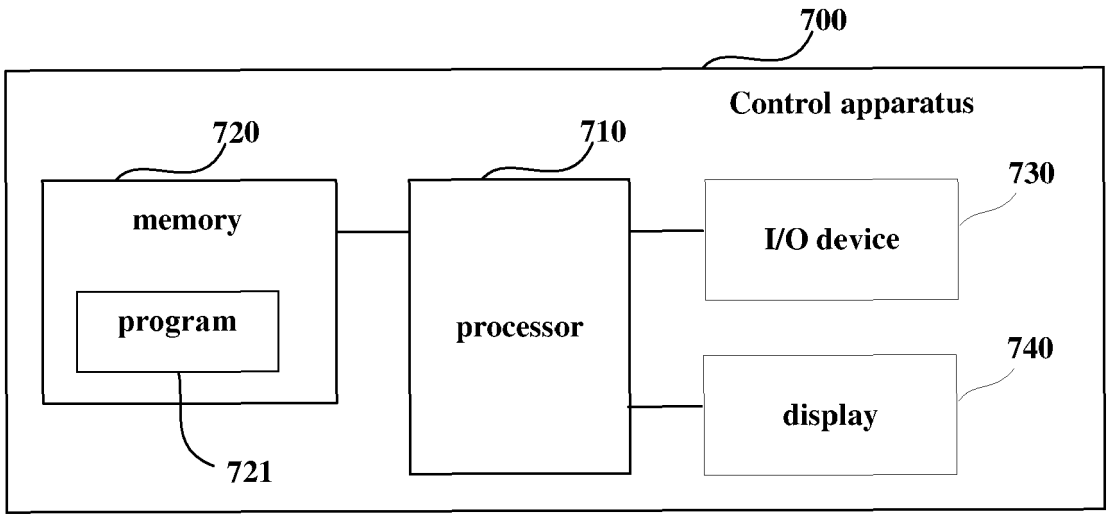
700
Control apparatus
720
memory
program
721
710
processor
730
I/O device
740
display

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 7732

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 657 380 A2 (SAURER GERMANY GMBH & CO KG [DE]) 30 October 2013 (2013-10-30) * paragraphs [0041] - [0050]; figures 1,2 *	1-15	INV. B65H63/08 B65H67/04 D01H9/04
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			TECHNICAL FIELDS SEARCHED (IPC)
			B65H D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 October 2022	Pussemier, Bart

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 17 7732

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19-10-2022

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