



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.08.2019 Bulletin 2019/32

(51) Int Cl.:
B65H 63/00 (2006.01)

(21) Application number: **19153645.7**

(22) Date of filing: **25.01.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
 Designated Extension States:
BA ME
 Designated Validation States:
KH MA MD TN

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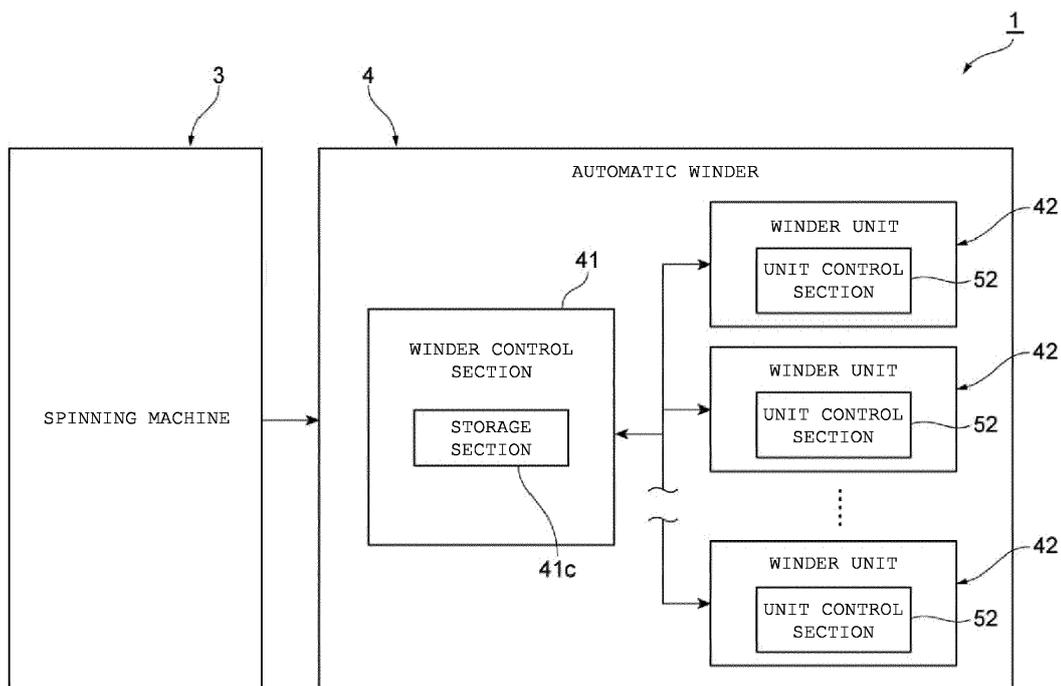
(30) Priority: **02.02.2018 JP 2018017301**

(54) **YARN WINDING MACHINE AND METHOD OF OPERATING YARN WINDING MACHINE**

(57) An automatic winder (4) includes a plurality of winder units (42) adapted to wind a yarn (14) to form a package (15), a storage section (41c) adapted to store a post-maintenance operation time, which is an operation time from when a simultaneous maintenance is per-

formed immediately before, for each of the plurality of winder units (42), and a winder control section (41) adapted to control at least either of startup and stop of the plurality of winder units (42) based on the post-maintenance operation time stored in the storage section (41c).

FIG. 3



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding machine and a method of operating the yarn winding machine.

2. Description of the Related Art

[0002] As a technique related to a conventional yarn winding machine, for example, Japanese Unexamined Patent Publication No. 2017-002415 describes an automatic winder including a plurality of winder units (winding units) adapted to wind a yarn from a yarn supplying bobbin formed with a spinning machine to form a package.

[0003] Each of the plurality of winding units is not necessarily limited to operating in the same manner, and it was found that each operation amount of the plurality of winding units varies among the winding units. Thus, in the yarn winding machine described above, when performing maintenance on the plurality of winding units all at once (all together), the plurality of winding units sometimes includes a winding unit that operates in excess of a defined limit operation amount. In this case, the function of the winding unit becomes difficult to sufficiently be exhibited, the quality and part performance may lower, and the reliability may lower.

BRIEF SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to provide a yarn winding machine and a method of operating the yarn winding machine capable of further enhancing the reliability.

[0005] A yarn winding machine according to the present invention includes a plurality of winding units adapted to wind a yarn to form a package; a storage section adapted to store information relating to an operation amount from a last predetermined maintenance targeting on the plurality of winding units has been performed for each of the plurality of winding units; and a control section adapted to control at least either of startup and stop of the plurality of winding units based on the information stored in the storage section.

[0006] In such a yarn winding machine, at least either of startup and stop of the plurality of winding units is controlled based on the information relating to an operation amount from the last predetermined maintenance had been performed immediately before (previously). Thus, the plurality of winding units can be controlled so that a winding unit operating in excess of the limit operation amount does not exist when performing the next predetermined maintenance. As a result, the lowering of the quality and part performance can be suppressed, and the reliability can be further enhanced.

[0007] In the yarn winding machine according to the present invention, the operation amount may include at least one of an operation time and a number of operations. In this configuration, at least either of the startup and the stop of the plurality of winding units can be controlled using the information on at least either of the operation time and the number of operations of the winding unit.

[0008] In the yarn winding machine according to the present invention, the control section may control at least either of the startup and the stop of the plurality of winding units so that the operation amounts of the plurality of winding units are equalized (averaged). In such a configuration, when performing the predetermined maintenance, not only a winding unit operating in excess of the limit operation amount but also a winding unit having excessive margin until the limit operation amount can be avoided. The lowering in the quality and the part performance can be avoided, and the excessive maintenance can be reduced. The usage period of the part can be extended by extending the period of maintenance.

[0009] In the yarn winding machine according to the present invention, the control section may execute a first control of starting up the plurality of winding units in an order of small operation amount. The operation amounts of the plurality of winding units can be equalized by executing the first control.

[0010] In the yarn winding machine according to the present invention, the control section may execute a second control of temporarily stopping some winding units having a large operation amount of the plurality of winding units. The operation amounts of the plurality of winding units can be equalized by executing the second control.

[0011] In the yarn winding machine according to the present invention, the winding unit may be a winder unit adapted to wind the yarn from a yarn supplying bobbin transferred from a spinning machine by way of a bobbin transferring device to form the package; and the control section may calculate a spinning waiting time of the plurality of winder units based on operation information of the spinning machine, and execute the second control when the spinning waiting time is greater than or equal to a predetermined time. In this case, the operation amounts of the plurality of winding units can be equalized using the spinning waiting time.

[0012] In the yarn winding machine according to the present invention, the predetermined maintenance is a maintenance performed at a same timing among the plurality of winding units; and the predetermined maintenance may include at least one of a regular maintenance that is repeatedly performed periodically and an irregular maintenance that is performed at a time of occurrence of abnormality or at a time of predicting abnormality.

[0013] In the yarn winding machine according to the present invention, the winding unit may include a cradle adapted to support the package; and the maintenance may include at least one of lubrication, cleaning, and part replacement of the cradle. In the maintenance of long

performing interval, sufficient margin is often taken into consideration until the limit operation amount, and even if each operation amount of the plurality of winding units varies, a winding unit operating in excess of the limit operation amount is less likely to exist. In the maintenance of short performing interval, on the other hand, there is a high possibility that a winding unit operating in excess of the limit operation amount exists for opposite reasons from the maintenance of long performing interval. With regards to this, when the predetermined maintenance includes at least one of lubrication, cleaning, and part replacement of the cradle, the operation effect in that the reliability can be enhanced is effective as the performing interval is relatively short.

[0014] In the yarn winding machine according to the present invention, the winding unit may include a yarn joining device adapted to carry out a yarn joining process; and the predetermined maintenance may include at least one of lubrication and cleaning of the yarn joining device. When the predetermined maintenance includes lubrication and cleaning in the yarn joining device, the operation effect in that the reliability can be enhanced is effective as the performing interval is relatively short.

A method of operating a yarn winding machine according to the invention comprises:

a plurality of winding units winding a yarn to form a package; and the following steps:

- storing information relating to an operation amount from when a last predetermined maintenance targeting on the plurality of winding units had been performed immediately before for each of the plurality of winding units; and
- controlling at least either of startup and stop of the plurality of winding units based on the information stored in the storage section.

[0015] In the method according to the invention, the operation amount may include at least either of an operation time and a number of operations.

[0016] The method according to the invention may comprise controlling at least either of the startup and the stop of the plurality of winding units so that the operation amounts of the plurality of winding units are equalized.

[0017] The method according to the invention may comprise executing a first control of starting up the plurality of winding units in an order of small operation amount.

[0018] The method according to the invention may comprise executing a second control of temporarily stopping some winding units having a large operation amount of the plurality of winding units.

[0019] In the method according to the invention, the winding unit may be a winder unit winding the yarn from a yarn supplying bobbin transferred from a spinning machine by way of a bobbin transferring device to form the package; with the step of

calculating a spinning waiting time of the plurality of winder units based on operation information of the spinning machine, and executing the second control when the spinning waiting time is greater than or equal to a predetermined time.

[0020] In the method according to the invention, the predetermined maintenance may be a maintenance performed at a same timing among the plurality of winding units; and

the predetermined maintenance may include at least one of a regular maintenance that is repeatedly performed periodically and an irregular maintenance that is performed at a time of occurrence of abnormality or at a time of predicting abnormality.

[0021] In the method according to the invention, the winding unit may include a cradle adapted to support the package; and

the predetermined maintenance may include at least one of lubrication, cleaning, and part replacement of the cradle.

[0022] In the method according to the invention, the winding unit may include a yarn joining device adapted to carry out a yarn joining process; and

the predetermined maintenance may include at least one of lubrication and cleaning of the yarn joining device.

[0023] According to the present invention, a yarn winding machine and a method of operating the yarn winding machine capable of further enhancing the reliability can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

FIG. 1 is a front view of a yarn winding system according to one embodiment of the present invention; FIG. 2 is a side view of a winder unit of the yarn winding system of FIG. 1;

FIG. 3 is a function block diagram of an automatic winder of FIG. 1;

FIG. 4A is a flowchart illustrating a startup control by a winder control section of the automatic winder of FIG. 1; and

FIG. 4B is a flowchart illustrating a stop control by the winder control section of the automatic winder of FIG. 1.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0025] One embodiment will be hereinafter described with reference to the accompanying drawings. The same components are denoted with the same reference numerals in the following description, and redundant description will be omitted.

[0026] As illustrated in FIG. 1, a yarn winding system 1 includes a spinning machine 3, an automatic winder (yarn winding machine) 4, and a bobbin transferring de-

vice 5. The spinning machine 3 is a ring spinning machine. The spinning machine 3 is adapted to produce a yarn from a rove, and wind the yarn to form a yarn supplying bobbin 11. The automatic winder 4 is adapted to wind the yarn from the yarn supplying bobbin 11 to form a package 15. The bobbin transferring device 5 is adapted to transfer the yarn supplying bobbin 11 from the spinning machine 3 to the automatic winder 4, and transfer an empty bobbin 12 (bobbin around which a yarn is not wound) from the automatic winder 4 to the spinning machine 3. The bobbin transferring device 5 is provided with a bobbin preparing device, a remaining yarn processing device, and the like. The bobbin preparing device is adapted to carry out a preliminary preparation for the automatic winder 4 to process the yarn of the yarn supplying bobbin 11. If the yarn remains on the bobbin 12 discharged from the yarn supplying bobbin 11, the remaining yarn processing device removes the yarn to obtain an empty bobbin 12. The yarn supplying bobbin 11 and the empty bobbin 12 are respectively transferred while being set on a tray 6.

[0027] The spinning machine 3 includes a spinning control section 31 adapted to control the operation of the spinning machine 3, and a plurality of spinning units 32 adapted to form the yarn supplying bobbin 11. The spinning control section 31 includes a display portion 31a such as a display, and an operating portion 31b such as input keys. The display portion 31a displays an operating status of each spinning unit 32, and the like. The operating portion 31b is a portion for a worker (operator or maintenance worker) to carry out setting of the operating conditions of each spinning unit 32, and the like. The display portion 31a and the operating portion 31b may be configured by a touch panel.

[0028] The spinning machine 3 including a plurality of spinning units 32 is configured as a so-called simultaneous doffing type. In other words, the spinning machine 3 stocks a plurality of empty bobbins 12 transferred from the automatic winder 4 by the bobbin transferring device 5, simultaneously sets the empty bobbin 12 in each spinning unit 32, and simultaneously starts the winding of the yarn. When the winding of the yarn is completed in each spinning unit 32 and the yarn supplying bobbin 11 is formed, the spinning machine 3 simultaneously doffs (doffing) all the yarn supplying bobbins 11. Then, the spinning machine 3 extracts the empty bobbins 12 stocked in the meantime from the tray 6, and again simultaneously sets such an empty bobbin 12 in each spinning unit 32, and simultaneously sets the doffed yarn supplying bobbins 11 on the tray 6 instead.

[0029] The automatic winder 4 includes a winder control section (control section) 41 adapted to control the operation of the automatic winder 4, and a plurality of winder units (winding units) 42 adapted to form packages 15. The winder control section 41 includes a display portion 41a such as a display, and an operating portion 41b such as input keys. The display portion 41a displays an operating status of each winder unit 42, and the like. The

operating portion 41b is a portion for a worker to carry out setting of the operating conditions of each winder unit 42, and the like. The winder control section 41 also controls the operation of the bobbin transferring device 5.

[0030] As illustrated in FIGS. 2 and 3, the winder unit 42 winds the yarn from the yarn supplying bobbin 11 transferred from the spinning machine 3 by way of the bobbin transferring device 5 to form the package 15. The winder unit 42 includes a winding device 43, a tension applying device 44, a yarn monitoring device 45, a first yarn catching device 46, a second yarn catching device 47, a yarn joining device 48, and a unit control section 52.

[0031] The winding device 43 includes a cradle 43a and a winding drum 43b. The cradle 43a supports the package 15. The winding drum 43b rotates the package 15 while traversing the yarn 14. The yarn 14 is thereby wound from the yarn supplying bobbin 11 set at a predetermined position to form the package 15. The structure of the winding device 43 is not limited thereto. For example, the winding device 43 may include the cradle 43a, a touch roller that comes into contact with the package 15, and a traverse mechanism provided separate from the touch roller to traverse the yarn 14. The package 15 may be directly rotationally driven. The tension applying device 44 applies a predetermined tension on the yarn 14 travelling from the yarn supplying bobbin 11 to the package 15.

[0032] The yarn monitoring device 45 is adapted to monitor the travelling yarn 14 to detect yarn defects (e.g., thickness abnormality of the yarn 14, mixing of foreign substance into the yarn 14, etc.). When the yarn defect is detected, the yarn 14 is cut with a cutter. The cutter may be provided on the yarn monitoring device 45, or may be provided separate from the yarn monitoring device 45. When the yarn 14 is cut, the first yarn catching device 46 catches a yarn end of the yarn 14 from the package 15 and guides the yarn end to the yarn joining device 48. When the yarn 14 is cut, the second yarn catching device 47 catches a yarn end of the yarn 14 from the yarn supplying bobbin 11 and guides the yarn end to the yarn joining device 48. The yarn joining device 48 carries out a yarn joining process of joining the yarn ends guided by the first yarn catching device 46 and the second yarn catching device 47.

[0033] The unit control section 52 controls the operations of the winding device 43, the tension applying device 44, the yarn monitoring device 45, the first yarn catching device 46, the second yarn catching device 47, the yarn joining device 48, and the like in the winder unit 42. For example, the unit control section 52 performs a cutting process of the yarn 14, and controls the yarn joining device 48 to connect the yarn end of the yarn 14 from the yarn supplying bobbin 11 and the yarn end of the yarn 14 from the package 15 that have been cutting processed.

[0034] As illustrated in FIG. 1, the bobbin transferring device 5 supplies the yarn supplying bobbin 11 from the spinning machine 3 to the automatic winder 4.

[0035] The winder control section 41 and the processing thereof will now be described with reference to FIGS. 3 and 4.

[0036] The winder control section 41 is an electronic control unit including, for example, a Central Processing Unit (CPU), a Read Only Memory (ROM), a Random Access Memory (RAM), an Electrically Erasable Programmable Read Only Memory (EEPROM), a communication unit, and the like. The winder control section 41 loads the program stored in the ROM in the RAM, and executes the program with the CPU using numerical values and the like stored in the EEPROM to execute various processes. The winder control section 41 may be configured as hardware by an electronic circuit, and the like. The winder control section 41 includes a storage section 41c such as hard disc, flash memory, or the like.

[0037] The storage section 41c stores information relating to an operation amount from a last predetermined maintenance for each of the plurality of winder units 42. The information relating to the operation amount is transmitted from each winder unit 42 in a wired or wireless manner. The operation amount includes an operation time (hereinafter referred to as "post-maintenance operation time") from a last predetermined maintenance. The post-maintenance operation time is, for example, an accumulation of time in which the winder unit 42 is winding the yarn 14 to form the package 15. The operation time is also referred to as operating hours. In other words, the post-maintenance operation time is a number of operating hours in which the winder unit 42 is operating to form the package 15, and is also referred to as operating hours of each winder unit 42 accumulated after the last predetermined maintenance had been performed. The predetermined maintenance is, for example, maintenance targeted on the plurality of winder units 42, and performed at the same timing (simultaneously) among the plurality of winder units 42. In other words, the predetermined maintenance includes simultaneous maintenance that is simultaneously carried out on the plurality of winder units 42. The predetermined maintenance includes regular maintenance that is repeatedly (every predetermined period) performed periodically. The predetermined maintenance includes an irregularly performed maintenance. For example, the predetermined maintenance is performed regularly at a predetermined interval corresponding to the type of maintenance. For example, when occurrence of abnormality is recognized or predicted (at the time of occurrence of abnormality or at the time of predicting abnormality), the predetermined maintenance is performed irregularly. A performing interval of the predetermined maintenance (time interval from when the previous predetermined maintenance is performed until the next predetermined maintenance is performed) is estimated as a predetermined interval of longer than or equal to one month and shorter than or equal to one year. The performing interval of the regular maintenance is set (scheduled) to an interval determined in advance.

[0038] From the current condition in which one or a few

workers basically perform the maintenance on one automatic winder 4, in the predetermined maintenance, the maintenance work is to be performed substantially at the same timing in all the winder units 42 of one automatic winder 4. Substantially the same timing does not include only the timing same in time and minute, but also includes timing shifted by a tolerable extent. In view of the period of the assumed predetermined maintenance being an interval of a few months to one year, the timing of maintenance on the plurality of winder units 42 may be a few dozen minutes to a few hours between the winder units 42 or may be shifted by about 1% with respect to the maintenance period. Such shift is a range that can be equalized in the equalization, to be described later. The machine refers to the entire single automatic winder 4.

[0039] In the predetermined maintenance, each winder unit 42 is sequentially subjected to the maintenance work in a state where all the winder units 42 arranged in the single automatic winder 4 are stopped, and the operation (winding) may be sequentially started from the winder unit 42 which maintenance work is completed. As the number of winder units 42 in which the operation can be started at the same time is limited by the limitation of air pressure for carrying out the yarn joining operation at the start of the operation (e.g., in the automatic winder 4 including sixty winder units 42, only ten winder units 42 can start the operation at the same time), the timing to start the operation of each winder unit 42 may shift. Thus, the timing to start the operation of each winder unit 42 in the predetermined maintenance includes a case where the timing is exactly the same and a case where the timing has a time lag. In the predetermined maintenance, each winder unit 42 (or a group of predetermined number of winder units 42) is sequentially stopped, and the maintenance work is sequentially performed from the stopped winder unit 42, and then the winder unit 42 subjected to the maintenance work may sequentially start the operation.

[0040] The information of the predetermined maintenance may be input to the winder control section 41 through the operating portion 41b (see FIG. 1) by the worker, and the like, may be input to the winder control section 41 by communication from an external high-order control section, may be acquired by automatic determination of the winder control section 41, and may be acquired by a combination of the above. For example, the information of the predetermined maintenance includes performed date and time, information relating to portion to perform maintenance, maintenance content, and the like.

[0041] The predetermined maintenance is at least one of inspection, adjustment, lubrication, cleaning, and part replacement (e.g., replacement of consumable goods) of a predetermined device including each winder unit 42, a predetermined area of each winder unit 42, or a predetermined operation mechanism of each winder unit 42. For example, the predetermined maintenance includes at least one of lubrication, cleaning, and part replacement

of the cradle 43a, as well as lubrication and cleaning in the yarn joining device 48. For example, the predetermined maintenance includes at least one of the following maintenances. The storage section 41c stores the post-maintenance operation time of each winder unit 42.

[Regular maintenance]

[0042]

- (1) Lubrication to a slide portion of a bearing center of the cradle 43a for every three months
- (2) Disassembling and cleaning of the slide portion of the bearing center of the cradle 43a for every six months
- (3) Lubrication to a bearing center portion of the bearing center of the cradle 43a for every six months
- (4) Grease application to a cradle lifter and a damper of the cradle 43a for every six months
- (5) Lubrication to a cutter of the yarn joining device 48 for every three months
- (6) Cleaning of the yarn joining device 48 for every six months
- (7) Cleaning of inner surface of untwisting pipe of the yarn joining device 48 for every twelve months

[Irregular maintenance/replacement of consumable goods]

[0043]

- (8) Replacement of a brake shoe incorporated in the bearing center of the cradle 43a (at the time of occurrence of abnormality, stop of the package 15 is delayed).
- (9) Replacement of a bearing of the cradle 43a (at the time of occurrence of abnormality, abnormal noise or rattling occurs)
- (10) Replacement of a bush of the cradle 43a (at the time of occurrence of abnormality, vibration becomes greater)

[0044] The winder control section 41 controls at least either of the startup and the stop of the plurality of winder units 42 based on the post-maintenance operation time stored in the storage section 41c. Specifically, the winder control section 41 controls at least either of the startup and the stop of the plurality of winder units 42 so that the post-maintenance operation time of the plurality of winder units 42 is equalized (averaged).

[0045] The winder control section 41 executes a startup control (first control) of starting up the plurality of winder units 42 in the order of small post-maintenance operation time. The startup of the winder unit 42 is, for example, the execution of the operation for starting the winding in the winder unit 42.

[0046] The startup control is executed at the time of startup (time of rise) of the automatic winder 4. In the

startup control, for example, as illustrated in FIG. 4A, the post-maintenance operation time of each winder unit 42 is read from the storage section 41c (step S1). The plurality of winder units 42 are then started up one at a time in order from the winder unit 42 of smaller post-maintenance operation time (step S2).

[0047] In step S2, the plurality of winder units 42 may be started up for every group of winder units 42 in the order of smaller post-maintenance operation time. In the automatic winder 4, the plurality of winder units 42 are sequentially started up for one or every group of winder units 42, but this is because all of the plurality of winder units 42 cannot be started up at the same time due to the limitation for ensuring the pressure of the driving air, and the like.

[0048] The winder control section 41 executes a spinning waiting time stop control (second control) of temporarily stopping some of the plurality of winder units 42 having a large post-maintenance operation time. The stop of the winder unit 42 means having the winding speed at zero. The stop of the winder unit 42 means not performing the operation for forming the package 15.

[0049] The spinning waiting time stop control is executed during the operation of the automatic winder 4. In the spinning waiting time stop control, for example, as illustrated in FIG. 4B, operation information indicating the operation state of the spinning machine 3 is acquired from the spinning machine 3 in a wired or wireless manner (step S11). The operation information includes a doffing waiting time, which is a time until the spinning machine 3 doffs the next yarn supplying bobbin 11. The operation information may include information on whether the spinning machine 3 is operating or stopping. The information on stopping may include a state in which the operation is stopped to wait for the replacement of the bobbin, and a state in which the operation is stopped due to malfunction. The operation information may include offline information indicating that communication cannot be made with the spinning machine 3. The operation information may include an operation efficiency in the spinning machine 3, a production amount of the yarn, a time stopped for malfunction, and the like, by way of example.

[0050] After step S11, the spinning waiting time, which is a standby time until the spinning machine 3 can supply the yarn supplying bobbin 11 to the automatic winder 4 next, is calculated based on the acquired operation information (step S12). The spinning waiting time can be calculated based on, for example, at least one of doffing waiting time included in the operation information, time necessary to wind the yarn supplying bobbin 11 in the spinning machine 3, and time the spinning machine 3 is stopped for malfunction.

[0051] After step S12, whether or not the spinning waiting time is greater than or equal to a constant time (predetermined time) defined in advance) is determined (step S13). When YES in step S13, the post-maintenance operation time of each winder unit 42 is read from the storage section 41c (step S14). Some of the plurality of wind-

er units 42 with long post-maintenance operation time are stopped (temporarily stopped) (step S15). In step S15, the number and stopping time of the winder units 42 to be temporarily stopped may be determined according to the spinning waiting time, may be defined in advance, may be fixed values, or may be variable values that vary according to the spinning waiting time. The number and stopping time of the winder units 42 to be temporarily stopped are determined such that the production amount of the automatic winder 4 and the production amount of the spinning machine 3 are balanced (not greatly diverged). The high-order N (N is a predetermined integer) winder units 42 with long post-maintenance operation time may be temporarily stopped.

[0052] When the temporarily stopped winder units 42 are returned (restarted) from the temporarily stopped state (YES in step S16) or when NO in step S13, the process returns to step S11 to continue the process.

[0053] Therefore, the automatic winder 4 controls at least either of the startup and the stop of the plurality of winder units 42 based on the post-maintenance operation time. Thus, the plurality of winder units 42 can be controlled so that a winder unit 42 operating in excess of the limit operation amount does not exist in the next maintenance. As a result, the lowering of the quality and part performance can be suppressed, and the reliability can be enhanced. When performing the maintenance related to regular maintenance in the automatic winder 4, maintenance without excess or deficiency can be realized even if a common (one) maintenance period is adopted in the plurality of winder units 42. The period of maintenance does not need to be adjusted or set for every winder unit 42.

[0054] In the automatic winder 4, the post-maintenance operation time is adopted as the operation amount of the winder unit 42 from when the last maintenance had been performed immediately before. At least either of the startup and the stop of the plurality of winder units 42 can be controlled using the post-maintenance operation time.

[0055] In the automatic winder 4, the winder control section 41 controls at least either of the startup and the stop of the plurality of winder units 42 so that the post-maintenance operation time of the plurality of winder units 42 is equalized. In such a configuration, in the maintenance, the existence of not only a winder unit 42 operating in excess of the limit operation amount but also a winder unit 42 having excessive margin until the limit operation amount can be avoided. The lowering in the quality and the part performance can be avoided, and the excessive maintenance can be reduced. The usage period of the part can be extended by extending the period of maintenance.

[0056] In the automatic winder 4, the winder control section 41 executes the startup control of starting up the plurality of winder units 42 in the order of small post-maintenance operation time. According to the execution of the startup control, the winder unit 42 with smaller post-maintenance operation time is preferentially started up.

The post-maintenance operation time of the plurality of winder units 42 can be equalized.

[0057] In the automatic winder 4, the winder control section 41 calculates the spinning waiting time of the plurality of winder units 42 based on the operation information of the spinning machine 3. When the spinning waiting time is greater than or equal to a predetermined time, the spinning waiting time stop control of temporarily stopping some winder units 42 with large operation amount of the plurality of winder units 42 is executed. In this case, in the spinning waiting time stop control, a winder unit 42 with long post-maintenance operation time is preferentially stopped when the spinning waiting time is greater than or equal to a predetermined time. The operation amounts of the plurality of winder units 42 can be equalized using the spinning waiting time.

[0058] In the maintenance of long performing interval, sufficient margin is often taken into consideration until the limit operation amount, and even if each operation amount of the plurality of winder units 42 varies, a winder unit 42 operating in excess of the limit operation amount is less likely to exist. In the maintenance of short performing interval, on the other hand, there is a high possibility a winder unit 42 operating in excess of the limit operation amount exists for opposite reasons from the maintenance of long performing interval.

[0059] With regards to this, the target maintenance of the automatic winder 4 includes at least one of the lubrication, cleaning, and part replacement of the cradle 43a, or at least one of the lubrication and cleaning in the yarn joining device 48. In this case, the operation effects described above in which the reliability can be enhanced are effective as the performing interval of the maintenance is relatively short.

[0060] One embodiment has been described above, but the present invention is not limited to the above embodiment.

[0061] In the embodiment described above, the operation amount of the winder unit 42 from the last maintenance immediately before is not limited to the post-maintenance operation time. The operation amount may include, in place of or in addition to the post-maintenance operation time, for example, at least either of the number of operations of the winder unit 42, and the number of yarn joining operations of the yarn joining device 48 of the winder unit 42.

[0062] In other words, the operation amount of the winder unit 42 merely needs to include at least one of the operation time (post-maintenance operation time) and the number of operations (number of post-maintenance operations). The number of operations (number of post-maintenance operations) is preferably a number of operations (number of post-maintenance operations) of a predetermined device, a predetermined area, or a predetermined operation mechanism counted after the previous predetermined maintenance had been performed.

[0063] The operation amount of the winder unit 42 may

be an operation amount related to one predetermined maintenance or may be an operation amount related to a plurality of predetermined maintenances.

[0064] When a target operation amount of the control (equalization) of the present invention is an operation amount related to one predetermined maintenance, one value is preferably stored for every winder unit 42 as the operation amount in the storage section 41c. The winder control section 41 preferably controls at least one of the startup and the stop of the winding unit based on the stored operation amount.

[0065] When a target operation amount of the control (equalization) of the present invention is an operation amount related to a plurality of predetermined maintenances, a plurality of values are preferably stored for every winder unit 42 as the operation amount in the storage section 41c. The operation amount is preferably stored for every type of maintenance with respect to each winder unit 42.

[0066] The winder control section 41 preferably extracts one arbitrary type of operation amount for every winder unit from the stored plurality of types of operation amounts. For example, the winder control section 41 calculates a varying amount among the winder units 42 for every operation amount based on the stored plurality of types of operation amounts, specifies the type of maintenance having the largest variation, and extracts the operation amount of the maintenance as the control operation amount for every winder unit 42.

[0067] Furthermore, the winder control section 41 may extract the control operation amount (e.g., total operation amount) for every winder unit 42 from the stored plurality of types of operation amounts based on a predetermined equation.

[0068] The winder control section 41 preferably controls at least one of the startup and the stop of the winder unit 42 based on the extracted or calculated one value for every winder unit 42.

[0069] The operation amount stored in the storage section 41c is preferably reset after the previous predetermined maintenance is performed.

[0070] Thus, in the embodiment described above, the operation amount (post-maintenance operation amount) of the winder unit 42 from the last maintenance performed immediately before may be assumed as the operation amount for every device mounted on each winder unit 42, every predetermined area of each winder unit 42, or every predetermined operation mechanism of each winder unit 42. The storage section 41c may store at least one of each operation time and each number of operations of a predetermined device, a predetermined area, and a predetermined operation mechanism, as the post-maintenance operation amount of each winder unit 42. In this case, for example, as will be described below, the control with respect to the variation in the operation amount for every device, area and operation mechanism mounted on the winder unit 42 may be carried out by the winder control section 41.

1) When the worker selects the target

[0071] The target is a predetermined device, a predetermined area, or a predetermined operation mechanism (e.g., yarn joining device 48, cradle lifter, etc.), or a predetermined operation (e.g., yarn joining operation, upper yarn finding operation, replacement of yarn supplying bobbin 11, etc.). The automatic winder 4 is configured such that the worker can select one or a plurality of arbitrary devices, areas, operation mechanisms, or operations (e.g., so as to include a selection input section). When selecting plurals, it is preferable to be able to set priorities. The priority of the operation amount to suppress the variation of a plurality of types of devices, and the like can be set. The stop control of temporarily stopping the winder unit is carried out from a winder unit 42 of a large operation amount of the arbitrary device, area, operation mechanism, or operation selected by the worker. Alternatively, the startup control of sequentially starting up from a winder unit 42 of small operation amount of the selected device, area, operation mechanism, or operation is carried out. The upper yarn finding operation is the operation of picking out the yarn end of the yarn 14 wound into the package 15 with the first yarn catching device 46, and the like.

2) When automatically selecting the target

[0072] The winder control section 41 obtains an in-machine standard deviation of the operation amount of each device, area, or operation mechanism, and assumes the device, area, and operation mechanism in which the variation of the operation amount is large among the winder units 42 as the target. Alternatively, the winder control section 41 obtains the total operation amount (information relating to operation amount) for every winder unit 42 based on a predetermined equation from the operation amount for every device, area, and operation mechanism in each winder unit 42 and the operation amount for every operation, and carries out the stop control of temporarily stopping the winder unit from a winder unit 42 in which the obtained total operation amount is large. Alternatively, the startup control of sequentially starting up from a winder unit 42 in which the obtained total operation amount is small is carried out.

[0073] In the embodiment described above, the winder control section 41 includes the storage section 41c, but where the storage section 41c is located is not particularly limited. For example, the high-order control section configured to communicate with the automatic winder 4 may include the storage section 41c.

[0074] In the embodiment described above, the automatic winder 4 is applied as the yarn winding machine, but the yarn winding machine according to the present invention is not limited to the automatic winder 4. A textile machine (e.g., pneumatic spinning machine and open end spinning machine) in which a plurality of winding units having the same configuration are set but each winding

unit does not operate in the same manner may be applied as the yarn winding machine. In the embodiment described above, in a case where the automatic winder 4 has a configuration of not being coupled with the spinning machine 3 by way of the bobbin transferring device 5, that is, in a case where the yarn supplying bobbin 11 is manually transferred from the spinning machine 3 to the automatic winder 4, only the startup control described above may be performed.

[0075] An automatic winder (4) includes a plurality of winder units (42) adapted to wind a yarn (14) to form a package (15), a storage section (41c) adapted to store a post-maintenance operation time, which is an operation time from when a simultaneous maintenance is performed immediately before, for each of the plurality of winder units (42), and a winder control section (41) adapted to control at least either of startup and stop of the plurality of winder units (42) based on the post-maintenance operation time stored in the storage section (41c).

Claims

1. A yarn winding machine (4) comprising:
 - a plurality of winding units (42) adapted to wind a yarn (14) to form a package (15); **characterized by**
 - a storage section (41c) adapted to store information relating to an operation amount from when a last predetermined maintenance targeting on the plurality of winding units (42) had been performed immediately before for each of the plurality of winding units (42); and
 - a control section (41) adapted to control at least either of startup and stop of the plurality of winding units (42) based on the information stored in the storage section (41c).
2. The yarn winding machine (4) according to claim 1, wherein the operation amount includes at least either of an operation time and a number of operations.
3. The yarn winding machine (4) according to claim 1 or 2, wherein the control section (41) controls at least either of the startup and the stop of the plurality of winding units (42) so that the operation amounts of the plurality of winding units (42) are equalized.
4. The yarn winding machine (4) according to claim 3, wherein the control section (41) executes a first control of starting up the plurality of winding units (42) in an order of small operation amount.
5. The yarn winding machine (4) according to claim 3 or 4, wherein the control section (41) executes a second control of temporarily stopping some winding units (42) having a large operation amount of the plurality of winding units (42).
6. The yarn winding machine (4) according to claim 5, wherein the winding unit (42) is a winder unit (42) adapted to wind the yarn (14) from a yarn supplying bobbin (11) transferred from a spinning machine (3) by way of a bobbin transferring device (5) to form the package (15); and the control section (41) calculates a spinning waiting time of the plurality of winder units (42) based on operation information of the spinning machine (3), and executes the second control when the spinning waiting time is greater than or equal to a predetermined time.
7. The yarn winding machine (4) according to any one of claims 1 to 6, wherein the predetermined maintenance is a maintenance performed at a same timing among the plurality of winding units (42); and the predetermined maintenance includes at least one of a regular maintenance that is repeatedly performed periodically and an irregular maintenance that is performed at a time of occurrence of abnormality or at a time of predicting abnormality.
8. The yarn winding machine (4) according to any one of claims 1 to 7, wherein the winding unit (42) includes a cradle (43a) adapted to support the package (15); and the predetermined maintenance includes at least one of lubrication, cleaning, and part replacement of the cradle (43a).
9. The yarn winding machine (4) according to any one of claims 1 to 8, wherein the winding unit (42) includes a yarn joining device (48) adapted to carry out a yarn joining process; and the predetermined maintenance includes at least one of lubrication and cleaning of the yarn joining device (48).
10. A method of operating a yarn winding machine (4) comprising:
 - a plurality of winding units (42) winding a yarn (14) to form a package (15); **characterized by** the following steps:
 - storing information relating to an operation amount from when a last predetermined maintenance targeting on the plurality of winding units (42) had been performed immediately before for each of the plurality of winding units (42); and
 - controlling at least either of startup and stop of the plurality of winding units (42) based on the information stored in the storage section (41c).

11. The method according to claim 10, wherein the operation amount includes at least either of an operation time and a number of operations.
12. The method according to claim 10 or 11, **characterized by** controlling at least either of the startup and the stop of the plurality of winding units (42) so that the operation amounts of the plurality of winding units (42) are equalized. 5
13. The method according to claim 12, **characterized by** executing a first control of starting up the plurality of winding units (42) in an order of small operation amount. 10
14. The method according to claim 12 or 13, **characterized by** executing a second control of temporarily stopping some winding units (42) having a large operation amount of the plurality of winding units (42). 15
15. The method according to claim 14, wherein the winding unit (42) is a winder unit (42) winding the yarn (14) from a yarn supplying bobbin (11) transferred from a spinning machine (3) by way of a bobbin transferring device (5) to form the package (15); **characterized by** calculating a spinning waiting time of the plurality of winder units (42) based on operation information of the spinning machine (3), and executing the second control when the spinning waiting time is greater than or equal to a predetermined time. 20
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FIG. 1

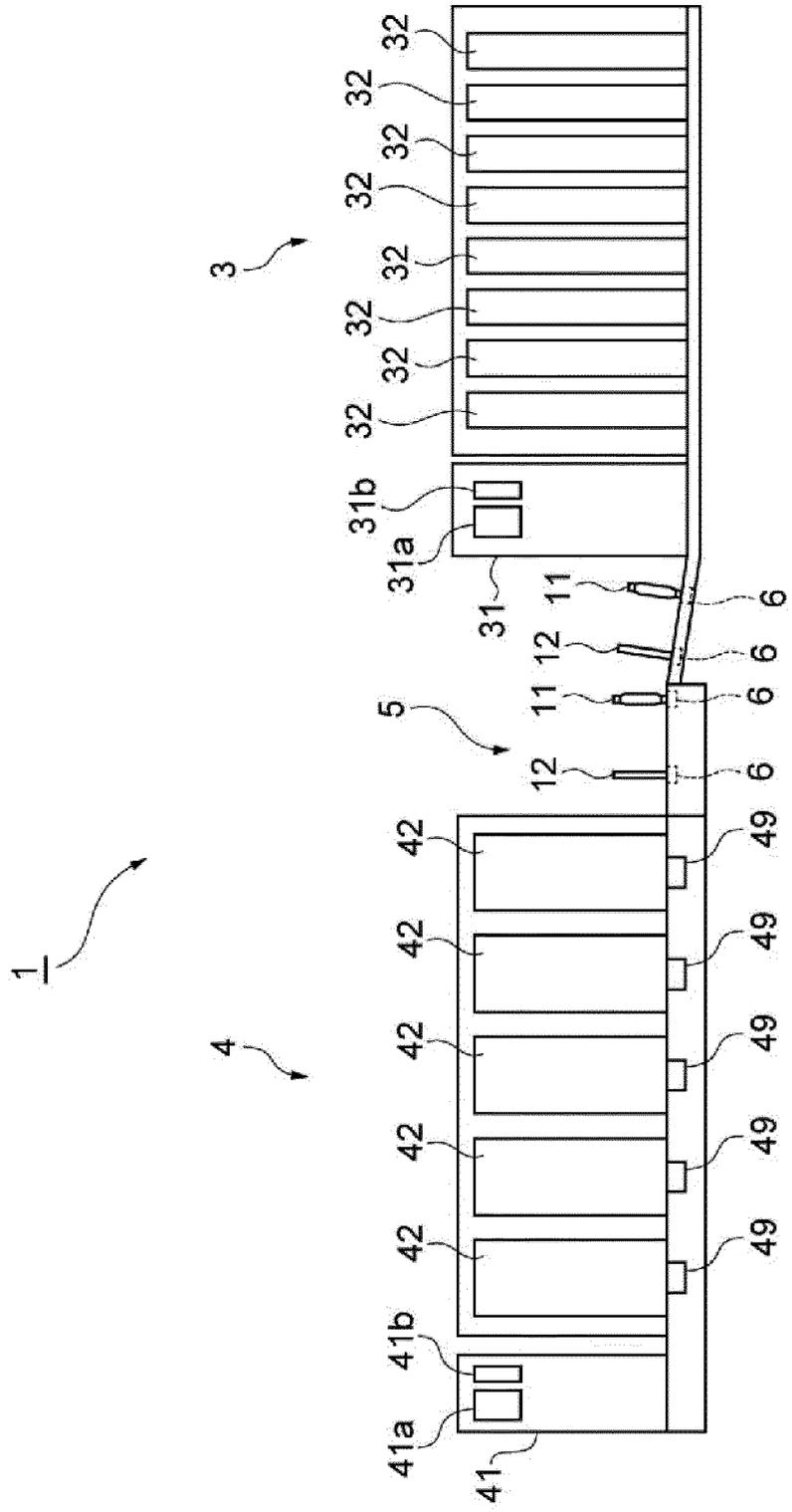


FIG. 2

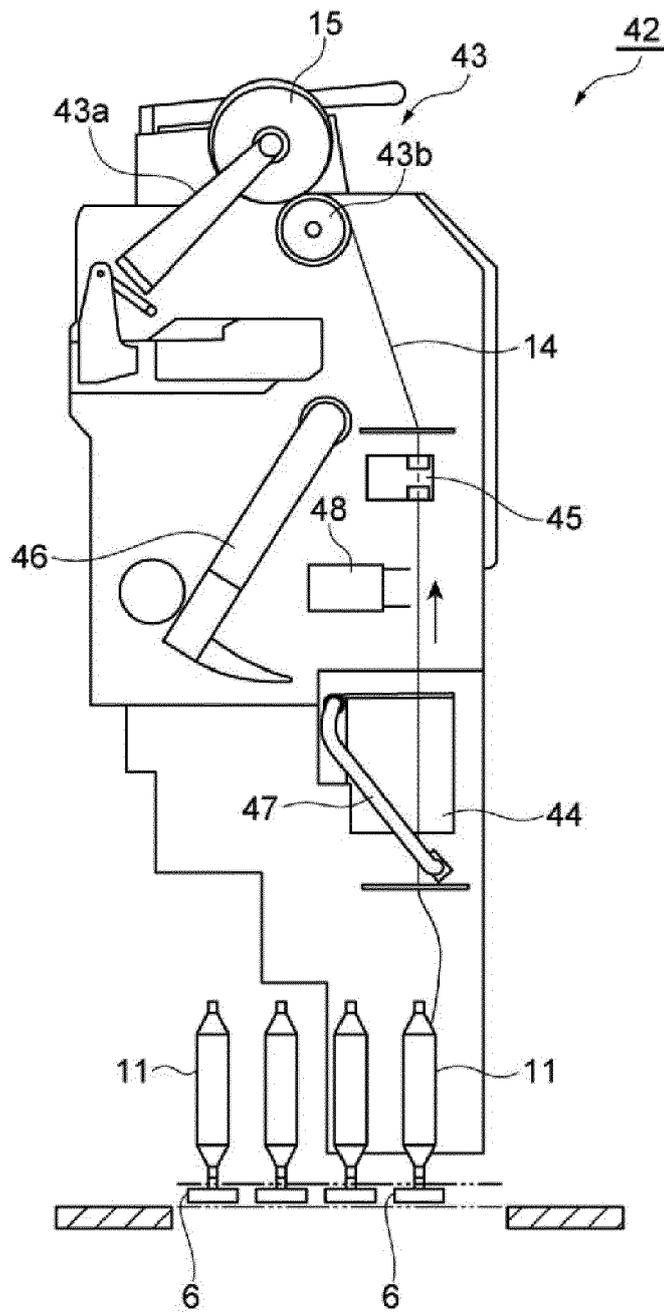


FIG. 3

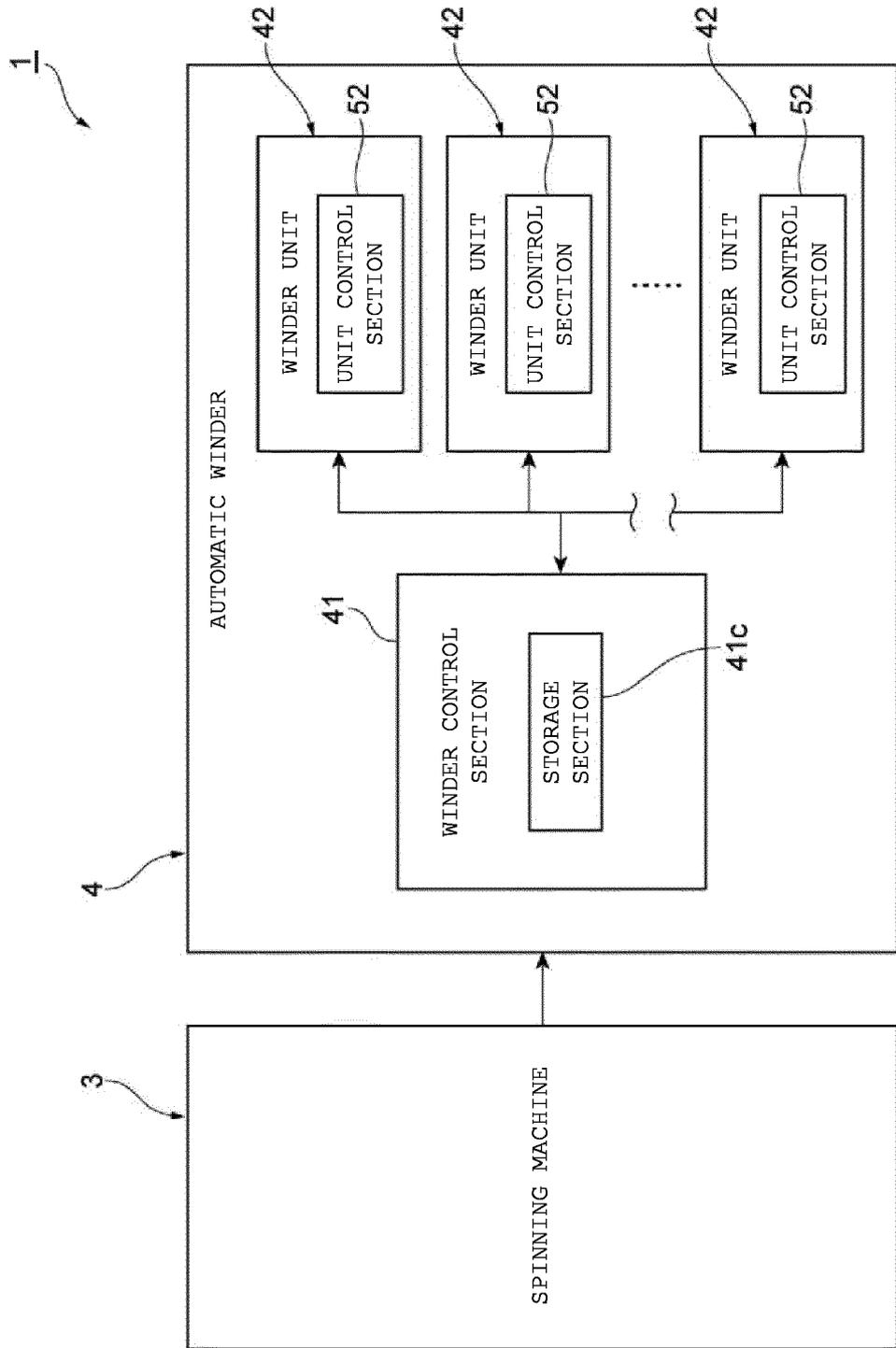


FIG. 4A

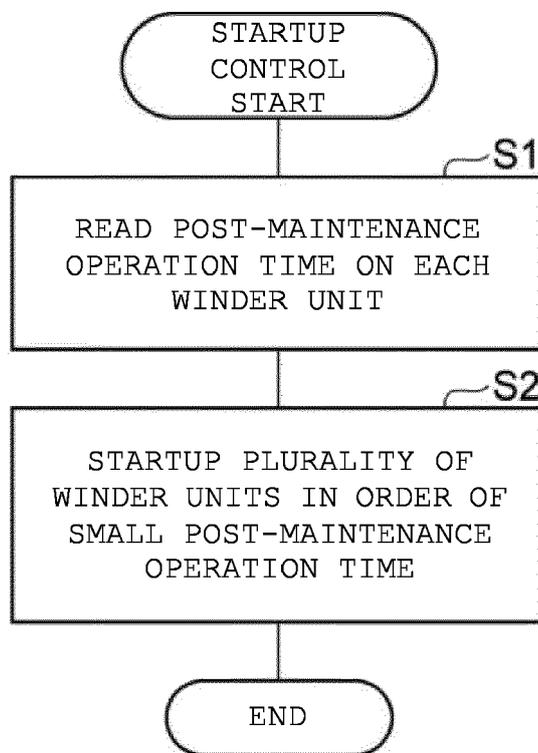
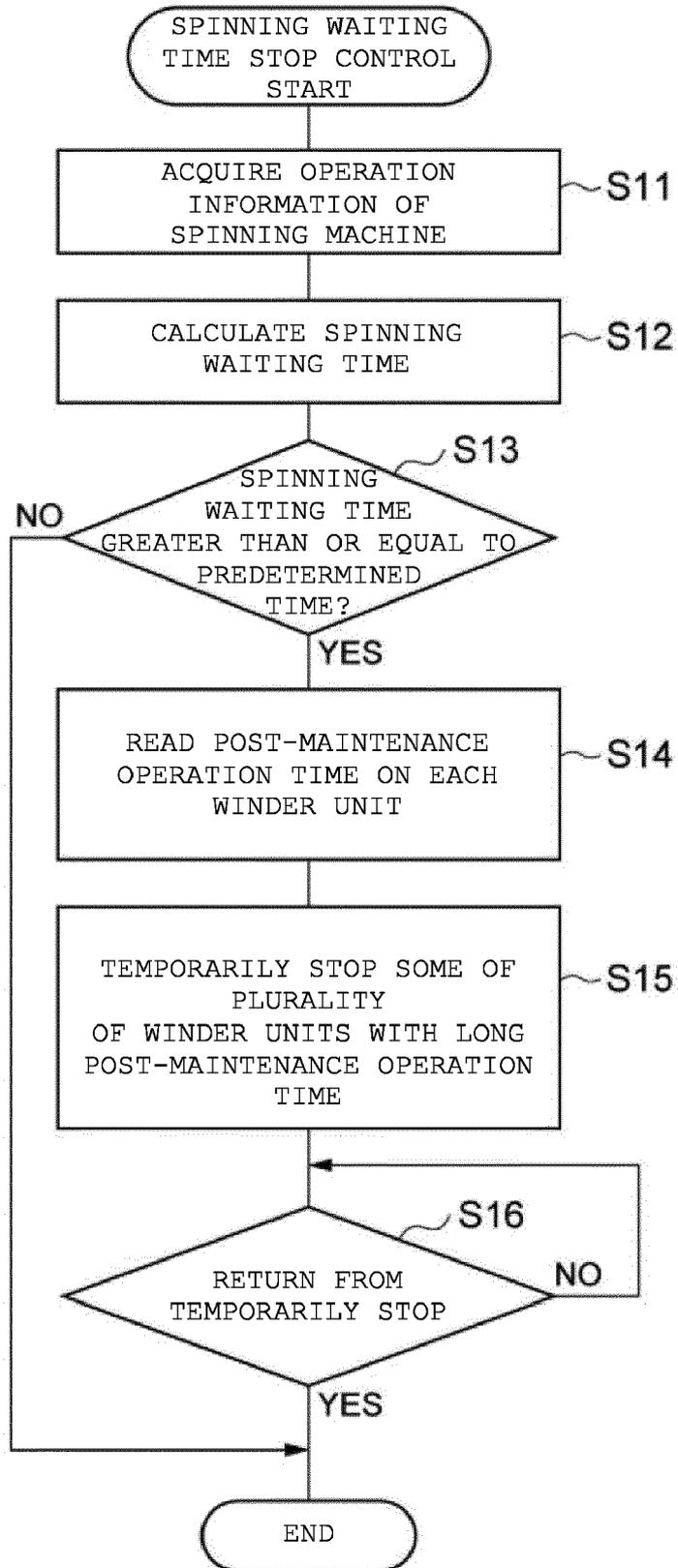


FIG. 4B





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Place of search The Hague		Date of completion of the search 21 June 2019	Examiner Lemmen, René
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