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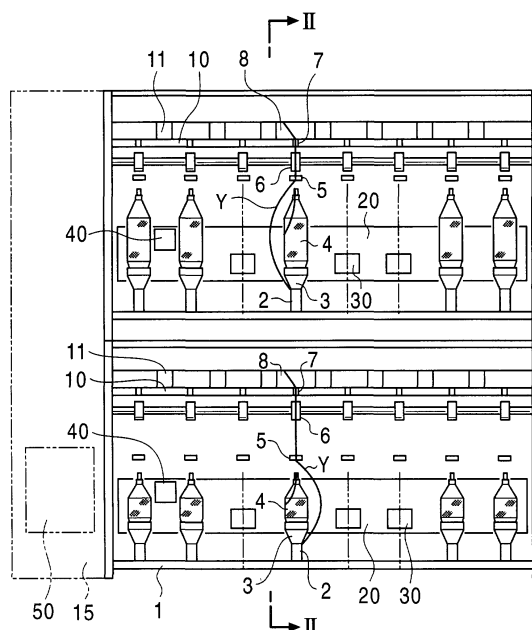
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(54) **Motor controlling system for individual-spindle-drive type textile machine**

(57) The present invention relates to a motor controlling system for an individual-spindle-drive type textile machine and eliminates the need to provide each of the motor controllers with a memory backup function for set values required to control motors, the motor controllers each controlling a corresponding driving motor for each processing unit of the textile machine. Motor controllers 30 each control a corresponding one of driving motors

2, and a master controller 40 solely controls all the motor controllers 30. A microcomputer 41 of the master controller 40 has a memory 43 always retaining set values. When the master controller 40 is activated and when it receives a predetermined signal from any of the motor controllers 30, the master controller 40 transmits the corresponding set values retained in the memory 43, to the motor controller 30, which then stores the values in a memory of a microcomputer 31 (Fig. 1).

FIG. 1



Description

Field of the Invention

[0001] The present invention relates to a motor controlling system for an individual-spindle-drive type textile machine comprising a spindle driving motor (hereinafter referred to as "driving motor") for each processing unit of the textile machine and a plurality of motor controllers each controlling the corresponding driving motors.

Prior Art

[0002] Individual-spindle-drive type textile machines such as individual-spindle-drive type multiple twisters which comprise driving motors each of which is exclusively used for a corresponding one of plural units have been known. In a twister of such a configuration, the rotation speed (number of rotations) of each driving motor affects the quality of twisted yarns, so that a motor controller is provided for each unit or for a group of plural units. Each motor controller accurately monitors the rotation speed of the corresponding driving motor, and optimally controls the corresponding driving motor on the basis of set values such as a target rotation speed and a control gain which are specified by a central controller.

[0003] These set values, which are used by each motor controller to control the corresponding motor, are stored in a memory of the motor controller. Further, the set values are changed in response to a command from the central controller depending on the type of yarns manufactured, so that the contents of the memory must be rewritten. Thus, each motor controller must be provided, for example, with an expensive EEPROM as a memory which is rewritable and which has a backup function activated when service interruption, an open circuit, or the like occurs. In particular, in a textile machine such as an individual-spindle-drive type multiple twister which has a large number of units, a large number of motor controllers are provided correspondingly to the large number of driving motors, so that the equipment costs of the entire machine are considerably high.

[0004] It is thus an object of the present invention to provide a motor controller system for an individual-spindle-drive type textile machine which eliminates the necessity of a memory backup function for set values required by a plurality of motor controllers to control motors and which generally has a simplified configuration so as to be more reliable.

Summary of the Invention

[0005] To attain the above object, the aspect of the present invention set provides a motor controlling system for an individual-spindle-drive type textile machine comprising a driving motor for each unit and a plurality of motor controllers each controlling the corresponding

driving motors, wherein a master controller for controlling and managing in common of the plural motor controllers, the master controller having set value retaining means for always retaining set values used by each of the motor controllers to control the corresponding motor, and wherein when the master controller is activated and/or receives a predetermined signal from any of the motor controllers, the master controller transmits the corresponding set values retained in the set value retaining means, to the motor controller.

[0006] In the above invention, the master controller shared by all the motor controllers always retains the set values required to control the motors and transmits them to each motor controller, thus eliminating the need to provide each motor controller with a memory backup function for the set values.

[0007] The aspect of the present invention provides a motor controlling system for an individual-spindle-drive type textile machine, wherein the master controller, before transmitting the set values, checks whether or not a parameter version thereof matches that of the motor controller, and after this check, transmits the set values.

[0008] In the above invention, the set values are transmitted after checking whether or not the parameter versions match each other, thereby preventing inappropriate motor control caused by the mismatch between the parameter versions.

[0009] The aspect of the present invention provides a motor controlling system for an individual-spindle-drive type textile machine, wherein if an error occurs in any of the motor controllers, information on this error is transmitted to the master controller, and the master controller comprises error information retaining means for always retaining the error information received from the motor controller.

[0010] In the above invention, the master controller shared by all the motor controllers always retains the error information, thus making it possible to produce an error history of each motor controller without the need to provide each motor controller with a memory backup function for the error information

Brief Description of the Drawings

[0011]

Figure 1 is a schematic front view of a twister according to an embodiment in which the present invention is applied to a motor controlling system for an individual-spindle-drive type multiple twister.

Figure 2 is a schematic side view of the twister along II-II line in Figure 1.

Figure 3 is a block diagram of a motor controlling system in the twister.

Figure 4 is a flow chart of a set value transmitting process executed when the master controller of the system is activated.

Figure 5 is a flow chart of a set value transmitting

process executed when a CPU of a motor controller of the system is reset.

Figure 6 is a flow chart of an error information process in the system.

Figure 7 is a flow chart of a set value changing process in the system.

Detailed Description of the Preferred Embodiment

[0012] An embodiment in which the present invention is applied to a motor controlling system for an individual-spindle-drive type multiple twister will be described with reference to the drawings.

[0013] First, the configuration of a twister according to the present invention will be schematically described.

[0014] In Figure 1 and Figure 2, 1 is a machine body of a twister, 2 is a plurality of variable-speed driving motors installed on the machine body 1, and 3 is a spindle coaxially driven by the corresponding driving motor 2. 4 is a supplying package which is installed so as to be removed coaxially with the corresponding spindle 3 and which is kept stationary by an appropriate braking means regardless of the rotation of the spindle 3. 5 is a yarn guide for guiding a yarn Y unwound from the supplying package 4 to a winding device, and 6 is a feed roller for feeding the yarn Y into the winding device while adjusting the tension thereof. 7 is a traverse guide for slantly transferring the yarn Y, and 8 is a winding drum for rotationally driving a winding package 9 on the basis of surface contact. Each unit is comprised of the driving motor 2, spindle 3, supplying package 4, yarn guide 5, feed roller 6, traverse guide 7, winding drum 8 and winding package 9, and so on. The traverse guide 7 is installed on a traverse shaft 10 for each unit, and the traverse shaft 10 is reciprocated in an axial direction by a control box 15 side driving mechanism, shown to the left of the machine body 1 using an imaginary line. For all the units, the winding drums 8 are rotationally driven at the same time by the drum shaft 11, and the drum shaft 11 is driven by the control box 15 side driving source. The yarn Y is wound on a winding tube 13 supported by a cradle 12 as the winding package 9.

[0015] With the configuration of the twister described above, a twisting operation for each unit is performed as follows.

[0016] The yarn Y unwound from the supplying package 4 is guided downward from a tip of the spindle 3 through the interior of the spindle 3 and is ejected from under the spindle 3 which is rotating at a high speed in a radial direction. Since the ejected yarn Y is turned while being unwound from the supplying package 4, it is twisted once in this stage. Furthermore, the yarn Y ejected from under the spindle 3 is guided to the feed roller 6 through the yarn guide 5 while being turned around an outer periphery of the supplying package 4 due to the rotation of the spindle 3. That is, in this stage, the yarn Y ejected from the spindle 3 is twisted again while being swung around the supplying package 4, so

that the twisted yarn Y, which has been twisted twice, is transferred to the traverse guide 7 by the feed roller 5. The twisted yarn Y, the tension of which is adjusted to a predetermined value by the feed roller 6, is wound into the winding package 9 rotationally driven by the winding drum 8.

[0017] In this embodiment, as shown in Figure 1, eight units, extending from the driving motor 2 to the winding drum 8, are installed in juxtaposition in a lateral direction of the machine body 1, and other eight units are installed behind the first eight units and opposite thereto. That is, the 16 units constitute one span. The same number of these spindles are installed on an upper stage of the machine body 1. That is, the 32 units in total are installed on the one frame of the machine body 1, and in actual twister, a large number of such frames are arranged in juxtaposition in lateral direction. The one host computer 50 disposed in a control box 15 controls the machine body 1 composed of a plurality of frames.

[0018] The quality of the twisted yarn Y wound up by the unit varies with the rotation speed of the spindle 3. Accordingly, for the uniform quality of the twisted yarn Y in the winding package 9, the rotation speed (number of rotations) of the driving motor 2 for each unit must be accurately controlled on the basis of an instruction signal from the host computer 50, and the rotation speed of the driving motor 2 for each unit must be accurately monitored. Further, if trouble such as yarn breakage occurs in any of the units, the loads on the corresponding driving motor 2 varies, so this must be immediately transmitted to the host computer 50.

[0019] The driving motors 2 are controlled by a plurality of motor controllers 30. A plurality of motor controllers 30 (8 motor controllers 30) for one span (16 units) are controlled and managed by a master controller 40, and a plurality of master controllers 40 for every each span (every 8 motor controllers 30) are integrally managed by the one host computer 50. In the twister of this embodiment, as shown in Figure 1 and Figure 2, a duct 20 for the one span is extended along a longitudinal direction of the machine body 1, and halfway between the front and rear rows of units arranged in juxtaposition in the longitudinal direction of the machine body 1. The eight motor controllers 30 and the one master controller 40 are arranged in the duct 20. The upper and lower spans have the same configuration.

[0020] Next, the configuration of the motor controlling system according to this embodiment will be described.

[0021] In Figure 3, the master controller 40 controls each motor controller 30 on the basis of an instruction from the host computer 50, and is composed of a microcomputer 41 comprising a CPU 42, a memory 43, and others, communication interfaces (I/F) 44, 45, a multiplexer (MPX) 46, an input/output interface (I/F) 47, and others. The microcomputer 41 is connected to the host computer 50 through a serial communication line La via the communication interface (I/F) 44, and to each motor controller 30 through a serial communication line Lb via

the communication interface (I/F) 45 and the MPX 46. A start, emergency stop, instantaneous stop, and other switches (not shown in the drawings) provided on the control box 15 are connected to the microcomputer 41 via the input/output interface (I/F) 47.

[0022] Each motor controller 30 is an inverter module for controlling the corresponding driving motors 2, and is composed of a microcomputer 31 comprising a CPU 32, a memory 33, and others, a communication interface (I/F) 34, inverter circuits 35, and others. The microcomputer 31 is connected to the master controller 40 through the serial communication line Lb via the communication interface (I/F) 34. The microcomputer 31 controls the inverter circuits 35 to in turn control the rotation of the driving motors 2, while monitoring the rotation speed of the driving motors 2 on the basis of data detected by a rotation sensor (not shown in the drawings). In this embodiment, one motor controller 30 individually controls the two driving motors 2 corresponding to the pair of front and rear units, but the motor controller 30 may be provided for one unit or three to four units as long as it individually controls the driving motors 2.

[0023] In this motor controlling system, all set values such as a target rotation speed (number of rotations) and a control gain which are required to control each driving motor 2 are always retained in the memory 43 of the microcomputer 41 of the master controller 40 side. When the master controller 40 is activated and when a predetermined signal is received from any of the motor controllers 30, the set values are transmitted from the master controller 40 to this motor controller 30, where they are stored in the memory 33 of the microcomputer 31. Moreover, when an error occurs in any of the motor controller 30, relevant error information is received by the master controller 40, which then stored the information in the memory 43 of the microcomputer 41. Accordingly, the memory 43 of the master controller 40 side has an EEPROM as set value retaining means and error information retaining means, in addition to a typical RAM or ROM, or the like, and it has a memory backup function for the set values and the error information which function is activated when service interruption, an open circuit, or the like occurs. On the other hand, the memory 33 of each motor controller 30 side is composed of a typical RAM or ROM, or the like, and need not be provided with the memory backup function. Consequently, the motor controller 30 is simplified.

[0024] Various data are transmitted and received between the host computer 50 and the master controller 40 and between the master controller 40 and each motor controller 30 by means of polling communications. For example, the master controller 40 polls each slave motor controller 30 during each predetermined cycle. Upon receiving a normal polling message, the motor controller 30 returns a polling response message to the master controller 40, the message containing a status such as a CPU reset or an error. Thereby, the error information is transmitted from the motor controller 30 to the master

controller 40 without interrupting the normal polling process between the one master controller 40 and a plurality of motor controllers 30.

[0025] Next, processes such as a set value transmitting process in the motor controlling system will be described with reference to Figures 4 to 7, in addition to Figure 3. Figures 4 to 7 are each a flow chart showing the flow of a process executed by the CPU 42 of the microcomputer 41 of the master controller 40.

[0026] First, when the master controller 40 is activated, that is, when a breaker is turned on to start the operation of all the units, the master controller 40 transmits a request for a parameter version to each motor controller 30 at step S1, as shown in Figure 4. In response, each motor controller 30 returns a polling response message with its own parameter version to the master controller 40. The master controller 40 receives the parameter version at step S2, and then checks whether its own parameter version matches that of the motor controller 30 at step S3. If the parameter versions match each other to validate the set value transmission, then at step S4, the master controller 40 adds the corresponding set values retained in the memory 43 of the microcomputer 40, to a polling message, and transmits the message to the motor controller 30. After transmitting all the set values at step S5, the master controller 40 transmits an operation permission to the motor controller 30 at step S6, and then starts the normal polling. Thereby, the motor driving is started by the motor controller 30 after each motor controller 30 normally received all the set values. The set values transmitted to the motor controller 30 are stored in the memory 33 of the microcomputer 31, so that the corresponding driving motors 2 are controlled based on these set values. On the other hand, if the parameter versions do not match each other at step S3, the error process is executed at step S7. In this error process, for example, the master controller 40 transmits a parameter version error to the host computer 50 during polling therewith to forcibly turning off an operation switch, while forcibly turning on a package brake.

[0027] Next, the operation of resetting the CPU 32, the central processing unit, of the microcomputer 31 of the motor controller 30 will be described. For example, after the motor controller 30 has been recovered from an open circuit or when a program uncontrollable-run monitoring timer overflows, the CPU 32 is reset. The program uncontrollable-run monitoring timer is called a "watchdog timer" and is programmed to be reset during each predetermined cycle. If the program runs uncontrollably, this timer cannot be reset but overflows to reset the CPU 32. When the master controller 40 receives a polling response message from the motor controller 30 and when the status data in the polling response message indicates that the CPU 32 has been reset as shown at step S8, the master controller 40 transmits a request for the parameter version to the motor controller 30 in which the CPU 32 has been reset. Then, from step S2' to step S7', a process similar to the above described

steps S2 to S7 is executed between the master controller 40 and the motor controller 30 in which the CPU 32 has been reset. Thereby, the correct set value is immediately transmitted to the motor controller 30 and written even if the reset is occurred in the motor controller 30.

[0028] In this manner, the memory 43 of the master controller 40 side always retains the set values, which are transmitted to the motor controller 30 and are stored in the memory 33, thus eliminating the need to provide each motor controller 30 with a memory backup function for the set values. Further, the function of checking for the parameter version between the master controller 40 and each motor controller 30 can prevent inappropriate motor control caused by the mismatch between the parameters.

[0029] Next, an error information process will be described. This process is executed, for example, if tripping, yarn breakage, or the like occurs in any of the units, if any control target cannot be achieved, or in other cases. When the master controller 40 receives a polling response message from any of the motor controllers 30 and when the status therein indicates that an error is occurring as shown at step S9 in Figure 6, the master controller 40 transmits a request for error information to this motor controller 30 at step S10. In response, the motor controller 30 returns a polling response message with relevant error information to the master controller 40. Upon receiving the error information at step S11, it stores the information in the memory 43 for continuous retention at step S12.

[0030] When the error information from the motor controller 30 is thus always retained by the master controller 40, the master controller 40 can manage the error histories of all the motor controllers 30 without the need to provide each motor controller 30 with a memory backup function for error information.

[0031] Next, a set value changing process will be described. If the master controller 40 receives a set value changing command from the host computer 50 at step S13 as shown in Figure 7, the master controller 40 transmits the contents of that change to the motor controller 30 as a write message during a polling cycle at step S14. Then, at step S15, the master controller 40 writes the changed set values to its own memory 43 for continuous retention. Consequently, the corresponding driving motor 2 is controlled on the basis of the changed set values. Further, if the set values must be transmitted to the motor controller 30 as described above, these changed set values are transmitted.

[0032] The embodiment of the present invention has been described. However, the set value retaining means and error information retaining means according to the present invention are not limited to the EEPROM shown in this embodiment, but various effective means can be employed as long as they can always retain set value data and error information data. Moreover, in this embodiment, the multiple twister has been illustrated, but the present invention is applicable to motor control sys-

tems for false-twisting processing machines or other various individual-spindle-drive type textile machines.

[0033] As described above, according to the aspect of the invention, the master controller shared by all the motor controllers always retains the set values required to control the motors and transmits them to each motor controller, thus eliminating the need to provide each motor controller with a memory backup function for the set values to thereby reduce the equipment costs of the entire machine. Further, since the common master controller can always manage the set values for all the motor controllers, it can easily accommodate changes in set values, thereby making it possible to simplify the configuration of the entire system.

[0034] Moreover, according to the aspect of the invention, the set values are transmitted after checking whether or not the parameter versions match each other, thereby preventing inappropriate motor control caused by the mismatch between the parameters to thereby allow the motor control system to operate more safely and reliably. Furthermore, checking the parameter versions allows the system to operate safely even if master controllers or motor controllers from another machine are used in the system, thus improving the compatibility between machines.

[0035] Further, according to the aspect of the present invention, the master controller shared by all the motor controllers always retains error information on each motor controller, thereby enabling the common master controller to always manage the error histories of all the motor controllers without the need to provide each motor controller with a memory backup function for error information. Therefore, the configuration of the entire system can be simplified, and the system can operate more reliably.

Claims

1. A motor controlling system for an individual-spindle-drive type textile machine comprising a spindle driving motor for each processing unit of the textile machine and a plurality of motor controllers each controlling the corresponding spindle driving motors, the motor controlling system being **characterized** by further comprising:

a master controller for controlling and managing in common of the plural motor controllers, the master controller having set value retaining means for always retaining set values used by each of said motor controllers to control the corresponding motor, and in that:

when said master controller is activated and/or receives a predetermined signal from any of said motor controllers, the master controller transmits the corresponding set values retained in said set value retaining means, to said

motor controller.

2. A motor controlling system for an individual-spindle-drive type textile machine according to Claim 1, **characterized in that** said master controller, before transmitting said set values, checks whether or not a parameter version thereof matches that of said motor controller, and after this check, transmits said set values.

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3. A motor controlling system for an individual-spindle-drive type textile machine according to Claim 1 or Claim 2, **characterized in that** if an error occurs in any of said motor controllers, information on this error is transmitted to said master controller, and said master controller comprises error information retaining means for always retaining the error information received from said motor controller.

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4. A motor controlling system for an individual-spindle-drive type textile machine according to Claim 3, **characterized in that** said master controller polls its slave motor controllers during each predetermined cycle, and said motor controller returns said error information to said master controller as a polling response message.

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5. A motor controlling system for an individual-spindle-drive type textile machine according to any one of Claims 1 to 4, **characterized in that** after transmitting all the set values to each of said motor controllers, said master controller transmits an operation permission signal to said motor controller.

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6. A motor controlling system for an individual-spindle-drive type textile machine according to any one of Claims 1 to 5, **characterized in that** said predetermined signal is a reset signal indicating that a central processing unit of said motor controller has been reset, and upon receiving the reset signal from said motor controller, said master controller transmits the corresponding set values retained in said set value retaining means, to the motor controller in which the reset has occurred.

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7. A motor controlling system for an individual-spindle-drive type textile machine according to any one of Claims 1 to 6, **characterized in that** said set values include a target rotation speed.

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8. A motor controlling system for an individual-spindle-drive type textile machine according to any one of Claims 1 to 7, **characterized in that** said spindle driving motor drives a twisting spindle, and said motor controller is an inverter module for controlling said spindle driving motor.

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FIG. 1

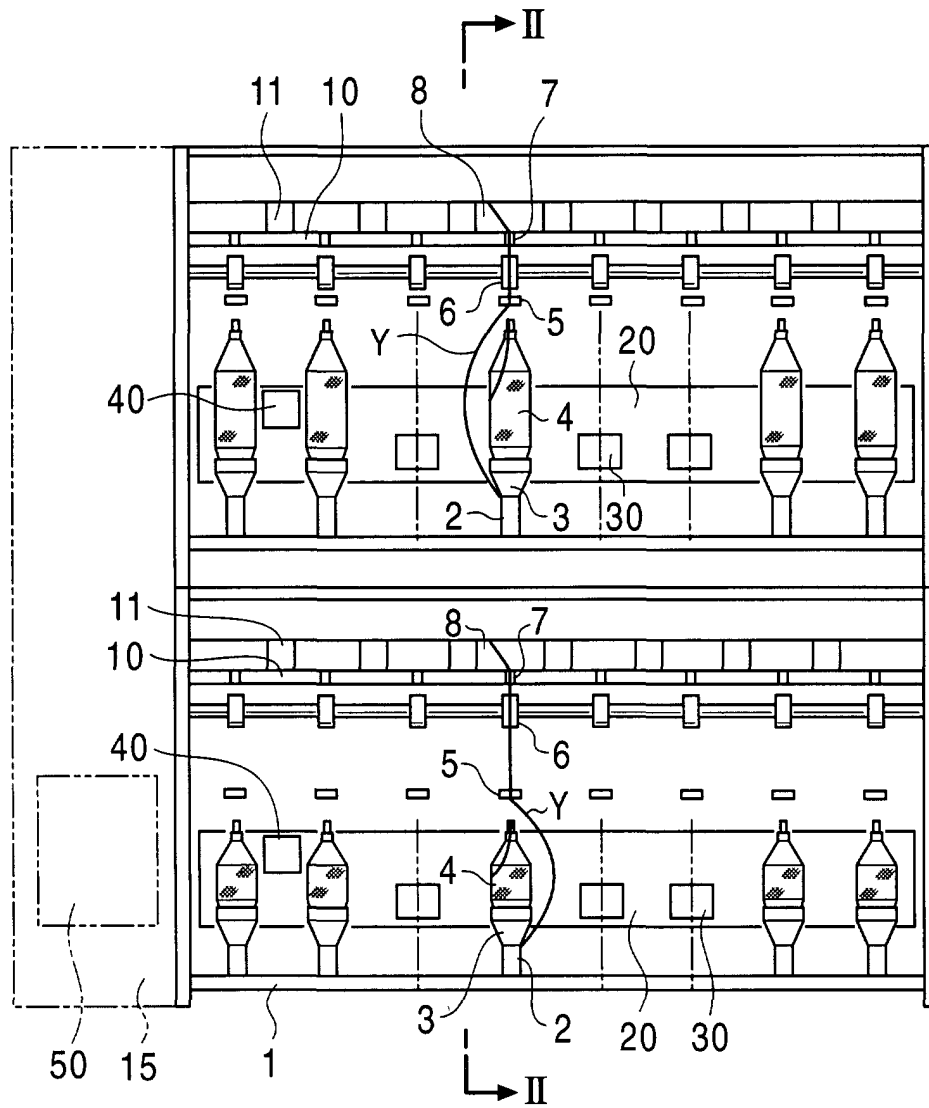


FIG. 2

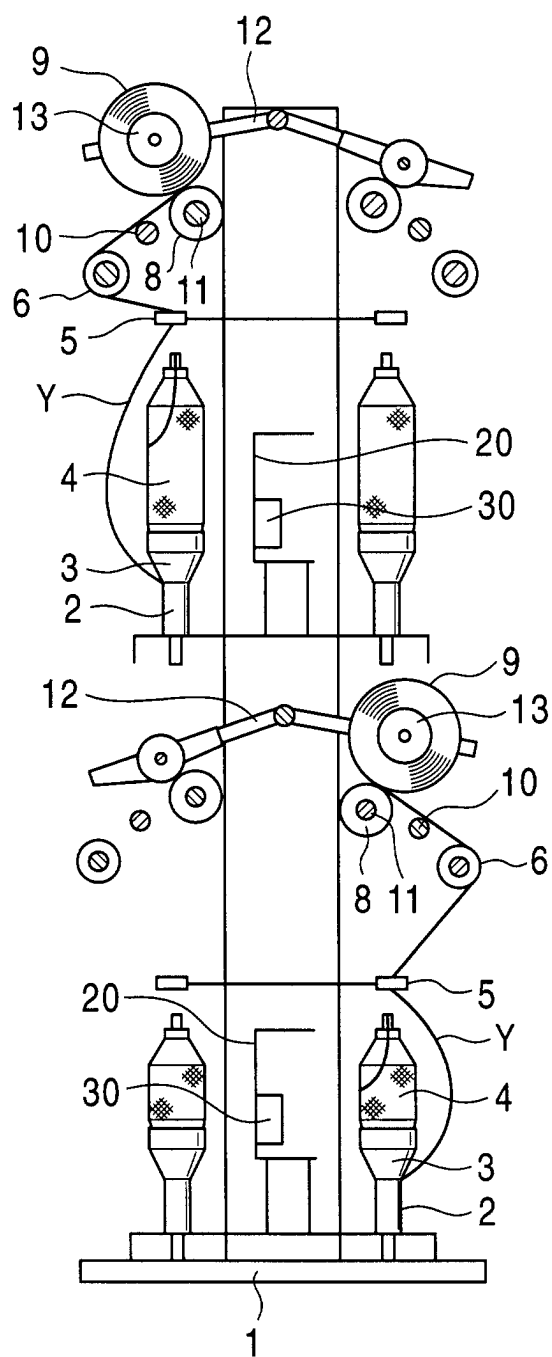


FIG. 3

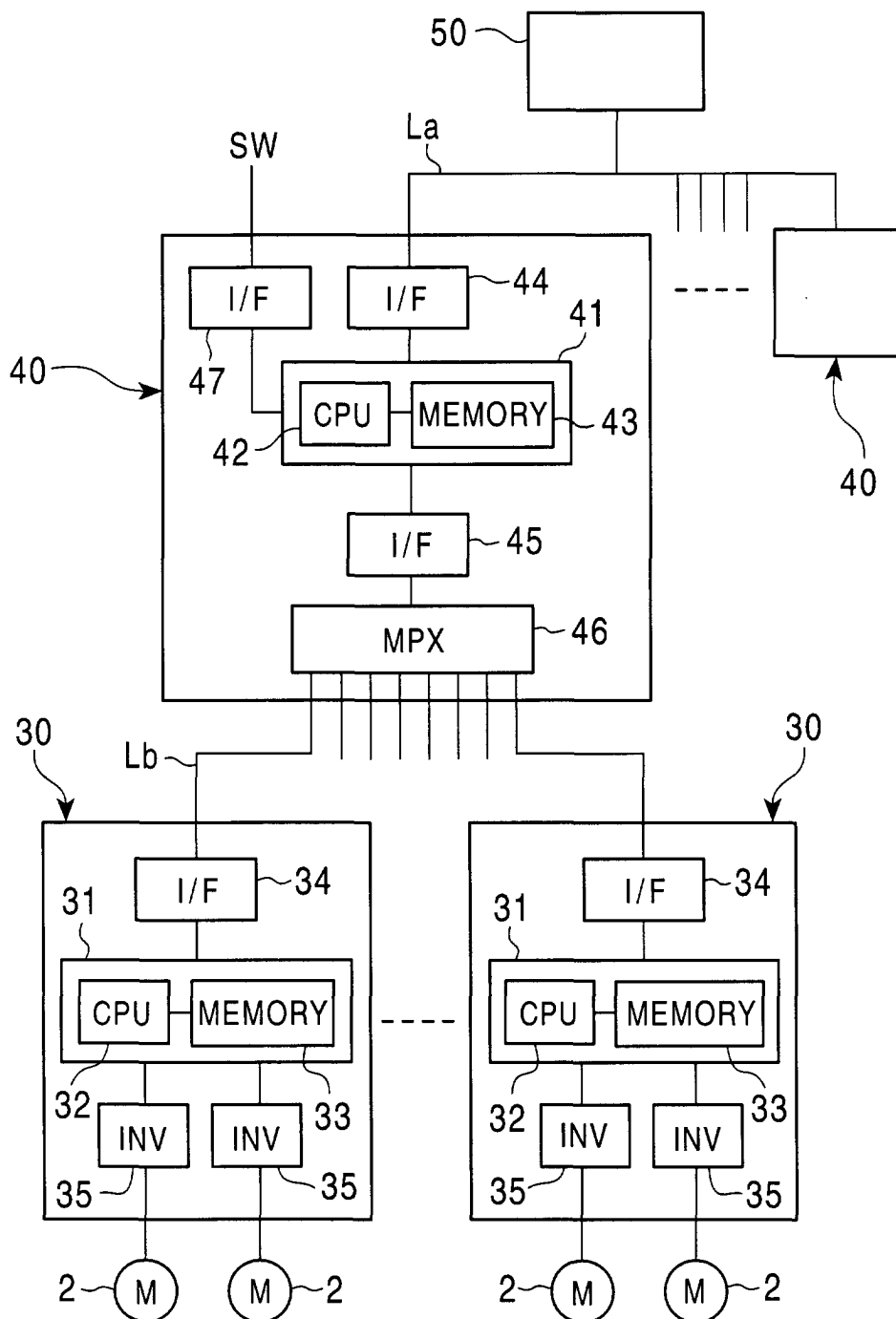


FIG. 4

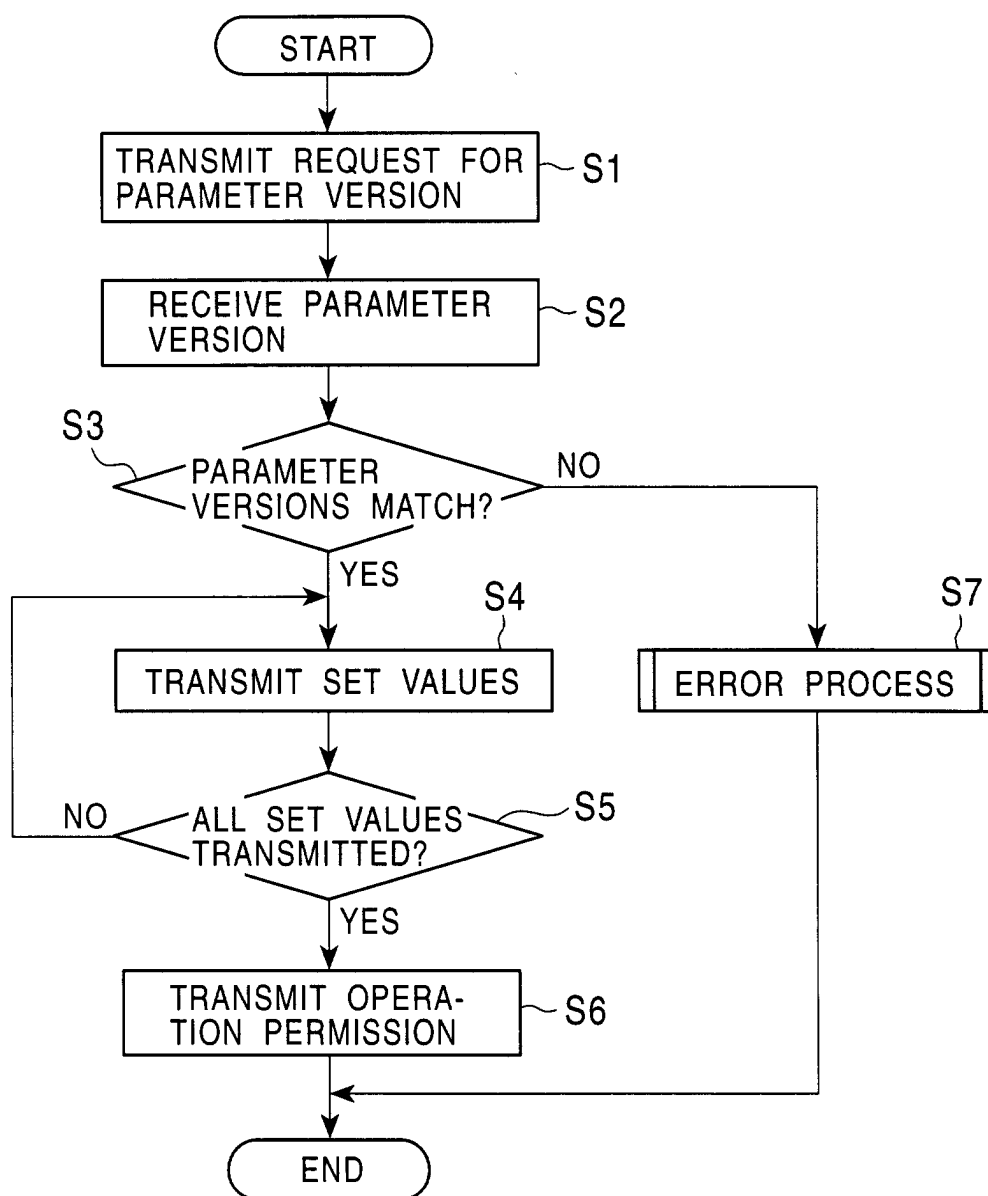


FIG. 5

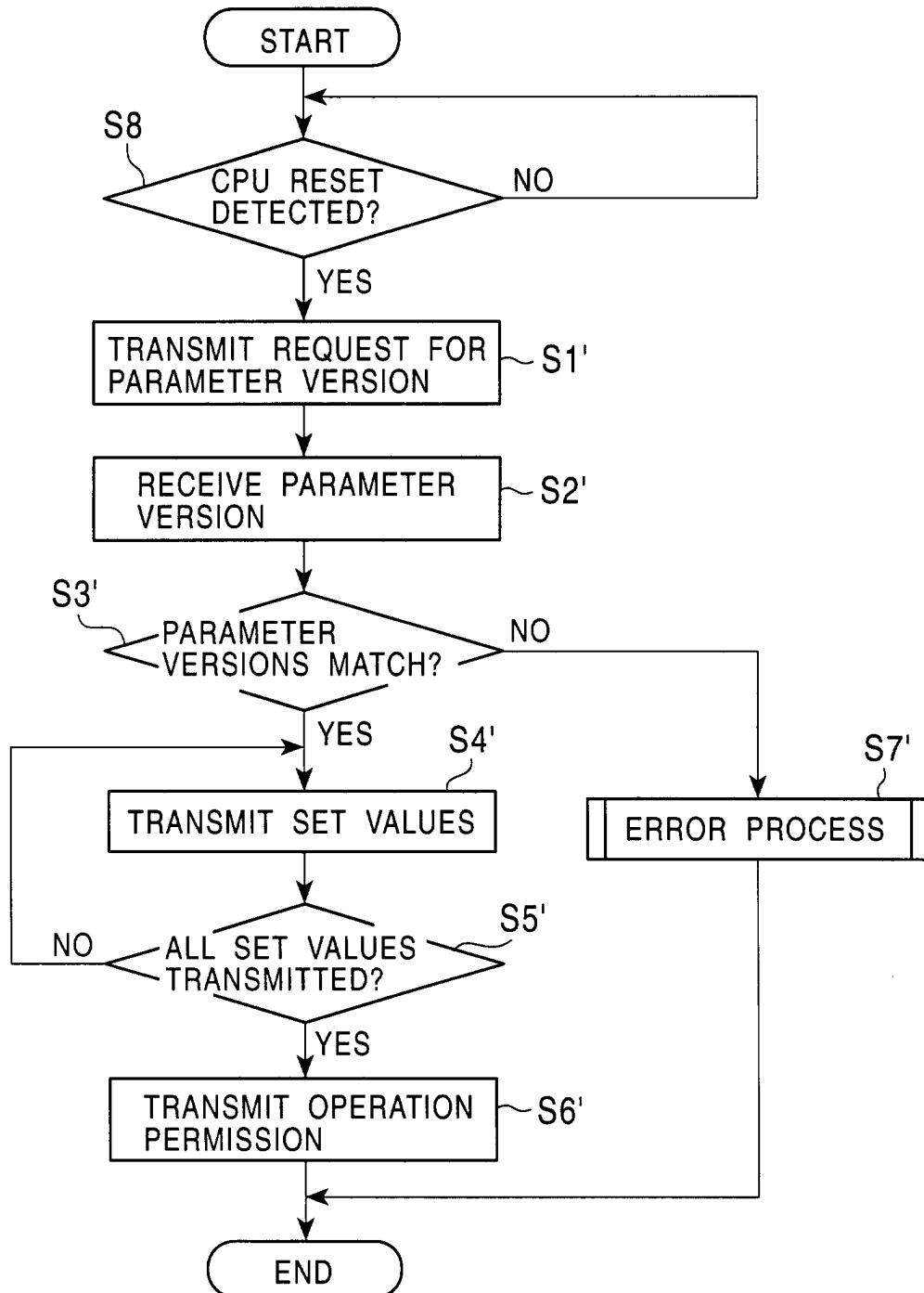


FIG. 6

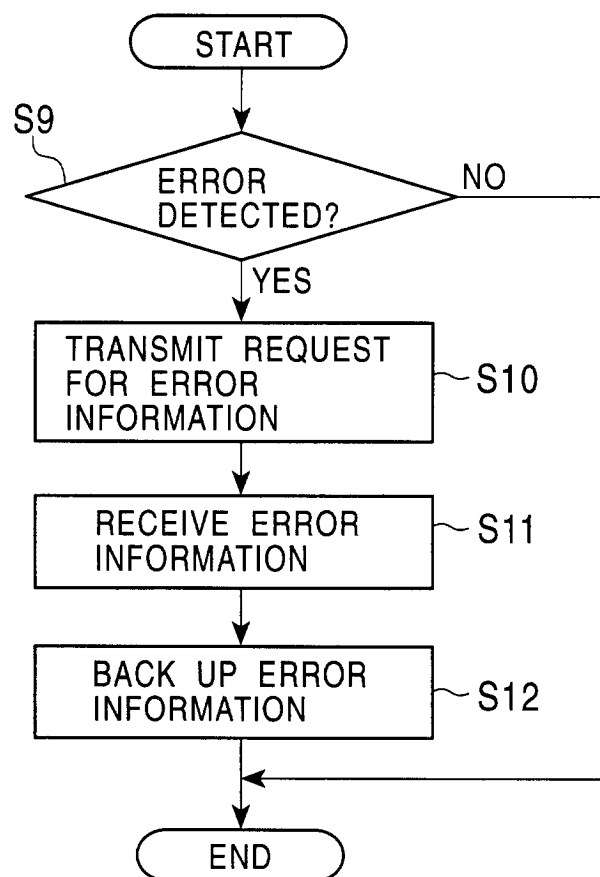


FIG. 7

