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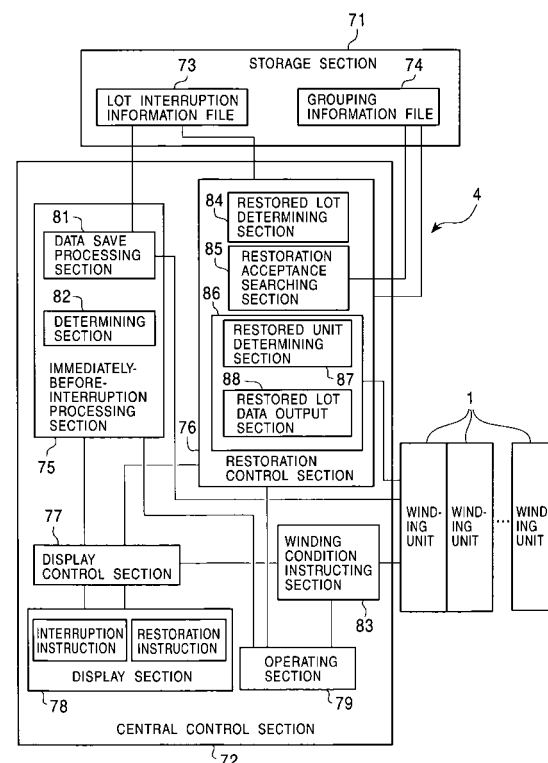
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(54) **Automatic winder**

(57) The present invention enables an unfinished package for which a winding process has been interrupted during a rewinding operation to be easily finished under original conditions to obtain a package of a pre-determined winding length.

An automatic winder has a frame control device 4 comprising winding units 1 each of which executes a winding process of unwinding a spun yarn Y from a supplying package B to wind the yarn into a winding package 9, a process starting and stopping function to start and stop the winding process, an interruption information control section 75 that operates when the winding process in a winding unit is interrupted during a rewinding operation, to acquire and store operational information provided to this winding unit immediately before the interruption, and a restoring section 76 that operates when the interrupted winding process is restarted, to read the operational information to cause the winding unit 1 to restart the winding process on the basis of the operational information (Fig.1).

FIG. 1



Description

Field of the Invention

[0001] The present invention relates to an automatic winder comprising winding units each of which unwinds a spun yarn from a yarn supplying body to wind the yarn into a package.

Background of the Invention

[0002] A spinning bobbin (an example of a yarn supplying body) around which a spun yarn produced by a ring spinning machine is wound is conveyed to an automatic winder. The automatic winder executes a winding process of splicing spun yarns from a large number of ring spinning bobbins together while eliminating defects in the spun yarns wound around the ring spinning bobbins, to rewind them into a winding package shaped like a cone, a cheese, or the like. In the prior art, to rewind the spun yarns into the package, the automatic winder passes each spun yarn unwound from the corresponding spinning bobbin through a large number of yarn guides and the like while applying a tension set for this package type to the spun yarn, to obtain a package of a predetermined winding length. The automatic winder then performs similar operations to obtain a different package type. The automatic winder repeats these operations (for example, refer to the Unexamined Japanese Patent Application Publication No.2002-356277).

[0003] However, with the above conventional method, before a package of a predetermined winding length is obtained, it is impossible to obtain a different package type through a rewinding operation. As a result, if the need arises to urgently produce a different package type through a rewinding operation, the new process must wait until the current rewinding operation is completed. This may result in a time lag in production. It is contemplated that the winding process may be forcibly stopped during the rewinding operation. However, there has been no means for recording information provided immediately before the interruption which information in connection with the unfinished package for which the winding process has been interrupted.

Summary of the Invention

[0004] To promptly deal with production of a different package type which must be urgently wound into a package, the present invention provides an automatic winder which can interrupt the current process and instead execute a winding process for a different package type and which can easily restore the state of a winding process interrupted during a rewinding operation and resulting in an unfinished package which state was present immediately before the interruption, to obtain a package of a predetermined winding length from the unfinished package.

[0005] To accomplish the above object, an aspect of the present invention according to Claim 1 is characterized by having a winding units each of which executes a winding process of unwinding a spun yarn from a yarn supplying body to wind the yarn into a package, and a frame control device comprising immediately-before-interruption information processing means for acquiring and storing operational information provided, immediately before interruption, to the winding unit in which the winding process has been interrupted, winding condition instructing means for allowing winding conditions corresponding to a package type to be inputted to the interrupted winding unit, to start a winding process on the basis of the winding conditions, and restoration control means for reading the operational information for the interrupted winding unit to cause the winding process to be restarted on the basis of the operational information.

[0006] This configuration enables the winding unit in the middle of winding to be interrupted to instead execute a winding process for producing a different package type. Moreover, it is possible to restore the state of the winding process interrupted during a rewinding operation and resulting in an unfinished package which state was present immediately before the interruption, to obtain a package of a predetermined winding length from the unfinished package.

[0007] An aspect of the present invention set forth in Claim 2 is an automatic winder according to Claim 1, characterized in that the operational information is information on the amount of yarn wound into a winding package immediately before the interruption of the winding. With this configuration, when the state present immediately before the interruption is restored, the state of the amount of yarn wound can be accurately restored. Consequently, a package can be generated which has an appropriate amount of wound yarn.

[0008] An aspect of the present invention set forth in Claim 3 is an automatic winder according to Claim 1 or Claim 2, characterized in that the winding unit comprises a tension applying device that tensions a spun yarn being wound, and the operational information is information on the amount of control provided to the tension applying device immediately before the interruption of the winding.

[0009] With this configuration, when the state present immediately before the interruption is restored, the state of tension application can be accurately restored. Consequently, a package can be generated which has been wound under an appropriate tension.

[0010] An aspect of the present invention set forth in Claim 3 is an automatic winder according to any one of Claims 1 to 3, characterized in that a plurality of the winding units are provided, and the winding conditions on which the winding condition instructing means instructs can be met by each group comprising an arbitrary number of winding units from the plurality of winding units, and the restoration control means has restoration acceptance searching means for searching for a

group having winding units that can accept restart of a winding process when the winding process interrupted in a certain group is restarted and display means for displaying results of the search. With this configuration, an interrupting process and a restoring process can be executed for each group.

[0011] An aspect of the present invention set forth in Claim 5 is an automatic winder according to Claim 4, characterized by having a plurality of frames each comprising the frame control device and the winding units and in that the frame control devices are connected together so as to communicate data to one another and the restoration acceptance searching means can search all the frames for a group having winding units that can accept restart of a winding process. With this configuration, the interrupting and restoring processes can be executed to a larger extent.

Brief Description of the Drawings

[0012]

Figure 1 is a block diagram showing a control system for an automatic winder.

Figure 2 is a block diagram of the illustrated control system for the automatic winder, showing the concept of grouping.

Figure 3 is a flow chart of an interrupting process routine.

Figure 4 is a flow chart of a restoring process routine.

Figure 5 is a diagram illustrating an interrupting process screen.

Figure 6 is a diagram illustrating a restoring process routine.

Figure 7 is a schematic diagram showing the configuration of a winding unit.

Figure 8 is a schematic diagram showing the configuration of one frame of automatic winder.

Figure 9 is a schematic diagram showing another embodiment in which a plurality of frames of automatic winders are installed.

Detailed Description of the Preferred Embodiment

[0013] An embodiment of the present invention will be described below with reference to Figures 1 to 9.

[0014] As shown in Figure 1, an automatic winder according to the present embodiment comprises, as one line of frame 61, a large number of winding units 1 and a frame control device 4 that can individually set operational conditions for these winding units 1 and which can monitor operations of the winding units 1. In the present embodiment, there is only one line of frame 61 as shown in Figure 8. However, plural lines of frames 61 may be connected to a higher control device such as a production managing device 62 or the like so as to transmit and receive data to and from it. In this case, the

higher control device can centrally control these frames 61.

[0015] As shown in Figure 7, the winding unit 1 has an unwind assisting device 2, a tension applying device 3 also used as a twist preventing device, a splicing device 5, a slab catcher 6, and a driving drum 7 disposed in this order in a direction in which a spun yarn Y wound around a supplying package B (a yarn supplying body) such as a spinning bobbin is unwound, and also has a unit control device 50 for controlling these equipments. Specifically, the automatic winder is configured to rotate the driving drum 7 to unwind the spun yarn Y from the supplying package B and wind it into a winding package P rotating in contact with the driving drum 7.

[0016] The tension applying device 3 is located above the supplying package B via the unwind assisting device 2. The tension applying device 3 is of a gate type on which movable comb teeth 12 are arranged alternately with fixed comb teeth 11. Specifically, the comb teeth 12 can be engaged with or released from the comb teeth 11 using a pivoting lever. The magnitude of an urging force exerted by the pivoting lever can be varied using a winding tension control solenoid 13.

[0017] The winding tension control solenoid 13 generates a rotative urging force in accordance with an electric signal from a unit control device 50. The tension applying device 3 serves to apply a tension corresponding to the urging force exerted on the movable comb teeth 12, to the spun yarn Y bent zigzag between the fixed comb teeth 11 and the movable comb teeth 12. Reducing a voltage (electric signal) applied to the winding tension control solenoid 13 reduces the magnitude of the zigzag in the spun yarn Y and thus the applied tension. In this manner, the applied tension is varied depending on the electric signal supplied by the unit control device 50 to the tension applying device 3. Accordingly, the amount of control provided to the tension applying device 3 corresponds to the voltage (electric signal) applied to the winding tension control solenoid 13. Moreover, this voltage value is preset in accordance with the amount of yarn wound into the winding package P.

[0018] The splicing device 5 executes a process of splicing a cut spun yarn present on the supplying package B side to a cut spun yarn present on the winding package P side. The splicing device 5 comprises a splicing device main body 35, a lower-yarn sucking and guiding member 35 that guides the supplying package B side spun yarn to the splicing device main body 35, and an upper-yarn sucking and guiding member 37 that guides the winding package B side spun yarn to the splicing device main body 35.

[0019] The lower-yarn sucking and guiding member 36 has a suction port 36a that can be opened and closed, and can be pivoted around a shaft 36b. When the spun yarn is forcibly cut, the suction port 36a is opened, and the tension applying device 3, also used as the twist preventing device, is also opened. Then, the supplying-side yarn end is sucked into the suction port

36a. With the yarn end held in the suction port 36a, the lower-yarn sucking and guiding member 36 pivots from a lower yarn-end catching position to an upper yarn-end guiding position. Thus, the lower yarn is guided into the splicing device main body 35 and then into the tension applying device 3. The lower-end sucking and guiding member 36 maintains substantially the same position as that taken during the yarn catching operation. When the suction port 36a is between the supplying package B and the tension applying device 3, the lower-yarn sucking and guiding member 36 is in its standby position. Accordingly, after the lower-yarn sucking and guiding member 36 has been activated, the supplying-side yarn end can be promptly caught.

[0020] The upper-yarn sucking and guiding member 37 has a suction port 37a and can be pivoted around a shaft 37b. When the spun yarn is forcibly cut, the upper-yarn sucking and guiding member 37 pivots to its upper yarn-end catching position. Then, the suction port 37a sucks the yarn end wound into the winding package P. Moreover, with the upper yarn caught, the upper-yarn sucking and guiding member 37 pivots downward to guide the upper yarn to the splicing device main body 35. Then, the splicing device main body 35 splices the upper yarn and the lower yarn together.

[0021] The slab catcher 6 is, for example, a capacitance type yarn thickness detecting device or an optical yarn thickness detecting device. An analyzer 40 processes signals from the slab catcher 6 to detect defects in the yarn such as a slab. When a defect is detected, an attached cutter 6a, which is disposed between the splicing device 5 and the slab catcher 6, is used to cut the spun yarn Y being unwound. The splicing device 5 removes the defective part during a splicing process and then splices the supply package B side spun yarn to the winding package P side spun yarn.

[0022] The driving drum 7 is configured as a traverse drum comprising a traversing groove. The driving drum 7 contacts with and rotates the winding package P, and traverses the spun yarn Y being wound into the winding package P. The driving drum 7 is driven by a motor 41 having its rotation speed controlled by an inverter 42. The motor 41 has its rotation speed controlled via the inverter 42 by a control signal outputted by the unit control device 50. Furthermore, a package winding length measuring sensor 43 is provided near a rotating shaft of the motor 41 to detect the rotation speed of the rotating shaft. The package winding length measuring sensor 43 outputs a detection signal to the unit control device 50 after each rotation of the rotating shaft.

[0023] The unit control device 50 determines the amount of yarn wound into the winding package P (hereinafter simply referred to as the "winding amount") on the basis of the detection signal from the package winding length measuring sensor 43. The unit control device 50 also controls the driving of the driving drum 7, the driving of the tension applying device 3, the driving of the splicing device 5, and the like. The method of deter-

mining the winding amount is not limited to the package winding length measuring sensor 43. For example, the yarn speed of the spun yarn being run during winding may be measured and integrated to determine the winding amount. The unit control device 50 has an applied tension storage section 56 that stores voltages applied to the tension applying device 3 and winding tension control solenoid 13 during winding, a winding amount storage section 57 that stores the winding amount, and a storage section that stores various process routines and the like. The unit control device 50 comprises a transmitting and receiving section, a calculating section, and other sections (not shown in the drawings).

[0024] The transmitting and receiving section can transmit and receive data to and from the frame control device 4 in Figure 1. The calculating section can execute an interruption responding function and a restoration responding function on the basis of the process routine stored in the storage section. The interruption responding function is activated if a processing operation in any winding unit 1 must be interrupted and is actually interrupted. With this function, when the frame control device 4 inputs an interruption instruction signal to the unit control device 50, the unit control device 50 determines whether or nor the instruction signal indicates this winding unit 1. If the instruction signal indicates this winding unit 1, the unit control device 50 transmits the amount of control provided to the tension applying device 3 immediately before the interruption, that is, the voltage value to the winding tension control solenoid 13 and winding amount to the frame control device 4 as operational information. With the restoration responding function, when the frame control device 4 inputs a restoration instruction signal to the unit control device 50, the unit control device 50 determines whether or nor the instruction signal indicates this winding unit 1. If the instruction signal indicates this winding unit 1, the unit control device 50 reads the voltage value to the winding tension control solenoid 13 and winding amount provided immediately before the interruption, which are contained in the signal. Then, the unit control device 50 uses this applied tension to restart the remaining part of the winding.

[0025] The unit control device 50 is connected to the frame control device 4 so as to transmit and receive data to and from it. The frame control device 4 has a storage section 71 and a central control section 72. The storage section 71 is composed of a mass storage such as a hard disk and has a lot interruption information file 73 and a grouping information file 74. The lot interruption information file 73 contains the voltage value to the winding tension control solenoid 13 and winding amount immediately before the interruption. The grouping information file 74 contains grouping information indicating how the plurality of winding units 1 in one frame connected to the frame control device 4 are pre-divided into groups each of an arbitrary number of units so that each group can operate unitedly. For example, as shown in Figure 2, if there are 60 winding units 1 in one frame,

the grouping information file 74 contains information indicative of a group 1 (GR1) composed of winding units 1 Nos. 1 to 12, a group 2 (GR2) composed of winding units 1 Nos. 13 to 24, and a group 3 (GR3) composed of winding units 1 Nos. 25 to 60.

[0026] On the other hand, the central control section 72 comprises an immediately-before-interruption information processing section 75 operating as immediately-before-interruption information processing means, a restoration control section 76 operating as restoration control means, a winding condition instructing section 83 operating as winding condition instructing means, a display control section 77, a display section 78, and an operating section 79. The immediately-before-interruption information processing section 75, the restoration control section 76, and the display control section 77 are formed of software containing an interrupting processing routine in Figure 3 and a restoring process routine in Figure 4. Alternatively, the sections 75 to 77 may be formed of hardware. In this connection, there are a plurality of winding conditions for the different types of winding packages. That is, parameters such as the amount of yarn wound into a winding package, the amount of tension control, and the winding yarn speed vary depending on the package type.

[0027] The immediately-before-interruption information processing section 75 has a data save processing section 81, a determining section 82, and a winding condition instruction section 83. The data save processing section 81 obtains operational information (the voltage to the winding tension control solenoid 13 and winding amount) for each winding unit 1 of the interrupted group which information was provided immediately before the interruption. The data save processing section 81 then stores this information in the lot interruption information file 73. The determining section 82 recognizes and determines a group specified by an operator to be interrupted. The winding condition instructing section 83 outputs a winding condition instruction signal to cause the winding units 1 of the specified group to execute a winding process on the basis of winding conditions corresponding to a package type desired to be produced.

[0028] The restoration control section 76 has a restored lot determining section 84, a restoration acceptance searching section 85 operating as a restoration acceptance searching means, and a restoration setting section 86. The restored lot determining section 84 is adapted to recognize and determine the package type (lot) specified by the operator to be restored. The restoration acceptance searching section 85 searches for a group that can accept the restart of winding for the package type to be restored, and displays it on a screen. The restoration setting section 86 has a restored unit determining section 87 that recognizes and determines the group specified by the operator and a restored lot data output section 88 that transmits operational information to the specified group in order to cause it to restart winding.

[0029] A description will be given of operation of the automatic winder configured as described above. It is assumed that while each group including winding units 1 such as the one shown in Figure 7 is performing an operation of winding the spun yarn Y, the need arises to urgently produce a package type different from the one currently being wound. First, to promptly start the urgent winding process, the operator forcibly interrupts the winding in a certain group (winding unit 1) and prepares for an interrupting process. Then, as shown in Figure 1, the operator operates the operating section 79 to instruct on an interrupting process. Thus, as shown in Figure 5, the display section 78 shows an interrupting process screen. Specifically, the display section 78 shows a list of currently active groups (GR1, GR2, GR3, ...) and information on the package type being processed by each group (LOT-(A) package type, LOT-(B) package type, LOT-(C) package type, ...).

[0030] Furthermore, as shown in Figure 3, the interrupting process routine is executed. In this case, it is monitored whether a saving operation has been performed using the operating section 79 (S1). If the saving operation has not been performed (S1, N0), step S1 is repeated to wait for a saving operation. On the other hand, it is assumed that the operator determines the group of winding units 1 in the group (GR2) as an interrupted group and forcibly interrupts the winding performed in the 12 winding units in the group (GR2). Subsequently, as shown in, for example, Figure 5, the operator moves a cursor in the interrupting process screen. If the operator operates the cursor so as to select the group of winding units 1 in the group (GR2) (a saving operation) (S1, YES), the contents of the saving operation are determined (S2). Then, a downward arrow is displayed below the cursor on the screen. Yarn type information to be saved is displayed below the arrow.

[0031] Furthermore, a confirmation window is popped up to allow the operator to determine whether or not to save the package type information (lot data) for this group. If the operator instructs on the avoidance of performance of a saving operation, step S1 is executed to wait for a saving operation again. On the other hand, if the operator instructs a saving operation to be performed, an interruption instruction signal is transmitted to obtain the voltage to the winding tension control solenoid 13 and winding amount provided immediately before the interruption, from each of the 12 units in the selected group (GR2) as operational information (S3). The operational information is stored in the lot interruption information file 73 together with the group number (GR2), the package type information (LOT-(B) package type), and the like (S4). Subsequently, the number of the group (GR2), the date and time when the interruption was started, and the like are displayed in a save list screen formed at the side of the position where the package type information is displayed (S5).

[0032] The winding package P into which the yarn has not been completely wound yet and the supplying pack-

age B are removed from the winding unit 1 in which the processing operation has been interrupted by the interruption instruction signal as described above. Subsequently, the operator uses the operating section 79, shown in Figure 1, to input the package type to be urgently produced (new winding conditions), and specifies the group (GR2) as the one to execute a winding process. Thus, a winding condition instruction for the urgent production is outputted to the group (GR2) via the winding condition instructing section 83. Thus, the group (GR2) interrupts the current process and instead executes a winding process for the different package type to start producing the winding package P.

[0033] Then, to restart the production of the interrupted package type, the operator operates the operating section, shown in Figure 1, to instruct on a restoring process. Thus, as shown in Figure 6, the display section 78 displays a restoring process screen. Specifically, the display section 78 shows the currently active groups (GR1, GR2, GR3, ...) and information on the package type being processed by each group (LOT-(A), LOT-(D), LOT-(C), ...). In this case, the package type (LOT-(D)) being processed by the group (GR2) is being processed in place of the package type (LOT-(B)) and needs to be urgently produced.

[0034] Furthermore, as shown in Figure 4, the restoring process routine is executed. First, it is determined whether or not the operator has used the operating section 79 to specify a lot corresponding to a package type to be restored (S11). If the operator has not specified any lots (S11, N0), step S11 is repeated to wait for a specifying operation. On the other hand, if the operator moves and operates the cursor in a restoring process screen to select a lot to be restored (in this case, the group (GR2) in a save list displayed at number "3" of the left end of the screen) as shown in, for example, Figure 6 (S11, YES), then the lot specified by this operation is determined to be a lot requiring restoration (S12). Then, the number of units for the requested lot (in this case, 12) is compared with the number of winding units 1 in each group obtained from the grouping information file 74. Then, groups having the same number of units as those for the requested lot are searched for and determined to be groups that can accept the restoration (S13). Then, the results of this search are displayed on the screen (S14). In this case, the group (GR1) has the same number of units as those of the group (GR2), that is, 12 units. Thus, as shown in the figure, in the row of the group (GR2) in the save list which row is shown by the number "3" at the left end of the screen, "LOT-(B)" is displayed not only in the column of the group (GR2) but also in the column of the group (GR1). Here, it is contemplated that the operator may pre-recognize information on the number of units in each group. However, in general, the automatic winder is a frame comprising a large number of groups, and a plurality of such frames are installed in a factory in parallel. Accordingly, it is difficult for the operator to memorize the number of

units in every group, and the operator may mistakenly memorize the numbers. Thus, by allowing the frame control device 4 to automatically display the information as in the case of the present invention, it is possible to more accurately and easily determine the number of units in each group.

[0035] The above described search is carried out by identifying the group having the same number of units as those for the lot requiring restoration. However, the present invention is not limited to this aspect. That is, when the operator specifies an arbitrary one of the groups on the display screen, lots (for which the winding has been interrupted) requiring restoration and having the same number of units as those in the specified group may be searched for and displayed on the screen. Then, the operator may select one of these lots as the lot to be restored.

[0036] Subsequently, it is determined whether or not the operator has moved the cursor to select a group to execute restoration (an instruction on a unit to execute restoration) (S15). If the group to execute restoration has not been specified (S15, N0), step S15 is re-executed to enter a standby state. On the other hand, if the group (GR2) has been specified to execute restoration (S15, YES), the group (GR2) is determined to execute restoration. Then, an upward arrow is displayed on the screen at the position where the group (GR2) is displayed (S16).

[0037] Subsequently, a confirmation window is popped up to allow the operator to determine whether or not to allocate package type information (lot data) to the group to execute restoration. If the operator instructs on the avoidance of allocation of the package type information, step S11 is executed to wait for a restoring operation again. On the other hand, if the operator instructs the information to be allocated, the operational information corresponding to the package type information (lot data) is extracted from the lot interruption information file 73 in Figure 1. Then, a restoration instruction signal containing this operational information is transmitted. The operational information is allocated to each winding unit 1 of the selected group (GR2). Then, the remaining part of the winding is restarted using the voltage to the winding tension control solenoid 13 and winding amount provided immediately before the interruption, which voltage and amount are contained in the operational information (S18). In the present invention, when the winding interrupted in the group (GR2) is restarted, a group that can accept the restart is searched for. This is because the winding need not necessarily be recovered in the group (GR2) in which the winding has been interrupted. For example, when the winding for the LOT-(D) package type being executed in the group (GR2) through interruption is still being continued or is finished, if the winding has already been finished in the group (GR1), then no problems occur if the interrupted winding for the LOT-(B) package type in the group (GR2) is recovered in the group (GR1). Alternatively, if

it is determined from the results of the search for available groups that the group (GR1) can accept the restoration after the winding for the LOT-(B) package type in the group (GR2) has been interrupted, then it is possible to interrupt the winding of the LOT-(A) package type in the group (GR1), store the operational information provided to the group (GR1) immediately before the interruption, and then restart the winding for the LOT-(B) package type in the group (GR1). When a group is selected which can accept restoration in restarting a winding process, the above search function makes it possible to more accurately determine an available group and also enables a more flexible selection.

[0038] As described above, as shown in Figures 1 and 7, the automatic winder according to the present embodiment has the winding units 1 each of which executes the winding process of unwinding the spun yarn Y from the yarn supplying body B to wind the yarn into the package P, and the frame control device 4 comprising the winding condition instructing means for causing the winding process to be started on the basis of winding conditions corresponding to the package type, the immediately-before-interruption information processing means (immediately-before-interruption information processing section 75 and restoring process routine in Figure 3) for acquiring and storing the operational information (applied tension and winding amount) provided, immediately before the interruption, to the winding unit in which the winding process has been interrupted, and the restoration control means (restoration control section 76 and restoring process routine in Figure 4) for reading the operational information for the interrupted winding unit to cause the winding process to be restarted on the basis of the operational information. This enables the winding unit in the middle of winding to be interrupted to instead execute a winding process for producing a different package type. It is also possible to easily restore the state of the winding process interrupted during a rewinding operation and resulting in an unfinished package which state was present immediately before the interruption, to obtain a package of a predetermined winding length from the unfinished package. Furthermore, in the present embodiment, the operational information is information on the amount of yarn wound into a winding package immediately before the interruption of the winding. This enables the winding unit in the middle of winding to be interrupted to instead execute a winding process for producing a different package type. It is also possible to easily restore the state of the winding process interrupted during the rewinding operation and resulting in the unfinished package which state was present immediately before the interruption, to obtain a package of a predetermined winding length from the unfinished package. Furthermore, in the present embodiment, the winding unit comprises the tension applying device that tensions the spun yarn being wound. The amount of control provided to the tension applying device is preset in accordance with the

amount of wound yarn. The operational information is the amount of control provided to the tension applying device immediately before the interruption of the winding. Thus, when the state present immediately before the interruption is restored, the state of tension application can be accurately restored. Therefore, a package can be generated which has been wound under an appropriate tension.

[0039] Furthermore, in the present embodiment, the plurality of winding units 1 are provided, and the winding conditions on which the winding condition instructing means instructs can be met by each group comprising an arbitrary number of winding units from the plurality of winding units, and the restoration control means has the restoration acceptance searching means (restoration acceptance searching section 85 and steps S13, S14 in Figure 4) for searching for a group having winding units that can accept restart of a winding process when the winding process interrupted in a certain group is restarted, and the display means for displaying results of the search. Thus, an interrupting process and a restoring process can be executed for each group.

[0040] As the data concerning the voltage to the winding tension control solenoid 13 and winding amount, only one of the voltage and the winding amount may be saved, or other data may be saved.

[0041] In the description of the present embodiment, the searching process is executed within one frame comprising the frame control device 4. However, the present invention is not limited to this aspect. As shown in Figure 9, a plurality of frames may be provided each of which is composed of the frame control device 4 and the winding units 1. Furthermore, the frame control devices 4 may be connected together so as to communicate data to one another. Then, the restoration acceptance searching means provided in the production managing device 62 or each frame control device 4 may be able to search all the frames for a group having winding units that can accept the restart of the winding process. In this case, the interrupting and restoring processes can be executed to a larger extent.

[0042] Furthermore, in the restoring process according to the present embodiment, the group that can accept restoration has the same number of units as those for the lot requiring restoration. However, the present invention is not limited to this aspect. The group that can accept the restoration to restart the winding may be selected to have more units than the group in which the winding process has been interrupted. In this case, a popup display is preferably provided which indicates that the number of units is larger or smaller than that in the group in which the winding process has been interrupted.

[0043] Moreover, the restoring process may be divided. Specifically, an arbitrary group may restore the winding previously executed in some of the units of the group in which the winding process has been interrupted. The operational information for the remaining units may con-

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tinue to be stored in the lot interruption information file 73 so that the corresponding winding can be restored at the next opportunity. In this case, the winding process can be restored as soon as a group corresponding to the number of the remaining units becomes available. Alternatively, the winder may be adapted to allow the selection of each unit in which the winding process is to be restored. In this case, the units in the group in which the winding has been interrupted may be sequentially selected in order of increasing amount of yarn in the package, starting with a unit having a package closest to a full one upon the interruption, to restore the winding in some of the units. Consequently, once the winding packages in the winding units in which the winding has been restored become full, the winding can be restored in the remaining winding units one by one to process the remaining winding packets for which the winding is to be restored. This enables the restoring process to be completed in all the interrupted winding units as quickly as possible. The above described restoring method is effective when groups having as many units as or more units than the group in which the winding process is to be restarted have no units available for restoration or when in spite of the presence of available units, the number of units available for restoration is insufficient.

[0044] According to the present invention, the automatic winder has the winding units each of which executes the winding process of unwinding the spun yarn from the yarn supplying body to wind the yarn into the package, and the frame control device comprising the immediately-before-interruption information processing means for acquiring and storing the operational information provided, immediately before the interruption, to the winding unit in which the winding process has been interrupted, the winding condition instructing means for allowing the winding conditions corresponding to the package type to be inputted to the interrupted winding unit, to start the winding process on the basis of the winding conditions, and the restoration control means for reading the operational information for the interrupted winding unit to cause the winding process to be restarted on the basis of the operational information. This configuration enables the winding unit in the middle of winding to be interrupted to instead execute a winding process for producing a different package type, by restoring the state present immediately before the interruption. Therefore, a package of a predetermined winding length can be obtained from the unfinished package.

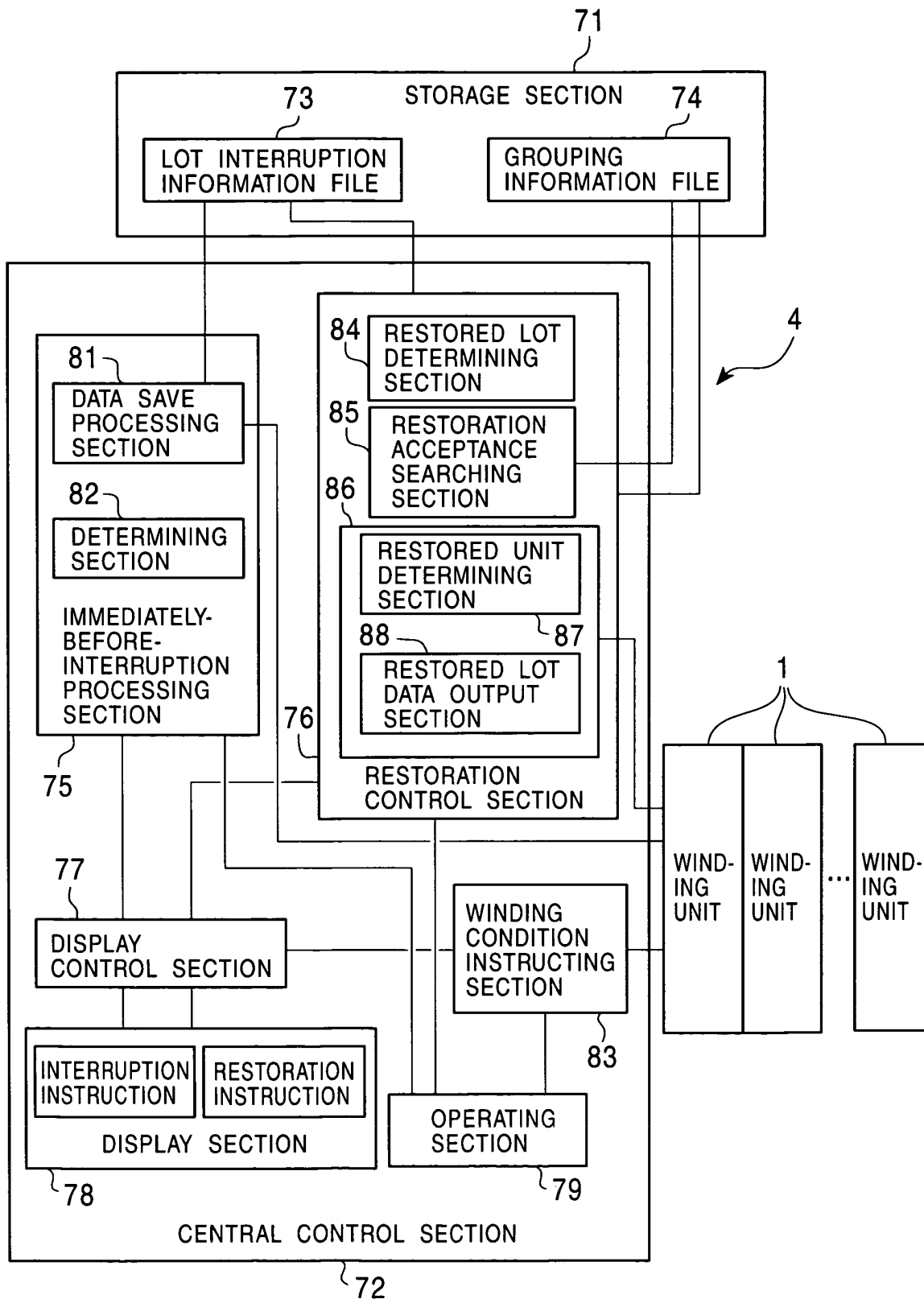
Claims

- 55
1. An automatic winder **characterized by** having a winding units each of which executes a winding process of unwinding a spun yarn from a yarn supplying body to wind the yarn into a package, and a frame control device comprising immediately-before-interruption information processing means for

acquiring and storing operational information provided, immediately before interruption, to the winding unit in which the winding process has been interrupted, winding condition instructing means for allowing winding conditions corresponding to a package type to be inputted to said interrupted winding unit, to start a winding process on the basis of the winding conditions, and restoration control means for reading said operational information for said interrupted winding unit to cause the winding process to be restarted on the basis of the operational information.

2. An automatic winder according to Claim 1, **characterized in that** said operational information is information on the amount of yarn wound into a winding package immediately before the interruption of the winding.
3. An automatic winder according to Claim 1 or Claim 2, **characterized in that** said winding unit comprises a tension applying device that tensions a spun yarn being wound, and said operational information is information on the amount of control provided to said tension applying device immediately before the interruption of the winding.
4. An automatic winder according to any one of Claims 1 to 3, **characterized in that** a plurality of said winding units are provided, and the winding conditions on which said winding condition instructing means instructs can be met by each group comprising an arbitrary number of winding units from said plurality of winding units, and said restoration control means has restoration acceptance searching means for searching for a group having winding units that can accept restart of a winding process when the winding process interrupted in a certain group is restarted and display means for displaying results of the search.
5. An automatic winder according to Claim 4, **characterized by** having a plurality of frames each comprising said frame control device and said winding units and in that said frame control devices are connected together so as to communicate data to one another and said restoration acceptance searching means can search all the frames for a group having winding units that can accept restart of a winding process.

FIG. 1



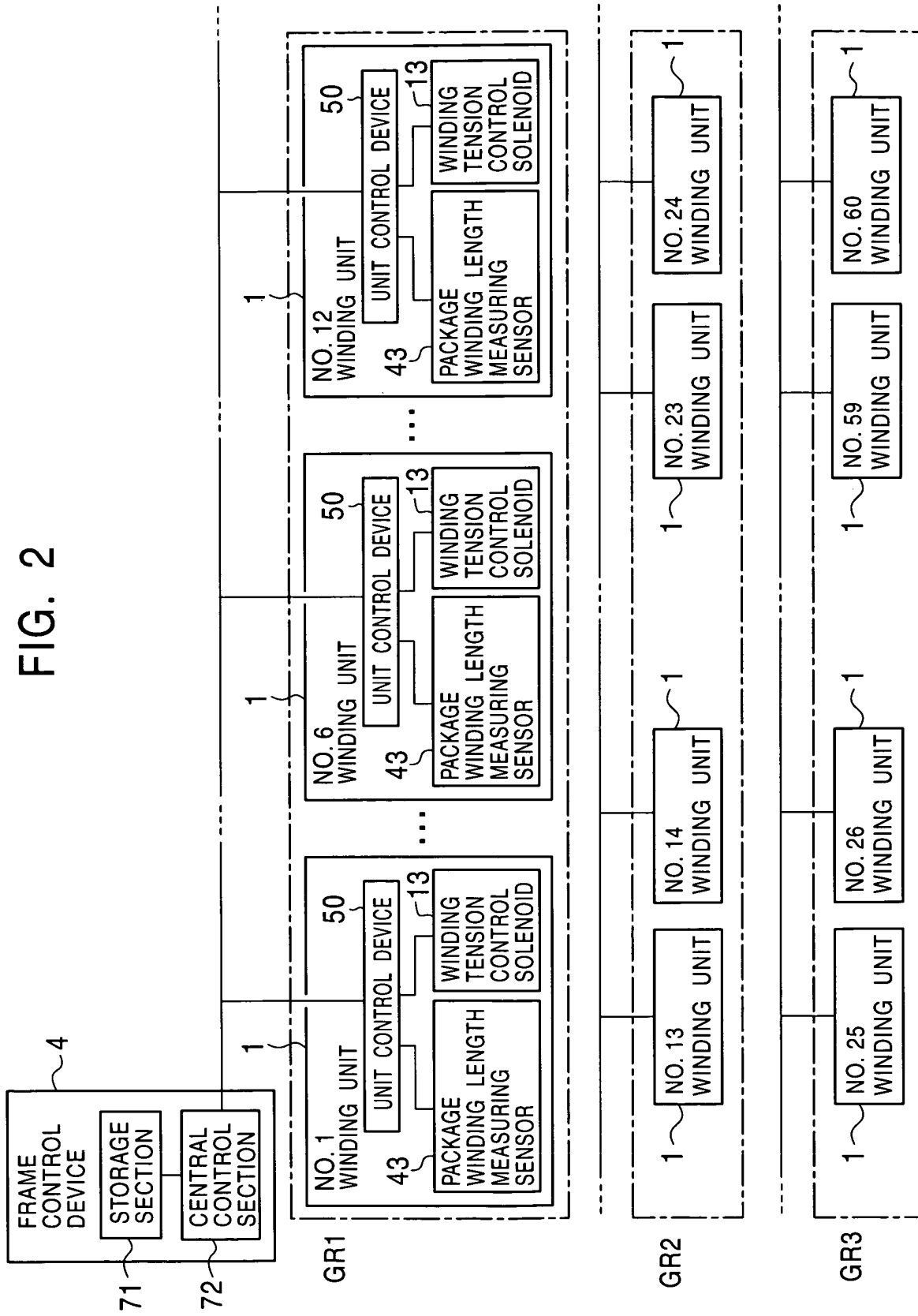


FIG. 3

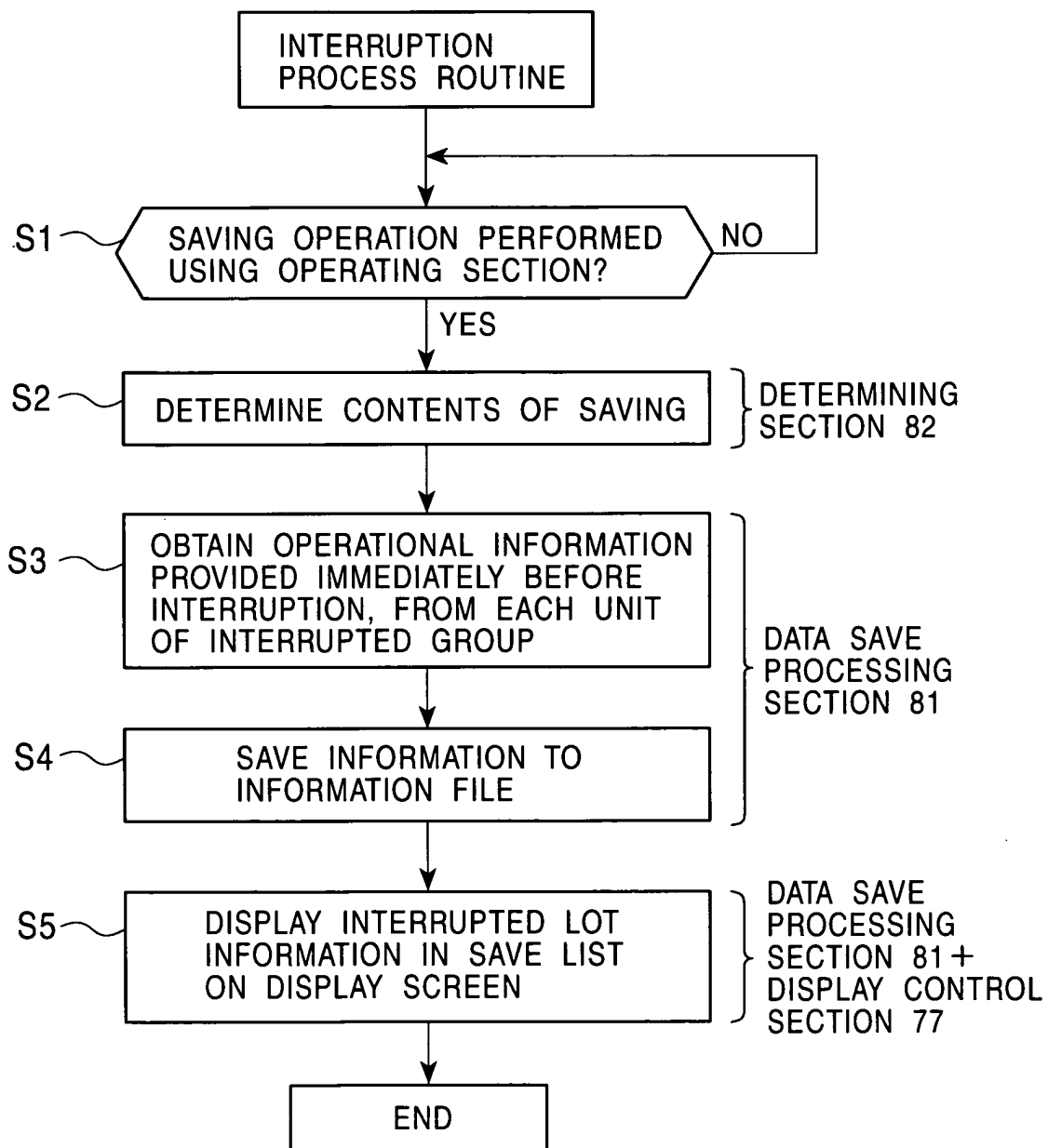


FIG. 4

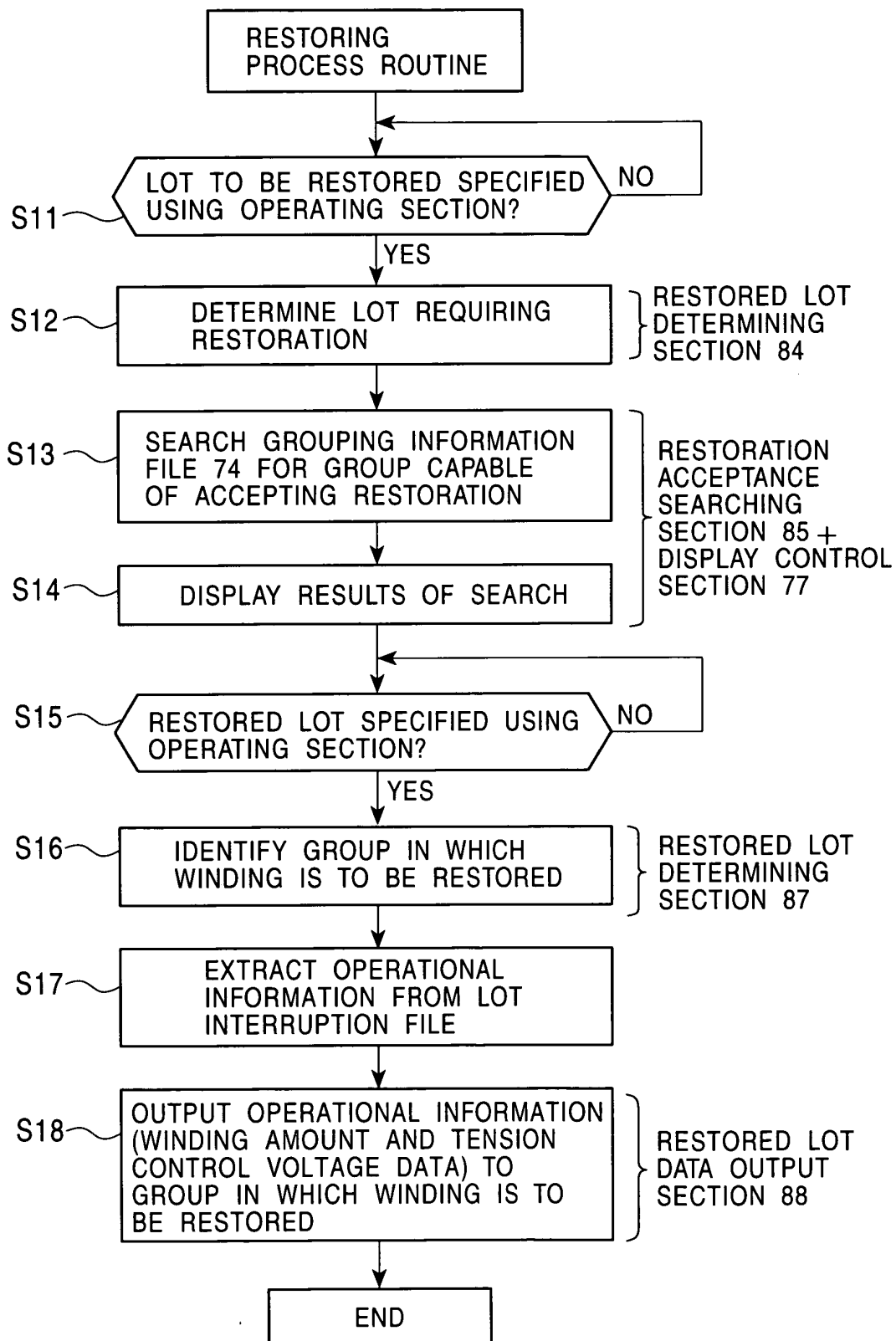


FIG. 5

	[PRESENT]	GR1(1-12) LOT-(A)	GR2(13-24) LOT-(B)	GR3(25-60) LOT-(C)
1	[SAVED] WINDING INTERRUPTED LOT		↓	
2				
3	GR2(13-24) 11/21/1S 14:20		LOT-(B)	
4				
5				
6		SAVE LOT DATA FOR GROUP 1: YES 3: NO		
7				
8				
9				

FIG. 6

	[PRESENT]	GR1(1-12) LOT-(A)	GR2(13-24) LOT-(D)	GR3(25-60) LOT-(C)
1	[SAVED] WINDING INTERRUPTED LOT		↑	
2				
3	GR2(13-24) 11/21/1S 14:20	LOT-(B)	LOT-(B)	
4				
5				
6		ALLOCATE LOT DATA 1: YES 3: NO		
7				
8				
9				

FIG. 7

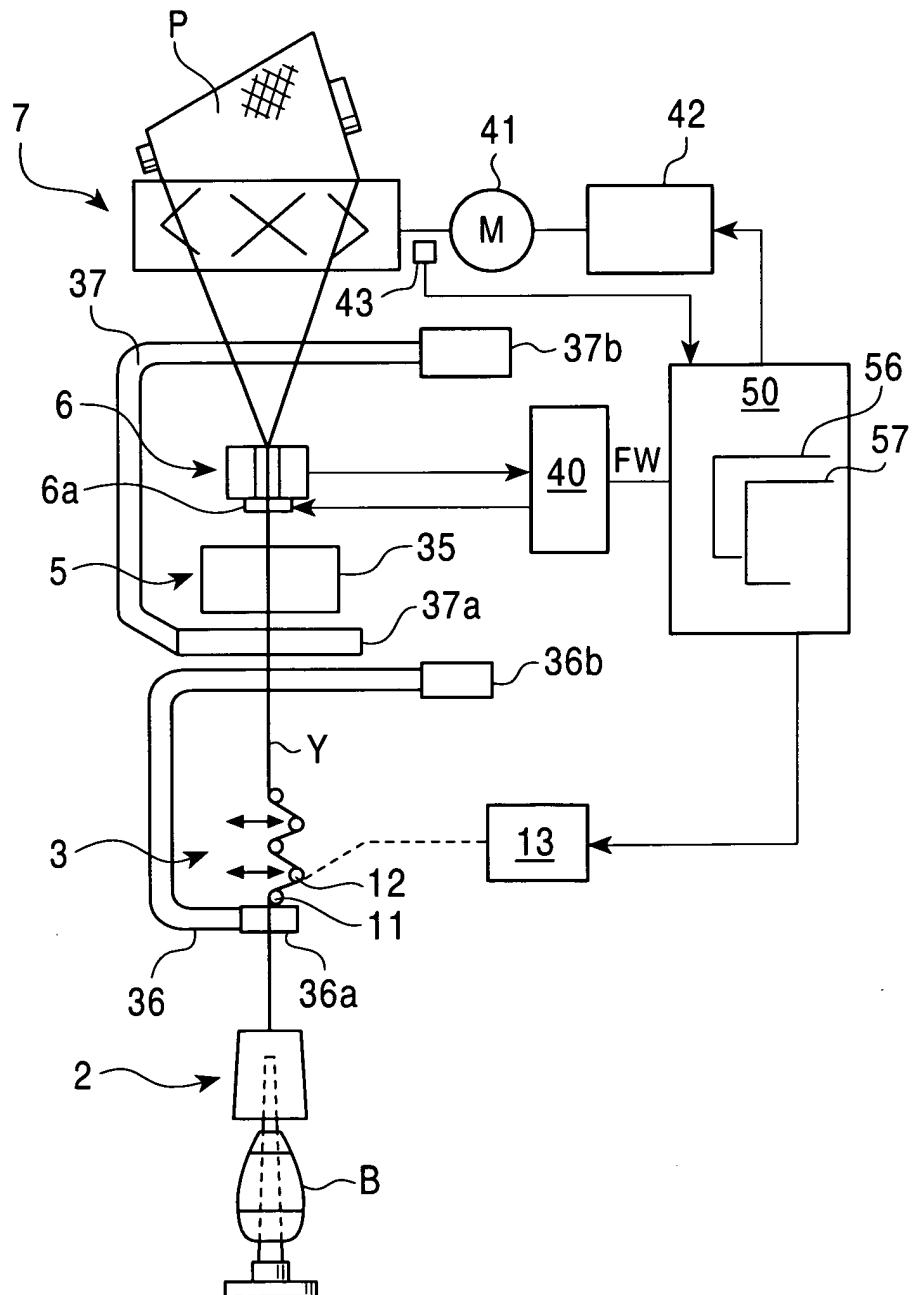


FIG. 8

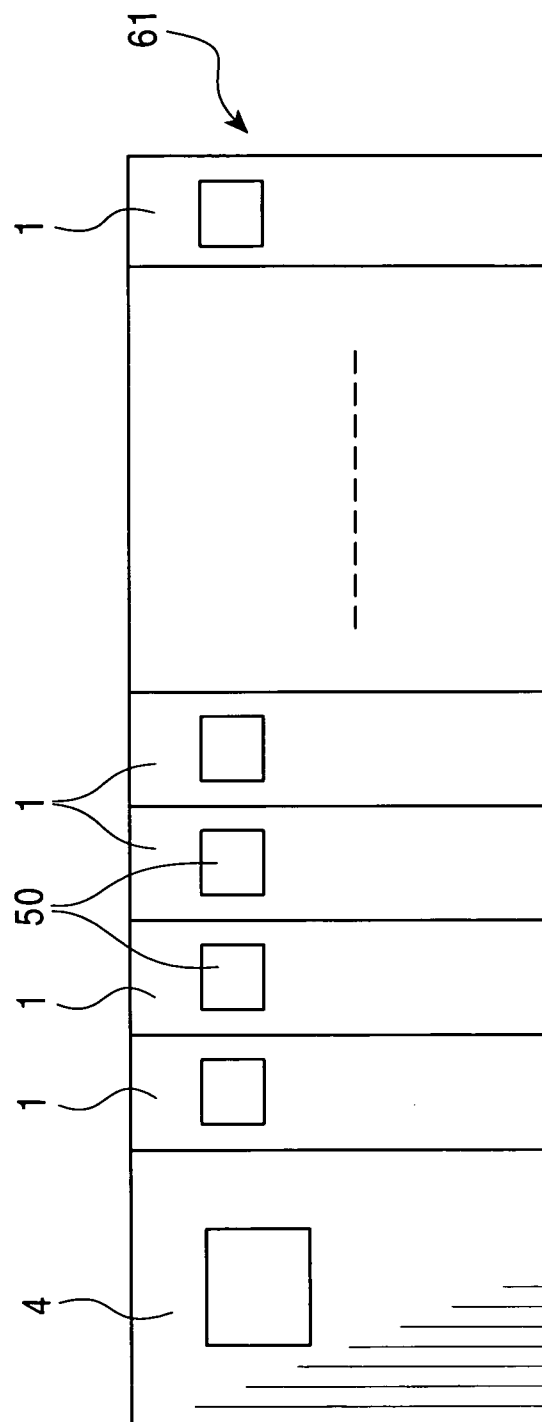
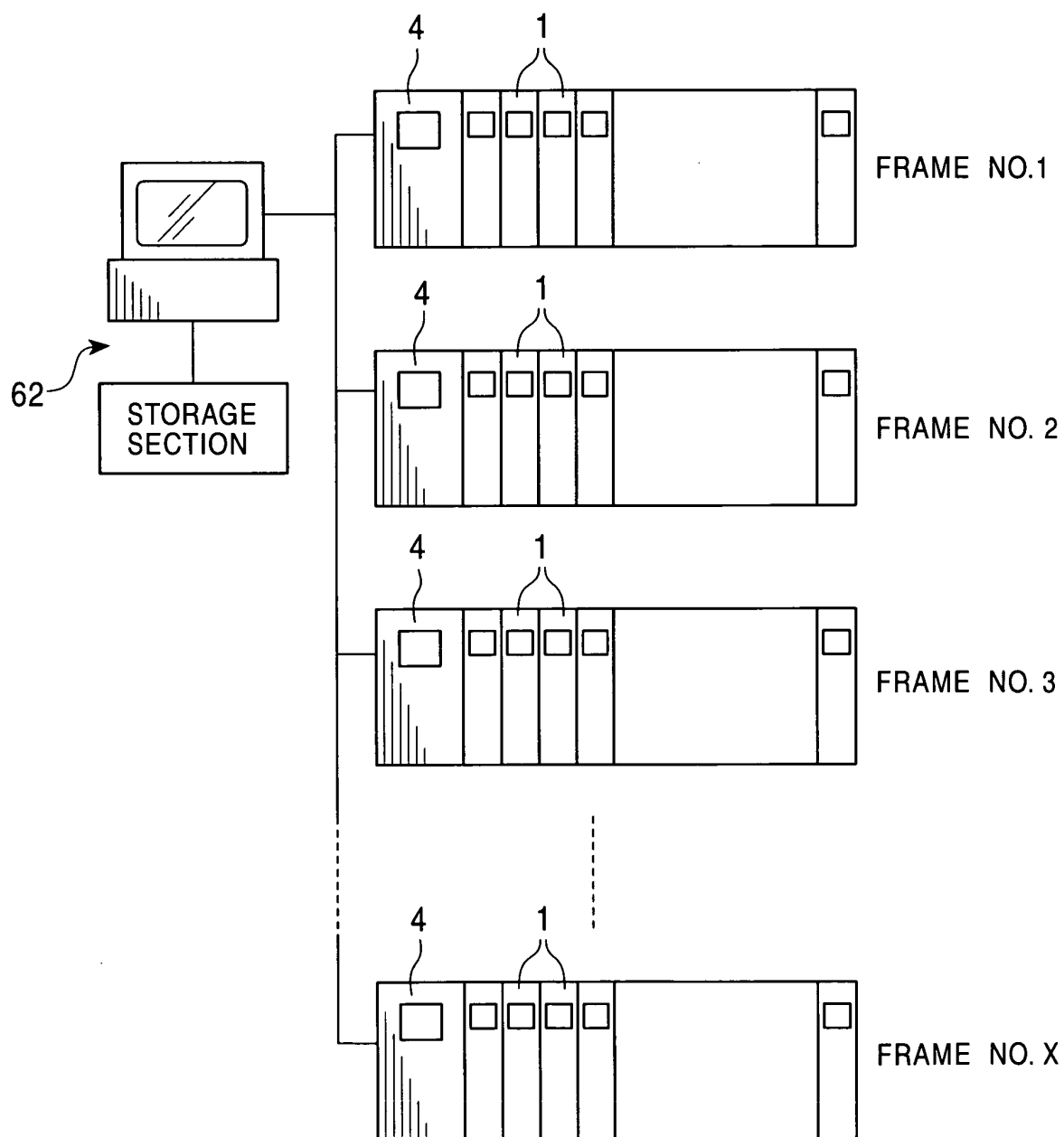


FIG. 9





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 00 6122

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			B65H D01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 July 2004	Examiner Hannam, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure 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			

EPO FORM 1503 03/82 (P04C01)

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