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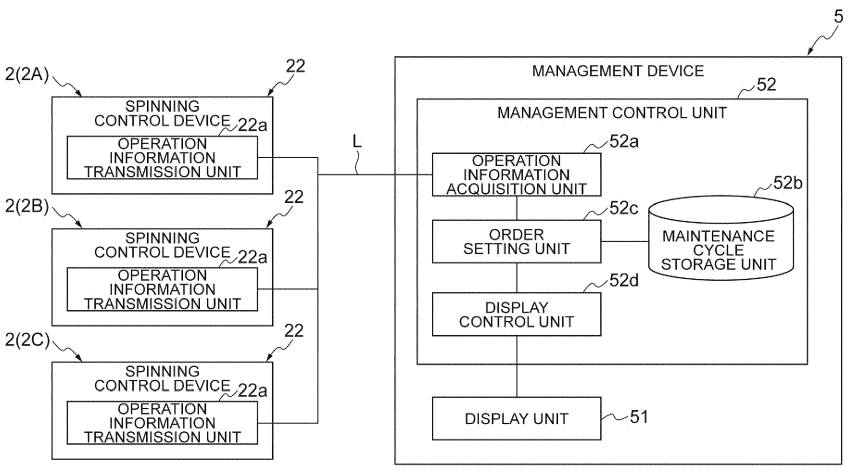
(54) MAINTENANCE ORDER ADJUSTMENT SYSTEM AND METHOD FOR TEXTILE MACHINERY TECHNICAL FIELD

(57) A maintenance order adjustment system (1) for textile machinery includes: one or more first textile machines (2, 2A, 2B, 2C) each configured to perform a first process on a first fiber assembly, a plurality of second textile machines (3, 3A, 3B, 3C) each configured to be supplied with a second fiber assembly (B) subjected to the first process by the first textile machine (2, 2A, 2B, 2C) and perform a second process on the supplied second fiber assembly (B) to generate a third fiber assembly (P) ; an operation information acquisition unit (52a) configured to acquire operation information representing an operation state of the first textile machine (2, 2A, 2B, 2C) ; an order setting unit (52c) configured to determine a maintenance order in performing maintenance on the second textile machines (3, 3A, 3B, 3C) based on a preset order and adjust the determined maintenance order based on the operation information acquired by the operation information acquisition unit (52a); and a presentation unit (51) configured to present the maintenance order adjusted by the order setting unit (52c).

Fig.2



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a maintenance order adjustment system for textile machinery.

BACKGROUND

[0002] There exists a system including textile machinery that generates a fiber assembly. For example, Patent Literature (Japanese Unexamined Patent Publication No. H1-183530) describes a system including a plurality of spinning frames configured to generate yarn and a plurality of auto winders configured to wind yarn, as textile machinery that generates yarn as a fiber assembly.

SUMMARY

[0003] In the system including textile machinery that generates a fiber assembly as described above, it is necessary to perform maintenance such as oiling for individual textile machines. For example, in a step of generating a fiber assembly, when maintenance of a textile machine in a subsequent step is performed, the operation states of a textile machine in the subsequent step may affect the operation of the textile machine in a previous step.

[0004] It is noted that the previous step is not limited to a step immediately before the subsequent step (a step one step before the subsequent step) but includes a step two or more steps before the subsequent step. Therefore, when maintenance is performed on a plurality of textile machines in a subsequent step, it is requested to perform maintenance of the textile machines in a subsequent step while suppressing the effects on the operation of a textile machine in a previous step.

[0005] The present disclosure is thus aimed to provide a maintenance order adjustment system for textile machinery that can adjust and present the maintenance order for the plurality of textile machines in a subsequent step according to the operation state of a textile machine in a previous step.

[0006] A maintenance order adjustment system for textile machinery in the present disclosure includes: one or more first textile machines each configured to perform a first process on a first fiber assembly; a plurality of second textile machines each configured to be supplied with a second fiber assembly subjected to the first process by the first textile machine and perform a second process on the supplied second fiber assembly to generate a third fiber assembly; an operation information acquisition unit configured to acquire operation information representing an operation state of the first textile machine; an order setting unit configured to determine a maintenance order in performing maintenance on the second textile machines based on a preset order and adjust the determined maintenance order based on the operation information acquired by the operation information acquisition unit; and a presentation unit configured to present the maintenance order adjusted by the order setting unit.

[0007] In this maintenance order adjustment system for textile machinery, the maintenance order of the plurality of second textile machines in a subsequent step can be adjusted and then presented according to the operation state of the first textile machine in a previous step. The maintenance worker therefore can perform maintenance of the second textile machines according to the presented maintenance order, whereby maintenance of the second textile machines can be performed while the effects on the operation state of the first textile machine are suppressed. It should be noted that the first textile machine is not limited to the textile machine that is used in the step immediately prior to the second textile machines, but may be the textile machine that is used in the step two or more steps before the second textile machines.

[0008] The order setting unit may repeatedly perform each of determination of a maintenance order of the second textile machines based on a preset order and adjustment of the determined maintenance order based on the operation information, every predetermined cycle. Thus, the order setting unit can repeatedly perform determination and adjustment of the maintenance order.

[0009] The order setting unit may perform adjustment of the maintenance order based on the operation information, every cycle shorter than a cycle of determination of a maintenance order based on a preset order. Thus, even when the operation state of the spinning frame continuously changes, the order setting unit can adjust the maintenance order according to a change in operation state.

[0010] The maintenance order adjustment system for textile machinery includes a plurality of the first textile machines, and one or more of the second textile machines may be associated as a supply destination of the second fiber assembly with one of the first textile machines. The order setting unit may calculate a supply waiting time based on the operation information, the supply waiting time being a time taken for the first textile machine to supply the second fiber assembly to the second textile machine next time. When the maintenance order is adjusted, the order setting unit may adjust the maintenance order such that maintenance of the second textile machine associated with the first textile machine with the supply waiting time equal to or longer than a predetermined time is preferentially performed. For example, when the supply waiting time is long, suspending the second textile machine during this time and performing maintenance has small effects on the operation of the first textile machine in the previous step. Therefore, the maintenance order is adjusted such that maintenance of the second textile machine associated with the first textile machine with the supply waiting time equal to or longer than a predetermined time is preferentially performed, whereby the effects on the operation of the first textile machine in the previous step can be suppressed even

when the second textile machine is suspended and maintenance is performed.

[0011] The order setting unit may further calculate a margin time that allows the second textile machine to be suspended for performing maintenance of the second textile machine, based on the supply waiting time. The presentation unit may further present the margin time calculated by the order setting unit. In this case, the maintenance worker can grasp the margin time in performing maintenance.

[0012] When there exists a plurality of maintenance contents to be performed on the second textile machine, the order setting unit may adjust the maintenance order such that a maintenance content to be finished within the supply waiting time is preferentially performed. Thus, the effects on the operation of the first textile machine can be suppressed even when maintenance of the second textile machine is performed.

[0013] The order setting unit may further adjust the maintenance order based on a present location of a maintenance worker. This enables the maintenance worker to perform maintenance tasks efficiently.

[0014] The presentation unit may further present maintenance contents of maintenance to be performed on the second textile machine. In this case, the maintenance worker can grasp the maintenance contents and the margin time. This enables the maintenance worker to determine whether maintenance can be performed within the margin time and then perform maintenance.

[0015] Based on an instruction from a maintenance worker, the presentation unit may sort presentation items to be presented, according to a predetermined rule. This enables the maintenance order adjustment system for textile machinery to perform a wide variety of assistance in the determination and the maintenance tasks of the maintenance worker.

[0016] The first textile machine may be a spinning frame configured to generate yarn from the first fiber assembly and wind the generated yarn to generate a yarn supply bobbin as the second fiber assembly. The second textile machine may be an auto winder configured to wind yarn from the yarn supply bobbin to generate a package as the third fiber assembly. For example, in a system including spinning frames and auto winders, the spinning frames may be a rate-determining step for the production capacity of the entire system. In such a case, it is not preferable that the maintenance task on the auto winder affects the operation of the spinning frame (suspend the process), in terms of production capacity. The maintenance order of the auto winders is then determined based on the operation state of the spinning frames, thereby suppressing reduction in production capacity of the entire system.

[0017] The plurality of spinning frames and the plurality of auto winders may be provided. One auto winder may be associated as a supply destination of the yarn supply bobbin with one spinning frame.

[0018] According to the present disclosure, the maintenance order for the plurality of textile machines in a subsequent step can be adjusted and presented according to the operation state of a textile machine in a previous step.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is a diagram showing a schematic configuration of a maintenance order adjustment system according to an embodiment.

FIG. 2 is a block diagram showing a functional configuration around a management control unit that performs a maintenance order-presenting process.

FIG. 3 is a diagram showing a display screen example on a display unit.

FIG. 4A is a diagram showing a display screen example on the display unit.

FIG. 4B is a diagram showing a display screen example on the display unit.

FIG. 5 is a flowchart showing the maintenance order-presenting process performed in the management control unit.

FIG. 6 is a diagram showing an overall configuration of a maintenance order adjustment system according to a modification.

FIG. 7 is a diagram showing an overall configuration of a maintenance order adjustment system according to another modification.

DETAILED DESCRIPTION

[0020] Embodiments of the present disclosure will be described below with reference to the drawings. The same elements are denoted by the same reference signs in the drawings, and an overlapping description will be omitted.

[0021] A maintenance order adjustment system in the present embodiment is a system configured to adjust the maintenance order of textile machines that process a fiber assembly. The fiber assembly refers to a textile product or a textile material such as yarn, sliver, rover, lap, web, fabric, and knit fabric. The fiber assembly may refer to a rover bobbin formed by winding rover, and a yarn supply bobbin or a package formed by winding yarn. In the present embodiment, as the process for a fiber assembly, a process of generating yarn from rover, winding the generated yarn to form (generate) a yarn supply bobbin, and winding the yarn on the yarn supply bobbin again to form (generate) a package will be described. As shown in FIG. 1, the maintenance order adjustment system (maintenance order adjustment system for textile machinery) 1 includes a plurality of spinning frames (first textile machines) 2, a plurality of auto winders (second textile machines) 3, and a management device 5. In the present embodiment, three spinning frames 2 and three auto winders 3 are provided. The number of spinning frames

2 and the number of auto winders 3 are not limited to three each.

[0022] The spinning frame 2 performs a process of generating yarn. The spinning frame 2 includes a plurality of spinning units 21 and a spinning control device 22. The spinning unit 21 performs a process (first process) of generating yarn from rover and winding the generated yarn to form a yarn supply bobbin (second fiber assembly) B. The spinning unit 21 is supplied with a rover bobbin (first fiber assembly) formed by winding rover in a not-illustrated roving frame. The spinning control device 22 controls the operation of the plurality of spinning units 21.

[0023] Here, the spinning frame 2 is of a simultaneous doffing type. Specifically, the spinning frame 2 stocks a plurality of empty bobbins transferred from a winder unit 31 by a bobbin transfer device 33, simultaneously sets the empty bobbins on the respective spinning units 21, and simultaneously starts yarn winding. When winding of yarn has been completed in the respective spinning units 21 and yarn supply bobbins B have been formed, the spinning frame 2 simultaneously doffs all of the yarn supply bobbins B. Subsequently, the spinning frame 2 pulls empty bobbins that have been already stocked out of corresponding trays 33a and simultaneously sets the empty bobbins on the respective spinning units 21 again and, instead, simultaneously sets the doffed yarn supply bobbins B on the trays 33a.

[0024] The auto winder 3 is supplied with a yarn supply bobbin B from the spinning frame 2 and performs a process (second process) of winding yarn from the supplied yarn supply bobbin B to form a package (third fiber assembly) P. The auto winder 3 includes a plurality of winder units 31, a winder control device 32, and a bobbin transfer device 33. The bobbin transfer device 33 transfers the yarn supply bobbin B set on the tray 33a to the corresponding winder unit 31.

[0025] The winder unit 31 unwinds yarn from a yarn supply bobbin B to form a package P on which a predetermined length of yarn is wound. The winder control device 32 controls the operation of the plurality of winder units 31 and the operation of the bobbin transfer device 33.

[0026] Here, for convenience of explanation, the three spinning frames 2 are called a spinning frame 2A, a spinning frame 2B, and a spinning frame 2C. Similarly, the three auto winders 3 are called an auto winder 3A, an auto winder 3B, and an auto winder 3C. In the present embodiment, the bobbin transfer device 33 transfers a yarn supply bobbin B received from one spinning frame 2. Specifically, the spinning frames 2 are configured such that one auto winder 3 is associated as a supply destination of a yarn supply bobbin B with one spinning frame 2.

[0027] Specifically, the bobbin transfer device 33 of the auto winder 3A receives a yarn supply bobbin B from the spinning frame 2A and transfers the yarn supply bobbin B to the winder unit 31 of the auto winder 3A. The bobbin transfer device 33 of the auto winder 3B receives a yarn supply bobbin B from the spinning frame 2B and transfers the yarn supply bobbin B to the winder unit 31 of the auto winder 3B. The bobbin transfer device 33 of the auto winder 3C receives a yarn supply bobbin B from the spinning frame 2C and transfers the yarn supply bobbin B to the winder unit 31 of the auto winder 3C.

[0028] The management device 5 is a device configured to manage the spinning frames 2 and the auto winders 3 as a whole. The management device 5 includes a display unit (presentation unit) 51 and a management control unit 52. The management control unit 52 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), and a communication unit. The management control unit 52 loads a program stored in the ROM onto the RAM and executes the program in the CPU using numerical values or others stored in the EEPROM to execute various processes.

[0029] The management control unit 52 can communicate with the spinning control device 22 in each spinning frame 2 and the winder control device 32 in each auto winder 3 through a communication cable L. The management control unit 52 determines a maintenance order in performing maintenance on the plurality of auto winders 3. The display unit 51 is equipment such as a display that can display information. The display unit 51 displays (presents) the maintenance order adjusted by the management control unit 52.

[0030] The spinning frames 2A to 2C and the auto winders 3A to 3C are provided with respective machine numbers for identification. When managing the spinning frames 2 and the auto winders 3 as a whole, the management device 5 can identify the spinning frames 2A to 2C and the auto winders 3A to 3C using the machine numbers.

[0031] The details of a maintenance order-presenting process performed in the management device 5 will now be described. As shown in FIG. 2, the spinning control device 22 of the spinning frame 2 includes an operation information transmission unit 22a. The operation information transmission unit 22a transmits the operation information representing the operation state of its corresponding spinning frame 2 to the management device 5 through the communication cable L.

[0032] Here, the operation information includes a doffing waiting time, which is the time taken for the spinning frame 2 to doff a yarn supply bobbin B next time. The operation information may include information as to whether the spinning frame 2 (spinning unit 21) is in operation or under suspension. The information indicating under-suspension may include a state in which the operation is suspended to wait for replacement of bobbins and a state in which the operation is suspended due to a failure. The operation information may include offline information indicating that communication with the spinning frame 2 fails. Examples of the failure of communi-

cation with the spinning frame 2 include a communication failure due to the power-off of the spinning frame 2 and a communication failure due to a malfunction in the communication cable L, for example. The operation information may include, for example, the operation efficiency in the spinning frame 2, the production volume of yarn, and the duration of suspension due to a failure.

[0033] The management control unit 52 functionally includes an operation information acquisition unit 52a, a maintenance cycle storage unit 52b, an order setting unit 52c, and a display control unit 52d. The operation information acquisition unit 52a acquires the operation information transmitted from the operation information transmission units 22a of the spinning frames 2 through the communication cable L.

[0034] The maintenance cycle storage unit 52b stores the maintenance cycle of the auto winders 3. This maintenance cycle is a cycle of maintenance performed every predetermined cycle preset for the plurality of auto winders 3A to 3C. For example, the maintenance cycle is preset based on the operation hours of the auto winders 3. This maintenance cycle is set for each of the maintenance contents. Specifically, the maintenance contents include, for example, oiling, parts replacement, and cleaning of the parts of the winder unit 31, and oiling, parts replacement, and cleaning of the parts of the bobbin transfer device 33. The maintenance cycle and contents are preset, for example, by the manufacturer of the auto winders 3.

[0035] The order setting unit 52c determines a maintenance timing (the timing for performing maintenance) in performing maintenance on the plurality of auto winders 3A to 3C, based on the maintenance cycle stored in the maintenance cycle storage unit 52b. Here, the order setting unit 52c can set a timing a predetermined period before the timing when the maintenance cycle is reached, as the maintenance timing, so as not to exceed the preset maintenance cycle. The maintenance performed based on the maintenance cycle is hereinafter referred to as "regular maintenance".

[0036] The order setting unit 52c determines a maintenance order in performing regular maintenance on the plurality of auto winders 3A to 3C, based on a preset order. For example, when oiling is to be performed as regular maintenance on the auto winders 3A to 3C, it is necessary to determine a maintenance order to allow a maintenance worker to perform work on the auto winders 3A to 3C in order. For this purpose, the order setting unit 52c determines a maintenance order based on a preset order. Here, the order setting unit 52c can determine a maintenance order, for example, using the machine numbers set for the auto winders 3A to 3B, as the preset order. Alternatively, the order setting unit 52c may determine a maintenance order according to an order other than the machine numbers as the preset order.

[0037] Here, the maintenance of the auto winders 3 includes irregular maintenance in addition to regular maintenance. For example, the irregular maintenance includes maintenance such as oiling, cleaning, or parts replacement for a certain auto winder 3 due to individual differences of the auto winders 3. The information of this irregular maintenance may be input to the management device 5, for example, by the operator of the auto winders 3 or may be input to the management device 5, for example, by the winder control device 32 automatically determining whether irregular maintenance is required. The information of irregular maintenance input to the management device 5 includes the timing for performing irregular maintenance, information as to a section to be subjected to maintenance, and maintenance contents.

[0038] The order setting unit 52c adds irregular maintenance in the maintenance order of regular maintenance, based on the timing for performing irregular maintenance. The maintenance order of maintenance including regular maintenance and irregular maintenance is thus determined by the order setting unit 52c.

[0039] In addition, after determining a maintenance order, the order setting unit 52c adjusts the determined maintenance order, based on the operation information acquired by the operation information acquisition unit 52a. Specifically, the order setting unit 52c calculates a supply waiting time, which is the time taken for each spinning frame 2 to supply a yarn supply bobbin B to each auto winder 3 next time, for each of the spinning frames 2, based on the operation information. The order setting unit 52c calculates the supply waiting time, for example, based on at least one of the doffing waiting time included in the operation information, the time required for winding of the yarn supply bobbin B in the spinning frame 2, and the time during which the spinning frame 2 is suspended due to a failure. As long as the information included in the operation information is used, the order setting unit 52c may calculate the supply waiting time using information other than the doffing waiting time, the time required for winding of the yarn supply bobbin B in the spinning frame 2, and the time during which the spinning frame 2 is suspended due to a failure.

[0040] When the maintenance order is to be adjusted, the order setting unit 52c selects a spinning frame 2 of which calculated supply waiting time is a predetermined time or longer, from among the spinning frames 2A to 2C. The order setting unit 52c adjusts the maintenance order such that maintenance of the auto winder 3 associated with the selected spinning frame 2 as a supply destination of the yarn supply bobbin B is preferentially performed.

[0041] The wording "maintenance is preferentially performed" means that maintenance is performed prior to any other maintenance. More specifically, the maintenance to be preferentially performed is accelerated (advanced), or the maintenance other than the maintenance to be preferentially performed is delayed later than the maintenance to be preferentially performed.

[0042] For example, it is assumed that the maintenance order determined by the order setting unit 52c is the auto winder 3A, the auto winder 3B, and the auto

winder 3C. It is also assumed that the supply waiting time of the spinning frame 2B is a predetermined time or longer, and the supply waiting time of the spinning frames 2A and 2C is shorter than a predetermined time. In this case, since there is time left before a yarn supply bobbin B is supplied from the spinning frame 2B to the auto winder 3B, maintenance of the auto winder 3B is performed during this time, thereby suppressing the effects on the operation of the spinning frame 2B. Thus, the order setting unit 52c adjusts the maintenance order such that maintenance of the auto winder 3B associated with the spinning frame 2B with the supply waiting time equal to or longer than a predetermined time is preferentially performed.

[0043] For example, in the maintenance of the auto winders 3, the plurality of maintenance contents may be performed simultaneously. In this case, when the maintenance order of the auto winders 3 is adjusted based on the supply waiting time, the order setting unit 52c may adjust the maintenance order such that the maintenance content that can be finished within the supply waiting time is preferentially performed.

[0044] For example, it is assumed that the supply waiting time of the spinning frame 2B is a predetermined time or longer. It is also assumed that the maintenance of the auto winder 3B includes the plurality of maintenance contents to be performed simultaneously. In this case, the order setting unit 52c selects a maintenance content that can be finished within the supply waiting time, from among the plurality of maintenance contents for the auto winder 3B. The order setting unit 52c may advance the selected maintenance content so that the selected maintenance content is preferentially performed. Thus, the effects on the spinning frame 2B by performing maintenance of the auto winder 3B can be suppressed.

[0045] For example, the operation information acquisition unit 52a may acquire the operation information of a textile machine (for example, the roving frame) in a step previous to the spinning frame 2. In this case, the order setting unit 52c may adjust the maintenance order of the auto winders 3 based on the operation information of the textile machine in the step previous to the spinning frame 2, instead of the operation state of the spinning frame 2. For example, when the roving frame is suspended for a long time, it can be predicted that the spinning frame 2 will be suspended to wait for supply of rover, although the spinning frame 2 is in operation at the present moment. For example, when it is predicted that the spinning frame 2B will be suspended in a short time, the order setting unit 52c may postpone (delay) the maintenance timing of the auto winder 3B so that performing maintenance of the auto winder 3B does not suspend the operation of the spinning frame 2B. For example, the order setting unit 52c may adjust the maintenance timing of the auto winder 3B such that the maintenance timing of the auto winder 3B overlaps the timing when the spinning frame 2B is suspended, as the timing at which performing maintenance of the auto winder 3B does not suspend the spinning frame 2B. It is noted that when the maintenance timing of the auto winder 3 is postponed, the order setting unit 52c sets the timing so as not to exceed the preset maintenance cycle.

[0046] In addition, the order setting unit 52c further calculates a margin time that allows the auto winder 3 to be suspended for performing maintenance, based on the supply waiting time included in the operation information. For example, the order setting unit 52c may set the supply waiting time as a margin time, or the time obtained by adding or subtracting a predetermined time to or from the supply waiting time as a margin time. The order setting unit 52c may determine a margin time based on the supply waiting time and information other than the supply waiting time. Furthermore, the order setting unit 52c may determine a margin time based on information other than the supply waiting time (for example, information as to whether the spinning frame 2 is in operation or under suspension), rather than using the supply waiting time included in the operation information.

[0047] The order setting unit 52c repeatedly performs determination of a maintenance order of regular and irregular maintenance of the auto winders 3 and adjustment of the maintenance order based on the operation state of the spinning frames 2, every predetermined cycle. The order setting unit 52c may perform determination of a maintenance order of the auto winders 3 and adjustment of the maintenance order based on the operation state of the spinning frames 2 in the same cycle or in different cycles. The operation state of the spinning frames 2 continuously changes. Therefore, the order setting unit 52c may perform adjustment of the maintenance order based on the operation state of the spinning frames 2 every predetermined cycle (for example, within 10 minutes) shorter than the cycle of determination of a maintenance order of the auto winders 3.

[0048] The order setting unit 52c creates schedule data that associates the determined maintenance timing, the machine number to be subjected to maintenance, the maintenance order, the maintenance contents, the margin time, and the like. The order setting unit 52c updates the schedule data, for example, every time the maintenance order of the auto winders 3 is adjusted.

[0049] The display control unit 52d converts the schedule data created by the order setting unit 52c into a predetermined format to be displayed on the display unit 51. Every time the schedule data is updated in the order setting unit 52c, the display control unit 52d updates the display on the display unit 51. The maintenance worker can view the display unit 51 to grasp, for example, the maintenance order in performing maintenance on the plurality of auto winders 3.

[0050] For example, the display control unit 52d converts the schedule data into a calendar display format as shown in a screen example SC1 in FIG. 3 to be displayed on the display unit 51. The screen example SC1 in FIG. 3 shows, for example, schedule data in March as of March 3. In this example, it is shown that there are six

maintenance tasks to be performed on March 12, 20XX, and there are three maintenance tasks to be performed on March 13. In this case, the maintenance worker can grasp the number and the date of maintenance processes to be performed.

[0051] Also in the screen example SC1 shown in FIG. 3, the maintenance order adjusted by the order setting unit 52c based on the operation state of the spinning frame 2 is reflected. The maintenance order adjusted by the order setting unit 52c is reflected, for example, in a case where the maintenance task originally scheduled to be performed on March 13 based on the maintenance cycle is changed to March 12 based on the operation state of the spinning frame 2.

[0052] For example, the display control unit 52d can convert the schedule data into a table format as shown in a screen example SC2 in FIG. 4A and a screen example SC3 in FIG. 4B to be displayed on the display unit 51. The screen example SC2 shown in FIG. 4A depicts the details of maintenance items to be performed on a certain date (here, March 12). The screen example SC3 shown in FIG. 4B depicts all the maintenance items to be performed in March. The screen example SC2 in FIG. 4A and the screen example SC3 in FIG. 4B depict the maintenance items as of March 3, in the same manner as the screen example SC1 shown in FIG. 3. These tables include the machine numbers of auto winders 3 to work on, maintenance sections (places), maintenance contents, and margin time. The maintenance tasks in the tables of the screen examples SC2 and SC3 are arranged in the maintenance order adjusted by the order setting unit 52c. The maintenance worker can view this table to grasp the maintenance order of the auto winders 3 determined based on the operation state of the spinning frame 2.

[0053] The display formats of schedule data shown in these screen samples SC1 to SC3 may be switched, for example, through switching operation by the maintenance worker. The maintenance worker may give an instruction for switching the display formats, for example, using a touch panel superimposed on the display unit 51 or may give an instruction for switching the display formats, for example, using a switch provided at a section different from the display unit 51. For example, the screen example SC2 shown in FIG. 4A may be displayed by touching the portion "March 12" in the calendar display format shown in the screen example SC1 in FIG. 3.

[0054] As shown in FIG. 4A and FIG. 4B, when the schedule data is displayed in a table format, the display control unit 52d may have the sorting function of sorting the display items (machine numbers, places, maintenance contents, and margin time) according to a predetermined rule. The sorting of the display can be performed based on an instruction from the maintenance worker.

[0055] For example, when a large number of spinning frames 2, auto winders 3, etc. are installed and the factory where they are installed is large, it takes time for the maintenance worker to move between machines and between units. In such a case, the maintenance worker, for example, sorts the maintenance items in the order of machine numbers thereby performing maintenance tasks efficiently in order from the one closest to the present location. In addition, for example, the maintenance worker can intensively perform maintenance tasks at the same place by sorting the maintenance items according to the place of maintenance tasks (maintenance section). For example, the maintenance worker can perform maintenance tasks in order from the task with a large margin time by sorting the maintenance items according to the margin time. In this way, the function of sorting maintenance items extends a wide variety of assistance in the determination and the maintenance tasks of the maintenance worker.

[0056] Here, the margin time shown in FIG. 4A and FIG. 4B is the margin time calculated as of March 3. Therefore, as shown in FIG. 4A and FIG. 4B, the same machine has the same margin time even when the maintenance date or the maintenance content varies. Since a maintenance task may be also performed ahead of the adjusted order for the maintenance item on a future date coming after the present time (March 3), the margin time of each machine that is calculated at present is provided along with the maintenance item.

[0057] In the example shown in FIG. 4A and FIG. 4B, for example, "unit number 1: parts replacement (splicer)" is included as irregular maintenance, in addition to regular maintenance such as "bobbin replenishing device: cleaning".

[0058] The screen examples in FIG. 3, FIG. 4A, and FIG. 4B are shown by way of example. The display control unit 52d can create a variety of display screen data based on the schedule data and display the display screen data on the display unit 51.

[0059] The maintenance order-presenting process performed in the management control unit 52 will now be described with reference to FIG. 5. The process shown in FIG. 5 is repeatedly executed every predetermined cycle as described above. As shown in FIG. 5, the order setting unit 52c determines a maintenance order of maintenance including regular maintenance and irregular maintenance (S101). The order setting unit 52c adjusts the determined maintenance order, based on the supply waiting time, which is the time taken for the spinning frame 2 to supply a yarn supply bobbin B next time (S102). When there exists a spinning frame 2 with the supply waiting time equal to or longer than a predetermined time, the order setting unit 52c adjusts the maintenance order. When there exists no spinning frame 2 with the supply waiting time equal to or longer than a predetermined time, the maintenance order is not adjusted.

[0060] The order setting unit 52c calculates a margin time that allows the auto winder 3 to be suspended for performing a maintenance process on the auto winder 3, based on the supply waiting time (S103). The order setting unit 52c may calculate a margin time for all main-

tenance performed on the auto winder 3 or may calculate a margin time solely for predetermined maintenance.

[0061] The order setting unit 52c creates schedule data based on, for example, the determined maintenance order or the adjusted maintenance order (S104). The display control unit 52d converts the schedule data into a predetermined format to be displayed on the display unit 51 (S105).

[0062] The present embodiment is configured as described above. In this maintenance order adjustment system 1, the maintenance order of the auto winders 3 in a subsequent step can be adjusted and presented according to the operation state of the spinning frame 2 in a previous step. The maintenance worker therefore can perform maintenance of the auto winders 3 according to the presented maintenance order, whereby maintenance of the auto winders 3 can be performed while the effects on the operation state of the spinning frame 2 are reduced.

[0063] The order setting unit 52c calculates the supply waiting time, which is the time taken for the spinning frame 2 to supply a yarn supply bobbin B next time, based on the operation information. The order setting unit 52c adjusts the maintenance order of auto winders 3 based on the calculated supply waiting time. For example, when the supply waiting time is long, suspending the auto winder 3 associated with the spinning frame 2 with a long supply waiting time and performing maintenance has small effects on the operation of the spinning frame 2. Thus, the maintenance order is adjusted such that maintenance of the auto winder 3 associated with the spinning frame 2 with the supply waiting time equal to or longer than a predetermined time is preferentially performed, whereby the effects on the operation of the spinning frame 2 can be suppressed even when the auto winder 3 is suspended and maintenance is performed.

[0064] The order setting unit 52c calculates the margin time that allows the auto winder 3 to be suspended for performing maintenance. The display control unit 52d also displays this margin time on the display unit 51. This enables the maintenance worker to grasp the margin time in performing maintenance of the auto winder 3. For example, when the maintenance is irregular maintenance and the margin time is short, the maintenance worker himself/herself can determine the timing of performing maintenance, for example, determine to perform this maintenance later, based on the margin time.

[0065] The display control unit 52d also displays the maintenance contents on the display unit 51. In this case, the maintenance worker can grasp the maintenance contents and the margin time. This enables the maintenance worker to determine whether maintenance can be performed within the margin time and then perform maintenance.

[0066] For example, in a system including spinning frames 2 and auto winders 3, the spinning frames 2 may be a rate-determining step for the production capacity of the entire system. In such a case, it is detrimental that the maintenance task on the auto winder 3 affects the operation of the spinning frame 2 (suspend the operation), in terms of production capacity. The maintenance order of auto winders 3 is then determined based on the operation state of the spinning frame 2, thereby suppressing reduction in production capacity of the entire system.

[0067] Although an embodiment of the present disclosure has been described above, the present disclosure is not limited to the foregoing embodiment. For example, the embodiment described above may be at least partially combined as desired.

[0068] As shown in FIG. 1, the spinning frames 2 are configured such that one auto winder 3 is associated as a supply destination of yarn supply bobbins B with one spinning frame 2. The embodiment is not limited to this configuration, and as in a maintenance order adjustment system 1A shown in FIG. 6, the spinning frames 2 may be configured such that two auto winders 3A and 3B are associated as supply destinations of yarn supply bobbins B with one spinning frame 2A. Alternatively, three or more auto winders 3 may be associated with one spinning frame 2, rather than one or two auto winders 3. As in a maintenance order adjustment system 1B shown in FIG. 7, the plurality of auto winders 3 may be associated with the plurality of spinning frames 2, as supply destinations of yarn supply bobbins B by the bobbin transfer device 33.

[0069] The transfer of a yarn supply bobbin B from the spinning frame 2 to the winder unit 31 of the auto winder 3 is not limited to the bobbin transfer device 33 of the auto winder 3. The transfer of a yarn supply bobbin B from the spinning frame 2 to the auto winder 3 may be performed, for example, by a device other than the bobbin transfer device 33 or a worker. Also in this case, one auto winder 3 may be associated with one spinning frame 2, or the plurality of auto winders 3 may be associated with one spinning frame 2, or the plurality of auto winders 3 may be associated with the plurality of spinning frames 2. Also in these cases, determination, adjustment, etc. of the maintenance order can be performed in the same manner as in the embodiment.

[0070] The display unit 51 may not be provided in the management device 5. For example, the display unit 51 may be a display unit provided in the spinning control device 22 or the winder control device 32. Alternatively, the display unit 51 may be a display screen of a portable terminal that can be carried by a maintenance worker. In the example described above, the spinning control device 22 of the spinning frame 2 and the winder control device 32 of the auto winder 3 communicate with the management control unit 52 of the management device 5 through the communication cable L. Alternatively, the communication may be performed by radio.

[0071] When the order setting unit 52c adjusts the maintenance order, for example, the maintenance order may be adjusted based on the present location of the maintenance worker, in addition to the operation information of the spinning frame 2 which is a textile machine

in a previous step. This adjustment based on the present location of the maintenance worker may be the adjustment considering the moving time for moving to the place where a maintenance task is to be performed next time (the adjustment to shorten the moving time) when maintenance tasks are performed successively according to the maintenance items. The order setting unit 52c can grasp the present location of the maintenance worker, for example, from the machine number of the spinning control device 22 or the winder control device 32 currently operated by the maintenance worker, or the positional information of the portable terminal carried by the maintenance worker. Alternatively, the order setting unit 52c may grasp the present location of the maintenance worker, for example, from the location where the maintenance worker has performed input operation to the spinning control device 22, the winder control device 32, or a potable terminal. In this way, the maintenance worker can efficiently perform maintenance tasks by adjusting the maintenance order considering the location of the maintenance worker.

[0072] In the present embodiment, the maintenance order is presented using the display unit 51. Alternatively, the maintenance order may be presented by a speaker (presentation unit) outputting sound, instead of the display on the display unit 51.

[0073] In the embodiment, an example in which the maintenance order of the auto winders 3 is adjusted based on the operation state of the spinning frame 2 has been illustrated by way of example. However, the embodiment is not limited to the application to the spinning frames 2 and the auto winders 3. For example, the embodiment may be applied to drawing frames each configured to form a string-shaped sliver with aligned fibers and spinning frames each configured to spin the sliver generated by the drawing frame to generate yarn and wind the generated yarn to form a package P. In this case, the maintenance order of the spinning frames is adjusted based on the operation state of the drawing frame. Additionally, the disclosure is not limited to the application to textile machines that are used in consecutive steps such as the spinning frame and the auto winder or the drawing frame and the spinning frame that spins yarn from the sliver generated by the drawing frame. For example, the disclosure may be applied to textile machines that are used in non-consecutive steps such as a roving frame and an auto winder.

[0074] In the foregoing embodiment, an example in which the maintenance order of textile machines (spinning frames 2, auto winders 3, etc.) that generate yarn is adjusted has been illustrated by way of example. The embodiment, however, is not limited to this example. The maintenance order of textile machines (such as carding machine, drawing frame, fly frame, loom, and knitting machine) that generate a fiber assembly other than yarn (sliver, rover, fabric, knit fabric, etc.) may be adjusted.

[0075] The present invention also refers to the following method steps:

A maintenance order adjustment method for textile machinery, comprising the following steps:

- performing a first process on a first fiber assembly, using one or more first textile machines (2, 2A, 2B, 2C),
- supplying a plurality of second textile machines (3, 3A, 3B, 3C) with a second fiber assembly (B) subjected to the first process by the first textile machines and performing a second process on the supplied second fiber assembly (B) to generate a third fiber assembly (P) ;
- acquiring operation information representing an operation state of the first textile machines (2, 2A, 2B, 2C);
- determining a maintenance order in performing maintenance on the second textile machines (3, 3A, 3B, 3C) based on a preset order and adjusting the determined maintenance order based on the operation information; and presenting the maintenance order adjusted by the order setting unit (52c).

The maintenance order adjustment method for textile machinery, including repeatedly performing each of determination of a maintenance order of the second textile machines (3, 3A, 3B, 3C) based on a preset order and adjustment of the determined maintenance order based on the operation information, every predetermined cycle.

The maintenance order adjustment method for textile machinery, including performing adjustment of the maintenance order based on the operation information, every cycle shorter than a cycle of determination of a maintenance order based on a preset order.

The maintenance order adjustment method for textile machinery, wherein the maintenance order adjustment system comprises a plurality of the first textile machines (2,2A, 2B, 2C), with the steps of:

- associating one or more of the second textile machines (3, 3A, 3B, 3C) as a supply destination of the second fiber assembly (B) with one of the first textile machines (2, 2A, 2B, 2C), and
- calculating a supply waiting time based on the operation information, the supply waiting time being a time taken for the first textile machine (2, 2A, 2B, 2C) to supply the second fiber assembly (B) to the second textile machine (3, 3A, 3B, 3C) next time, and when the maintenance order is adjusted, the order setting unit (52c) adjusts the maintenance order such that maintenance of the second textile machine (3, 3A, 3B, 3C) associated with the first textile machine (2, 2A, 2B, 2C) with the supply waiting time equal to or longer than a predetermined time is preferentially performed.

The maintenance order adjustment method for textile machinery with the further steps of:

- calculating a margin time that allows the second textile machine (3, 3A, 3B, 3C) to be suspended for performing maintenance of the second textile machine (3, 3A, 3B, 3C), based on the supply waiting time, and presenting the margin time calculated by the other setting unit (52c).

The maintenance order adjustment method for textile machinery, wherein when there exists a plurality of maintenance contents to be performed on the second textile machine (3, 3A, 3B, 3C), the order setting unit (52c) adjusts the maintenance order such that a maintenance content to be finished within the supply waiting time is preferentially performed.

The maintenance order adjustment method for textile machinery, wherein the order setting unit (52c) further adjusts the maintenance order based on a present location of a maintenance worker.

The maintenance order adjustment method for textile machinery, wherein the presentation unit (51) further presents maintenance contents of maintenance to be performed on the second textile machine (3, 3A, 3B, 3C).

The maintenance order adjustment method for textile machinery, wherein based on an instruction from a maintenance worker, the presentation unit (51) sorts presentation item to be presented, according to a predetermined rule.

The maintenance order adjustment method for textile machinery, wherein the first textile machine (2, 2A, 2B, 2C) is a spinning frame (2, 2A, 2B, 2C), which generates yarn from the first fiber assembly and winds the generated yarn to generate a yarn supply bobbin (B) as the second fiber assembly (B), and the second textile machine (3, 3A, 3B, 3C) is an auto winder (3, 3A, 3B, 3C) which winds yarn from the yarn supply bobbin (B) to generate a package (P) as the third fiber assembly (P).

The maintenance order adjustment method for textile machinery, wherein the plurality of spinning frames (2, 2A, 2B, 2C) and the plurality of auto winders (3, 3A, 3B, 3C) are provided, and one of the auto winders (3, 3A, 3B, 3C) is associated as a supply destination of the yarn supply bobbin (B) with one of the spinning frames (2, 2A, 2B, 2C).

Claims

1. A maintenance order adjustment system (1, 1A, 1B) for textile machinery, comprising:

one or more first textile machines (2, 2A, 2B, 2C) each configured to perform a first process on a first fiber assembly;
a plurality of second textile machines (3, 3A, 3B, 3C) each configured to be supplied with a second fiber assembly (B) subjected to the first process by the first textile machines and to perform a second process on the supplied second fiber assembly (B) to generate a third fiber assembly (P);
an operation information acquisition unit (52a) configured to acquire operation information representing an operation state of the first textile machines (2, 2A, 2B, 2C); **characterized by**
an order setting unit (52c) configured to determine a maintenance order in performing maintenance on the second textile machines (3, 3A, 3B, 3C) based on a preset order and adjust the determined maintenance order based on the operation information acquired by the operation information acquisition unit (52a); and
a presentation unit (51) configured to present the maintenance order adjusted by the order setting unit (52c).

2. The maintenance order adjustment system (1, 1A, 1B) for textile machinery according to claim 1, wherein the order setting unit (52c) is adapted to repeatedly perform each of determination of a maintenance order of the second textile machines (3, 3A, 3B, 3C) based on a preset order and adjustment of the determined maintenance order based on the operation information, every predetermined cycle.

3. The maintenance order adjustment system (1, 1A, 1B) for textile machinery according to claim 2, wherein the order setting unit (52c) is adapted to perform adjustment of the maintenance order based on the operation information, every cycle shorter than a cycle of determination of a maintenance order based on a preset order.

4. The maintenance order adjustment system (1, 1A, 1B) for textile machinery according to any one of claims 1 to 3, wherein
the maintenance order adjustment system comprises a plurality of the first textile machines (2, 2A, 2B, 2C),
one or more of the second textile machines (3, 3A, 3B, 3C) are associated as a supply destination of the second fiber assembly (B) with one of the first textile machines (2, 2A, 2B, 2C), and
the order setting unit (52c) is adapted to calculate a supply waiting time based on the operation information, the supply waiting time being a time taken for the first textile machine (2, 2A, 2B, 2C) to supply the second fiber assembly (B) to the second textile machine (3, 3A, 3B, 3C) next time, and when the maintenance order is adjusted, the order setting unit (52c) is adapted to adjust the maintenance order such that maintenance of the second textile machine (3, 3A, 3B, 3C) associated with the first textile machine (2, 2A, 2B, 2C) with the supply waiting time equal to or longer than a predetermined time is preferentially performed.

5. The maintenance order adjustment system (1, 1A, 1B) for textile machinery according to claim 4, wherein
the order setting unit (52c) further is adapted to calculate a margin time that allows the second textile machine (3, 3A, 3B, 3C) to be suspended for performing maintenance of the second textile machine (3, 3A, 3B, 3C), based on the supply waiting time, and the presentation unit (51) further is adapted to present the margin time calculated by the order setting unit (52c).

6. The maintenance order adjustment system (1, 1A, 1B) for textile machinery according to claim 4 or 5, wherein when there exists a plurality of maintenance contents to be performed on the second textile machine (3, 3A, 3B, 3C), the order setting unit (52c) is adapted to adjust the maintenance order such that a maintenance content to be finished within the supply waiting time is preferentially performed.

7. The maintenance order adjustment system (1, 1A, 1B) for textile machinery according to any one of claims 1 to 6, wherein the order setting unit (52c) further is adapted to adjust the maintenance order based on a present location of a maintenance worker.

8. The maintenance order adjustment system (1, 1A, 1B) for textile machinery according to any one of claims 1 to 7, wherein the presentation unit (51) further is adapted to present maintenance contents of maintenance to be performed on the second textile machine (3, 3A, 3B, 3C).

9. The maintenance order adjustment system (1, 1A, 1B) for textile machinery according to any one of claims 1 to 8, wherein based on an instruction from a maintenance worker, the presentation unit (51) is adapted to sort presentation items to be presented, according to a predetermined rule.

10. The maintenance order adjustment system (1, 1A, 1B) for textile machinery according to any one of claims 1 to 9, wherein
the first textile machine (2, 2A, 2B, 2C) is a spinning frame (2, 2A, 2B, 2C) configured to generate yarn from the first fiber assembly and wind the generated yarn to generate a yarn supply bobbin (B) as the second fiber assembly (B), and
the second textile machine (3, 3A, 3B, 3C) is an auto winder (3, 3A, 3B, 3C) configured to wind yarn from the yarn supply bobbin (B) to generate a package (P) as the third fiber assembly (P).

11. The maintenance order adjustment system (1, 1A, 1B) for textile machinery according to claim 10, wherein
the plurality of spinning frames (2, 2A, 2B, 2C) and the plurality of auto winders (3, 3A, 3B, 3C) are provided, and
one of the auto winders (3, 3A, 3B, 3C) is associated as a supply destination of the yarn supply bobbin (B) with one of the spinning frames (2, 2A, 2B, 2C).

12. A maintenance order adjustment method for textile machinery comprising one or more first textile machines (2, 2A, 2B, 2C) configured to perform a first process on a first fiber assembly, and a plurality of second textile machines (3, 3A, 3B, 3C) supplied with a second fiber assembly (B) subjected to the first process by the first textile machines and configured to perform a second process on the supplied second fiber assembly (B) to generate a third fiber assembly (P), the maintenance order adjustment method comprising the steps of:

- acquiring operation information representing an operation state of the first textile machines (2, 2A, 2B, 2C);
- determining a maintenance order in performing maintenance on the second textile machines (3, 3A, 3B, 3C) based on a preset order and adjusting the determined maintenance order based on the operation information; and
- presenting the adjusted maintenance order.

13. The maintenance order adjustment method for textile machinery according to claim 12, wherein
the textile machinery comprises a plurality of the first textile machines (2, 2A, 2B, 2C), with the steps of

- associating one or more of the second textile machines (3, 3A, 3B, 3C) as a supply destination of the second fiber assembly (B) with one of the first textile machines (2, 2A, 2B, 2C), and

calculating a supply waiting time based on the operation information, the supply waiting time being a time taken for the first textile machine (2, 2A, 2B, 2C) to supply the second fiber assembly (B) to the second textile machine (3, 3A, 3B, 3C) next time, and when the maintenance order is adjusted, adjusting the maintenance order such that maintenance of the second textile machine (3, 3A, 3B, 3C) associated with the first textile machine (2, 2A, 2B, 2C) with the supply waiting time equal to or longer than a predetermined time is preferentially performed.

14. The maintenance order adjustment method for textile machinery according to claim 13, with the further steps of: calculating a margin time that allows the second textile machine (3, 3A, 3B, 3C) to be suspended for performing maintenance of the second textile machine (3, 3A, 3B, 3C), based on the supply waiting time, and

presenting the calculated margin time.

15. The maintenance order adjustment method for textile machinery according to claim 13 or 14, wherein when there exists a plurality of maintenance contents to be performed on the second textile machine (3, 3A, 3B, 3C), adjusting the maintenance order such that a maintenance content to be finished within the supply waiting time is preferentially performed.

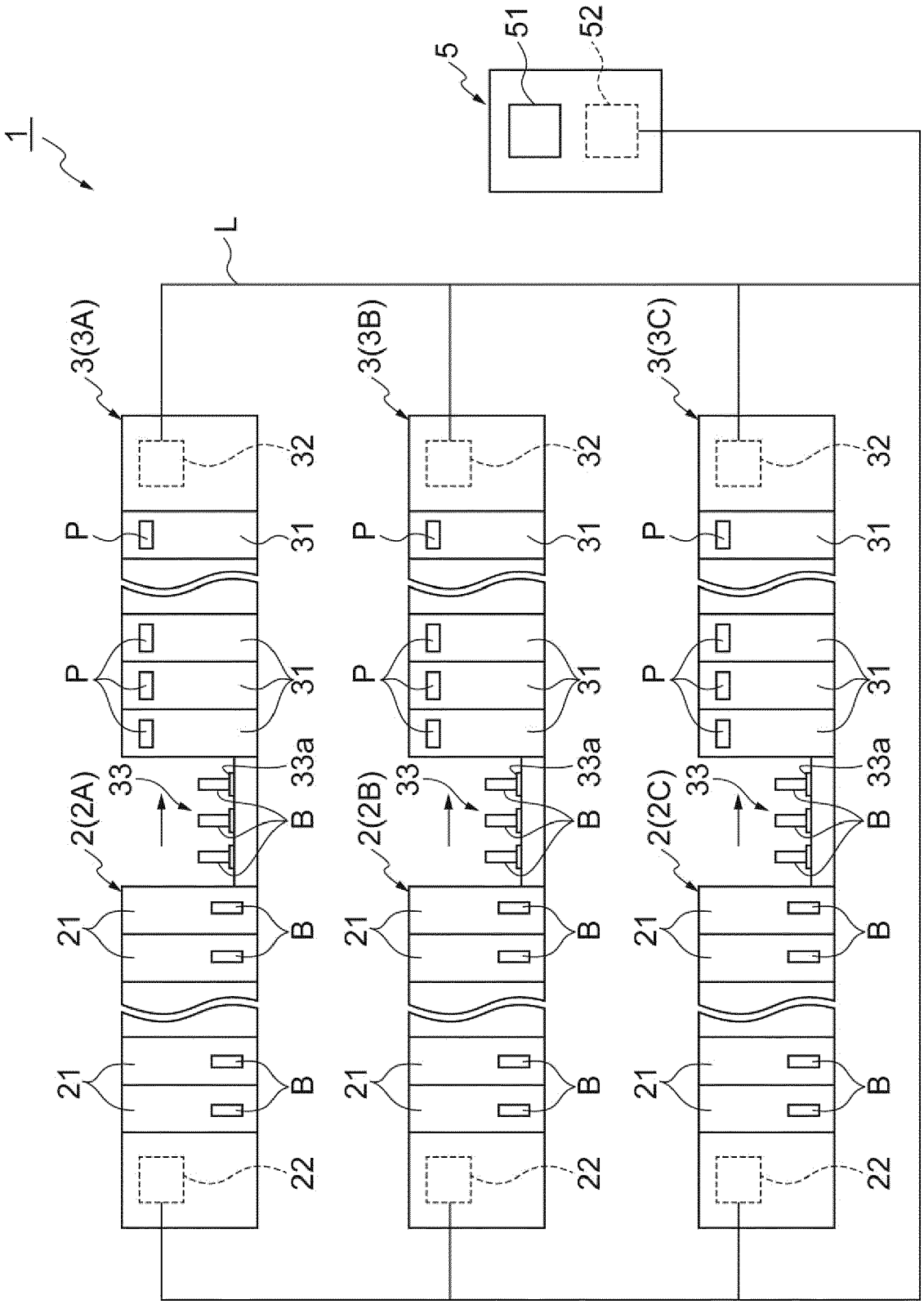


Fig.1

Fig.2

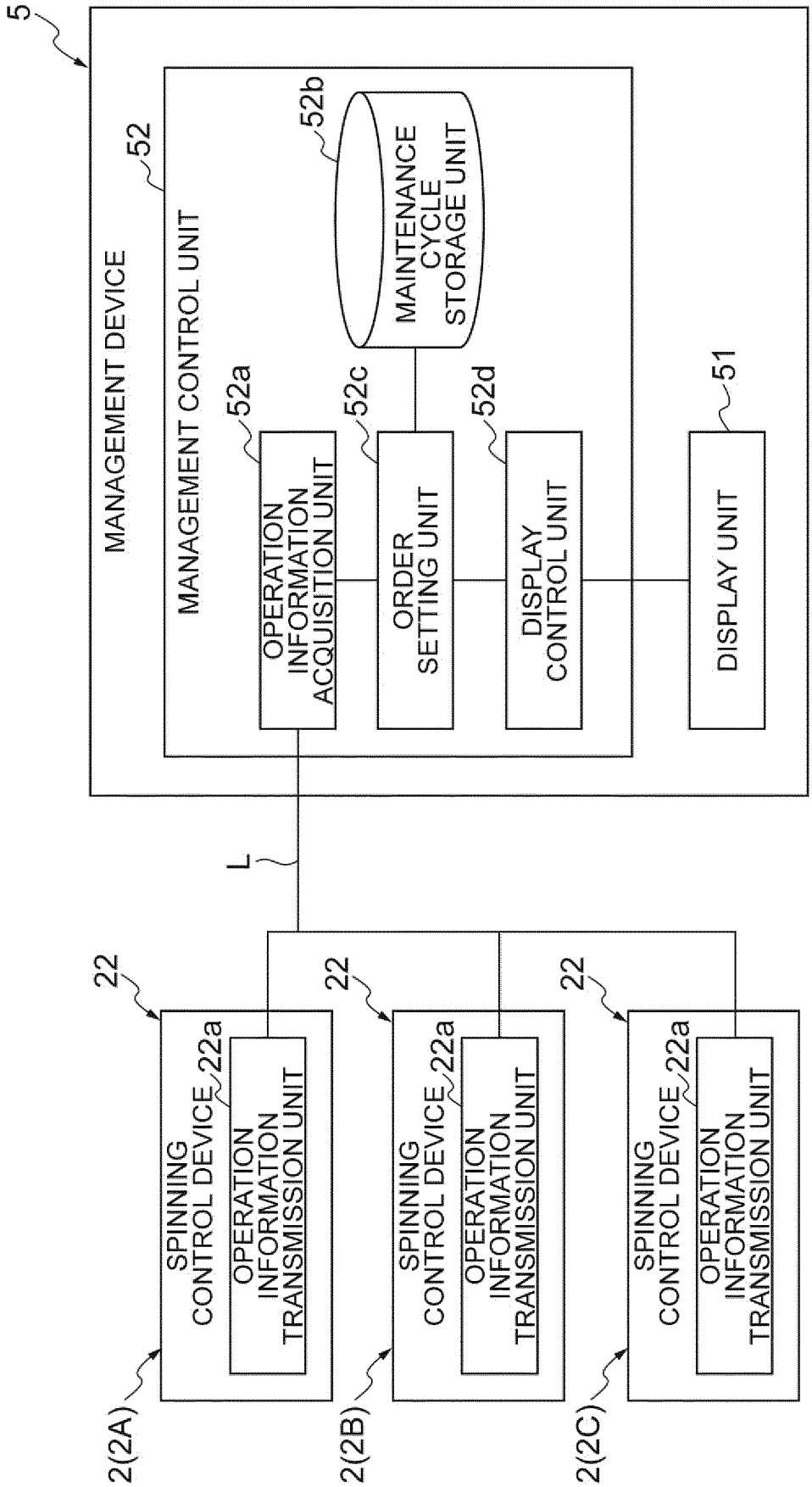

5
MANAGEMENT DEVICE
52
MANAGEMENT CONTROL UNIT
52b
MAINTENANCE CYCLE STORAGE UNIT
52a
OPERATION INFORMATION ACQUISITION UNIT
52c
ORDER SETTING UNIT
52d
DISPLAY CONTROL UNIT
51
DISPLAY UNIT
L
22
SPINNING CONTROL DEVICE
22a
OPERATION INFORMATION TRANSMISSION UNIT
2(2A)
2(2B)
2(2C)

Fig.3

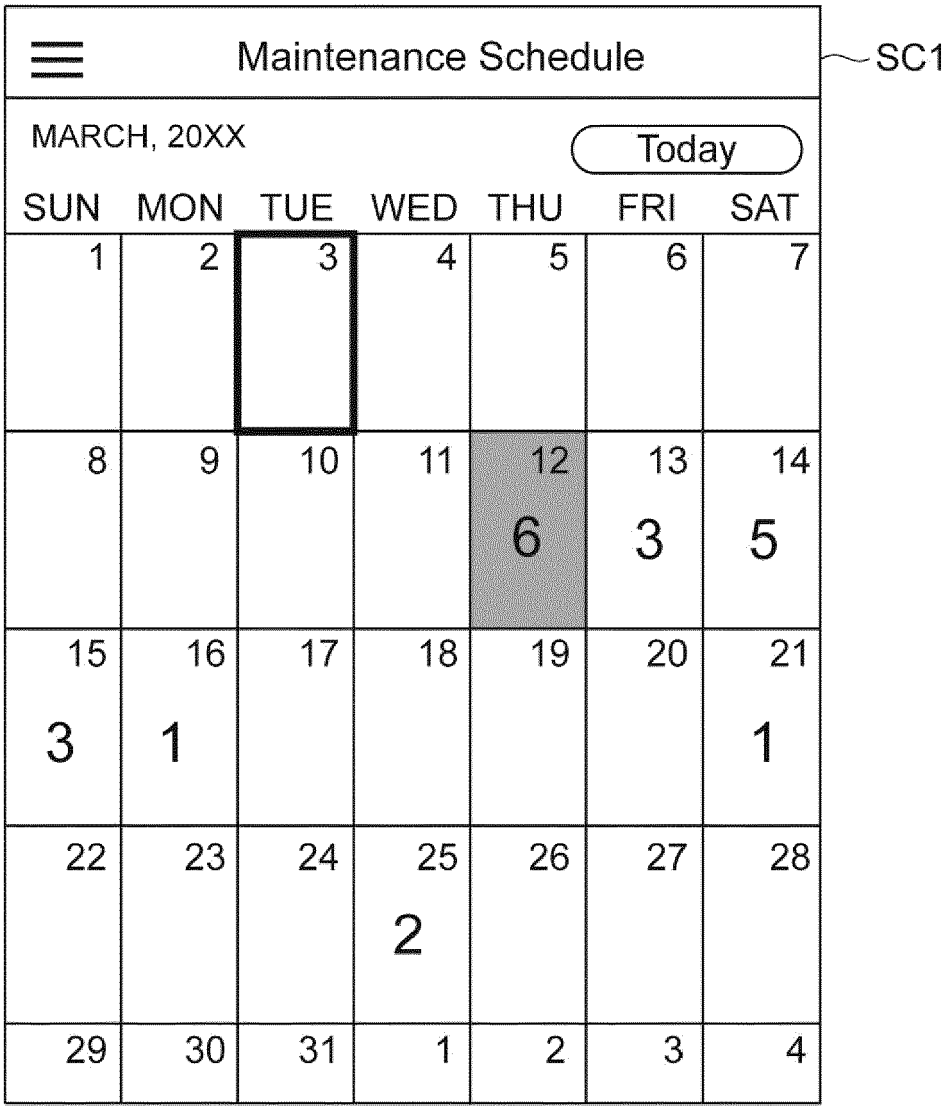

Maintenance Schedule
SC1
MARCH, 20XX
Today
SUN MON TUE WED THU FRI SAT
1 2 3 4 5 6 7
8 9 10 11 12 13 14
6 3 5
15 16 17 18 19 20 21
3 1 1
22 23 24 25 26 27 28
2
29 30 31 1 2 3 4

Fig.4A

SC2

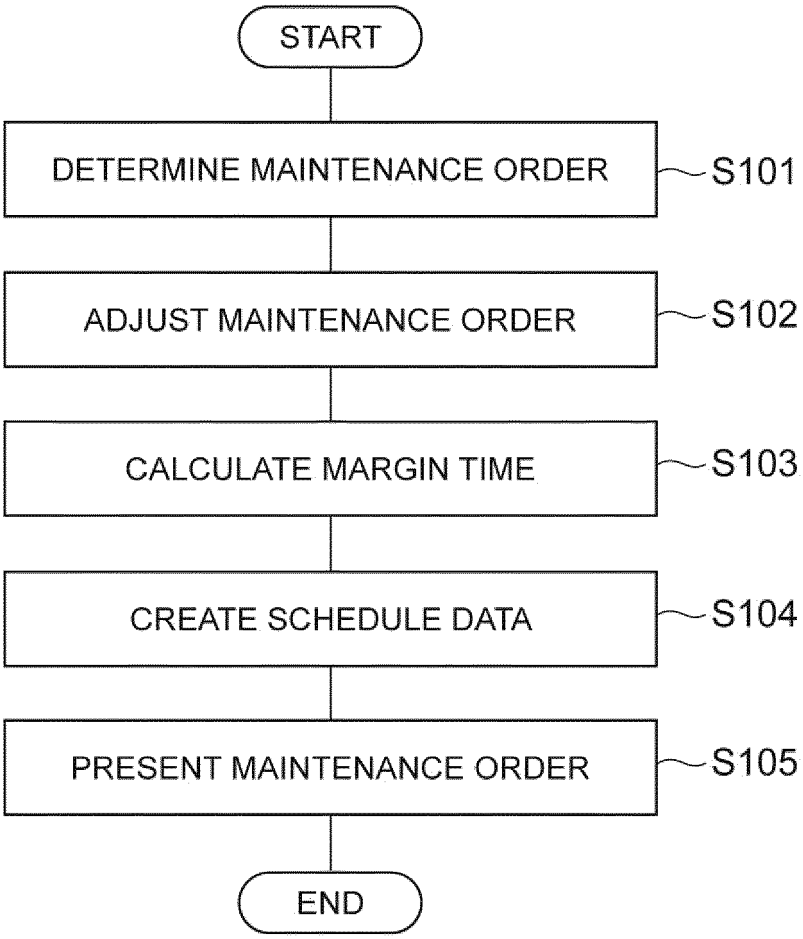
MACHINE NUMBER	PLACE	MAINTENANCE CONTENTS	MARGIN TIME
1	BOBBIN REPLENISHING DEVICE	CLEANING	10 MINUTES
3	DOFFING CARRIER	OILING	2 MINUTES
2	BOBBIN REPLENISHING DEVICE	OILING	7 MINUTES
1	DOFFING CARRIER	CLEANING	10 MINUTES
1	UNIT NUMBER 1	PARTS REPLACEMENT(SPLICER)	10 MINUTES
3	UNIT NUMBER 8	PARTS REPLACEMENT(TENSOR)	2 MINUTES

Fig.4B

SC3

☰ Maintenance Schedule				
MARCH, 20XX				Today
MAINTENANCE DATE	MACHINE NUMBER	PLACE	MAINTENANCE CONTENTS	MARGIN TIME
20XX.3.12	1	BOBBIN REPLENISHING DEVICE	CLEANING	10 MINUTES
20XX.3.12	3	DOFFING CARRIER	OILING	2 MINUTES
20XX.3.12	2	BOBBIN REPLENISHING DEVICE	OILING	7 MINUTES
20XX.3.12	1	DOFFING CARRIER	CLEANING	10 MINUTES
20XX.3.12	1	UNIT NUMBER 1	PARTS REPLACEMENT(SPLICER)	10 MINUTES
20XX.3.12	3	UNIT NUMBER 8	PARTS REPLACEMENT(TENSOR)	2 MINUTES
20XX.3.13	2	DOFFING CARRIER	OILING	7 MINUTES
20XX.3.13	3	UNIT NUMBER 1	PARTS REPLACEMENT(TENSOR)	2 MINUTES
≈				≈
20XX.3.25	1	BOBBIN REPLENISHING DEVICE	CLEANING	10 MINUTES

Fig.5


START
DETERMINE MAINTENANCE ORDER
S101
ADJUST MAINTENANCE ORDER
S102
CALCULATE MARGIN TIME
S103
CREATE SCHEDULE DATA
S104
PRESENT MAINTENANCE ORDER
S105
END

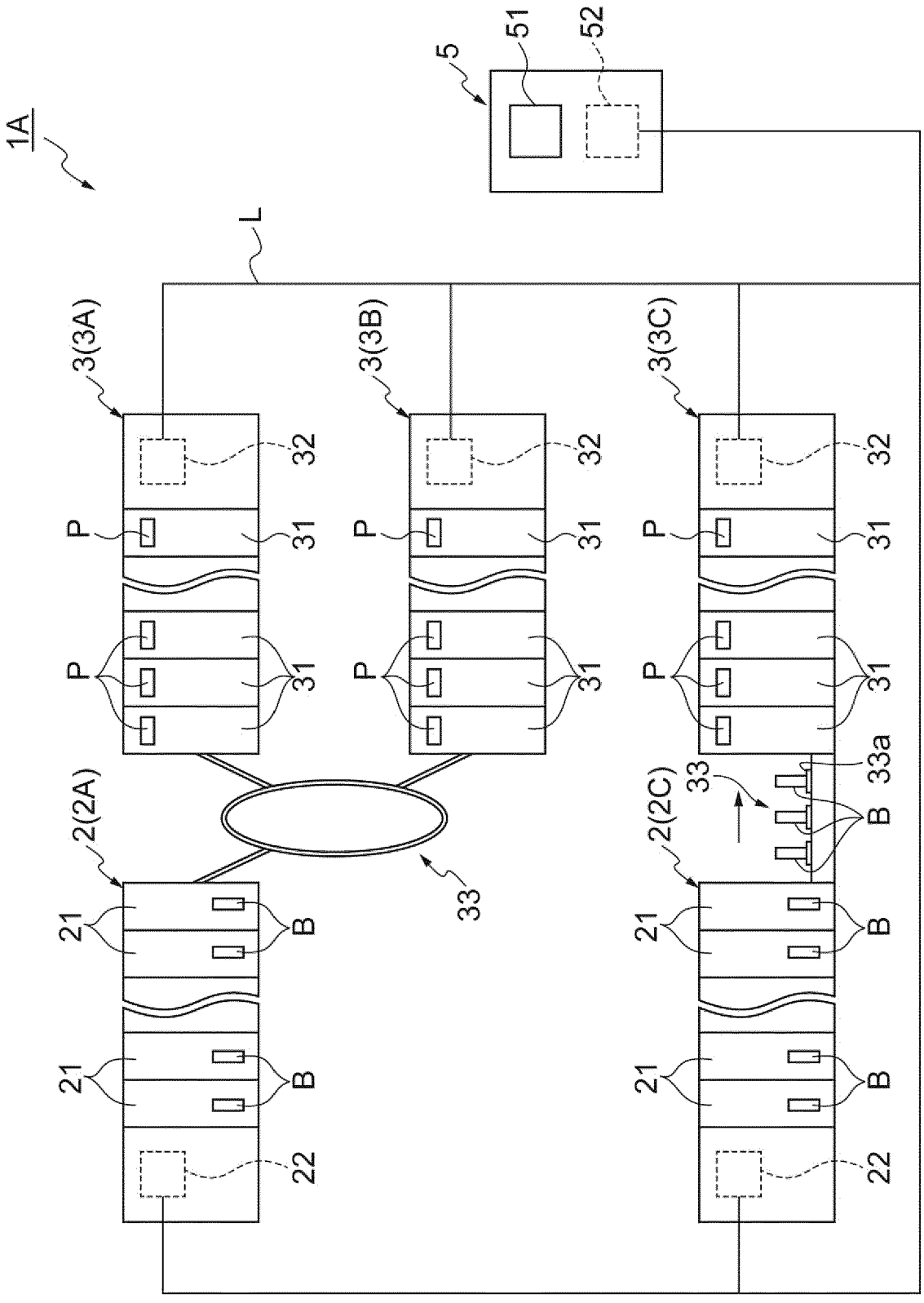


Fig.6

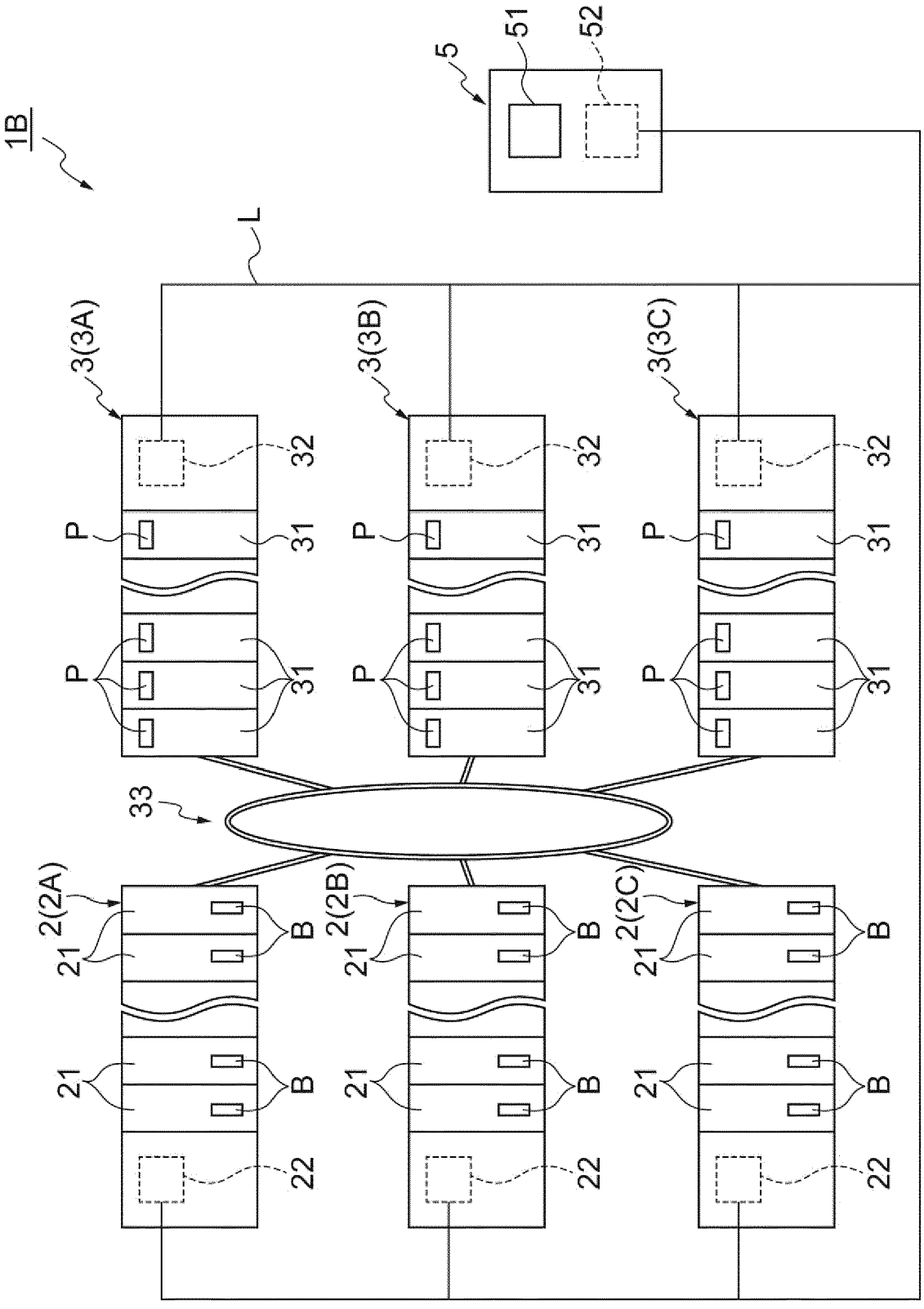


Fig.7

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 7182

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	JP H01 183530 A (MURATA MACHINERY LTD) 21 July 1989 (1989-07-21) * the whole document * -----	1-15	INV. B65H63/00 D01H13/14 B65H67/06
A	EP 1 006 069 A2 (SCHLAFHORST & CO W [DE]) 7 June 2000 (2000-06-07) * abstract * * paragraph [0013] - paragraph [0018] * -----	1-15	D01H13/32
A	DE 40 12 930 A1 (RIETER AG MASCHF [CH]) 31 October 1991 (1991-10-31) * abstract * -----	1-15	

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	13 March 2018	Guisan, Thierry

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 19 7182

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13-03-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP H01183530 A	21-07-1989	NONE	
EP 1006069 A2	07-06-2000	DE 19855126 A1	31-05-2000
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		JP 4616952 B2	19-01-2011
		JP 2000169040 A	20-06-2000
		US 6290165 B1	18-09-2001
DE 4012930 A1	31-10-1991	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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