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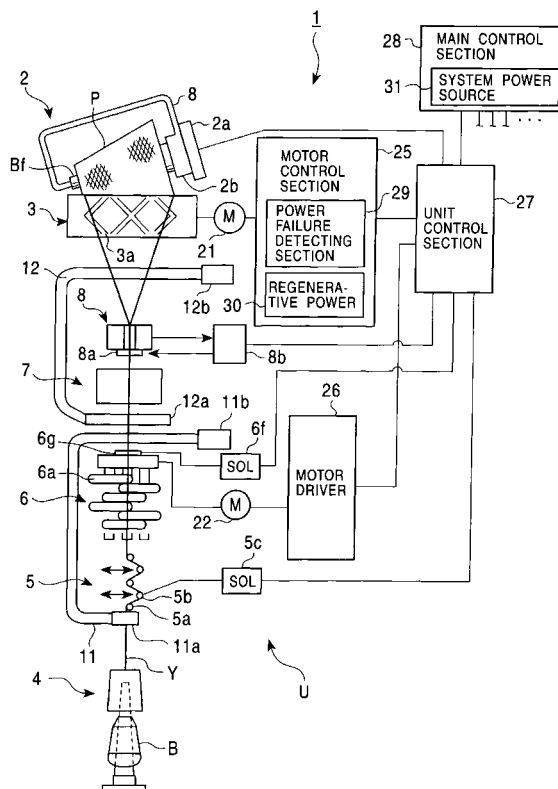
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(54) **Power failure handling system for automatic winder**

(57) The present invention relates to a power failure handling system for an automatic winder having a large number of yarn winding units each driven by an individual spindle drive. If a power failure occurs in the automatic winder each yarn winding unit is to be stopped to avoid the creation of scrambled packages. If a power failure detecting section 29 detects a power failure, a motor 21 undergoes slowdown stop control. A regenerative power generating section 30 supplies a unit control section 27 with regenerative power resulting from this slowdown stop control. The unit control section 27 uses the supplied regenerative power to activate a lift-up mechanism 2a to separate a winding package P from a winding drum 3 (Fig. 1).

FIG. 1



Description

Field of the Invention

[0001] The present invention relates to a power failure handling system for an automatic winder having a large number of yarn winding units each driven by an individual-spindle-drive.

Background of the Invention

[0002] An automatic winder comprises a large number of yarn winding units provided on a machine frame in a line and each driven by an individual-spindle-drive. A single yarn winding unit has a function of winding a yarn rewind from a yarn supplying package produced by a ring spinning machine, while eliminating yarn defects, to obtain a winding package of a predetermined shape.

[0003] Each yarn winding unit is provided with a direct current (DC) brushless motor (BLM) that rotatively drives a winding drum, a motor control section that controls the rotative driving of the DC brushless motor, and a unit control section that controls the motor control section. Further, a main control section is provided at one end of the machine frame to control the large number of winding units installed in a line. A system power source is disposed in the main control section. Power supplied by this system power source is used to activate the large number of unit control sections and the motor control section.

[0004] If a power failure occurs in this automatic winder, the power supply from the system power source is interrupted. Accordingly, the large number of yarn winding units are each stopped. A device has been proposed which is useful on this occasion (see the Japanese Patent No. 3006562). Specifically, the main control section detects the power failure to notify each unit control section of the power failure via an exclusive signal line. Then, the yarn winding units simultaneously cut their yarns. Subsequently, the DC brushless motor is stopped through free running.

[0005] If each yarn winding unit cuts its yarn and then the winding drum and a winding package are stopped through free running, then the winding drum and the winding package may rub against each other to create a scrambled package (a straight wound part of the yarn created in the center of the winding package owing to a yarn cut is rubbed and twisted).

[0006] It is an object of the present invention to provide a power failure handling system for an automatic winder which can prevent the creation of a scrambled package when each yarn winding unit is stopped owing to a power failure in the automatic winder.

Summary of the Invention

[0007] To accomplish this object, an aspect of the

present invention set forth in Claim 1 provides a power failure handling system for an automatic winder characterized by comprising a motor that rotatively drives a winding drum, a lift-up mechanism provided in a cradle supporting a winding package that rotates in contact with the winding drum, a motor control section that controls the rotative driving of the motor, a unit control section that controls the motor control section and the lift-up mechanism, a power failure detecting section that detects a power failure in these control sections, and a regenerative power generating section that causes, on the basis of the detection of a power failure by the power failure detecting section, the motor control section to execute slowdown stop control to generate regenerative power, and in that power from the regenerative power generating section is used to activate the lift-up mechanism upon a power failure.

[0008] With this arrangement, when the power failure detecting section detects a power failure, the motor undergoes slowdown stop control to stop the system rapidly. Regenerative power resulting from this slowdown stop control is supplied to the unit control section. The unit control section uses the supplied regenerative power to activate the lift-up mechanism to release the winding package from the winding drum. Once the motor is halted to stop generating regenerative power, the lift-up mechanism stops operating to bring the winding package into contact with the winding drum.

[0009] A second aspect of the present invention set forth in Claim 2 is the power failure handling system for an automatic winder according to Claim 1, further comprising a winding package brake mechanism for the winding package which is controlled by the unit control section. Power from the regenerative power generating section is used to activate the winding package brake mechanism upon a power failure.

[0010] With this arrangement, the winding package brake mechanism is activated simultaneously with the activation of the lift-up mechanism. Thus, the winding package leaves the winding drum, and the winding package stops rotating.

[0011] A third aspect of the present invention set forth in Claim 3 is the power failure handling system for an automatic winder according to Claim 1, in which the power failure detecting section is provided in the motor control section.

[0012] With this arrangement, if the motor control section detects a power failure, then almost simultaneously with the detection of the power failure, the motor control section can execute slowdown control to generate regenerative power.

Brief Description of the Drawings

[0013]

Figure 1 is a diagram showing an arrangement of equipment of a yarn winding unit of an automatic

winder.

Figure 2A is a front view showing the structure of a hairiness suppressing device, and Figure 2B is a plane view showing the structure of a hairiness suppressing device.

Figure 3 is a functional block diagram of a power failure handling system.

Figure 4 is a flow chart of a power failure handling process.

Figure 5A ~ Figure 5C are diagrams showing the contents of an operation instruction command from a main control section.

Figure 6 is a graph showing operations of a motor and others during a power failure handling process, and Figure 6A shows a slowdown control condition based on a normal PI control for a high speed rotation, and Figure 6B shows a slowdown control condition based on a PI control with the opposite phase for a low speed condition.

Detailed Description of the Preferred Embodiments

[0014] A preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings.

[0015] As shown in Figure 1, a yarn winding unit U of an automatic winder 1 winds a spun yarn Y unwound from a yarn supplying package B, around a bobbin Bf while traversing the spun yarn Y. This results in a winding package P of a predetermined length and a predetermined shape. A large number of such yarn winding units U are installed on a machine frame (not shown in the drawings) in a line to constitute an automatic winder 1.

[0016] The yarn winding unit U comprises a cradle 2 that grips the bobbin Bf and a traversing drum (winding drum) 3 that traverse the spun yarn Y. The cradle 2 can pivot freely toward and away from the traversing drum 3 to contact and separate the winding package P wound and formed around the bobbin Bf, with and from the traversing drum 3. Further, the following mechanisms are attached to the cradle 2: a lift-up mechanism 2a that lifts up the cradle 2 upon a yarn breakage to separate the winding package P from the traversing drum 3 and a winding package brake mechanism 2b that stops, simultaneously with the lift-up of the cradle 2, the rotation of the winding package P gripped by the cradle 2.

[0017] A unit control section 27 controls operations of the lift-up mechanism 2a and the winding package brake mechanism 2b.

[0018] The traversing drum 3 has a spiral traversing groove 3a formed in its surface to traverse the spun yarn. The traversing drum 3 is rotatively driven by a DC brushless motor (BLM) 21. The traversing drum 3 and a drive shaft of the DC brushless motor 21 are connected together by being coupled together directly or via a pulley and a belt. The rotative driving of the DC brushless motor is controlled by a motor control section 25.

[0019] The yarn winding unit U has the following components in the yarn running path between the yarn supplying package B and the traversing drum 3: an unwind supplementing device 4, a tension applying device 5, a hairiness suppressing device 6, a yarn splicing device 7, and a clearer (yarn thickness detector) 8, which are arranged in this order following the yarn supplying package B.

[0020] The unwind supplementing device (balloon controlling device) 4 supplements the unwinding of the yarn from the yarn supplying package B by lowering a cylinder that covers the bobbin as the yarn is unwound from the yarn supplying package B. The tension applying device 5 applies a predetermined tension to the running spun yarn Y. In the illustrated example, the tension applying device is of a gate type in which movable comb teeth 5b are arranged in association with fixed comb teeth 5a. The movable comb teeth 5b can pivot freely toward or away from the fixed comb teeth 5a so as to establish an engaged condition or a released condition, respectively. This pivoting operation is performed by a rotary solenoid 5c. The tension applying device 5 also functions as a twist preventing device for the hairiness suppressing device 6 by engaging the movable comb teeth 5b with the fixed comb teeth 5a.

[0021] The hairiness suppressing device 6 suppresses hairiness of the spun yarn Y unwound from the yarn supplying package B, by falsely twisting the spun yarn Y to twist hairinesses of a group of fibers into the spun yarn Y itself, the fibers constituting the spun yarn Y. In the illustrated example, the hairiness suppressing device 6 is of a disk type in which a plurality of disks 6a are stacked together in the axial direction of the device.

[0022] As shown in Figure 2, a first drive shaft 6b, a second drive shaft 6c, and a third drive shaft 6d which are all parallel with a yarn path are arranged at vertices (a), (b) and (c) of an equilateral triangle as viewed from above. The plurality of (in the illustrated example, two) disks 6a are attached to each of the drive shafts 6b, 6c, 6d and are sized to partly overlap each other in their radial direction. Further, the disks 6a are sequentially arranged around the third drive shaft 6d, the second drive shaft 6c, the first drive shaft 6b, the third drive shaft 6d, the second drive shaft 6c, and the first drive shaft 6b in this order so as to be staggered in the axial direction. The drive shafts 6b, 6c, 6d are rotated in the same direction by the DC brushless motor 22 (see Figure 1). The rotative driving by a DC brushless motor 22 is controlled by a motor control section 26 (see Figure 1). As shown in Figure 2B, possible hairinesses are suppressed by threading the spun yarn Y through a central portion A in which the disks 6a overlap one another, to bring the spun yarn Y into contact with the disks 6a to bend them zigzag to falsely twist them.

[0023] As shown in Figure 1, a clamp 6g for the spun yarn Y is provided downstream (upstream) of the hairiness suppressing device 6. Upon a yarn cut or breakage, the clamp 6g is activated to prevent the yarn from

being wound around the hairiness suppressing device 6. The clamp 6g is activated by a solenoid 6f. The activation by the solenoid 6f is controlled by the unit control section 27.

[0024] The splicing device 7 splices a lower yarn from the yarn supplying package B and an upper yarn from the winding package P together when the yarn is cut because a yarn defect is detected or when the yarn is broken during unwinding. The clearer 8 detects a thickness defect in the spun yarn Y. An analyzer 8b processes a signal corresponding to the thickness of the spun yarn Y to detect a yarn defect such as a slab. Further, the clearer 8 is provided with a cutter 8a for cutting a yarn when a yarn defect is detected. Operations of the cutter 8a are controlled by the analyzer 8b or the unit control section 27. Power used to activate the cutter 8a is charged in a capacitor in the clearer 8.

[0025] Lower yarn capturing and guiding means 11, and upper yarn capturing and guiding means 12 are provided below and above the splicing device 7, respectively, and the lower yarn capturing and guiding means 11 captures and guides the lower yarn from the yarn supplying package B, and the upper yarn capturing and guiding means 12 captures and guides the upper yarn from the winding package P. Upon a yarn cut or breakage, in the illustrated position, the lower yarn is captured in a suction opening 11 in the lower yarn capturing and guiding means 11. Then, the lower yarn capturing and guiding means 11 pivots upward around a shaft 11b to guide the lower yarn to the splicing device 7. At the same time, the upper yarn capturing and guiding means 12 pivots upward from the illustrated position around a shaft 12b to capture, in its mouth 12a, the upper yarn from the winding package P being reversed. The upper yarn capturing and guiding means 12 further pivots downward around the shaft 12b to guide the upper yarn to the splicing device 7. The splicing device 7 aligns the lower and upper yarns with each other and then splices them together using a whirling air current.

[0026] The unit control section 27 controls the motor control section 25 of the DC brushless motor 21 for the traversing drum 3, the motor control section 26 of the DC brushless motor for the hairiness suppressing device 6, the lift-up mechanism 2a and package brake mechanism 2b, the analyzer 8b for the cutter 8a, the solenoid 6f for the clamp 8a, and the solenoid 5c for the tension applying device 5. Further, a main control section 28 controls the unit control section 27 corresponding to each winding unit U. The main control section 28 is provided with a system power source 31. The unit control section 27 of each yarn winding unit U is connected to the system power source 31. Furthermore, the motor control sections 25, 26 and others are connected to the system control section 27. Thus, each piece of equipment is activated.

[0027] Now, a description will be given of a configuration of a power failure handling system for the above described automatic winder 1.

[0028] In Figure 3, a power failure handling system S for an automatic winder comprises the DC brushless motor 21 for the traversing drum 3, the motor control section 25 for the motor 21, and the unit control section 27.

[0029] The unit control section 27 controls the cutter 8a via the analyzer 8b, controls the lift-up mechanism 2a and the winding package brake mechanism 2b, and controls the clamp 6g via the solenoid 6f.

[0030] The motor control section (motor driver) 25 is composed of a speed control section 35, an instantaneous-stop control section 36, an output section (drive circuit) 37, a series connection of a power circuit (switching circuit) 38, a bus voltage detecting circuit 40 for a PC power source 39 connected to the power circuit 38, a bus voltage monitoring section 41 connected between the bus voltage detecting circuit 40 and the instantaneous-stop control section 36, and an instantaneous-stop control command 42 arranged in parallel with the speed control section 35. A central processing unit (CPU) mainly implements the functions of the motor control section 25, which will be described below. Further, the bus voltage detecting circuit 40, the bus voltage monitoring section 41, and others form a power failure detecting section 29 provided in the motor control section 25. Furthermore, the instantaneous-stop control section 36, the output section 37, and others form a regenerative power generating section 30.

[0031] The output section 37 switches energizing of armature windings on the basis of a rotor position detection signal outputted by a magnetic-pole position detecting sensor 43. The output section 37 also generates a PWM signal and outputs a drive signal to the power circuit 38. A switching element is thus PWM-controlled to rotatively drive the DC brushless motor.

[0032] On the basis of the deviation between a target speed inputted to the speed control section 35 from the main control section 28 via the unit control section 29 and a rotation speed (current speed) calculated on the basis of a signal inputted by a rotation speed detector (not shown in the drawings), the speed control section 35 calculates a duty amount used to adjust power (torque) supplied to the DC brushless motor 26. The speed control section 35 then outputs a duty instruction to the output section 25.

[0033] When a power failure is detected, the instantaneous-stop control section 36 generates regenerative power by executing predetermined brake control instead of the speed control based on the deviation between the target speed and the current speed. The predetermined brake control includes two slowdown modes ① and ②. Selection from the two slowdown modes depends on the instantaneous-stop control command outputted to the instantaneous-stop control section 36 from the main control section 28 via the unit control section 27. As shown in Figure 5, an operation instruction command outputted to the speed control section 35 contains various operational conditions such as those shown in

Figure 5A, as well as an instruction byte. The seventh and sixth bits of the instruction byte contain operation codes such as those shown in Figure 5B. The fifth bit contains either the slowdown mode ① or the slowdown mode ②, which is switched by instantaneous stop control as shown in Figure 5C.

[0034] The bus voltage monitoring section 41 subjects the voltage at the DC power source 39 detected by the bus voltage detecting circuit 40 to A/D conversion. If the voltage remains lower than a predetermined reference value for a predetermined time, the bus voltage monitoring section 41 determines that a power failure or instantaneous stop is occurring. The bus voltage monitoring section 41 outputs a power failure signal to the instantaneous-stop control section 36 and the unit control section 27.

[0035] With the above configuration, the motor control section 25 for the DC brushless motor 21 for the traversing drum 3 detects a power failure and immediately executes slowdown control without waiting for an instruction from the unit control section, in response to the instantaneous-stop control command 42, issued upon detection of a power failure. Regenerative power is thus generated and supplied to the pieces of equipment 2a, 2b, 6f via the unit control section 27.

[0036] The slowdown mode ① and slowdown mode ②, which will be described below, are switched by the instantaneous-stop control section 36 depending on the rotation speed of the traversing drum 3. Specifically, the slowdown mode ① or ② is automatically determined on the basis of a speed set by the operation instruction command in Figure 5A.

[0037] The slowdown mode ① is selected for a high rotation speed, e.g. if the traversing drum 3 rotates at more than 4,000 rpm. The slowdown mode ① comprises slowdown control in which a duty ratio is calculated according to PI or PID control. For example, if the traversing drum 3 is rotating at 8,000 rpm and is to be stopped in 0.8 seconds, a target speed of 100 rpm is subtracted from the current speed every 10 milliseconds to achieve a zero speed 0.8 seconds later. As shown in the upper stage in Figure 6A, regenerative power having a voltage exceeding a rated voltage of 280 volts is generated. Overcurrent, indicated by the alternate long and two short dashes line in the figure, is discharged by a discharge circuit to maintain constant regenerative power so as not to exceed an upper limit.

[0038] The slowdown mode ② is selected for a medium or low rotation speed, e.g. if the traversing drum 3 rotates at 4,000 rpm or less. The slowdown mode ① does not provide sufficient regenerative power at a medium or low rotation speed. Accordingly, the motor is slowed down and stopped using a special slowdown pattern allow much regenerative power to be quickly generated. Specifically, the duty ratio is zeroed (the ratio of on time to off time is set to 1:1), and an opposite phase is established to reverse the order of three phases U, V, W (the motor is reversed to be stopped). Then, this slow-

down control is executed to calculate the duty ratio according to the PI or PID control.

[0039] Now, a description will be given of operations of the above described power failure handling system S. A description will be given of the flow of the power failure handling process in Figure 4 in connection with the block diagram of the equipment in Figure 3.

[0040] At S1 in Figure 4, the unit control section 27 transmits an instantaneous-stop control selection code 1 or 0 in a start operation instruction command to the motor control section (driver) 25. The driver 25 retains this code in the instantaneous-stop control command 42. At S2, the speed control section 35 executes PI control to control the rotative driving by the DC brushless motor 21 so as to maintain a set speed. If, at S3, the power failure detecting section 29, provided in the motor control section 25 itself, detects a power failure (S3, YES), then at S4, the instantaneous-stop control section 36 starts slowdown stop control. At this time, a power failure signal is transmitted to the analyzer 8b through the unit control section 27. If the yarn winding unit U is winding the yarn, this power failure signal activates the cutter 8a to cut the yarn being wound. The power used to activate the cutter is charged in the capacitor inside the clearer 8. The cutter is activated first without any regenerative power.

[0041] At S5, the instantaneous-stop control section 36 determines whether or not the instantaneous-stop control selection code is zero. If the code is zero (S5, YES), the slowdown mode ① for a high rotation speed is employed to execute the normal control in which the duty ratio is calculated according to the PI control at S6. If the code is not zero (S5, NO), the slowdown mode ② for a medium or low speed is employed. First, at S7, the duty ratio is calculated according to the PI control, and it is then determined whether or not the duty ratio is positive. If the duty ratio is not positive, i.e. it is negative (opposite phase) (S7, NO), then the normal control is executed in which the duty ratio is calculated according to the PI control at S6. If the duty ratio is positive (S7, YES), then at S8, the duty ratio is set to zero to establish the opposite phase before the PI control is executed.

[0042] The slowdown stop control at S6 or S8 slows down the winding drum 3 to generate regenerative power. The DC power source 39 of the motor control section 25 supplies this regenerative power to the pieces of equipment 2a, 2b, 6f through the unit control section 27.

[0043] At S10, the lift-up mechanism 2a and the winding package brake mechanism 2b activate a cradle lift-up that separates the winding package P from the winding drum 3 and a winding package brake that stops the rotation of the winding package P separated from the winding drum 3. Simultaneously with S10, at S11, the clamp 6g, arranged downstream of the hairiness suppressing device 6, is turned on to grip a part of the spun yarn Y located at an outlet of the hairiness suppressing device 6. At S12, this slowdown stop control is continued until the motor is stopped (S12, NO). Once the motor is

stopped (S12, YES), no regenerative power is generated. Then, as in the case with S13 and S14, the winding package brake mechanism 2b and the solenoid 6f for the clamp are deactivated. The winding package brake is turned off, and the cradle lift-up is moved downward. Further, the clamp 6g releases the yarn. However, at this time, the yarn winding unit U remains stopped, so that no problems occur.

[0044] This slowdown and stop condition is shown in Figure 6. Figure 6A shows a slowdown control condition based on the normal PI control for a high speed rotation. The high speed rotation of the traversing drum 3 effected by overcurrent serves to generate sufficient regenerative power and prevent the motor control section 25 from being damaged. Figure 6B shows a slowdown control condition based on the PI control with the opposite phase for a low speed rotation. In spite of the low speed rotation of the traversing drum, regenerative power is generated which is required for the cradle lift-up.

[0045] A brief description will be given of the effects produced by the above embodiment. (1) Even if a power failure occurs to interrupt the power supply to the unit control section 27 to preclude the yarn winding unit U from continuing operation, the clearer 8, which retains its own power, cuts the yarn. Subsequently, the lift-up mechanism 2a and the winding package brake mechanism 2b are activated using regenerative power generated by the slowdown stop control of the DC brushless motor 21 for the winding drum 3. Thus, before the motor is slowed down and stopped, the winding package P remains separated from the traversing drum 3. This prevents the creation of a scrambled package that may be formed when the traversing drum 3 rubs against a straight wound part resulting from a yarn cut. Therefore, the quality of the winding package is not adversely affected by stoppage resulting from a power failure.

(2) A power failure is detected by monitoring the power source in the motor control section 25, which generates regenerative power. The motor control section 25 itself can immediately execute slowdown stop control without waiting for a stoppage instruction from the unit control section 27. This serves to avoid failing to obtain sufficient regenerative power because of much time wasted on communication required to receive a slowdown instruction from the unit control section 27.

(3) If the hairiness suppressing device 6 falsely twists the spun yarn using the disks 6a, then upon a power failure, a lower yarn resulting from a yarn cut may be wound around the disks 6a before the disks 6a stop rotating. However, upon a power failure, regenerative power is used to activate the clamp 6g, arranged downstream of the hairiness suppressing device 6. This prevents the lower yarn from being wound around the hairiness suppressing device 6.

(4) The slowdown control is executed depending on

the rotation speed of the traversing drum 3. The normal PI or PID control is executed for a high speed rotation that provides sufficient regenerative power. On the other hand, the PI or PID control is executed for a medium or low speed rotation that provides insufficient regenerative power. This avoids damaging the motor control section 25 owing to overcurrent or failing to lift up the winding package because of insufficient regenerative power.

[0046] The above embodiment can be changed as described below. (1) If the hairiness suppressing device 6 is used, the motor control section 26 preferably executes slowdown stop control similar to that executed by the motor control section 25. If the disks 6a of the hairiness suppressing device 6 are stopped through free running, much time is required before the disks 6a are stopped. This prevents the upper yarn from being wound around the disks 6a after the clamp 6a has been turned off.

(2) The hairiness suppressing device 6 may be of a nip type in which two rollers cross each other, in place of the disk type. Alternatively, the yarn winding unit U need not use the hairiness suppressing device 6. In this case, the equipment attached to the hairiness suppressing device 6 is not provided.

(3) In connection with the lift-up mechanism 2a and winding package brake mechanism 2b, both of which act on the cradle 2, the winding package brake mechanism 2b may employ logic by which the winding package brake mechanism 2b automatically applies brakes upon a power failure. On the other hand, only the lift-up mechanism 2a may be activated using regenerative power.

(4) The power failure detecting section 29 need not be provided in the motor control section 25. The main control section 28 may detect a power failure in the system power source 31 to notify the motor control section 25 of it through an exclusive high-speed communication line.

(5) The automatic winder 1 need not use the traversing drum with the traversing groove. The automatic winder 1 may be a yarn winding mechanism that winds a running yarn traversed by a separate traverse device around a winding package rotating in contact with the winding drum. Further, it is possible to arbitrarily install the pieces of equipment other than the tension applying device 5, splicing device 7, and clearer 8. That is, these pieces of equipment may or may not be installed.

(6) The motor as a rotative driving source for the traversing drum is not limited to the DC brushless motor (synchronous AC motor). It may be any motor that generates regenerative power based on slowdown stop control, e.g. DC servo motor.

[0047] In brief, the present invention produces the ex-

cellent effects described below.

[0048] According to the aspect of the invention Claims 1 ~ 3, upon a power failure, the winding package is lifted up from the traversing drum using regenerative power obtained by the slowdown stop control. Consequently, 5
no scrambled packages are created.

[0049] According to the aspect of the invention set forth in Claims 4, 5 the rotation of the winding package P can be stopped simultaneously with its lift-up.

[0050] According to the aspect of the invention in Claim 6, regenerative power can be generated which is required to lift up the winding package. 10

Claims

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1. A power failure handling system for an automatic winder **characterized by** comprising a motor that rotatively drives a winding drum, a lift-up mechanism provided in a cradle supporting a winding package that rotates in contact with said winding drum, a motor control section that controls the rotative driving of said motor, a unit control section that controls the motor control section and said lift-up mechanism, a power failure detecting section that detects a power failure in these control sections, and a regenerative power generating section that causes, on the basis of the detection of a power failure by the power failure detecting section, said motor control section to execute slowdown stop control to generate regenerative power, and in that power from the regenerative power generating section is used to activate said lift-up mechanism upon a power failure. 20
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2. A power failure handling system for an automatic winder according to Claim 1, **characterized in that** said slowdown stop control is carried out in a slowdown mode selected from a plurality of slowdown modes according to a speed at which the winding drum rotates during a power failure. 40
3. A power failure handling system for an automatic winder according to Claim 2, **characterized in that** said slowdown mode is based on ordinary PI or PID control when the winding drum rotates at a high speed and on PI or PID control with an opposite phase when the winding drum rotates at a medium or low speed. 45
50
4. A power failure handling system for an automatic winder according to Claim 1, **characterized by** further comprising a winding package brake mechanism controlled by said unit control section, and in that power from said regenerative power generating section is used to activate said winding package brake mechanism upon a power failure. 55

5. A power failure handling system for an automatic winder according to Claim 4, **characterized in that** said winding package brake mechanism is activated after the lift-up mechanism has been activated, to stop rotation of the winding package separated from the winding drum.

6. A power failure handling system for an automatic winder according to Claim 1, **characterized in that** said power failure detecting section is provided in said motor control section.

FIG. 1

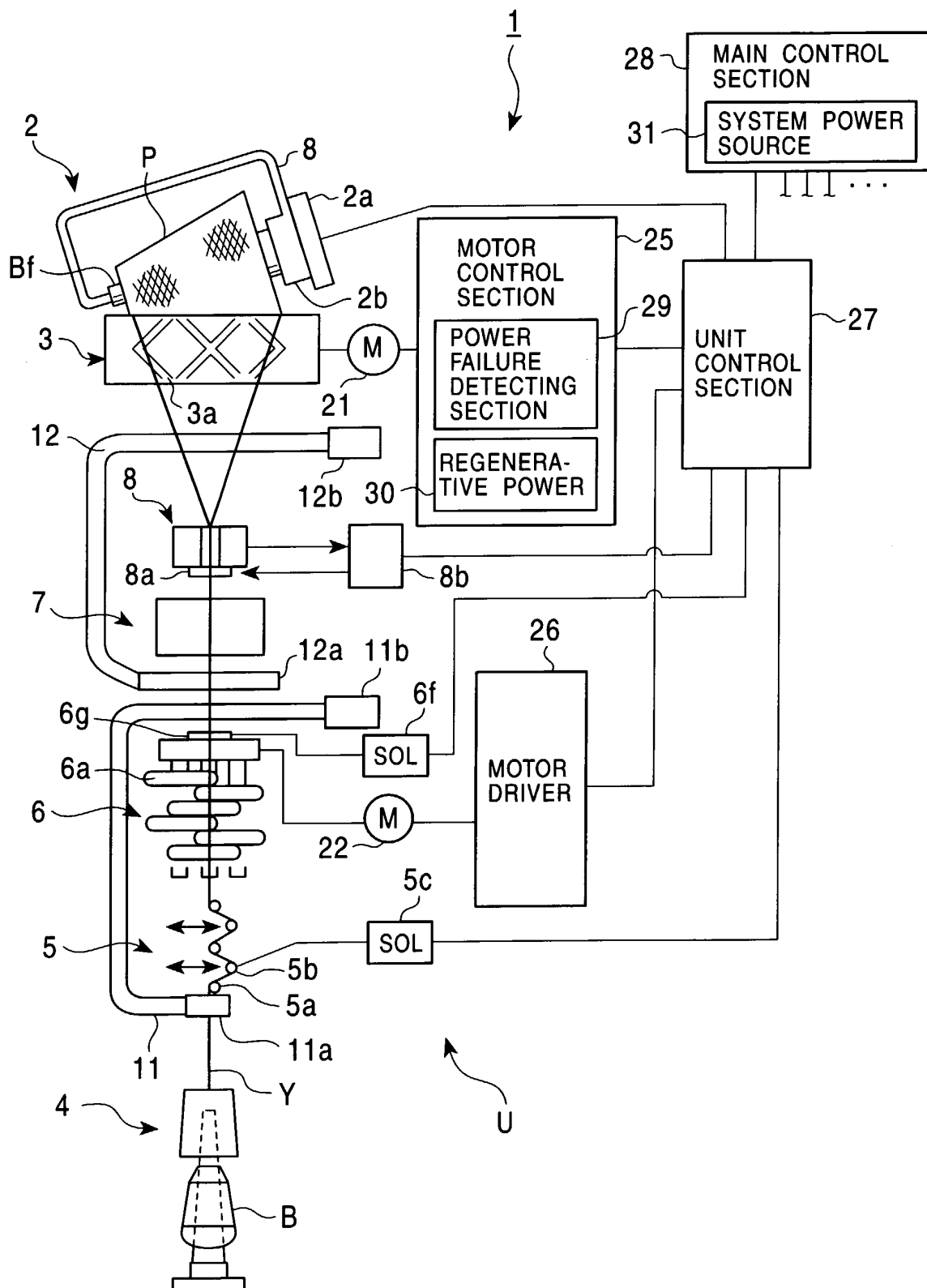


FIG. 2A

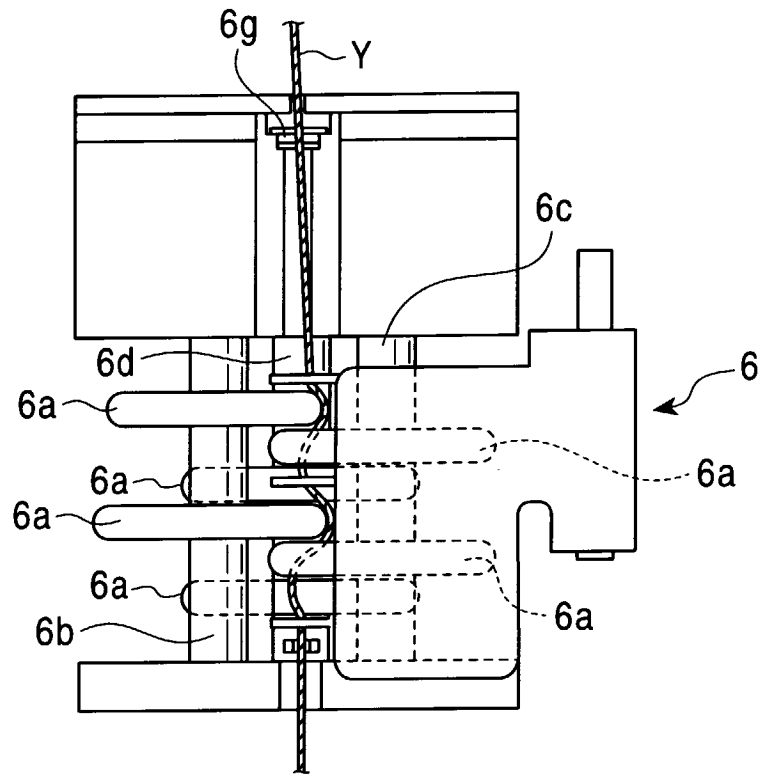


FIG. 2B

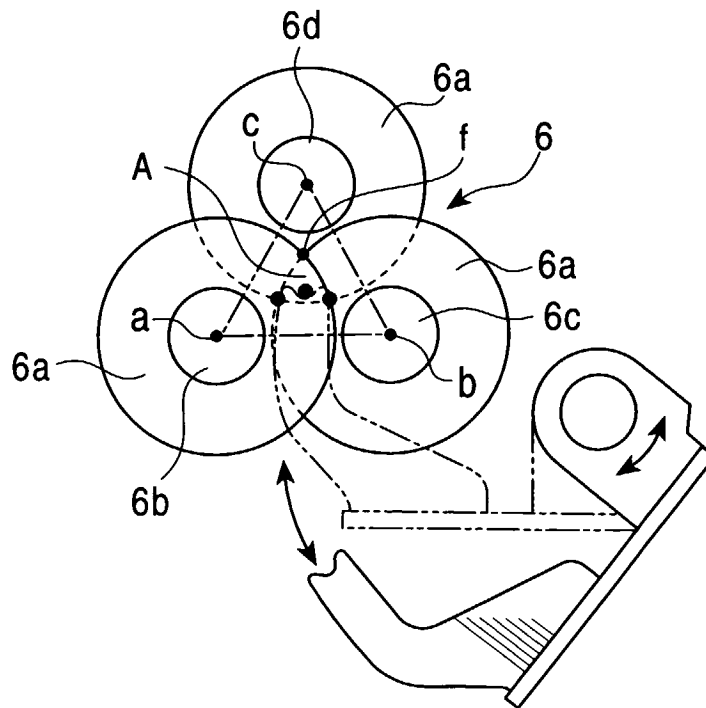


Fig. 3

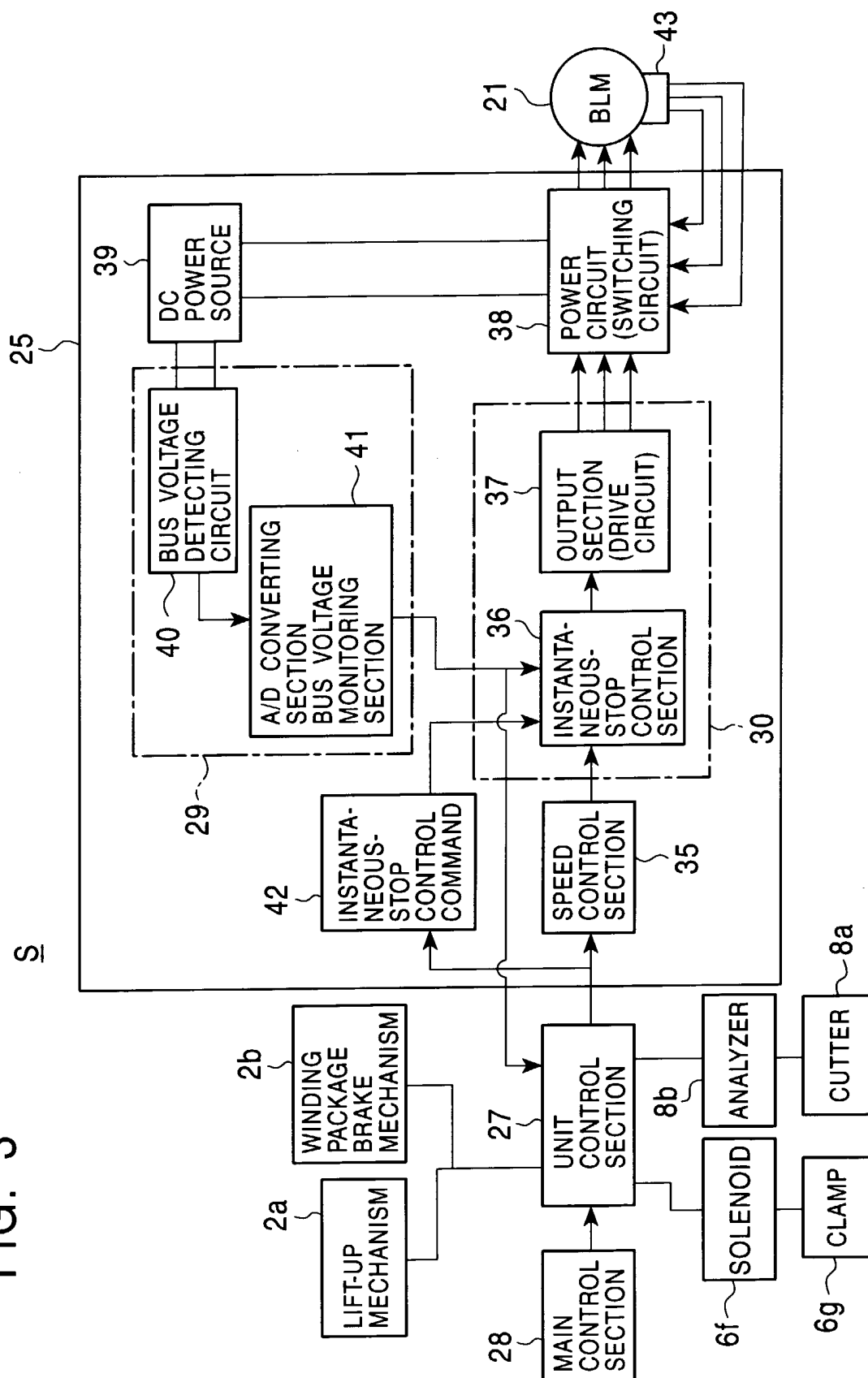


FIG. 4

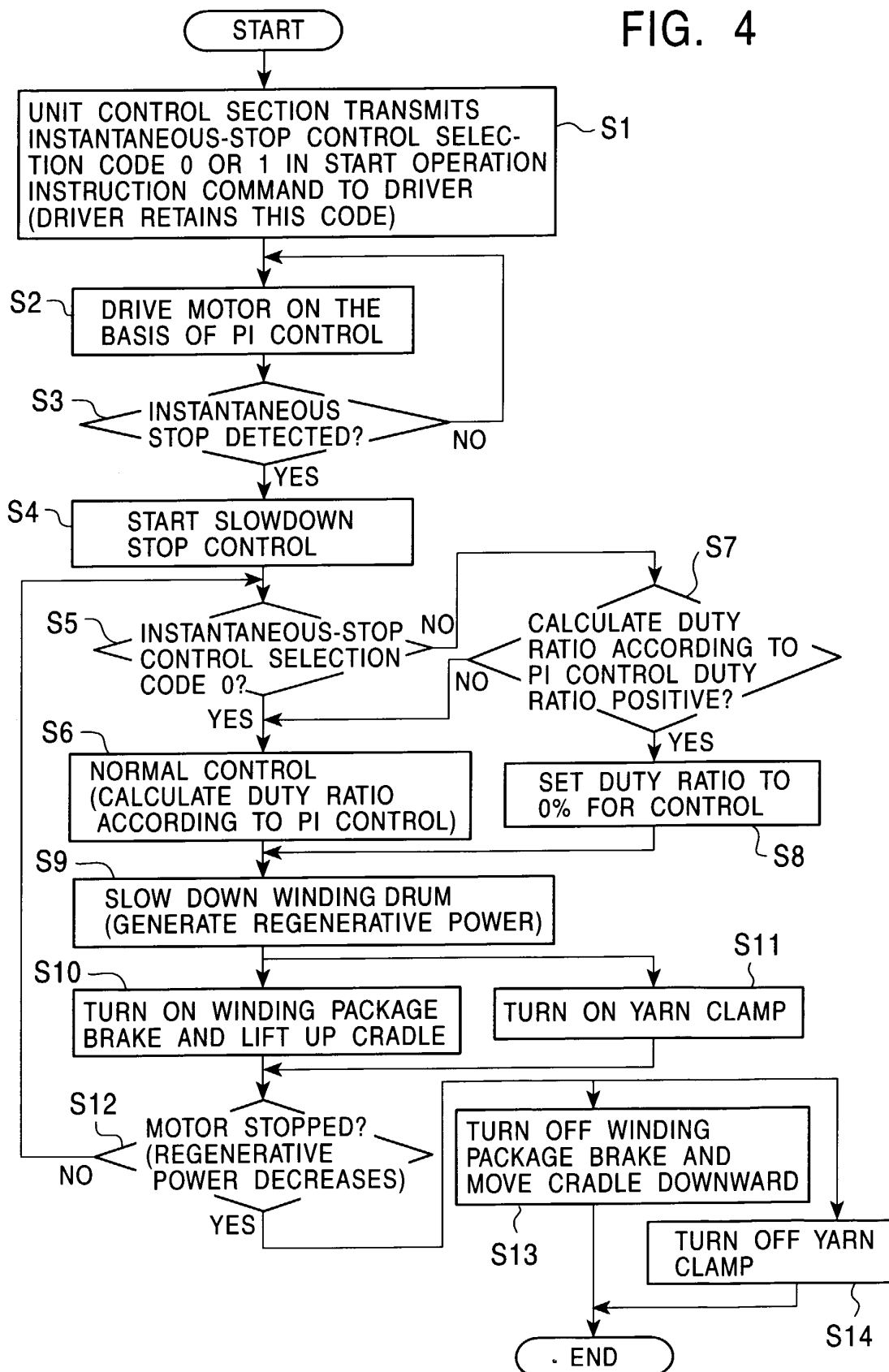


FIG. 5A

OPERATION INSTRUCTION COMMAND

HEADER	SET SPEED	ACCELERATION OR DECELERATION TIME	DISTURB RATIO	DISTURB PERIOD (RISING)	DISTURB PERIOD (FALLING)	INSTRUC- TION BIT
1 BYTE	2 BYTES	2 BYTES	1 BYTE	1 BYTE	1 BYTE	1 BYTE

FIG. 5B

DETAILS OF INSTSRUCTION BIT

SEVENTH BIT	SIXTH BIT	OPERATION CODE
0	0	STOP
1	0	FORWARD ROTATION
0	1	REVERSE ROTATION
1	1	FREE RUNNING

FIG. 5C

FIFTH BIT	INSTANTANEOUS- STOP CONTROL SWITCHING
0	CONTROL ①
1	CONTROL ②

FIG. 6B

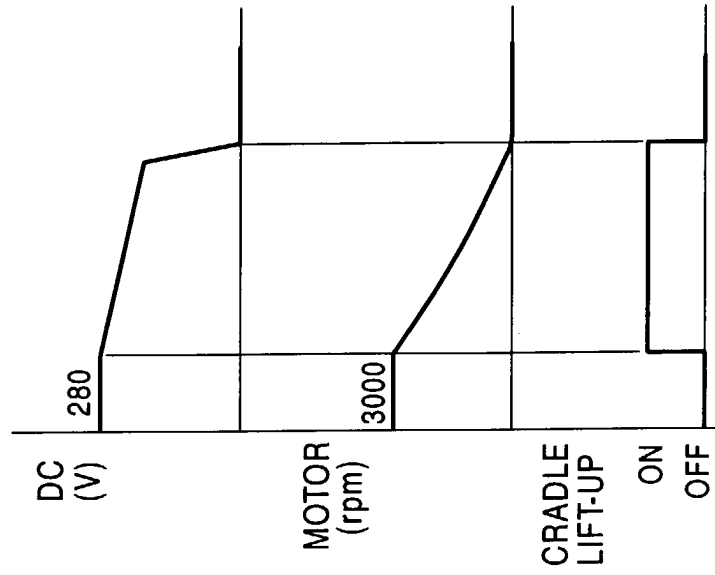


FIG. 6A

