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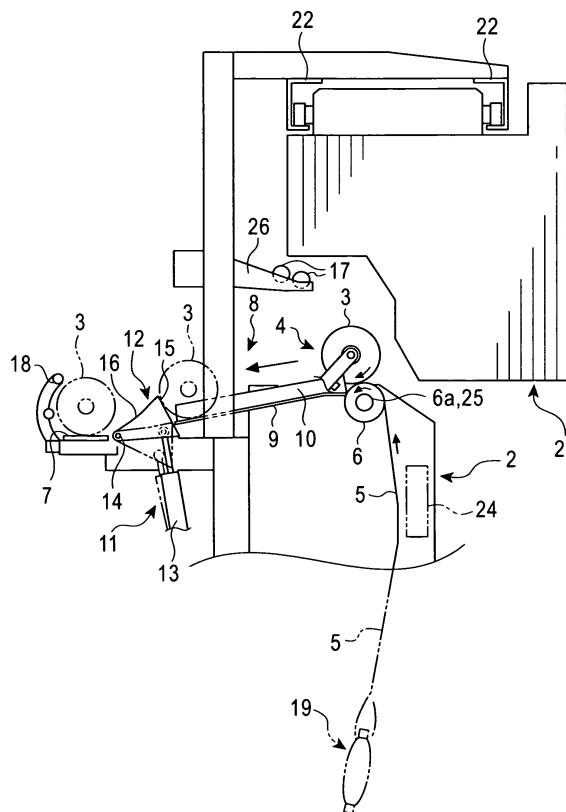
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(54) **Full package unloading device for automatic winder**

(57) The present invention provides a configuration of an unloading device that can unload a full package 3 without the need for using a timer to perform a cumbersome operation of setting time intervals at which a shutter 12 is opened and without reducing the serviceability ratio of a winding unit 2 or the conveying efficiency of a conveyor 7. In an automatic winder, a conveyor 7 is provided along a direction in which a large number of winding units are arranged in a line. A guide path 8 is provided through which a full package 3 is guided from a cradle portion 4 of each winding unit 2 to the conveyor 7. A shutter 12 is provided which can open and close the guide paths 8 in a plurality of winding units 2 at a time. When a winding progress sensor 23 senses that the full package 3 doffed is stopped by the shutter 12 to stand by and that winding on the winding package 3 in the cradle portion 4 has progressed to a predetermined level, the winding unit 2 opens the shutter 12 to simultaneously unload the full packages 3.

FIG. 2



Description

Field of the Invention

[0001] The present invention relates to the configuration of a device that operates in an automatic winder having a plurality of winding units, to unload a full package doffed by each winding unit.

Background of the Invention

[0002] The Examined Japanese Patent Application Publication (Tokkou-Hei) No. 1-46428 (Figure 2; 3rd column, 11th to 28th lines; for the stock bar, 3rd column, 39th line and below and fifth column, 24th and subsequent lines; for the plurality of sections, 7-th column, 18-th and subsequent lines) discloses the configuration of a full package unloading device of this kind. Figure 2 in the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 1-46428 shows that in an automatic winder having a large number of winding units arranged in a line, a conveyor is extended along the winding unit. The figure also shows that a stock bar (corresponding to a shutter) is provided between the conveyor and a position where a full package leaves a cradle portion of each winding unit. When a doffing operation is performed to separate the full package from the cradle portion, the full package is stopped at the position of the stock bar. The full package is then remains stocked for a predetermined time. Then, at a predetermined time set in a timer, the stock bar is opened. All the full packages stocked in the respective winding units are simultaneously supplied to the conveyor. Consequently, a large number of full packages can be efficiently conveyed by driving the conveyor once for a short time.

[0003] The Examined Japanese Patent Application Publication (Tokkou-Hei) No. 1-46428 also discloses a configuration used for a single automatic winder divided into sections for respective units and in which different types of yarns are wound in the respective sections. In this configuration, a stock bar is provided and operated independently for each section.

[0004] Moreover, the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 2-12869 (Figure 6; Claim 1; 8th column, 18th and subsequent lines) discloses a configuration in which a stock bar is provided for each winding unit group so that different types of yarn supplying packages are obtained from the respective groups. In this configuration, each stock bar is opened at specified time intervals on the basis of a timer provided for each winding unit group. This allows different types of full packages to be unloaded at the respective times, while allowing the same type of full packages to be simultaneously unloaded. It is thus possible to prevent different types of packages from being mixed at an outlet of the conveyor.

[0005] However, in both configurations according to the Examined Japanese Patent Application Publication

(Tokkou-Hei) No. 1-46428 and the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 2-12869, the stock bar (shutter) is opened on the basis of the timer. Accordingly, it is necessary to set, in the timer, such time intervals as enable a large number of full packages to be efficiently conveyed along the conveyor without reducing the operating efficiency of the winding units. To achieve this, it is necessary to set the optimum shutter opening time intervals for the average time required to obtain full packages. However, since the wind-up time varies with certain conditions such as the thicknesses of wound yarns, it is cumbersome to set or adjust the wind-up time.

[0006] As described above, since the average wind-up time varies with certain conditions such as yarn types, the standard wind-up time varies with the unit groups according to the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 2-12869. In this connection, in the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 2-12869, the stock bar opening timing is varied with the winding unit groups in order to avoid the mixture of different types of packages. However, the same opening time intervals are used for each unit group (Figure 8 in the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 2-12869). Accordingly, in some winding unit groups, the stock bar is opened before a large number of full packages have been stocked. This prevents the efficient conveyance of full packages along the conveyor. In other winding unit groups, a very long time needs to pass before it is possible to start to unload full packages stocked to the conveyor. This may prevent full packages around the cradle portions from being doffed, thus reducing operating efficiency.

Summary of the Invention

[0007] A description has been given of the problems to be solved by the present invention. Now, a description will be given of means for solving these problems and the effects of the means.

(1) According to an aspect of the present invention, there is provided a full package unloading device for an automatic winder configured as described below. The full package unloading device comprises a conveyor extended along a direction in which a large number of winding units are arranged in a line, a guide path along which a full package is guided from a cradle portion of each winding unit to the conveyor, a shutter provided in the guide path and which can be switched between a closed state in which the full package is inhibited from moving to the conveyor and an open state in which the full package is allowed to move, and a winding progress sensor that detects whether or not winding on the winding package at the cradle portion has progressed to a predetermined level. Each winding

unit is configured to generate a shutter open request signal while the full package in the guide path is stopped by the shutter closed and when the winding progress sensor detects that winding on the winding package at the cradle portion has progressed to the predetermined level. The full package unloading device is further provided with a control device that controllably switches the shutter from the closed state to the open state when the winding unit generates the shutter open request signal.

With this configuration, when winding on the winding package at the cradle portion has progressed to the predetermined level, the winding progress sensor detects this, and at this time, if the full package in the guide path is stopped by the shutter, the winding process sensor generates a shutter open request to open the shutter. This relieves an operator from a cumbersome operation of setting shutter opening time intervals in a timer as shown in Examined Japanese Patent Application Publication (Tokkou-Hei) No. 1-46428. Further, even if any condition such as the type of the yarn is changed to vary a standard wind-up time, the timer set value need not be changed. Therefore, this effect is particularly marked when for example, the automatic winder is operated while frequently changing the type of the yarn.

(2) The full package unloading device for an automatic winder is preferably configured as follows. The shutter is provided in association with each of a plurality of winding unit groups. When one of the winding units generates the shutter open request signal, the control device controllably switches the shutter corresponding to the winding unit group to which the winding unit belongs between the closed state to the open state.

With this configuration, the shutter is opened and closed for each winding unit group. This prevents the mixture of full packages unloaded from different winding unit groups.

(3) The full package unloading device for an automatic winder is preferably configured to wind different types of yarns in respective the winding unit groups.

This configuration can prevent the mixture of full packages into which different types of yarns have been wound, while relieving the operator from the cumbersome operation of setting shutter opening time intervals in the timer as shown in the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 1-46428 and the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 2-12869. Moreover, since the respective winding unit groups use different yarns, the average wind-up time often varies with the winding unit groups. However, according to the present invention, when the shutter needs to be opened in a cer-

tain winding unit group, it is opened regardless of the order of opening or the time intervals. This improves the operating efficiencies of the winging units and of the conveyor.

(4) The full package unloading device for an automatic winder is preferably configured as follows. The winding unit has a drum that rotates in contact with the winding package at the cradle portion at a fixed speed. The winding progress sensor is a rotation sensor that detects rotation of the drum.

With this configuration, the rotation sensor can detect rotation of the drum while the yarn is being wound. Counting the rotation makes it possible to determine how the winding has progressed. This eliminates the need for a special sensor for detecting the progress of the winding. The configuration of the device can thus be simplified.

(5) The full package unloading device for an automatic winder is preferably configured as follows. The winding unit has a control section. The control section sets a package standby flag when a doffing operation is performed to remove the full package from the cradle portion, and generates the shutter open request signal when the winding progress sensor detects that winding on the winding package at the cradle portion has progressed to the predetermined level while the package standby flag remains set. The control section further resets the package standby flag in response to a shutter operation signal from the control device.

With this configuration, it is possible to determine that the full package is stopped (stocked), on the basis of the package standby flag, provided by software. This eliminates the need for a special sensor for determining whether or not there is any full package stocked. The configuration of the device can thus be simplified.

Brief Description of the Drawings

[0008]

Figure 1 is a perspective view showing an automatic winder to which a full package unloading device according to the present invention is applied.

Figure 2 is a vertical sectional view of the automatic winder.

Figure 3 is a schematic plan view of the automatic winder.

Figure 4 is a block diagram showing the electric configuration of the automatic winder.

Figure 5 is a flowchart showing control performed by each winding unit.

Figure 6 is a flowchart showing control performed by a package shutter conveyor device in the automatic winder.

Detailed Description of the Preferred Embodiments

[0009] Now, an embodiment of the present invention will be described.

[0010] In Figures 1 and 3, an automatic winder 1 has a large number of (in the present embodiment, 60) winding units 2 arranged in a line in a longitudinal direction of a frame. As shown in Figure 2, each winding unit 2 comprises a cradle portion 4 that supports a winding package 3 and a traversing drum 6 that contacts and rotates the winding package 3 while traversing a yarn 5 from a yarn supplying package 19.

[0011] As shown in Figure 3, the 60 winding units are sequentially numbered from 1 to 60 starting with the one located at one end of the frame (#1 to #60). The 60 winding units are divided into two winding unit groups G1 and G2 so that the winding units #1 to #40 belong to the first group G1, while the winding units #41 to #60 belong to the second group G2. Different types of yarn supplying packages 19 are set for the first group G1 and for the second group G2 so that different types of yarns 5 can be wound.

[0012] As shown in Figure 2, a conveyor 7 is provided behind the winding unit 2 (the yarn 5 runs in front of the winding unit 2). As shown in Figures 1 and 3, the conveyor 7 is disposed so as to extend along the direction in which the winding units 2 are arranged in a line. Each winding unit 2 is provided with a guide path 8 along which the full package 3 removed from the cradle portion 4 is guided to the conveyor 7. As shown in Figure 2, the guide path 8 is composed of a bottom plate 9 and side plates 10. The bottom plate 9 is slightly inclined so that the full package 3 having left the cradle portion 4 can roll and move to the conveyor 7 under its own weight.

[0013] As shown in Figure 3, a lifter 41 is provided at a terminal of the conveyor 7 in a conveying direction. An overhead conveyor 43 with a plurality of hooks 42 is disposed above the lifter 41. With this configuration, the full package 3 unloaded using the conveyor 7 can then be conveyed using the overhead conveyor 43.

[0014] As shown in Figure 3, the guide path 8 is provided with a shutter device 11 that temporarily stops the full package 8 leaving the cradle portion 4. The shutter device 11 comprises a shutter 4 extended along the direction in which the winding units 2 are arranged in a line and a fluid pressure cylinder 13 that drivingly opens and closes the shutter 12.

[0015] The shutter 12 is configured to be pivotable around a rotationally moving shaft 14 parallel to the direction in which the winding units 2 are arranged in a line. The shutter 12 also comprises a stop surface 15 that abuts against an outer periphery of the full package 3 rolling along the guide path 8 and a rolling surface 16 that allows the full package 3 to roll.

[0016] A cylinder rod of the fluid pressure cylinder 13 is pivoted to an appropriate position of the shutter 12. The fluid pressure cylinder 13 is normally expanded to project the stop surface 15 of the shutter 12 above the

height of the bottom plate 9 (closed state). On the other hand, when the fluid pressure cylinder 13 is contracted, the shutter 12 is rotationally moved downward to lower the stop surface 15 below the height of the bottom plate 9. Further, the rolling surface 16 is joined to the bottom plate 9 so as to form a substantially continuous surface (as shown by a chain line in Figure 2). In this open state, the full package 3 having rolled on the bottom surface 9 then rolls on the rolling surface 16. The full package 3 can thus be moved onto the conveyor 7.

[0017] As shown in Figure 3, the shutter device 11 is configured to be able to open and close the guide paths 8 for the 10 winding units 2 at a time. Six shutters 11 numbered from 1 to 6 are provided so that the shutter 11 No. 1 corresponds to the winding units 2 Nos. 1 to 10, the shutter 11 No. 2 corresponds to the winding units 2 Nos. 11 to 20, and so on. In connection with the winding unit groups G1, G2, the shutter device 11 Nos. 1 to 4 correspond to the winding units (Nos. 1 to 40) of the first group G1. The shutter device 11 Nos. 5, 6 correspond to the winding units (Nos. 41 to 60) of the second group G2. These correspondences are stored in a RAM and so on of a higher control device 31 described later.

[0018] As shown in Figures 1 and 2, a guide bar 18 is extended alongside the conveyor 7. The guide bar 18 prevents the full package 3 having rolled on the bottom plate 9 and then on the rolling surface 16 from passing beyond and falling from the conveyor 7.

[0019] As previously described, the one shutter 12 and the one fluid cylinder 13 are provided for every 10 of the 60 winding units, and in total, the six shutters 12 and the six fluid cylinders 13 are provided. With this configuration, by placing one of the shutters 12 in the closed position, it is possible to stock the 10 full packages 3 at that shutter 12. Opening the shutter 12 enables the 10 full packages to be simultaneously discharged to the conveyor 7.

[0020] A doffing operation for each winding unit 2 is performed by a doffing vehicle 21 shown in Figure 2. The doffing vehicle 21 is provided so as to hang from an overhead rail 22 extended along the direction in which the winding units 2 are arranged in a line. The doffing vehicle 21 can run along the overhead rail 22. When the package at the cradle portion 4 of the winding unit 2 becomes full, a control section 24 provides a doffing request signal. This causes the doffing vehicle 21 to run to and stop in front of the winding unit 2. Then, a doffing mechanism (not shown in the drawings) provided in the doffing vehicle 21 removes the full package 3 from the cradle portion 4. The doffing mechanism further takes one of the empty bobbins 17 stocked on a shelf 26 provided above the winding unit 2 and installs the empty bobbin 17 at the cradle portion 4. The doffing mechanism further draws the yarn 5 out of the yarn supplying package 19. Then, a bunch winding device (not shown in the drawings) is used to execute bunch winding on the empty bobbin 17. This enables the winding unit 2 to restart winding.

[0021] The traversing drum 6 of the winding unit 2 comprises a driving motor 6a containing a drum rotation sensor 23 serving as a winding progress sensor. The rotation sensor 23 is configured to provide a pulse signal every time the drum 6 rotates. The control section 24 is electrically connected to the rotation sensor 23 and can count the pulse signals (rotation pulses) transmitted by the rotation sensor 23.

[0022] Now, the electric configuration of the automatic winder 1 will be described with reference to Figure 4. The control section 24 of the winding unit 2 is composed of a well-known microcomputer. The control section 24 comprises a CPU (arithmetic means), a ROM, a RAM, an EPROM and the like (storage means). The control section 24 of each winding unit 2 stores, in the RAM, EPROM or the like, one of the unit number 1, 2, ... which is assigned to the winding unit 2 and information as to whether the winding unit belongs to the group G1 or the group G2.

[0023] The control section 24 pre-stores the number of rotation pulses (hereinafter referred to as a "full package count value") corresponding to the full package, in the RAM, EPROM or the like as a set value. When the count value for pulse signals from the rotation sensor 23 reaches the full package count value, the control section 24 determines that the package in the winding unit has become full. The control section 24 also pre-stores the number of rotation pulses (hereinafter referred to as an "about-to-become-full package count value") corresponding to a time when the winding has progressed to a certain level (for example, the winding has been completed to about 90%), so that a few more windings make the package full. The control section 24 can thus recognize this state as in the case of the full package.

[0024] Moreover, as shown in Figure 4, the automatic winder 1 comprises a higher control device 31 that generally controls the whole full package unloading device. The higher control device 31 is also configured as a well-known microcomputer and comprises a CPU (arithmetic means) a ROM, and a RAM (storage means) and the like. The higher control device 31 is connected to the winding units 2 Nos. 1 to 60 via signal lines to transmit and receive various signals. The RAM or the like of the higher control device 31 pre-stores information as to whether each winding unit 2 belongs to the winding unit group G1 or the winding unit group G2 (group assignment information).

[0025] The higher control device 31 is further connected to the six shutter devices 11, the conveyor 7, the doffing vehicle 21, and a yarn supplying package supplying device 32. The higher control device 31 controllably causes the shutter 12 of the shutter device 11 to be drivingly opened and closed, causes the doffing vehicle 21 to perform the above doffing operation, and causes the full package 3 on the conveyor 7 to be unloaded.

[0026] Now, with reference to Figure 5, a description will be given of a flow for the control section 24 of each of the winding units 2. The flow starts when the package

standby flag is off (S101). The package standby flag is a flag variable for which a storage area is provided in the RAM or the like of the control section 24. The package standby variable can take two values, ON and OFF. The package standby variable of ON indicates that the shutter device 11 has a full package 3 in stock. The package standby variable of OFF indicates that the shutter device 11 has no full package 3.

[0027] Then, in step S102, the traversing drum 6 is driven to unwind the yarn 5 from the yarn supplying package 19. As previously described, during winding, the control section 24 uses the rotation sensor 23 to detect rotation of the traversing drum 6. Every time the control section 24 receives a pulse signal from the rotation sensor 23, it counts up the value of a counter variable stored in the RAM or the like. At a branch of step S103, the control section 24 checks whether or not the winding has been completed to about 90%, that is, the counter variable has reached the about-to-become-full package count value. If in step S103, the control section 24 determines that the winding has not been completed to about 90%, it executes processing following step S112, described later.

[0028] If in step S103, the control section 24 determines that the winding has been completed to about 90%, it checks the contents of the package standby flag (S104). If the content of the package standby flag is ON (that is, the shutter device 11 has a full package 3 in stock), the control section 24 sends a shutter open request signal to the higher control device 31 (S105). Then, upon receiving a signal indicating that the shutter is open (shutter operation signal), from the higher control device 31 (S106), the control section 24 resets the package standby flag to OFF (S107). If in step S104, the content of the package standby flag is OFF (that is, the shutter device 11 has no full package 3 in stock), the processing in steps S105 to S107 is skipped.

[0029] Then, the winding is continued until a full package is detected in step S108 (that is, the count value of the counter variable reaches the full package count value). Once the package has become full, the rotation of the traversing drum 6 is immediately stopped to end the winding (S109). The control section 24 causes the doffing vehicle 21 to perform a doffing operation (S110), and the package standby flag is set to ON (S111). Subsequently, the control section 24 returns to step S102 to cause the yarn 5 to be wound around a new bobbin.

[0030] If in step S103, the control section 24 determines that the winding has not been completed to about 90%, it checks whether or not a shutter operation signal has been received from the higher control device 31 (S112). If the shutter operation signal has not been received, the control section 24 returns to step S103. If the shutter operation signal has been received, the control section 24 checks the content of the package standby flag (S113). If the content of the package standby flag is OFF, the control section 24 returns to step S112. If the content of the package standby flag is ON, the control

section 24 resets the flag to OFF (S114), and the control section 24 then returns to step S103.

[0031] Now, control by the higher control device 31 will be described with reference to the flowchart in Figure 6. The higher control device 31 is configured to perform various types of control such as the control of the doffing vehicle 21 and the control of the yarn supplying package supplying device 32. However, Figure 6 shows only the control relating to the unloading of the full package 3.

[0032] A description will be given with reference to Figure 6. First, in step S201, the higher control device 31 checks whether or not the shutter open request signal (signal transmitted by the winding unit 2 during the processing in step S105 in Figure 5) has not been received. If the signal has not been received, the higher control device 31 stands by until the signal is received.

[0033] If the shutter open request signal has been received, the higher control device 31 checks whether or not the conveyor 7 is being driven (S202). If the conveyor 7 is being driven, the higher control device 31 stands by until the driving of the conveyor 7 has been finished (S203).

[0034] Then, in step S204, the higher control device 31 analyzes the shutter open request signal to check the number of the winding unit 2 having transmitted the signal. The higher control device 31 then checks whether the source winding unit 2 determined belongs to the winding unit group G1 or the winding unit group G2. The higher control device 31 thus opens the shutter 12 of the shutter device 11 corresponding to the winding unit group G1 or the winding unit group G2 to which the winding unit 2 belongs. Specifically, the above fluid pressure cylinder 13 is driven so that the shutter 12 remains open for a predetermined time (for example, about several seconds) and is then closed. Thus, the full package 3 stocked by the shutter 12 is moved onto the conveyor 7.

[0035] Then, in step S205, the higher control device 31 transmits a shutter operation signal to all the winding units 2 Nos. 1 to 60, indicating that the shutter corresponding to the winding unit group has been driven. Then, the higher control device 31 drives the conveyor 7 for a predetermined time to unload all the full packages 3 on the conveyor 7 to the overhead conveyor 43 (S206). The series of processes for the shutter open request signal are thus completed. The higher control device 31 then returns to step S201 to stand by until a new shutter open request signal is received.

[0036] The effects of the above control will be described below. It is assumed that when the automatic winder 1 starts to be controlled, the shutters 12 of the six shutter devices 11 are closed, with no full package 3 stocked at the position of each shutter 12. It is further assumed that no full package 3 has been unloaded to the conveyor 7, which is at a stop.

[0037] First, the processing in step S101 in Figure 5 is executed on the 60 winding units 2 of each of the groups G1, G2. The package standby flag is set to OFF

in all of the 60 winding units 2.

[0038] Then, the 60 winding units 2 concurrently carry out winding (S102). Each winding unit 2 counts signals from the rotation sensor 23 to monitor the progress of yarn winding (S103). If the yarn winding has not been completed to 90%, the control section 24 monitors whether or not a shutter operation signal has been received (S112). When in step S103, the control section 24 senses that the yarn winding has been completed to about 90%, it checks the content of the package standby flag (S104). However, since the content of the package standby flag is OFF at the start of the flow, the processing in steps S105 to S107 is not executed. The shutter open request signal is not transmitted.

[0039] When the counter variable reaches the full package count value in one winding unit 2 (for example, the winding unit 2 No. 42) (S108), the winding unit 2 No. 42 immediately stops winding (S109). The doffing vehicle 21 performs a doffing operation (S110). The doffing causes the full package 3 to leave the cradle portion 4 and then fall onto the guide path 8. The fallen full package 3 rolls on the guide path 8, inclined as previously described, under its own weight. However, since the higher control device 31 controllably places the shutter 12 of the shutter device 11 in the closed position, the shutter 12 inhibits the full package 3 from moving to the conveyor 7. The full package 3 is thus stopped. After the doffing operation has been completed, the winding unit 2 No. 42 sets the package standby flag to ON. That is, the package standby flag is set (S111). Subsequently, the winding unit 2 No. 42 executes winding on a new bobbin 17 (S102 and subsequent steps).

[0040] Similarly, when a full package is sensed in other winding units (for example, Nos. 52, 15, ...) (S108), these winding units 2 stop winding. The doffing operation is then performed on the winding units 2 (S109, S110). The shutter 12 closed stocks the full package 3. Subsequently, the winding units 2 Nos. 52, 15, ... set the package standby flag to ON (S111) and execute winding on a new bobbin 17 (S102 and subsequent steps).

[0041] Then, in the winding unit 2 No. 15, the winding on the new bobbin 17 is completed to about 90%. In this case, the control section 24 of the winding unit 2 No. 15 detects that the counter variable has reached the about-to-become-full package count value (S103). The control section 24 then checks the content of the package standby flag (S104). The package standby flag has been ON since the package in the last winding became full. Accordingly, the winding unit 2 No. 15 transmits a shutter open request signal to the higher control device 31 (S105). The shutter open control signal contains information on the unit number of the signal source (in this example, the winding unit 2 No. 15).

[0042] Upon receiving the shutter open request signal (S201 in Figure 6), the higher control device 31 checks whether or not the conveyor 7 is being driven (S202). Since the conveyor 7 is stopped at the start of operation, the higher control device 31 shifts to the processing in

step S204.

[0043] In step S204, the higher control device 31 analyzes the content of the shutter open request signal to acquire the unit number of the source of the shutter open request signal (that is, the shutter open requesting unit). This process enables the higher control device 31 to recognize that the winding unit 2 No. 15 is requesting that the shutter be opened. Then, the higher control device 31 checks group assignment information pre-stored in the higher control device 31 to determine whether the winding unit 2 No. 15 belongs to the winding unit group G1 or the winding unit group G2. The higher control device 31 can thus determine that the winding unit 2 No. 15 belongs to the first group G1.

[0044] Then, the higher control device 31 controllably opens the shutter 12 of the shutter device 11 belonging to the first group G1, and several seconds later, closes it again. In this case, only the target shutters 12 Nos. 1 to 4 remain open for several seconds, while the shutters 12 Nos. 5, 6 remain closed. As a result, the full packages 3 roll simultaneously onto the conveyor 7, and the full packages 3 have been removed from the cradle portions 4 of the winding units 2 Nos. 1 to 40 and then stocked by the shutters 12.

[0045] Then, the higher control device 31 transmits a shutter operation signal to all the winding units 2 Nos. 1 to 60, indicating "that the shutters 12 in the first group G1 have been completely driven" (S205). Upon receiving this signal (S112 in Figure 5), each winding unit 2 determines whether or not it belongs to the group number (in this example, the first group G1) contained in the shutter operation signal. If the winding unit 2 belongs to that group number, the winding unit 2 checks the content of the package standby flag (S113). If the content of the package standby flag is ON, it is reset to OFF (S114). In this example, for all the winding units 2 Nos 1 to 40 belonging to the first group G1, if the package standby flag is ON, it is reset to OFF.

[0046] Moreover, the higher control device 31 drives the conveyor 7 for a specified time in step S206 in Figure 6 to unload all the full packages 3, which have been doffed by the winding units 2 belonging to the first group G1, to the overhead conveyor 43 side.

[0047] Then, for example, for the winding unit 2 No. 42 (belonging to the second group G2), if the winding on the empty bobbin 17 has been completed to about 90% (S103 in Figure 5), then since the content of the package standby flag is ON (S104), the winding unit 2 transmits a shutter open request signal as described above (S105). Then, if the conveyor 7 has not been completely driven yet, the higher control device 31 waits for the driving to be finished (S202, S203 in Figure 6). The higher control device 31 then opens the shutter devices 11 Nos. 5, 6 corresponding to the second group G2 (S204). Thus, the full packages 3 doffed by the winding units 2 Nos. 41 to 60 and then stocked by the shutters 12 are simultaneously unloaded to the conveyor 7. The higher control device 31 then transmits a shutter

operation signal to all the winding units 2 Nos. 1 to 60, indicating that "the shutters 12 in the second group G2 have been completely driven" (S205). As a result, for all the winding units 2 Nos 1 to 60, if the package standby flag is ON, it is reset to OFF.

[0048] The control has been specifically described. However, in each winding unit 2, the time at which the package becomes full may vary depending on various conditions such as the number of times that yarn breakage occurs. Accordingly, the timing for doffing may vary with the units even though the units simultaneously start winding. However, in the present embodiment, the full packages 3 doffed are once stopped and stocked by the shutters 12 closed. If any of the winding units 2 meets the above predetermined conditions (that is, the full package 3 in the guide path 8 is stopped by the shutter 12 closed, that is, the package standby flag is ON and the winding on the winding package 3 at the cradle portion 4 has been completed to about 90%), the shutter 12 is opened. Consequently, the full packages 3 can be simultaneously discharged from the winding unit group to which the winding unit 2 belongs, to the conveyor 7.

[0049] If the full packages 3 are discharged directly to the conveyor 7 every time a doffing operation is performed using a rough timing, packages rolling on the guide path 8 after being doffed may collide against full packages 3 being conveyed on the conveyor 7. The present embodiment can prevent such a trouble.

[0050] Further, only the shutters 12 are opened which correspond to the winding unit group to which the winding unit 2 belongs. This avoids the mixture of winding packages 3 with different types of yarns.

[0051] Moreover, with the configuration of the present embodiment, the rotation sensor 23 detects the progress of winding. When the winding on the winding package 3 caused by the shutter 12 to stand by has been completed to about 90%, the control section controllably transmits a shutter open request signal to open the shutter 12. That is, when a single doffing operation has been performed to stock a full package 3 at the shutter 12 and a package 3 at the cradle portion 4 is about to become full (the winding has been completed to about 90%), a doffing operation may have already been performed on almost all the other winding units 2 belonging to the same winding unit group, with the full packages 3 stocked by the shutters 12. Accordingly, by driving the shutter device 11 and the conveyor 7 once, it is possible to efficiently convey a large number of full packages 3.

[0052] Further, in contrast to the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 1-46428 and the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 2-12869, in which a timer is used to repeat an operation of opening the shutter at predetermined time intervals, the present embodiment eliminates the need for setting the timer so that optimum time intervals are obtained. In particular, the recent need for more types and smaller quantity makes it necessary to frequently change, for example, the type

of the yarn 5 wound in the automatic winder 1. This may correspondingly vary the average wind-up time. However, even in this case, the present invention can omit a cumbersome operation of changing the set value for the timer as required.

[0053] The above control is suitable in the case where the winding units 2 are divided into a plurality of groups (winding unit groups G1, G2) and where different types of yarns 5 are wound in the winding unit groups G1, G2. That is, when conditions such as the thickness of the yarn 5 wound vary with the groups, there may be a difference in average wind-up time between the winding unit groups G1, G2. The configuration in the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 2-12869 can only alternately discharge the winding unit groups G1, G2 once. Consequently, depending on timings, the shutters 12 may be forcibly opened with few full packages stocked at the shutters 12 or a delay may occur in the opening of the shutters 12 to preclude the doffing operation, thus reducing the serviceability ratio of the winding units 2. In contrast, in the present embodiment, for the winding unit group to which the winding unit 2 on which winding has been completed belongs, the shutters 12 are opened at any time regardless of the order or time intervals. For example, if one G1 of the winding unit groups is winding a thicker yarn 5 and requires a shorter wind-up time than the other winding unit group G2, it is possible to controllably consecutively open the shutters 12 corresponding to the winding unit group G1 twice. This makes it possible to improve the conveying efficiency of the conveyor 7 and the serviceability ratio of the winding units 2.

[0054] Moreover, when the doffing device removes the full package 3 from the cradle portion 4, the control section 24 of the winding unit 2 sets the package standby flag to ON. Once the winding on the winding package 3 in the cradle portion 4 has been completed to about 90% with the package standby flag set, the control section 24 generates the shutter open request signal. Then, upon receiving a shutter operation signal from the higher control device 31, the control section 24 sets the package standby flag to OFF (reset).

[0055] This eliminates the need for providing the winding unit 2 with a sensor for detecting whether or not any full package 3 is stocked at the position of the shutter 12. The package standby flag provided by software can be used to determine whether or not any full package 3 is in stock.

[0056] The preferred embodiment of the present invention has been described.

However, the above configuration may be changed as described below.

(1) The shutter 12 may be arbitrarily configured as long as it can switch the state of the full package 3 passing through the guide path 8 between the one where the movement of the full package 3 is inhibited and the one where the movement is allowed.

For example, it is possible to use shutters based on a stock bar system such as the one disclosed in the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 2-12869.

(2) In the above embodiment, the rotation sensor 23 is employed as a winding progress sensor. Instead, it is possible to use a sensor that detects that the diameter of the full package 3 has reached at least a predetermined value.

Alternatively, the sensor may be configured to detect the rotation of the full package 3 per unit time. Alternatively, the control section may determine that the package has become full or is about to become full when the rotation speed of the winding package 3 decreases to a predetermined value.

(3) A sensor may be provided which detects the full package 3 stopped by the shutter 12. However, it is more advantageous to use the package standby flag provided by software to determine whether or not any full package 3 is in stock as in the above embodiment. This configuration is simpler because it enables the sensor to be omitted.

(4) It is possible to arbitrarily determine the level of progress of the winding on the package 3 in the cradle section 4 to be detected by the winding process sensor (rotation sensor 23) (that is, the "predetermined level").

However, in view of an increase in the conveying efficiency of the conveyor 7, it is not preferable to transmit a shutter open request signal in an earlier stage of the winding. The winding progress sensor should detect that the winding has been completed to at least about 50%. Moreover, if the sensor generates the shutter open request signal upon sensing that the package is about to become full (for example, the winding has been completed to 80 or 90%), more full packages 3 can preferably be simultaneously unloaded to the conveyor 7 by a performing single operation of opening the shutters 12.

(5) In the example shown in the above embodiment, the winding units Nos. 1 to 60 are divided into the two winding unit groups G1, G2. However, more or less winding units 2 may be used and the manner of the division may be appropriately determined in accordance with the application of the automatic winder 1 or the like. For example, the winding units 2 may be divided into three or more winding unit groups.

(6) Alternatively, all the 60 winding units 2 may simultaneously open and close the shutters 12 rather than being divided into winding unit groups. This configuration can also advantageously eliminate the need for a cumbersome operation of setting the timer, in contrast to the configuration in the Examined Japanese Patent Application Publication (Tokkou-Hei) No. 1-46428.

(7) In the above embodiment, the shutter 12 is provided for every 10 winding units 2, and the shutter

12 can simultaneously open and close the guide paths 8 in the 10 winding units 2. However, the present invention is not limited to the 10 winding units. For example, one shutter 12 may be provided for the 40 winding units 2 Nos. 1 to 40, while one shutter 12 may be provided for the 20 winding units 2 Nos. 41 to 60. In short, it is only necessary to be able to substantially simultaneously open and close the guide paths 8 in the winding units 2 belonging to the same winding unit group and to independently open and close the guide paths 8 of the respective winding unit groups.

(8) Control may be switched between an operation of opening the shutter 12 in response to a shutter open request signal from the winding unit 2 (first control mode) and an operation of opening the shutter 12 using such a timer as shown in Patent Document 1 or 2 (second control mode).

Claims

1. A full package unloading device for an automatic winder **characterized by** comprising:

a conveyor extended along a direction in which a large number of winding units are arranged in a line;

a guide path along which a full package is guided from a cradle portion of each winding unit to the conveyor;

a shutter provided in the guide path and which can be switched between a closed state in which the full package is inhibited from moving to the conveyor and an open state in which the full package is allowed to move; and

a winding progress sensor that detects whether or not winding on the winding package at the cradle portion has progressed to a predetermined level, and in that each winding unit is configured to generate a shutter open request signal while the full package in the guide path is stopped by the shutter closed and when the winding progress sensor detects that winding on the winding package at the cradle portion has progressed to the predetermined level, and the full package unloading device is provided with a control device that controllably switches the shutter from the closed state to the open state when the winding unit generates the shutter open request signal.

2. A full package unloading device for an automatic winder according to Claim 1, **characterized in that**:

the shutter is provided in association with each of a plurality of winding unit groups, and when one of the winding units generates the

shutter open request signal, the control device controllably switches the shutter corresponding to the winding unit group to which the winding unit belongs between the closed state to the open state.

3. A full package unloading device for an automatic winder according to Claim 2, **characterized by** being configured to wind different types of yarns in respective the winding unit groups.

4. A full package unloading device for an automatic winder according to any one of Claims 1 to 3, **characterized in that**:

the winding unit has a drum that rotates in contact with the winding package at the cradle portion at a fixed speed, and

the winding progress sensor is a rotation sensor that detects rotation of the drum.

5. A full package unloading device for an automatic winder according to any one of Claims 1 to 4, **characterized in that**:

the winding unit has a control section, the control section sets a package standby flag when a doffing operation is performed to remove the full package from the cradle portion, and generates the shutter open request signal when the winding progress sensor detects that winding on the winding package at the cradle portion has progressed to the predetermined level while the package standby flag remains set, and

the control section further resets the package standby flag in response to a shutter operation signal from the control device.

FIG. 1

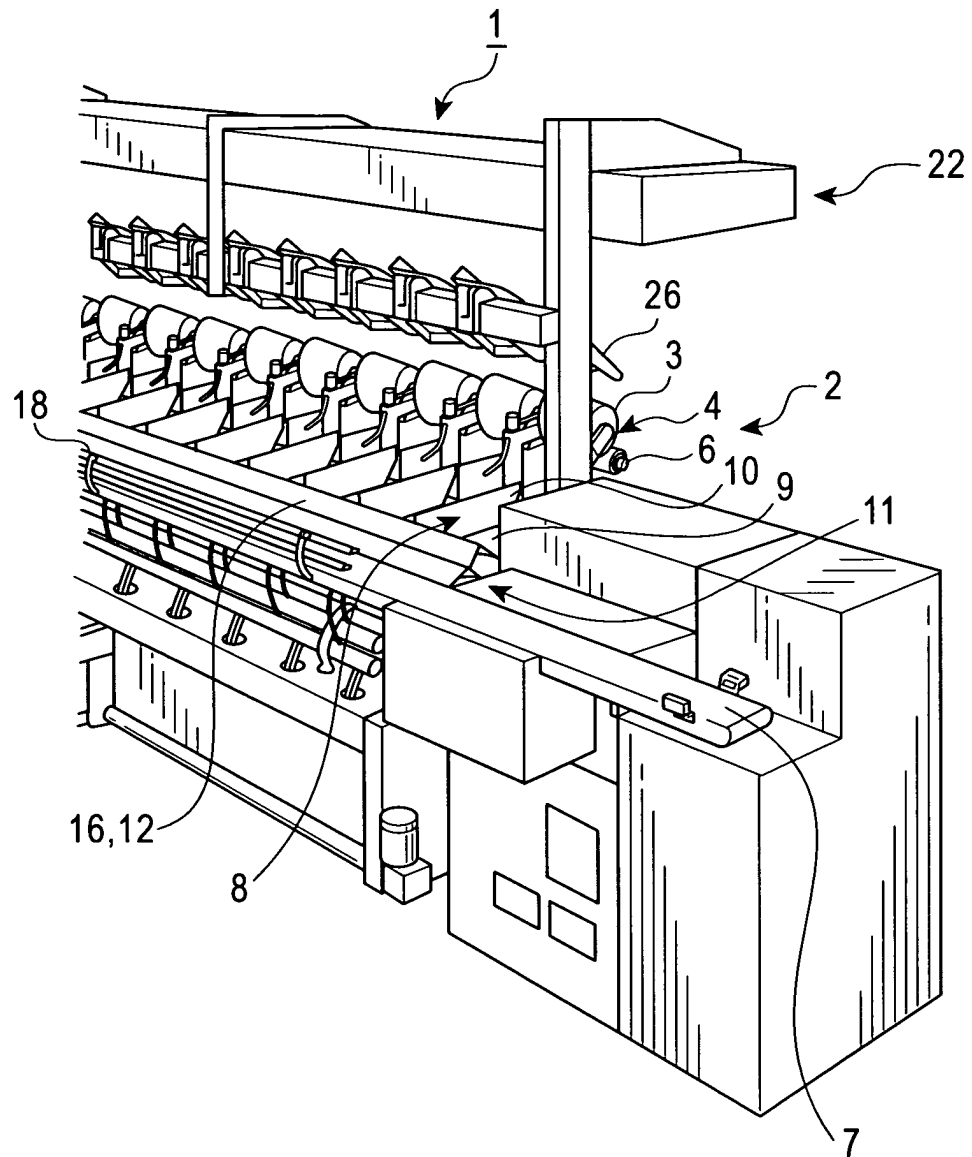


FIG. 2

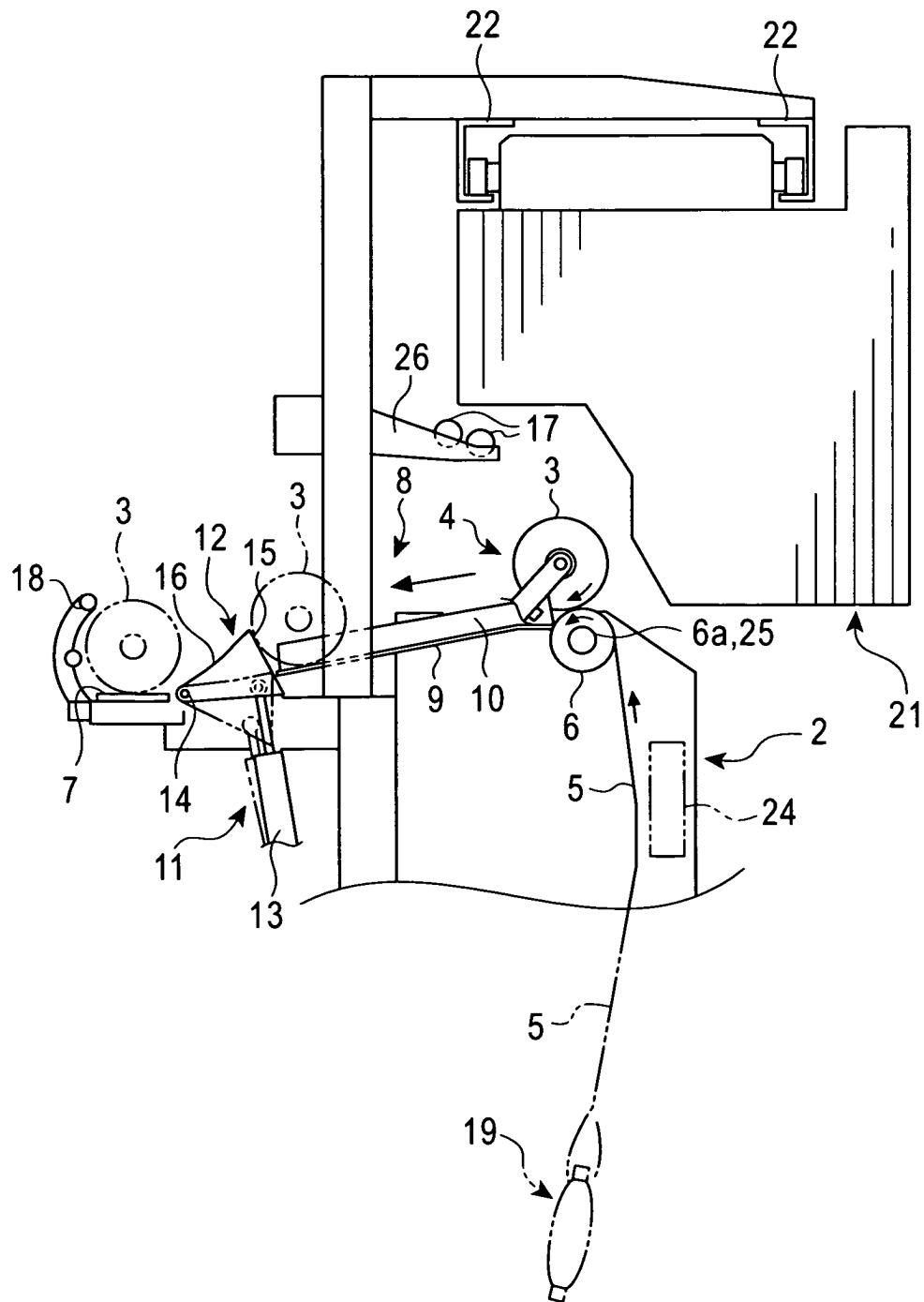


FIG. 3

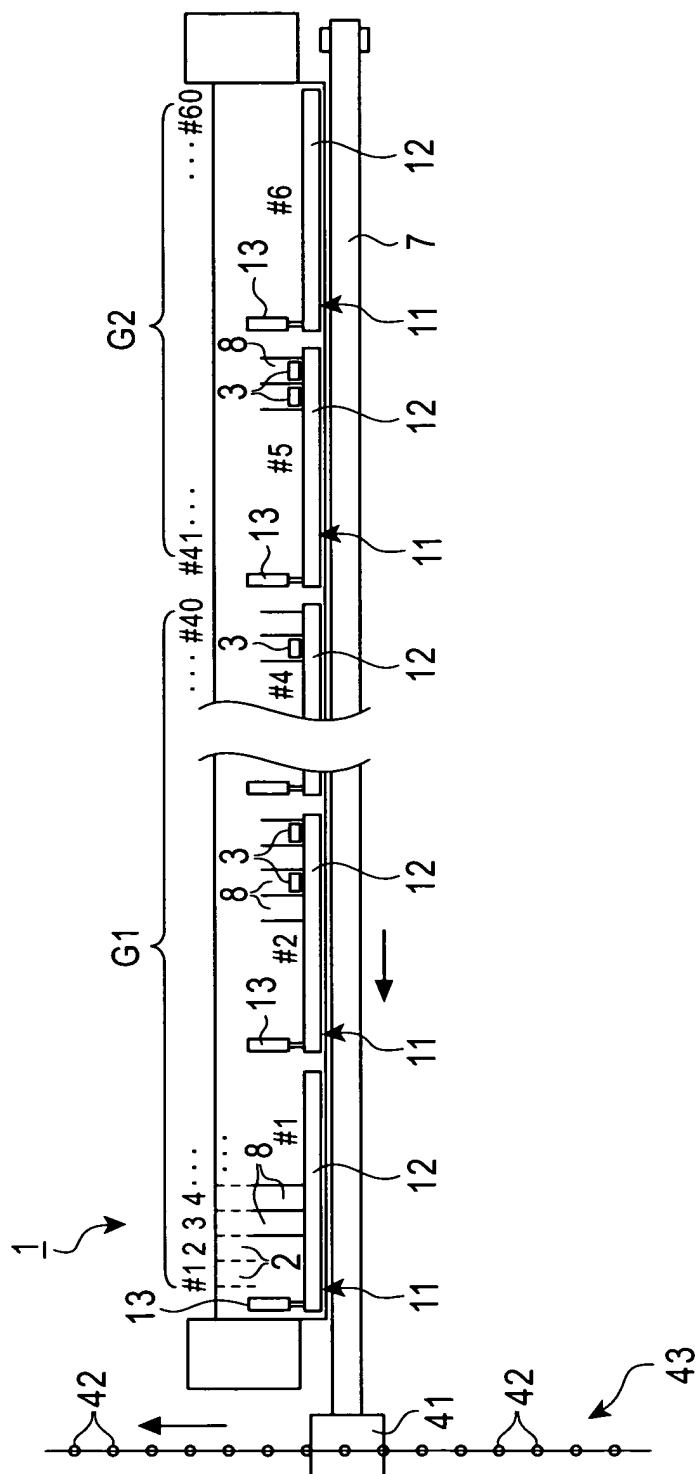


FIG. 4

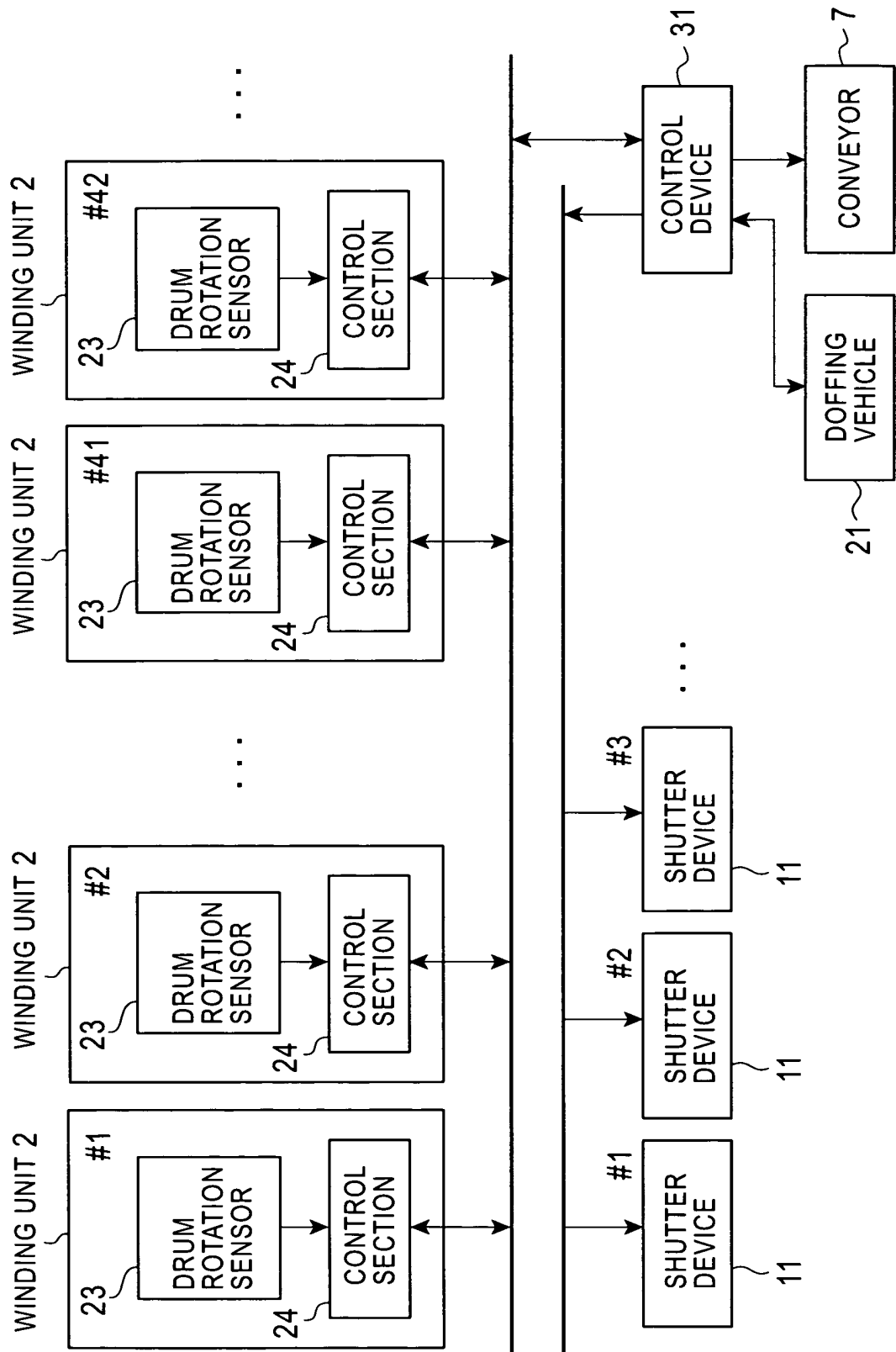


FIG. 5

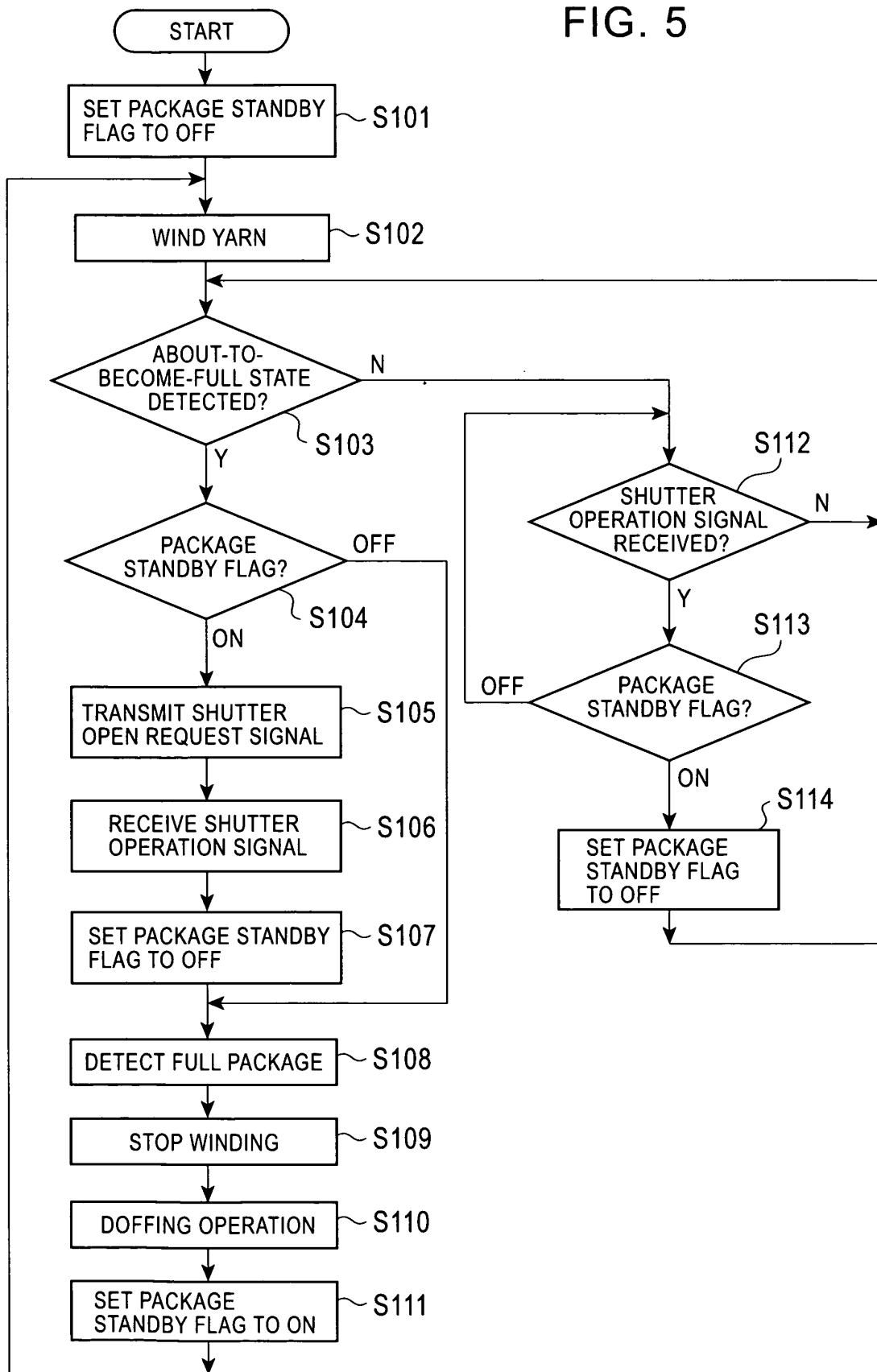
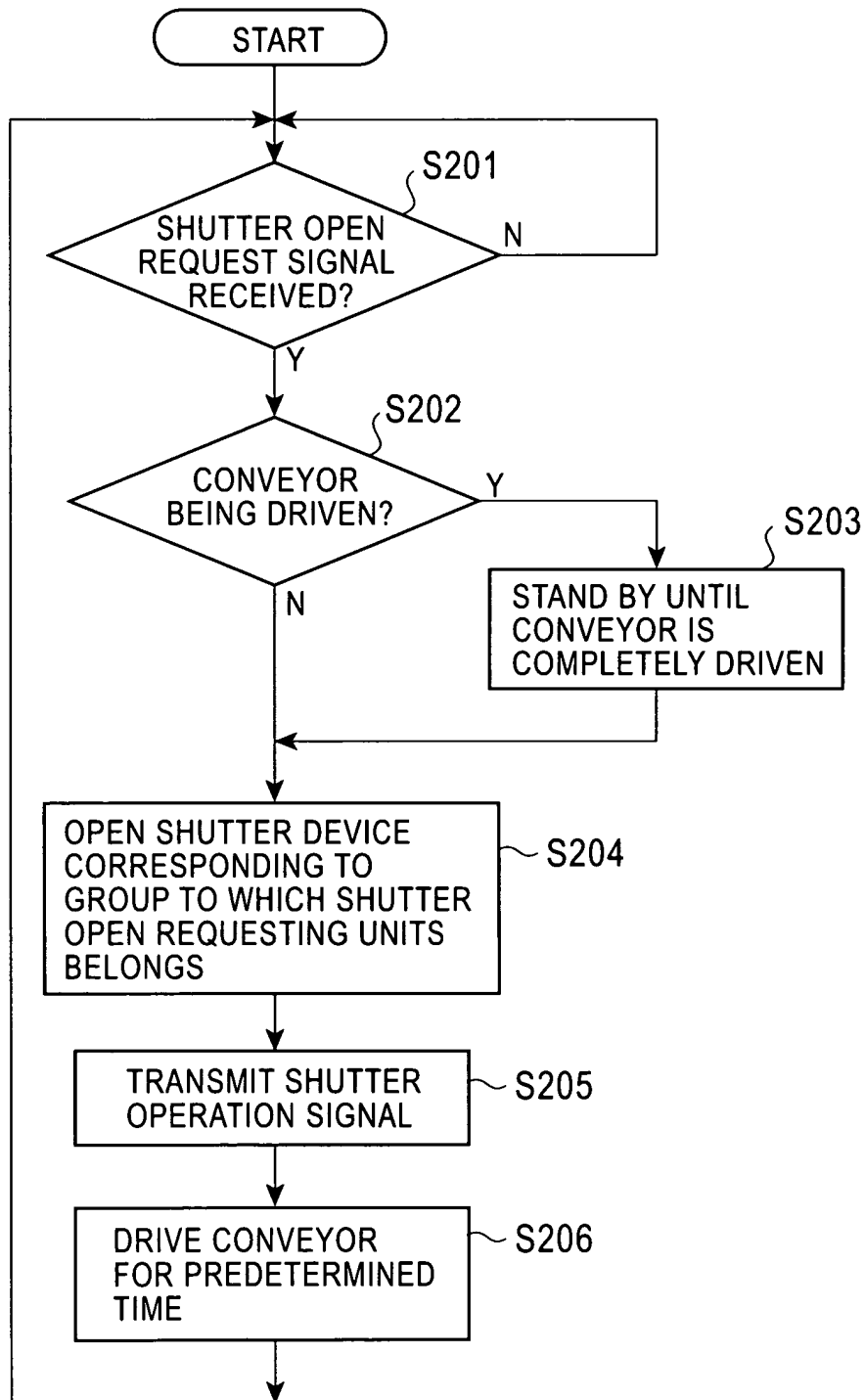


FIG. 6





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 05 00 7576

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Place of search Munich		Date of completion of the search 2 June 2005	Examiner Kising, A
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EP 05 00 7576

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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