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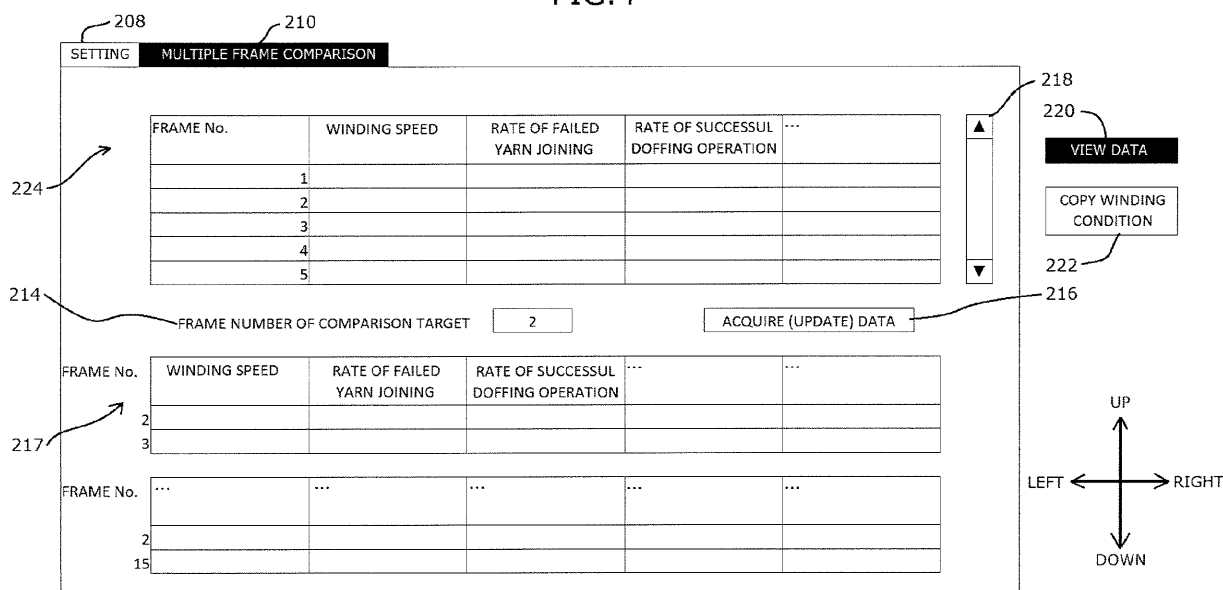
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(54) **Textile machine and textile machine system**

(57) It is an object of the present invention to provide a textile machine system that can analyze operation data about textile machines in one factory more accurately. A textile machine system (70) includes a plurality of textile machines (60). Each of the textile machines (60) includes at least one textile processing unit (16) and a management device (11) that collects and manages an operation data set about the textile processing unit (16). The man-

agement device (11) includes a display section (13) that displays the operation data set and a communication section (62) that transmits and receives the operation data set to and from the management device (11) of another textile machine (60). The display section (13) can display the operation data sets about the textile processing units (16) of a plurality of the textile machines (60) within one screen.

FIG.4



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention primarily relates to a textile machine according to the preamble of claim 1.

2. Description of the Related Art

[0002] Textile machines that include multiple textile processing units and a management device that controls operations of those textile processing units are known in the art. The management device of the textile machine is capable of monitoring the present operational status of each of the textile processing units and setting various types of yarn processing conditions.

[0003] It is general that a large number of textile machines configured as described above are installed and operated in a factory. There can arise a situation in such factories that a plurality of the textile machines need to be operated under the same yarn processing condition, or a situation that yarn processing conditions of a plurality of textile machines are to be collectively changed. If an operator is required to go to each of the textile machines to change settings one by one, this job is not only inefficient but also places a burden on the operator.

[0004] A textile machine system that includes multiple textile machines each including a winding unit (textile processing unit) and being capable of mutually communicating winding information (yarn processing conditions) is disclosed in Japanese Patent Application Laid-open No. 2009-242029. The textile machine system disclosed in Japanese Patent Application Laid-open No. 2009-242029 includes a frame control device (management device) that allows batch-setting or viewing-in-one-screen of the winding information about the winding units (textile processing units) belonging to the respective textile machines. Accordingly, frame management can be performed efficiently.

SUMMARY OF THE INVENTION

[0005] The inventors recognized that the frame management device of the textile machine system disclosed in Japanese Patent Application Laid-open No. 2009-242029 does not allow viewing winding information about a plurality of the textile machines of the textile machine system or operation data such as operation efficiencies of the frames within one screen. For this reason, in the textile machine system disclosed in Japanese Patent Application Laid-open No. 2009-242029, operation data analysis is performed by comparing current operation data about a frame with past operation data about the same frame. However, an undesirable situation can occur in this approach. That is, for example, even when one frame in a factory is poor in operation efficiency as

compared to other textile machines in the same factory, an operator inappropriately determines that the frame does not need an additional maintenance work based on operation data in a case where the operation efficiency of the frame is favorable relative to past operation efficiencies of the frame.

[0006] It is a primary object of the present invention to provide a textile machine and a textile machine system that can analyze operation data about textile machines in one factory more accurately. This object is achieved by a textile machine according to claim 1 and a textile machine system according claim 3.

[0007] A textile machine system according to an aspect of the present invention includes a plurality of textile machines, each textile machine including at least one textile processing unit and a management device that collects and manages an operation data set about the textile processing unit. Each management device includes a display section that displays the operation data set about the textile processing unit, and a communication section that transmits and receives the operation data set to and from a management device of another textile machine. The display section includes a first mode in which the display section displays the operation data sets about the textile processing units of a plurality of the textile machines within one screen.

[0008] A textile machine according to another aspect of the present invention includes at least one textile processing unit and a management device that collects and manages an operation data set about the textile processing unit. The management device includes a display section that displays the operation data set about the textile processing unit, and a communication section that transmits and receives the operation data set to and from a management device of another textile machine. The display section includes a first mode in which the display section displays operation data sets about textile processing units of a plurality of textile machines within one screen.

[0009] The above and other objects, features, advantages and the technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a schematic front view of an automatic winder of a textile machine of a textile machine system according to an embodiment of the present invention;

FIG. 2 is a schematic diagram of the textile machine system that includes the automatic winders according to the embodiment of the present invention; FIG. 3 is a front view of a touch-panel display of a management device on which a setting window is displayed;

FIG. 4 is a front view of the touch-panel display on which operation data sets about a plurality of the textile machines are displayed;

FIG. 5 is a front view of the touch-panel display on which operation efficiencies of a plurality of the textile machines are displayed; FIG. 6 is a front view of the touch-panel display where winding units in which a malfunction has occurred are displayed in a chart form; and

FIG. 7 is a front view of the touch-panel display on which a window for transmitting yarn-processing-condition setting data about a textile machine to management devices of other textile machines is displayed.

DETAILED DESCRIPTION OF EMBODIMENTS

[0011] Exemplary embodiments of the present invention are explained below with reference to the accompanying drawings.

[0012] As shown in FIG. 1, an automatic winder 60 (textile machine) includes a management device 11, a plurality of winding units (textile processing units) 16 arranged side by side, a yarn-supplying-bobbin supplying device 52, and an automatic doffer 51.

[0013] The yarn-supplying-bobbin supplying device 52 conveys a yarn supplying bobbin 21 along a not shown supply path so as to supply the yarn supplying bobbin 21 to each of the winding units 16. When a package 30 of one of the winding units 16 is fully wound, the automatic doffer 51 moves to a position of the winding unit 16 to collect the fully-wound package 30 from the winding unit 16 and supplies an empty bobbin without a yarn to the winding unit 16. Operation of the yarn-supplying-bobbin supplying device 52 and the automatic doffer 51 is controlled by the frame management device 11.

[0014] Each of the winding units 16 unwinds a yarn 20 from the yarn supplying bobbin 21 and winds the yarn 20 while causing the yarn 20 to traverse using a traverse drum 41, thereby forming the package 30. The winding unit 16 includes a clearer (yarn-quality measuring device) 42 that monitors a thickness or the like of the running yarn 20 and a splicer 39 that joins yarn ends of a cut yarn. When the clearer 42 detects a defect in the yarn 20, the winding unit 16 suspends yarn winding, cuts the yarn 20 to remove a defective portion, joins the yarn ends of the yarn 20 using the splicer 39, and thereafter resumes yarn winding. The winding unit 16 also includes a light-emitting section that is to be lit when a malfunction has occurred in the winding unit 16.

[0015] Each of the winding units 16 includes a unit control section 50. The unit control section 50 includes a not shown central processing unit (CPU) and a not shown read-only memory (ROM). The ROM stores therein control programs for controlling various constituents (e.g., the traverse drum 41) of the winding unit 16. The CPU controls the various constituents by executing the control programs stored in the ROM so that yarn winding is per-

formed appropriately.

[0016] A configuration of the management device 11 is explained below. The management device 11 includes a touch-panel display 13 (display section) and input keys 14. The management device 11 also includes a management-device CPU 63, a ROM, a communication section 62, and a clock section.

[0017] The touch-panel display 13 and the input keys 14 are connected to the management-device CPU 63. The touch-panel display 13 functions both as the display section that outputs operation data received from the unit control section 50 as an on-screen display and as a setting area that receives various types of input operations from an operator.

[0018] The ROM of the management device 11 stores therein control programs for controlling operations of the yarn-supplying-bobbin supplying device 52, the automatic doffer 51, and the winding units 16. The automatic winder 60 controls the operations of the winding unit 16, the yarn-supplying-bobbin supplying device 52, and the automatic doffer 51 by executing the control programs stored in the ROM of the management device 11 so that yarn winding is performed appropriately.

[0019] The communication section 62 of the management device 11 is connected to the yarn-supplying-bobbin supplying device 52, the automatic doffer 51, and each of the unit control sections 50 via an intra-frame communication channel 90 such that information can be transmitted and received with each other. This configuration allows the management device 11 to transmit and receive operation data sets about the yarn-supplying-bobbin supplying device 52, the automatic doffer 51, and the winding units 16 among the yarn-supplying-bobbin supplying device 52, the automatic doffer 51, and each of the unit control sections 50. In short, this configuration allows the management device 11 to collect operation data from the winding units 16 and manage the operation data.

[0020] The clock section of the management device 11 stores therein uptime of the automatic winder 60, and uptime and downtime of each winding unit 16, the yarn-supplying-bobbin supplying device 52, and the automatic doffer 51 that constitute the automatic winder 60.

[0021] Data items of the operation data to be collected by the frame management device 11 about the winding unit 16 from the unit control section 50 include data about the current yarn winding status of the winding unit 16. Examples of the yarn winding status data include the current diameter of the package, the current winding speed, a yarn-breakage occurrence status, a yarn-defect detection status, and a light-on rate of the light-emitting section that indicates a malfunction of the winding unit.

[0022] The management-device CPU 63 of the management device 11 accumulates data about yarn winding statuses collected from each of the winding units 16 of the automatic winder 60 and performs a predetermined calculation on the data to obtain operational status data about the entire automatic winder 60. An example of the

data concerning an operation value of the entire automatic winder 60 that can be calculated by the management-device CPU 63 of the management device 11 is an operation efficiency of the entire automatic winder 60 obtained by averaging operation efficiencies of the winding units 16.

[0023] The clock section of the management device 11 stores therein the uptime of the automatic winder 60 and the downtime of the yarn-supplying-bobbin supplying device 52. The management-device CPU 63 of the management device 11 calculates an average winding time of winding times each received from the winding units 16. Furthermore, the management-device CPU 63 of the management device 11 obtains the operation efficiency of the automatic winder 60 by calculating the following equation: (operation efficiency of the automatic winder 60)=[(average winding time of the winding units 16)/((uptime of the automatic winder 60) - (downtime of the yarn-supplying-bobbin supplying device 52))] × 100.

[0024] One method of calculating the data about the operational status of the entire automatic winder 60 from the yarn winding status data collected by the management-device CPU 63 of the management device 11 from each of the winding units 16 has been described above by way of the example of the operation efficiency of the automatic winder 60. However, the operation value that can be calculated is not limited thereto. Examples of the operation value that can be calculated by the management-device CPU 63 of the management device 11 include a rate of failed yarn joining performed by the splicer 39, a rate of successful doffing operation performed by the automatic doffer 51, a rate of full-wound packages discharged by the yarn-supplying-bobbin supplying device 52, a rate of successful yarn-end finding performed by the yarn-supplying-bobbin supplying device 52, and a rate of yarn breakage due to tension. The management-device CPU 63 of the management device 11 is configured so as to calculate data about the operational status of the entire automatic winder 60 from the operation data about the constituents of the automatic winder 60 as described above.

[0025] The management device 11 functions as a transmitting-and-selecting section that can transmit yarn-processing-condition setting data, which is one data item of the operation data, to the winding unit 16 and set a winding condition. Examples of the yarn-processing-condition setting data include the winding speed, a yarn count, a winding tension, an amount of yarn that has been wound to form a package, weight of the package, and an item related to a yarn defect.

[0026] An operator can cause a winding-condition setting menu to be displayed on the touch-panel display 13 by performing an operation as appropriate and set a winding condition by entering numerical values using the input keys 14. The yarn-processing-condition setting data can be individually transmitted to the winding units 16 that are specified or batch-transmitted to all the winding units 16.

[0027] The frame management device 11 can cause the yarn winding status data that changes from moment to moment to be displayed on the touch-panel display 13 in real-time. Furthermore, the frame management device 11 can store past history data about the yarn winding status. For example, the frame management device 11 may display a graph in which a frequency of yarn defect occurrence is plotted along a time axis on the touch-panel display 13. Furthermore, the frame management device 11 can calculate statistical data by analyzing history data about the yarn winding status. For example, the frame management device 11 may calculate a winding rate, the number of yarn breakage occurrences within a given period of time, and/or the like of each of the winding units 16 and display the calculation result on the touch-panel display 13.

[0028] In the description below, the yarn-processing-condition setting data, the yarn winding status data, the past history data, and the statistical data are collectively referred to as "operation data" as appropriate. Thus, the frame management device 11 allows an operator to perform batch setting of the operation data sets about a plurality of the winding units 16 or view the same within one screen. Accordingly, the operator can manage the automatic winder 60 efficiently.

[0029] An automatic winder system (textile machine system) according to an embodiment of the present invention is explained below with reference to FIG. 2. Due to limitation of space, only four textile machines are shown in FIG. 2; however, the number of the textile machines in the automatic winder system is not limited to four. Generally, 50-odd textile machines are installed in a textile machine factory. Generally, one textile machine includes approximately 60 to 80 winding units.

[0030] As shown by arrows in FIG. 2, in this automatic winder system 70, a plurality of the automatic winders 60 forms a network over which operation data about the automatic winders 60 can be transmitted and received. An extra-frame communication channel 96 that connects a plurality of the automatic winders 60 to one another enables transmission and reception of the operation data about the automatic winders. The automatic winders 60 shown in FIG. 2 are denoted by reference numerals 60(1), 60(2), 60(3), ..., and 60(50) to distinguish the automatic winders individually. In the description below, the automatic winders are explained by specifying with these reference numeral as appropriate. Frame numbers shown in FIGS. 4 to 7 are numbers used to specify each of the automatic winders. In the description below, the automatic winder No. 1, the automatic winder No. 2, the automatic winder No. 3, ..., and the automatic winder No. 50 are indicated with 60(1), 60(2), 60(3), ..., and 60(50), respectively, as appropriate.

[0031] The management device 11 of one of the automatic winder 60 is connected to the management devices 11 of the other automatic winders 60 enabling communication therebetween via the extra-frame communication channel 96. This configuration makes mutual com-

munication among a plurality of the automatic winders 60 possible and allows an arbitrary one of the automatic winder 60 to acquire operation data sets stored in the other automatic winders 60.

[0032] Generally in an actual textile factory, a plurality of the automatic winders (frames) 60 is arranged in parallel as shown in FIG. 2. Furthermore, in a factory large enough to contain several tens of frames therein, if the frames are arranged with a gap of approximately 2 meters, for example, between adjacent frames in the direction of the length, the length of the installation area of the frames can even exceed 100 meters in a direction along the length of the sheet of FIG. 2. In this regard, when the automatic winders 60 according to the present embodiment that can mutually communicate are installed in such a factory, an operator is saved from the trouble of moving to in front of each of the automatic winders 60 to check an operational status and change settings of the automatic winder 60.

[0033] Furthermore, because the automatic winders 60 can mutually communicate, a (what is called as "ad-hoc") network that allows direct mutual communication can be constructed without installing a particular host computer or an access point. Accordingly, the automatic winders 60 of the present embodiment can directly mutually transmit and receive operation data.

[0034] Furthermore, the touch-panel display 13 of the management device 11 of each of the automatic winders 60 displays, when operated as appropriate, operation data sets about the other automatic winders 60 stored in the management devices 11 of the other automatic winders. A first mode (hereinafter, "multiple-frame comparison mode") in which operation data sets about the winding units 16 of a plurality of the automatic winders 60(1), 60(2), 60(3), ..., and 60(50) is displayed within one screen on the management device 11 of one of the automatic winders 60 is explained below by way of an example of the management device 11(1) of the automatic winder 60(1) with reference to FIGS. 3 to 7.

[0035] In the description below, it is assumed that the touch-panel display 13 depicted in FIGS. 3 to 7 are windows displayed on the management device 11(1) of the automatic winder 60(1). A setting area 206 and window switching tabs 212 (switching area) are displayed on the touch-panel display 13 where a setting window is displayed. The setting area 206 includes a frame-number setting area 200 for setting identification numbers of the automatic winders, an IP-address setting area 202 for setting IP addresses which are network addresses, and a subnet-mask setting area 204. Other general values, such as language, date, time, factory name, and gateway, can also be set in the setting area 206. The window switching tabs 212 include a setting window tab 208 and a multiple-frame comparison tab 210. The setting window tab 208 is a tab for the setting window of the management device 11 shown in FIG. 3. The multiple-frame comparison tab 210 is a tab for windows, shown in FIGS. 4 to 7, of the management device 11 that display operation data

sets about a plurality of the textile machines within one screen.

[0036] An operator selects the setting window tab 208 from the window switching tabs 212 by operating the input keys 14 or the touch-panel display 13 as appropriate, and then inputs values of language, date, time, factory name, frame number, IP address, subnet mask, gateway, and/or the like in the setting area 206 on the touch-panel display 13. The management device 11(1) of the automatic winder 60(1) in a textile factory is capable of transmitting and receiving operation data to and from the management device 11(2), 11(3), ..., and 11(50) of the other automatic winders 60(2), 60(3), ..., and 60(50), respectively, in the same textile factory when values different from those of the other automatic winders 60(2), 60(3), ..., and 60(50) are input to the frame-number setting area 200 and the IP-address setting area 202 and the same value as that of the automatic winders 60(2), 60(3), ..., and 60(50) is input to the subnet-mask setting area 204 in this window.

[0037] After performing the setting as described above, the operator selects the multiple-frame comparison tab 210 from the window switching tabs 212. In response thereto, the touch-panel display 13 shifts from a second mode, shown in FIG. 3 where the operation data set about the single automatic winder 60 is displayed, to the multiple-frame comparison mode (first mode) where, as shown in FIGS. 4 to 7, the operation data sets about a plurality of the automatic winders 60 belonging to the automatic winder system 70 are displayed in a comparison chart form. Meanwhile, the multiple-frame comparison mode has a data viewing mode for displaying the operation data sets about a plurality of the automatic winders 60 in a comparison chart form and a winding-condition copy mode for copying a winding condition (yarn processing condition) of a particular one of the automatic winders 60 to another one or more of the automatic winders 60.

[0038] Each of the windows of the multiple-frame comparison mode shown in FIGS. 4 to 7 contains a data-viewing-mode switching button 220 and a winding-condition-copy-mode switching button 222. The data-viewing-mode switching button 220 is arranged in a window where the operation data sets about a plurality of the automatic winders 60 are displayed in a comparison chart form. The winding-condition-copy-mode switching button 222 is arranged in a winding-condition-copy mode window used in copying a winding condition of a particular one of the automatic winders 60 to another one of the automatic winders 60. An operator can switch between the data viewing mode and the winding-condition copy mode by selecting one of the data-viewing-mode switching button 220 and the winding-condition-copy-mode switching button 222. The data viewing mode is explained below with reference to FIGS. 4 to 6.

[0039] As shown in FIG. 4, the window for displaying the operation data sets about a plurality of the automatic winders 60 in a comparison chart form contains an op-

eration-data-chart area 224, a scroll bar 218, a comparison-target-frame-number input area 214, a sampled-operation-data area 217, a data acquiring/updating button 216, and the data-viewing-mode switching button 220.

[0040] The operation data sets about a plurality of the automatic winders 60 belonging to the automatic winder system 70 are displayed in the operation-data-chart area 224 in a chart form. More specifically, a list of frame numbers and the operation data sets about the frames is displayed in the operation-data-chart area 224.

[0041] The scroll bar 218 is laid in a direction (top-bottom direction in FIG. 4) in which a plurality of the frame numbers in the operation-data-chart area 224 is arranged. Another scroll bar can be laid if required in a direction (left-right direction in FIG. 4) in which a plurality of operation data items is arranged. The operation data sets about the automatic winder No. 1 60(1) to the automatic winder No. 5 60(5) are displayed in the operation-data-chart area 224 of FIG. 4. However, an operator can view operation data about the other automatic winders, such as the automatic winder No. 50 60(50), by scrolling the operation-data-chart area 224 up or down using the scroll bar 218. In FIG. 4, the winding speed, the rate of failed yarn joining, and the rate of successful doffing operation are displayed as the operation data. However, an operator can view operation data of the other data items by scrolling the operation-data-chart area 224 sideways using the scroll bar 218. Examples of the other data items of the operation data include a production efficiency of the automatic winder 60, the rate of fully-wound yarn-supplying bobbins that have returned to the yarn-supplying-bobbin supplying device 52, and the rate of successful yarn-end finding operation performed by the yarn-supplying-bobbin supplying device 52. The yarn end finding is an operation of placing a yarn end of a yarn-supplying bobbin on a top end of the yarn-supplying bobbin.

[0042] A frame number of any one of a plurality of the automatic winders 60(1) to 60(50) belonging to the automatic winder system 70 can be input to the comparison-target-frame-number input area 214. Operation data sets about two of the automatic winders 60 can be displayed in in-line rows in the sampled-operation-data area 217. When the data acquiring/updating button 216 is activated, the operation data sets about the automatic winders 60 at a point in time when the button is activated can be acquired. The data-viewing-mode switching button 220 is a button for switching the display on the touch-panel display 13 to one of the other data viewing modes shown in FIGS. 5 and 6.

[0043] In the above configuration, when an operator inputs a desired frame number in the comparison-target-frame-number input area 214, the frame number is displayed at a position above the sampled-operation-data area 217. The operator then selects desired frame numbers of the automatic winders 60 that are to be compared with the automatic winder of which frame number has been input in the comparison-target-frame-number input area 214 from the list displayed in the operation-

data-chart area 224. When the operator activates the data acquiring/updating button 216, operation data sets about the two selected automatic winders 60 are displayed in in-line rows in the sampled-operation-data area 217. FIG. 4 shows an example in which an operation data set about the automatic winder No. 3 and that of the automatic winder No. 15 are displayed in a comparison chart form as being compared with the operation data set about the automatic winder No. 2.

[0044] As described above, the display section 13 of the management device 11 of the automatic winder system 70 according to the present invention can display the operation data sets about a plurality of the automatic winders 60 within one screen. Therefore, comparison among operation data sets across a plurality of textile machines can be made in a factory where the automatic winder system 70 according to the present invention is installed. Thus, an operator can determine an operation to be performed on the automatic winders 60 based on a result of analysis of operational statuses of the automatic winders 60 that is carried out based on the comparison among the operation data sets about a plurality of the automatic winders 60. As a result, accuracy and efficiency of maintenance works performed by the operator increase, and production efficiency of the automatic winder system 70 according to the present invention increases.

[0045] By inputting a frame number of an under-operation frame, which is a frame that is being currently operated by an operator, to the comparison-target-frame-number input area 214, comparison of operation data between the under-operation frame and other frames can be made. Accordingly, each of the automatic winders 60 belonging to the automatic winder system 70 according to the present invention allows comparing operation data between the under-operation frame and the other frames by viewing the display section 13 of the management device 11. As a result, an operator can view an operation data set about a target winding unit 16 on a window of the nearest management device 11. Furthermore, the operator can perform a maintenance work on the target winding unit 16 while comparing the operation data set displayed on the window of the management device 11 of the under-operation frame against an actual operation of the target winding unit 16. As a result, accuracy and efficiency of the maintenance work can be further increased.

[0046] The operation data displayed in the operation-data-chart area 224 and the sampled-operation-data area 217 is automatically updated at fixed intervals, e.g., at every two minutes. However, an operator can view latest operation data by activating the data acquiring/updating button 216 rather than waiting for the operation data to be automatically updated. When the data-viewing-mode switching button 220 is activated, the window on the touch-panel display 13 switches from the window that displays operation data sets about a plurality of the automatic winders 60 in the comparison chart form

shown in FIG. 4 to the window shown in FIG. 5 or FIG. 6.

[0047] FIG. 5 is a window showing a chart of operation efficiencies of the automatic winders 60 from the automatic winder No. 1 60(1) to the automatic winder No. 20 60(20) belonging to the automatic winder system 70. The window showing the chart of the operation efficiencies includes an operation-rate-chart area 226. When an operator selects the data-viewing-mode switching button 220, the management-device CPU 63 of the management device 11 collects operation data about operation efficiencies from the management devices 11 of all the automatic winders 60 belonging to the automatic winder system 70, processes the operation data, and displays the operation data as a graph. Although a graph of the operation efficiencies of the automatic winders No. 1 to No. 20 is shown in FIG. 5 due to limitation of space, the number of automatic winders to be displayed is not limited thereto. There can be a situation where it is difficult in terms of window layout to display operational statuses of all the automatic winders within one screen as in a case where, for example, the screen display is for an automatic winder system that includes a large number of automatic winders. For such a situation, the scroll bar 218 is preferably provided along the direction in which the frame numbers are arranged so that the operation data sets about all the automatic winders belonging to the automatic winder system 70 can be viewed by window scrolling using the scroll bar 218.

[0048] The configuration described above allows an operator to determine which one (or more) of the automatic winders 60 belonging to the automatic winder system 70 has declined in operation efficiency by viewing the window containing the comparison chart. As a result, it becomes possible to keep track of statuses of the automatic winders 60 belonging to the automatic winder system 70 clearly and quickly. Accordingly, an operation necessary to increase production efficiency of the automatic winder system 70 can be started earlier.

[0049] FIG. 6 is a diagram of a window showing a chart of winding units in each of which a malfunction has occurred. When, for example, a malfunction alarm is issued from one of the winding units 16 that is under centralized control of the management device 11 of one of the textile machines belonging to the automatic winder system 70, an operator activates the data-viewing-mode switching button 220 to collect data associated with a unit number of the winding unit 16 from the management device 11 and display the data. As shown in FIG. 6, malfunctions have occurred in winding units #10, #50, and #24 of the automatic winder No. 1, the winding unit #40 of the automatic winder No. 6, and the winding units #13 and #60 of the automatic winder No. 11.

[0050] The configuration described above allows an operator to obtain, by viewing the screen, information as to in which one (or more) of the winding units 16 belonging to the automatic winder system 70 a malfunction has occurred. Accordingly, because the operator can draw up a maintenance plan while prioritizing maintenance jobs

and taking a layout of a textile machine factory into consideration, the operator can perform a maintenance work efficiently. Thus, production efficiency increases in the automatic winder system 70 according to the present embodiment.

[0051] FIG. 7 is a drawing of a window showing a chart of condition setting data concerning yarn processing performed by the textile machine. When the data-viewing-mode switching button 220 is activated by an operator, the management-device CPU 63 of the management device 11 transmits a request signal to each of the management devices of the other textile machines for transmission of yarn-processing-condition setting data stored in the management devices 11. Upon receiving the request signal, the management devices 11 transmit winding conditions concerning currently performed winding stored in the ROM of the management devices 11 to the management device 11 that has issued the request signal. The management device of the automatic winder, which has issued the request signal, displays in a tabular form a chart of the winding conditions received from the management devices 11 of the other textile machines.

[0052] This configuration allows the operator to obtain information as to what winding jobs are performed in the automatic winder system by taking a glance at the chart. Accordingly, the operator can not only obtain information as to whether intended winding jobs are appropriately performed in the automatic winder system easily but also can detect an automatic winder that is performing an inappropriate winding job early and take a corrective measure.

[0053] A process procedure for transmitting setting values to management devices of other textile machines is explained below with reference to FIG. 7. FIG. 7 is a diagram of a window showing transmission of yarn-processing-condition setting values of the textile machine, which includes the management device where the window is displayed, to management devices of other textile machines. This setting window includes a transmission-data setting area 230, a receiver-frame-number setting area 234, and a copy button 232. Winding conditions recorded in the management-device CPU 63 of the management device 11 are displayed in a chart form in the transmission-data setting area 230. The frame numbers of the automatic winders 60 belonging to the automatic winder system 70 are displayed in a chart form in the receiver-frame-number setting area 234. A check box is arranged beside each of the list of the winding conditions and the list of the frame numbers as appropriate.

[0054] First, an operator causes the setting window shown in FIG. 7 to appear by activating the winding-condition-copy-mode switching button 222. Subsequently, the operator selects one or more winding conditions to be copied to one or more of the other automatic winders 60 from the chart of the winding conditions displayed in the transmission-data setting area 230. Subsequently, the operator selects one or more of the automatic winders, to which the winding condition is to be copied, from

the list of the frame numbers of the automatic winders 60 displayed in the receiver-frame-number setting area 234. The winding setting values are transmitted by activating the copy button 232.

[0055] An example is shown in FIG. 7 where setting values "COTTON 40" and "COTTON 50" are selected as setting values to be transmitted, and the automatic winder No. 1, the automatic winder No. 2, and the automatic winder No. 8 are selected as frames by which the setting values are to be received. Meanwhile, it is possible to transmit all the winding conditions recorded in the management-device CPU 63 of the management device 11 by activating a select all button 208(a). It is also possible to cause all the automatic winders 60 belonging to the automatic winder system 70 to receive the winding-condition setting values by activating a select all button 208 (b).

[0056] This configuration saves the operator from the need for setting winding setting values on each of the automatic winders 60 belonging to the automatic winder system 70. Furthermore, this configuration prevents a situation where different winding jobs are performed under the same setting name.

[0057] In the automatic winder system 70 according to the present embodiment, operation data can be transmitted cumulatively between the automatic winders 60. This will be described more specifically below on an assumption that first, second, and third automatic winders 60 of the automatic winders 60 are arranged in this order. In a situation where the second automatic winder 60 receives operation data from the first automatic winder 60 and then further transmits the received data to the third automatic winder 60, the second automatic winder 60 can add operation data managed by the second automatic winder 60 itself to the received operation data and transmit the thus-obtained cumulative operation data to the third automatic winder 60.

[0058] Accordingly, each time data is transmitted/received between the automatic winders 60, latest data is added to the data. Consequently, data is automatically collected and updated, causing the automatic winders 60 to share latest data. As a result, operation data sharing among the automatic winders 60 included in the automatic winder system 70 can be implemented efficiently without arranging an apparatus, e.g., a central server, for centralized management of data. However, it is also possible to use at least one of the automatic winders 60 as a centralized management apparatus so that data about the automatic winders 60, which are connected so as to make communication therebetween possible, is centrally controlled at a particular location.

[0059] More specifically, for example, it is possible to set the same winding condition to a plurality of the automatic winders 60 collectively by transmitting the same winding condition to the automatic winders 60. Because the operation data is transmitted/received as described above, it is possible to monitor yarn winding status data and statistical data about all the frames on the touch-

panel display 13 of any one of the automatic winders 60 as appropriate. Accordingly, by causing the information to be displayed on the touch-panel display 13 of a nearest one of the automatic winders 60, an operator can obtain information that, for example, the X-th winding unit 16 of the automatic winder 60(2) is poor in package production efficiency, without going to an installation location of the automatic winder 60(2).

[0060] The automatic winder system 70 according to the present embodiment also includes the second mode in which an operation data set about one of the automatic winders 60 belonging to the automatic winder system 70 is displayed. More specifically, by selecting by an appropriate operation a frame number from the frame numbers displayed in the multiple-frame comparison mode that is displayed on the multiple-frame comparison mode window shown in FIGS. 4 to 6, it is possible to view an operation data set about the frame that is selected.

[0061] Although some exemplary embodiments of the present invention are explained above, the configurations disclosed therein can be modified as described below, for example.

[0062] The operation data explained above is an example and data other than that described above can certainly be communicated among the automatic winders. A configuration in which only a part of the operation data is communicated and the remaining operation data is not communicated can alternatively be employed. For example, a modification can be made such that only winding conditions are communicated among the automatic winders 60.

[0063] The yarn-supplying-bobbin supplying device 52 and the automatic doffer 51 can be omitted or modified. For example, a configuration in which the yarn-supplying-bobbin supplying device 52 supplies the yarn supplying bobbin 21 can be modified to a configuration in which a magazine-type bobbin supplying device is arranged on a front surface of each of the winding units 16.

[0064] The textile machine is not limited to the automatic winder but can be a spinning machine that includes at least one spinning unit, for example. In this case, each of the spinning machines transmits spinning data about the spinning unit of the spinning machine to other spinning machines and receives spinning data from the other spinning machines.

[0065] Communication provided by the system is not limited to communication among frames of the same type. For example, the system can be constructed as a textile machine system that includes a plurality of automatic winders and a plurality of spinning machines. Such a system allows managing information consistently from yarn spinning to package production.

[0066] In the above embodiments, the wired extra-frame communication channel 96 connects the automatic winders 60 to one another so as to make communication therebetween possible. Alternatively, a configuration in which the textile machines are wirelessly connected to one another can be employed as in the case

of the textile machine system disclosed in Japanese Patent Application Laid-open No. 2009-242029.

[0067] In the above embodiments, the wired intra-frame communication channel 90 connects the winding units 16 and the management device 11 arranged in the automatic winder 60 to one another to make communication therebetween possible. Alternatively, a configuration in which the yarn winding units 16 are wirelessly connected to the management device 11 can be employed.

[0068] In the above embodiments, the clock section of the management device 11 stores therein uptime and downtime relating to the winding units 16. However, an element that measures time related to the winding units 16 is not limited thereto. Alternatively, for example, a configuration in which each of the unit control sections 50 includes a clock section, and each of the winding units 16 measures its own uptime and downtime and transmits measurement results to the management device 11 can be employed.

[0069] According to an aspect of the present invention, a textile machine system that includes a plurality of textile machines is configured as described below. Each textile machine includes at least one textile processing unit and a management device that collects and manages an operation data set about the textile processing unit. Each management device includes a display section that displays the operation data set about the textile processing unit, and a communication section. The communication section transmits and receives the operation data set to and from a management device of another textile machine. The display section includes a first mode in which the display section displays the operation data sets about the textile processing units of a plurality of the textile machines within one screen.

[0070] The display section of the textile machine system preferably further includes a second mode in which the display section displays the operation data set about the textile processing unit of one of the textile machines. Each management device further includes a switching section that switches between the first mode and the second mode.

[0071] The above configuration allows, in a factory where the textile machine system according to the present invention is installed, comparison among operation data sets about the textile processing units of a plurality of the textile machines. Accordingly, an operator can determine an operation to be performed on the textile machines based on a result of analysis of operational statuses of the textile machines that is carried out based on the comparison among the operation data sets concerning the frames. As a result, accuracy and efficiency of maintenance works performed by the operator increases, and production efficiency of the textile machine system increases.

[0072] The textile machine system is preferably configured as follows. The display section of each management device is capable of displaying the operation data

set about the textile processing unit of the textile machine to which the management device belongs and the operation data set about the textile processing unit of at least one of the other textile machines within one screen.

[0073] This configuration allows, in the textile machine belonging to the textile machine system according to the present invention configured as described above, comparison of the operation data sets between the under-operation frame, which is the textile machine being operated by an operator, and at least one of the other frames by viewing the display section of the management device. Accordingly, an operator can view an operation data set about a target textile processing unit on a window of the nearest management device. Furthermore, the operator can perform a maintenance work while comparing the operation data set displayed on the management window of the under-operation frame that includes the target textile processing unit against an actual operation of the target textile processing unit, thereby further increasing accuracy and efficiency of the maintenance works.

[0074] The textile machine system is preferably configured as follows. The operation data set to be collected and managed by the management device includes data about an operation efficiency of the textile processing unit. The display section is capable of displaying data about operation efficiencies of the textile processing units of a plurality of the textile machines within one screen.

[0075] This configuration allows, in the textile machine system according to the present invention, an operator to view a list of the operation efficiencies of the textile processing units belonging to a plurality of the textile machines while making comparison across the textile machines. Accordingly, the operator is saved from the need for checking each management device provided in the respective textile machines to acquire the operation efficiencies. As a result, the operator can more accurately and quickly find a textile processing unit that has declined in operation efficiency.

[0076] The textile machine system is preferably configured as follows. The operation data set to be collected and managed by the management device includes data about a malfunction that occurred in the textile processing unit. The display section is capable of displaying textile processing units, in each of which a malfunction occurred, in a chart form.

[0077] This configuration allows, in a factory where the textile machine system according to the present invention is installed, collectively displaying the textile processing units in each of which a malfunction has occurred in the factory. Accordingly, an operator can quickly and accurately determine which one (or more) of the large number of textile processing units installed in the factory requires maintenance.

[0078] The textile machine system is preferably configured as follows. The management device classifies data about malfunctions of the textile processing units by malfunction type and manages the data by calculating a total number of the textile processing units, in each of

which a malfunction has occurred, on a per-malfunction-type basis. The display section is capable of displaying on a per-malfunction-type basis the total number of the textile processing units, in each of which a malfunction has occurred, calculated by the management device.

[0079] This configuration allows the textile machine system according to the present invention to display the total number of the textile processing units, in each of which a malfunction has occurred, on a per-malfunction-type basis. Accordingly, an operator can draw up a maintenance plan based on the malfunction types and the number of malfunction occurrences for each of the malfunction types, and perform a maintenance work according to the maintenance plan. As a result, the operator can perform maintenance works more efficiently.

[0080] The textile machine system is preferably configured as follows. The operation data set to be managed by the management device includes a yarn-processing-condition setting data set about the textile processing unit. The display section is capable of displaying yarn-processing-condition setting data sets about the textile processing units of the textile machines within one screen.

[0081] This configuration allows, in a factory where the textile machine system according to the present invention configured as described above is installed, collectively displaying data sets about condition settings for yarn processing performed in the factory. Accordingly, an operator can accurately and quickly obtain information as to what winding jobs are performed in the factory.

[0082] The textile machine system is preferably configured as follows. The management device further includes a transmitting-and-selecting section that selects a particular one of a plurality of the textile machines and transmits the operation data set about the textile machine to which the management device belongs to the selected particular textile machine.

[0083] This configuration allows, in a factory where the textile machine system according to the present invention is installed, unifying textile winding condition data in the factory. The textile machine system can be configured to make comparison among the data sets about condition settings for yarn processing performed by the textile machines in the factory and transmit yarn-processing-condition setting data to a textile machine that requires setting change. The textile machine system configured as described above can prevent a setting value of a textile machine that requires setting change from being left unchanged, thereby preventing an undesirable situation that the textile machine is operated under an unintended winding condition.

[0084] In the textile machine system, the textile machine is preferably an automatic winder.

[0085] This allows, in a factory where a plurality of automatic winders is installed, efficient comparison of operation data across the automatic winders.

[0086] In the textile machine system, the textile machine is preferably an air spinning machine.

[0087] This allows, in a factory where a plurality of air spinning machines is installed, efficient comparison of operation data across the air spinning machines.

[0088] According to another aspect of the present invention, a textile machine includes at least one textile processing unit and a management device that collects and manages an operation data set about the textile processing unit. The management device includes a display section that displays the operation data set about the textile processing unit, and a communication section. The communication section transmits and receives the operation data set to and from a management device of another textile machine. The display section includes a first mode in which the display section displays operation data sets about textile processing units of a plurality of textile machines within one screen.

[0089] The display section of the textile machine preferably includes a second mode in which the display section displays an operation data set about a textile processing unit of one of a plurality of the textile machines. The management device further includes a switching section that switches between the first mode and the second mode.

[0090] This configuration allows, in a factory where the textile machines according to the present invention are installed, comparison among operation data sets about textile processing units provided in the textile machines. Accordingly, an operator can determine an operation to be performed on the textile machines based on a result of analysis of operational statuses of the textile machines that is carried out based on the comparison among the operation data sets concerning a plurality of the frames. As a result, accuracy and efficiency of maintenance works performed by the operator are increased, and production efficiency of the textile machine system according to the present invention increases.

Claims

1. A textile machine (60) comprising:

at least one textile processing unit (16); and
a management device (11) that is adapted to collect and manage an operation data set about the textile processing unit (16), wherein
the management device (11) includes
a display section (13) that is adapted to display the operation data set about the textile processing unit (16), and
a communication section (62) that is adapted to transmit and receive the operation data set to and from a management device (11) of another textile machine (60), and
the display section (13) includes a first mode in which the display section (13) displays operation data sets about textile processing units (16) of a plurality of textile machines (60) within one

screen.

2. The textile machine (60) according to Claim 1, wherein the display section (13) further includes a second mode in which the display section (13) displays an operation data set about a textile processing unit (16) of one of the textile machines (60), and the management device (11) further includes a switching section (212) that switches between the first mode and the second mode. 5 10
3. A textile machine system (70) comprising a plurality of textile machines according to claim 1.
4. The textile machine system (70) according to Claim 3, wherein the display section (13) further includes a second mode in which the display section (13) displays the operation data set about the textile processing unit (16) of one of the textile machines (60), and each management device (11) further includes a switching section (212) that is adapted to switch between the first mode and the second mode. 15 20
5. The textile machine system (70) according to Claim 3 or 4, wherein the display section (13) of each management device (11) is capable of displaying within one screen the operation data set about the textile processing unit (16) of the textile machine (60) to which the management device (11) belongs and the operation data set about the textile processing unit (16) of at least one of the other textile machines. 25 30
6. The textile machine system (70) according to Claim 3 or 4, wherein the operation data set to be collected and managed by the management device (11) includes data about an operation efficiency of the textile processing unit (16), and the display section (13) is capable of displaying within one screen data about operation efficiencies of the textile processing units (16) of the textile machines (60). 35 40 45
7. The textile machine system (70) according to Claim 3 or 4, wherein the operation data set to be collected and managed by the management device (11) includes data about a malfunction that occurred in the textile processing unit (16), and the display section (13) is capable of displaying a list of textile processing units (16) in each of which a malfunction has occurred. 50 55
8. The textile machine system (70) according to Claim 7, wherein the management device (11) is adapted to classify
- data about malfunctions of the textile processing units (16) by malfunction type and to manage the data by calculating a total number of the textile processing units (16), in each of which a malfunction has occurred, on a per-malfunction-type basis, and the display section (13) is capable of displaying on the per-malfunction-type basis the total number of the textile processing units (16), in each of which a malfunction has occurred, calculated by the management device (11).
9. The textile machine system (70) according to Claim 3 or 4, wherein the operation data set to be managed by the management device (11) includes a yarn-processing-condition setting data set about the textile processing unit (16), and the display section (13) is capable of displaying within one screen yarn-processing-condition setting data sets about the textile processing units (16) of the textile machines (60).
10. The textile machine system (70) according to any one of Claims 3 to 9, wherein the management device (11) further includes a transmitting-and-selecting section (232) that is adapted to select a particular one of a plurality of the textile machines and to transmit the operation data set about the textile machine (60) to which the management device (11) belongs to the selected particular textile machine (60).
11. The textile machine system (70) according to any one of Claims 3 to 10, wherein the textile machine (60) is an automatic winder.
12. The textile machine system (70) according to any one of Claims 3 to 10, wherein the textile machine (60) is an air spinning machine.

FIG.1

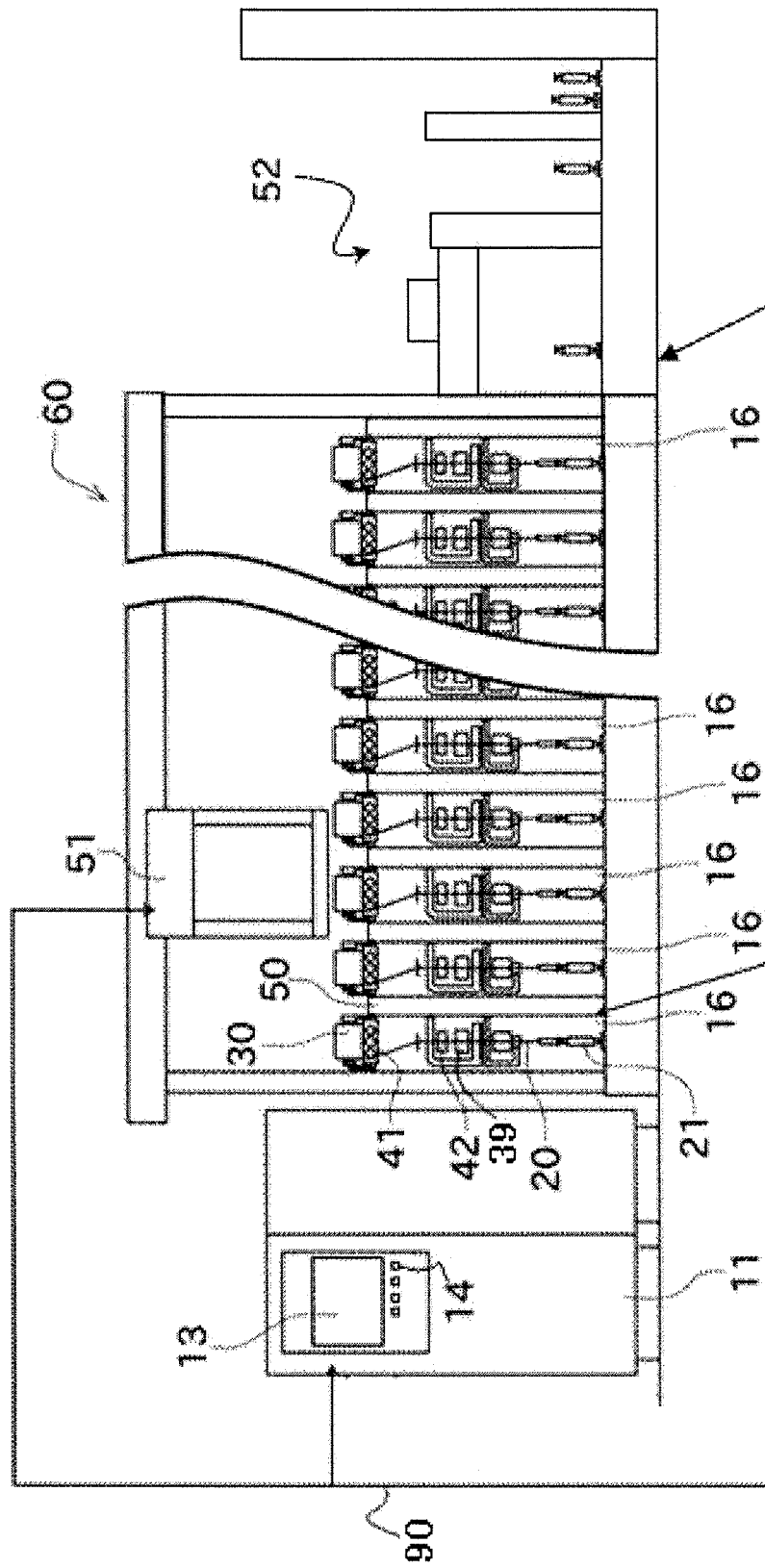


FIG. 2

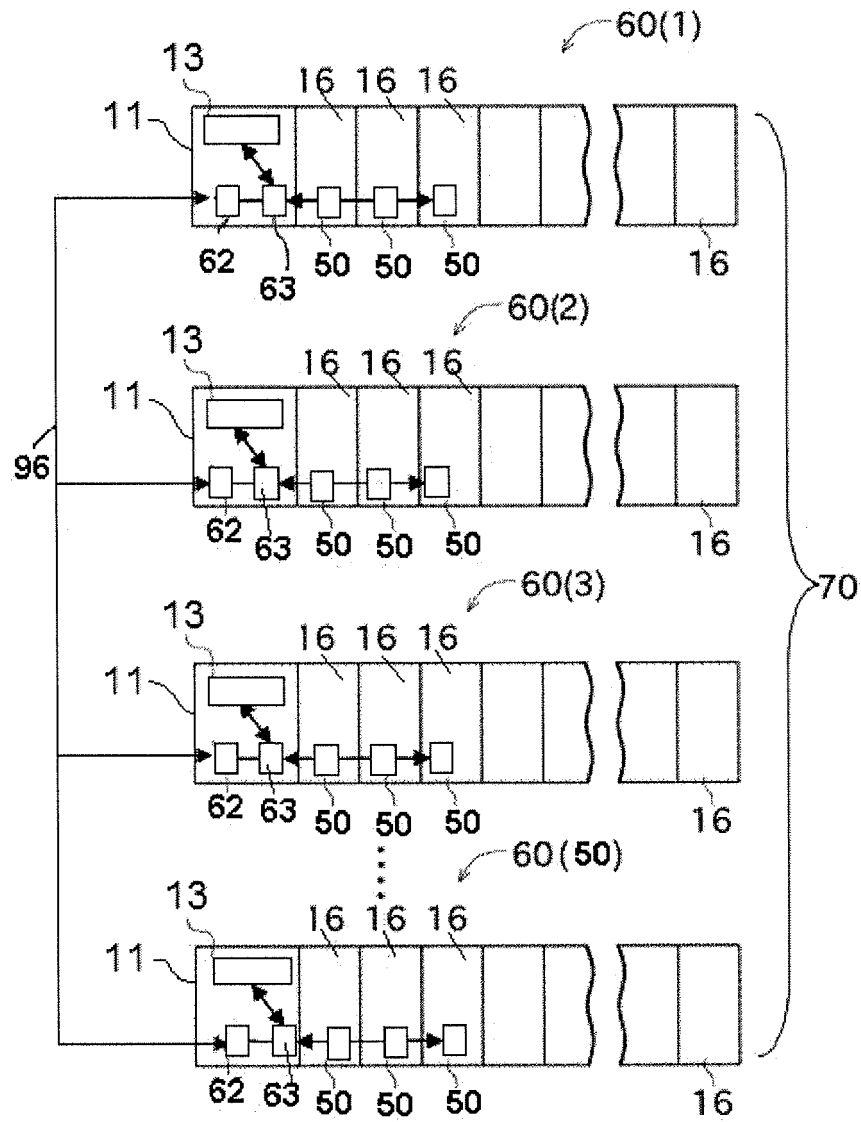


FIG.3

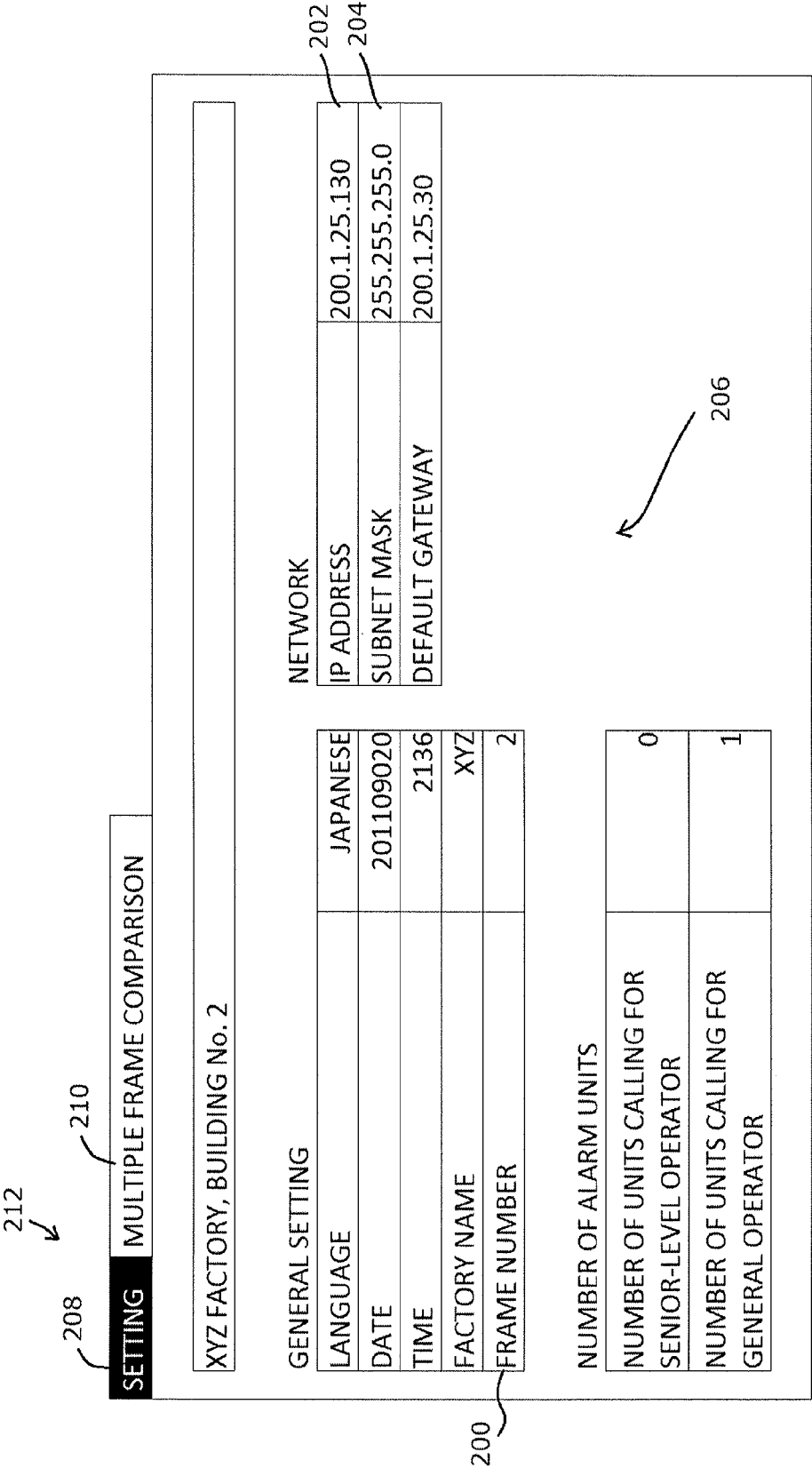


FIG.4

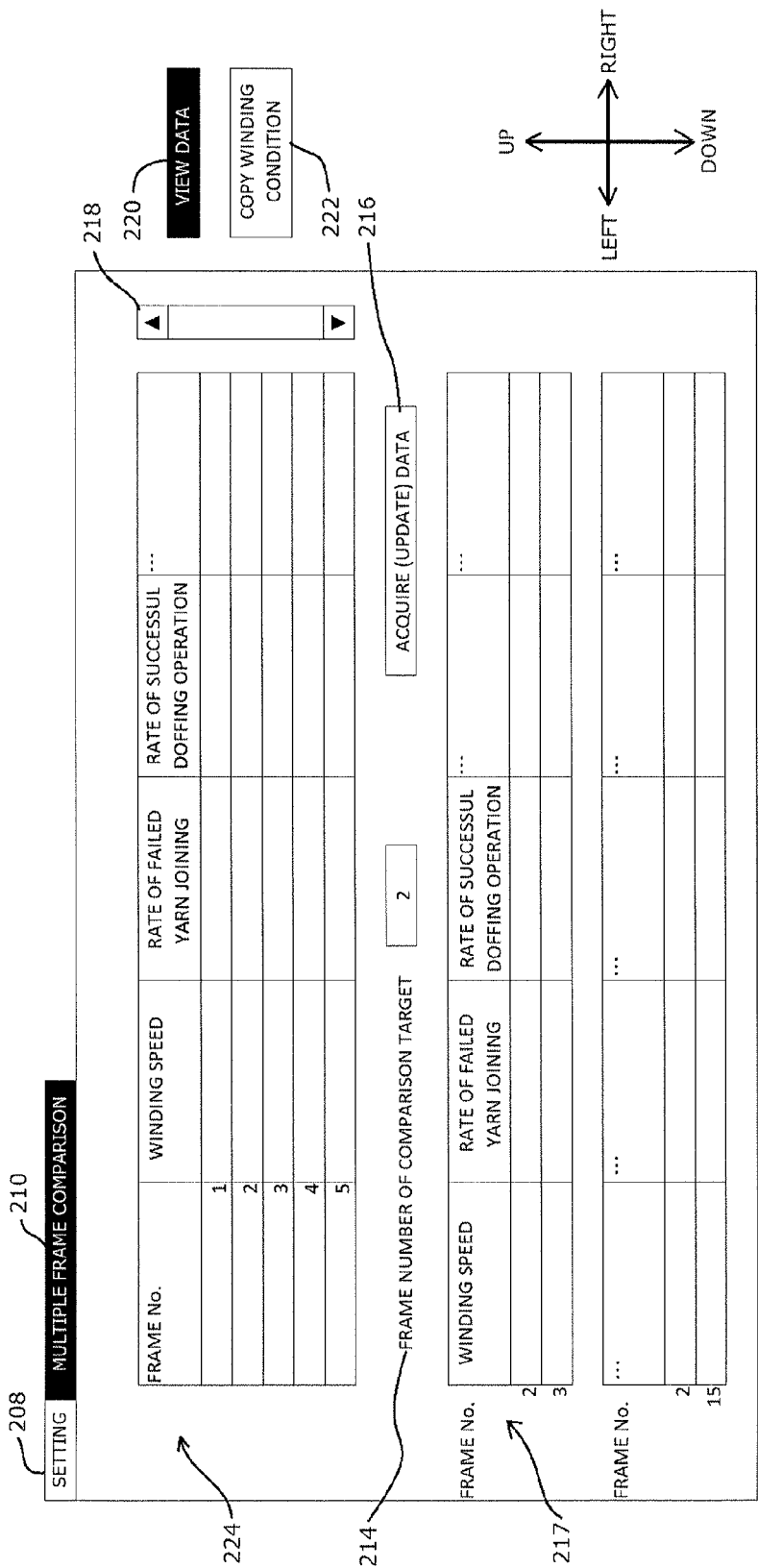


FIG.5

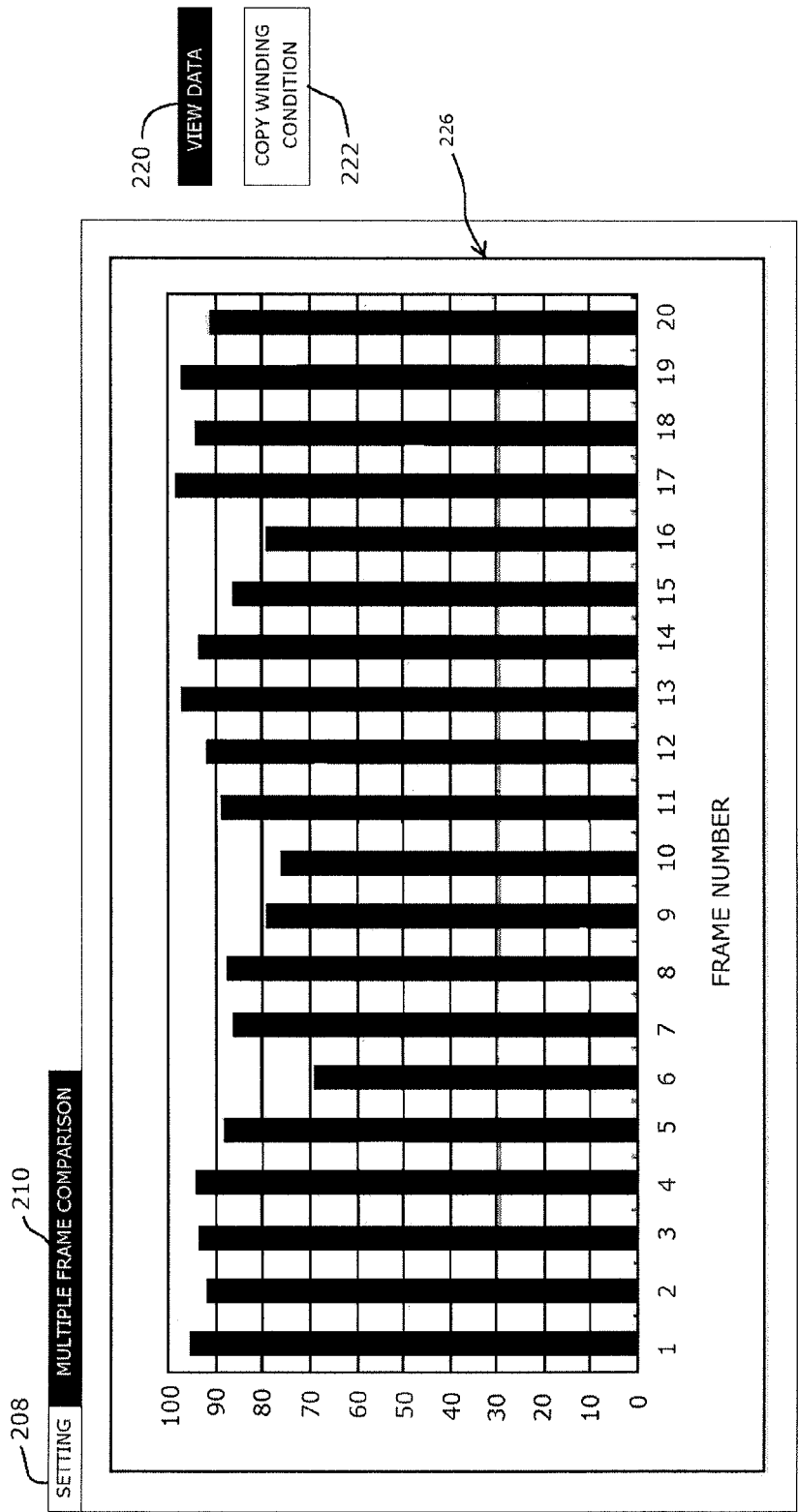


FIG.6

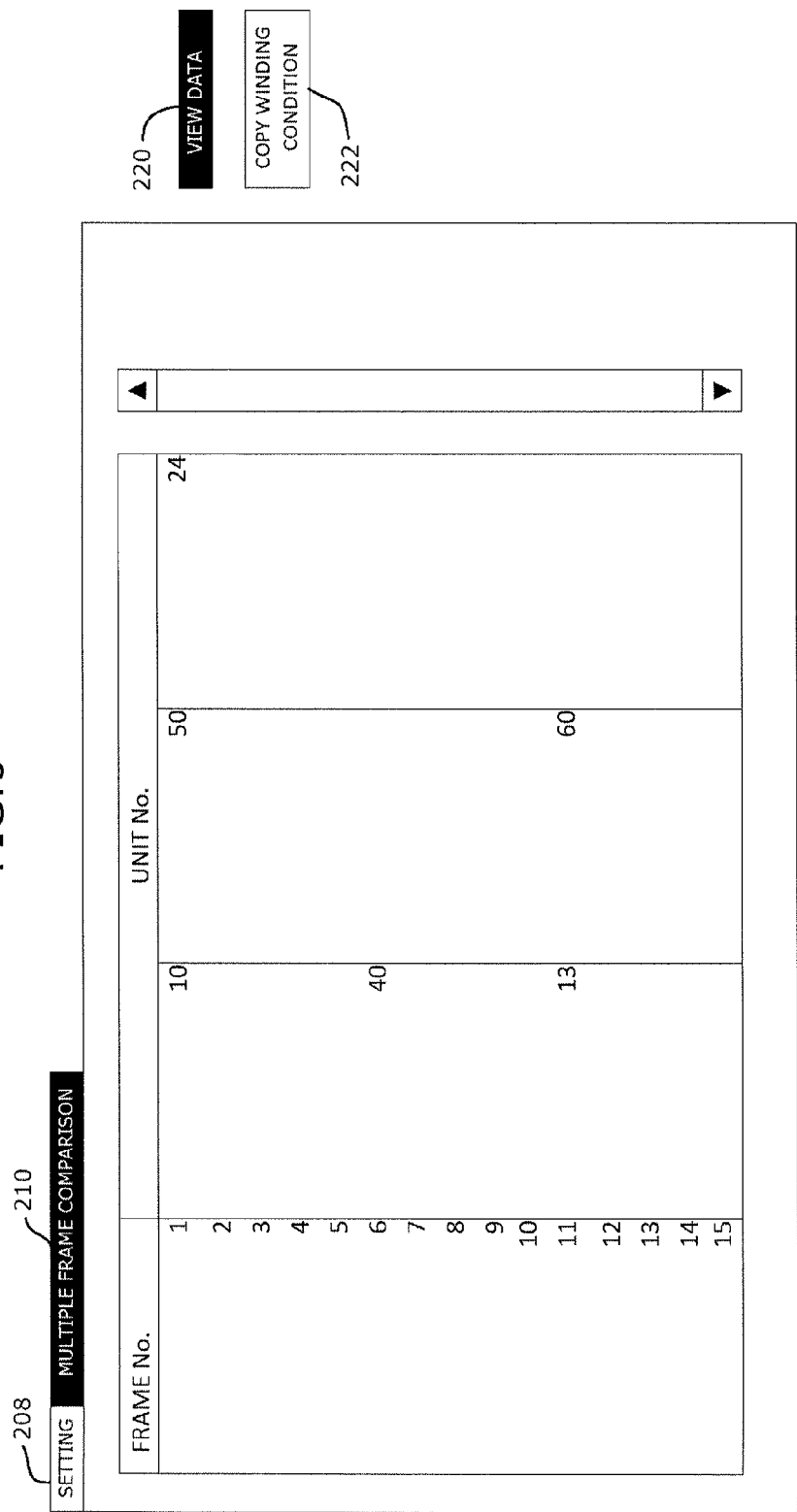


FIG.7

208

SETTING

MULTIPLE FRAME COMPARISON

210

208(a)

SELECT	WINDING CONDITION
SELECT ALL	
☒	COTTON 40
☒	COTTON 50
☐	COTTON 60
☐	COTTON 70
☐	COTTON 80
☐	COTTON 90
☐	FLAX 40
☐	FLAX 50
☐	FLAX 60
☐	FLAX 70
☐	FLAX 80
☐	FLAX 90
☐	WOOL 20
☐	WOOL 30
☐	WOOL 40

208(b)

SELECT	FRAME No.
SELECT ALL	
☒	1
☒	2
☐	3
☐	4
☐	5
☐	6
☐	7
☒	8
☐	9
☐	10
☐	11
☐	12
☐	13
☐	14
☐	15

232

COPY

⇒

230

234

220

VIEW DATA

222

COPY WINDING
CONDITION

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009242029 A [0004] [0005] [0066]