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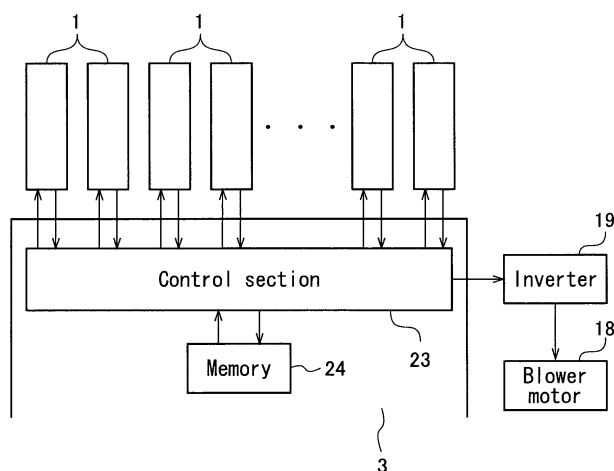
(54) **Method for controlling blower motor and blower system**

(57) The present invention enables the rotation speed of a motor (18) driving a blower to be controlled without the need for an additional device such as a sensor.

The present invention enables the rotation speed of the motor driving the blower to be controlled while supplying a minimum required negative pressure. The

present invention thus saves required energy while smoothly operating an automatic winder. The number of yarn splicing operation in each winding unit 1 and the number of failures in yarn splicing are counted to calculate the mistake rate of the whole system. On the basis of the calculated mistake rate, the output frequency of an inverter (19) supplying power to the blower motor (18) is controllably increased or reduced (Fig. 1).

FIGURE 1



Description

Field of the Invention

[0001] The present invention relates to a method for controlling a blower motor that supplies a negative pressure to a plurality of winding units constituting an automatic winder and a blower system.

BACKGROUND OF THE INVENTION

Description of Related Art

[0002] A winding unit in an automatic winder which winds a yarn unwound from a supplying bobbin to form a package has a yarn splicing function that, when a yarn defect is detected, cuts the yarn and fully automatically splices the cut yarn while eliminating the yarn defect. During a yarn splicing operation, a negative pressure (suction force) supplied to a suction mouth allows an upper yarn end located on a package side to be caught. Then, the suction mouth delivers the upper yarn end to a yarn splicing device. Thus, in an automatic winder in which a plurality of winding units are juxtaposed, a negative pressure needs to be supplied to the individual winding units. Thus, a blower system is adopted in which a single blower connected to an intake duct supplies the negative pressure to the individual winding units via the common intake duct.

[0003] In recent years, in connection with the issue of global warming or running costs, energy saving has been an important challenge for automatic winders. Analysis of the power consumption of an automatic winder indicates that a blower motor (hereinafter simply referred to as a motor) that drives a blower in a blower system accounts for a high percentage of the power consumption. Thus, energy saving is expected to be achieved by properly controlling the rotation speed of the motor so as to prevent an excessive negative pressure from being supplied, to reduce the power consumption. For example, the Unexamined Japanese Utility Model Application Publication (Jikkai-Hei) No. 2-40759 is a known example of a method for controlling the motor in the blower system of this kind. In this system, a sensor provided in a suction box detects the negative pressure so that the frequency of an inverter is controlled on the basis of the detected value from the sensor so as to maintain the negative pressure constant, to control the rotation speed of the motor driving the blower. That is, the detected value from the sensor is compared with a preset threshold so that where the detected value is smaller than the threshold, the frequency of the inverter is increased to increase the rotation speed of the inverter. In contrast, where the detected value is greater than the threshold, the frequency of the inverter is reduced to reduce the rotation speed of the motor.

BRIEF SUMMARY OF THE INVENTION

[0004] In the Unexamined Japanese Utility Model Application Publication (Jikkai-Hei) No. 2-40759, the preset threshold is a theoretical value for the negative pressure required to allow the automatic winder to operate smoothly. The preset threshold is set slightly greater than the actually required value. Thus, the rotation speed of the motor is increased by an amount corresponding to the value by which the preset threshold is greater than the actually required value. Consequently, extra power is disadvantageously consumed. The pressure sensor may operate incorrectly or break down in the worst case. As a result, adjustment or repair costs are required.

[0005] An object for the present invention is to provide a blower system and a method for controlling a blower motor which eliminate the need for an additional device such as a sensor to enable a reduction in the costs of the whole system as well as facilitation of maintenance of the whole system. Another object of the present invention is to provide a blower system and a method for controlling a blower motor which enables a reduction in the rotation speed of the blower motor driving the blower while supplying the minimum required negative pressure, thus allowing required energy to be saved while smoothly operating the automatic winder.

[0006] The present invention is intended for a method for controlling a blower motor for a blower system that supplies a negative pressure used for a yarn splicing operation, to a plurality of winding units having a yarn splicing function. Number of yarn splicing operations in each of the winding units and number of failures in yarn splicing are counted to calculate mistake rate of the whole system. The present invention is characterized in that an output frequency of an inverter supplying power to the blower motor is controllably increased or reduced on the basis of the mistake rate.

[0007] Specifically, the blower system includes an intake duct comprising a plurality of manifolds connected to the respective winding units, a blower connected to one end of the intake duct to generate a negative pressure, a blower motor rotationally driving the blower, and an inverter supplying power to the blower motor. A rotation speed of the blower motor is controlled by the output frequency of the inverter supplying power to the blower motor. The winding unit comprises a yarn cutting device cutting a yarn when a yarn defect is detected, a yarn splicing device performing an operation of splicing a lower yarn end and an upper yarn end formed by the yarn cutting operation, and a suction mouth utilizing a negative pressure generated by the blower to suck, catch, and deliver the upper yarn end to the yarn splicing device. The method for controlling the blower motor comprises a mistake rate calculating step of acquiring the number of yarn splicing operations in each of the winding units and the number of failures in yarn splicing to calculate an upper yarn end leading mistake rate of the whole system on the basis of the number of operations and the

number of failures, and a frequency changing step of controllably increasing or reducing the output frequency of the inverter on the basis of the upper yarn end leading mistake rate calculated in the mistake rate calculating step.

[0008] Specifically, in the mistake rate calculating step, the upper yarn end leading mistake rate is calculated every set time and stored in a storage section. In the frequency changing step, the last upper yarn end leading mistake rate stored in the storage section is read. Where the calculated upper yarn end leading mistake rate is higher than the read upper yarn end leading mistake rate, the output frequency of the inverter is increased. Where the calculated upper yarn end leading mistake rate is the same as or lower than the read upper yarn end leading mistake rate, the output frequency of the inverter is reduced.

[0009] In the mistake rate calculating step, the upper yarn end leading mistake rate may be calculated every set time. In this case, in the frequency changing step, the calculated upper yarn end leading mistake rate is compared with a preset threshold value. Where the calculated upper yarn end leading mistake rate is higher than the threshold value, the output frequency of the inverter is increased. Where the calculated upper yarn end leading mistake rate is the same as or lower than the threshold value, the output frequency of the inverter is reduced.

[0010] In the frequency changing step, the output frequency of the inverter is preferably varied within a range between a preset maximum value and a preset minimum value.

[0011] Furthermore, the present invention is intended for a blower system supplying a negative pressure to a plurality of winding units comprising an automatic winder. The blower system includes an intake duct comprising a plurality of manifolds connected to the respective winding units, a blower connected to one end of the intake duct to generate a negative pressure, a blower motor rotationally driving the blower, an inverter supplying power to the blower motor, and a control section controlling a rotation speed of the blower motor by controllably increasing or reducing an output frequency of the inverter. The winding unit comprises a yarn cutting device cutting a yarn when a yarn defect is detected, a yarn splicing device performing an operation of splicing a lower yarn end and an upper yarn end formed by the yarn cutting operation, and a suction mouth utilizing a negative pressure generated by the blower to suck, catch, and deliver the upper yarn end to the yarn splicing device. The blower system is characterized in that the control section acquires number of yarn splicing operations in each of the winding units and number of failures in yarn splicing to calculate an upper yarn end leading mistake rate of the whole system on the basis of the number of operations and the number of failures, and controllably increases or reduces the output frequency of the inverter on the basis of the upper yarn end leading mistake rate.

[0012] Specifically, the system may comprise a stor-

age section storing the upper yarn end leading mistake rate calculated every set time by the control section. When the upper yarn end leading mistake rate is calculated, the control section reads the last upper yarn end leading mistake rate stored in the storage section. The control section increases the output frequency of the inverter where the calculated upper yarn end leading mistake rate is higher than the read upper yarn end leading mistake rate. The control section reduces the output frequency of the inverter where the calculated upper yarn end leading mistake rate is the same as or lower than the read upper yarn end leading mistake rate.

[0013] The blower system may comprise a storage section storing a preset threshold value. In this case, when the upper yarn end leading mistake rate is calculated, the control section compares the calculated upper yarn end leading mistake with a threshold value stored in the storage section. The control section increases the output frequency of the inverter where the calculated upper yarn end leading mistake rate is higher than the threshold value. The control section reduces the output frequency of the inverter where the calculated upper yarn end leading mistake rate is the same as or lower than the threshold value.

[0014] The control section preferably varies the output frequency of the inverter within a range between a preset maximum value and a preset minimum value.

[0015] With the blower system and the method for controlling the blower motor according to the present invention, the upper yarn end leading mistake rate (mistake rate) of the whole system is calculated on the basis of the number of operations performed by the suction mouth of each of the winding units to deliver the upper yarn end to the yarn splicing device and the number of failures in the operation of delivering the upper yarn end to the yarn splicing device. Then, on the basis of the upper yarn end leading mistake rate, the output frequency of the inverter is controllably increased or reduced to increase or reduce the rotation speed of the blower motor. That is, the number of delivery operations in each winding unit and the number of failures are counted to calculate the upper yarn end leading mistake rate so that the output frequency of the inverter is controllably increased or reduced on the basis of the upper yarn end leading mistake rate. Therefore, the present invention can eliminate the need for a sensor for detecting a negative pressure which is indispensable for the conventional blower system, to simplify the structure of the whole system. The costs of the blower system can thus be reduced. The sensor is prevented from operating incorrectly or break down, thus reducing the time and effort required for maintenance as well as the maintenance costs of the blower system.

[0016] As described above, in the Unexamined Japanese Utility Model Application Publication (Jikkai-Hei) No. 2-40759, the preset threshold is the theoretical value for the negative pressure required to allow the automatic winder to operate smoothly. The preset threshold is set slightly greater than the actually required value. Thus,

the rotation speed of the motor is increased by the amount corresponding to the value by which the preset threshold is greater than the actually required value. Consequently, extra power is unavoidably consumed. In contrast, according to the present invention, the output frequency of the inverter is controllably increased or reduced on the basis of the upper yarn end leading mistake rate so as to increase or reduce the rotation speed of the blower motor. Thus, the rotation speed of the blower motor, driving the blower, can be reduced with the minimum required negative pressure supplied. Moreover, required energy can be saved with the automatic winder smoothly operated. That is, where the upper yarn end leading mistake rate (mistake rate) is higher than a reference value, the blower system can determine that an insufficient negative pressure is being supplied to prevent a proper upper yarn end leading operation from being performed. Furthermore, where the upper yarn end leading mistake rate is equivalent to or lower than the reference value, the blower system can determine that a sufficient negative pressure is being supplied. Therefore, the rotation speed of the blower motor, driving the blower, can be effectively reduced with the minimum required negative pressure supplied. The present invention is also excellent in that the rotation speed of the blower motor can be appropriately and automatically controllably increased or reduced according to the condition of a yarn processed by the winding unit.

[0017] Specifically, the last upper yarn end leading mistake rate can be adopted as the above-described reference value. Then, when the calculated mistake rate is compared with the last mistake rate and where the former is higher than the latter, the blower system determines that an insufficient negative pressure is being supplied to the suction mouth and that the number of failures in delivering operation tends to increase. Thus, the output frequency of the inverter is increased to increase the rotation speed of the blower motor. When the calculated mistake rate is compared with the last mistake rate and where the former is lower than the latter, the blower system determines that an excessive negative pressure is being supplied to the suction mouth. Thus, the output frequency of the inverter is reduced to reduce the rotation speed of the blower motor.

[0018] The above-described reference value may be a preset threshold value. Then, when the calculated mistake rate is compared with the threshold value and where the former is higher than the latter, the blower system determines that an insufficient negative pressure is being supplied to the suction mouth and that the number of failures in delivering operation tends to increase. Thus, the output frequency of the inverter is increased to increase the rotation speed of the blower motor. When the calculated mistake rate is compared with the last mistake rate and where the former is lower than the latter, the blower system determines that an excessive negative pressure is being supplied to the suction mouth. Thus, the output frequency of the inverter is reduced to reduce

the rotation speed of the blower motor.

[0019] In addition, when a minimum value and a maximum value are set for the output frequency of the inverter, the minimum value for the negative pressure to be supplied can be specified. Furthermore, the rotation speed of the motor can be prevented from increasing beyond the appropriate range of output characteristics of the blower. Additionally, the rotation speed of the blower is prevented from decreasing or increasingly abnormally. A very reliable blower system can thus be obtained.

[0020] Other features, elements, processes, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments of the present invention with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

Figure 1 is a block diagram of an automatic winder according to the present invention.

Figure 2 is a front view of a winding unit.

Figure 3 is a diagram generally showing the automatic winder.

Figure 4 is a flowchart showing a first embodiment of a control method according to the present invention.

Figure 5 is a flowchart showing a second embodiment of a control method according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0022] A first embodiment for an automatic winder to which a method for controlling a blower motor according to the present invention will be described with reference to Figures 1 to 4. As shown in Figure 2, the automatic winder is composed of a group of winding units 1 arranged in a row, a blower system 2 that supplies a negative pressure to each of the winding units 1, and a control device 3 that manages the operation of the group of winding units 1 and the blower system.

[0023] In Figure 3, the winding unit 1 is composed of a main body frame 5 fixed upright and shaped like a vertically long box, and serving as a base. A balloon breaker 6, a tension device 7, a yarn splicing device 8, a slab catcher 9, and the like are arranged on one side of the main body frame 5 in this order from the bottom to top of the frame. A traverse drum 10, a cradle 11, and the like are arranged at the top of the above-described side of the main body frame 5; the traverse drum 10 displaceably manipulates a yarn Y over a given width range, and the cradle 11 rotatably supports a package P. In addition to these devices, a relay pipe 12 and suction mouth 13 are provided in a middle portion of the row of the above-

described devices so as to be swingable in a vertical direction; the relay pipe 12 that sucks, catches, and passes the cut yarn Y to the yarn splicing device 8.

[0024] A spinning bobbin B is supported in an upright posture below the balloon breaker 6. The yarn Y unwound from the spinning bobbin B is checked for a yarn defect while passing through the above-described devices 6 to 9. When a yarn defect is detected, the yarn is cut by a cutter provided in the slab catcher 9. The cutter constitutes a yarn cutting device according to the present invention.

[0025] During an operation of winding the yarn Y, a defective portion of the yarn Y is detected, and the yarn Y is cut. A yarn splicing operation is performed to remove the defective portion and splice an upper yarn and a lower yarn. When the yarn Y is cut, the upper yarn containing the defective portion is wound into the package P. The lower yarn is caught by the relay pipe 12. Then, the suction mouth 13 swings upward and sucks and catches an upper yarn end of the upper yarn wound into the package P. Subsequently, each of the relay pipe 12 and the suction mouth 13 respectively swings to deliver the lower yarn and the upper yarn to the yarn splicing device 8, which removes the defective portion and splices the lower yarn and the upper yarn. The upper yarn, containing the defective portion, is sucked and caught by the suction mouth 13, and when the upper yarn is spliced with the lower yarn by the yarn splicing device 8, the yarn end portion of the upper yarn, containing the defective portion, is cut by the cutter, provided in the yarn splicing device 8, and is disposed of as a waste yarn. A negative pressure supplied to the winding unit 1 is required for the yarn splicing device 8, the relay pipe 12, and the suction mouth 13 mostly during the yarn splicing operation. The largest amount of negative pressure is consumed when the suction mouth 13 sucks and catches the upper yarn end.

[0026] As shown in Figures 2 and 3, the blower system 2 comprises an intake duct 16 including a blower 17 installed at one end and sealed at the other end, a motor (blower motor) 18 that rotationally drives the blower 17, an inverter 19 that supplies power to the motor 18, a manifold 20 that connects each of the winding units 1 and the intake duct 16 together to supply a negative pressure, and a suction box 21 installed between the blower 17 and the winding unit 1. The intake duct 16 is located to extend toward a rear surface side of the winding unit 1 along the direction of the row of the winding units 1. The blower 17 is a centrifugal fan in which an impeller rotates in a casing to generate the negative pressure. A filter (not shown in the drawings) is attached to the suction box 21 to remove dust such as yarn waste which is sucked during the yarn splicing operation or the like.

[0027] The control device 3 manages the operation of each winding unit 1 and the operation of the blower system 2. As shown in Figure 1, the control device 3 comprises a control section 23 that controls the devices and a memory 24 (storage section) in which various data is

saved. The memory 24 is a nonvolatile storage device from which no data is deleted even when a power supply is turned off. An input device (not shown in the drawings) is provided on a front surface of the control device 3 so as to allow an operator to give an instruction on an operation or to change settings.

[0028] The negative pressure is supplied to each of the winding units 1 by the blower system 2. When the inverter 19 supplies power to the motor 18, rotationally driving the blower 17, the blower 17 generates the negative pressure, and the negative pressure is supplied to the winding unit 1 via the intake duct 16 and the manifold 20. The supplied negative pressure enables each of the winding units 1 to perform the yarn splicing operation or the like. The yarn Y is wound from the spinning bobbin B to form the package P.

[0029] The winding unit 1 is supplied with the negative pressure by the blower system 2, and almost all of the negative pressure is used for the yarn splicing operation. In particular, the negative pressure is required for the suction mouth 13, which sucks and catches the upper yarn wound into the package when the yarn Y is cut. When an insufficient negative pressure is supplied, the suction mouth 13 fails to suck and catch the upper yarn end during the yarn splicing operation. The upper yarn end thus fails to be delivered to the yarn splicing device, preventing the yarn splicing operation from being completed. Where the yarn splicing operation fails to be completed, the suction mouth 13 swings again to perform an operation of attempting to catch the upper yarn end.

[0030] As described above, the winding unit 1 records the result of the yarn splicing operation. The control section 23 counts the upper yarn end leading mistake rate (MUP) of each of the winding units 1 (mistake rate calculating step) to calculate the upper yarn end leading mistake rate. The control section 23 compares the calculated mistake rate with the last calculated value stored in the memory 24 to increase or reduce the output frequency of the inverter 19. In the present embodiment, the output frequency of the inverter 19 is increased or reduced in increments of 1 Hz.

[0031] Where the calculated upper yarn end leading mistake rate (MUP) is higher than the last value, the output frequency of the inverter 19 is controllably increased by 1 Hz to increase the rotation speed of the motor 18 and thus the negative pressure generated by the blower 17 in order to allow the yarn splicing operation to be smoothly operated. In contrast, where the calculated upper yarn end leading mistake rate (MUP) is lower than or the same as the last value, the output frequency of the inverter 19 is controllably reduced by 1 Hz to reduce the rotation speed of the motor 18 and thus the power supplied to the motor 18. The negative pressure generated by the blower 17 is thus reduced.

[0032] The method for controlling the blower motor and the frequency changing step according to the present embodiment will be described in further detail with reference to Figure 4. When the automatic winder is powered

on, the control section 23 reads the output frequency of the inverter 19 and the upper yarn end leading mistake rate (MUP) saved in the memory 24 (S1). That is, when the power supply is turned on, the motor 18 for the blower 17 is supplied with power at the last output frequency of the inverter 19. When a yarn winding operation is started, a timer is actuated to start clocking (S2). Once a set time for the winding operation elapses (YES in S3), the control section 23 reads data recorded in the operating winding unit 1. The control section 23 then calculates an MUP value on the basis of the data acquired and compares the MUP value with the last one saved in the memory 24 (S4). Where the compared MUP value is greater than the last value (YES in S5), the control section checks whether or not the current output frequency of the inverter 19 is equal to the maximum value preset in the control section 23 (S6). Where the output frequency is equal to the maximum value, the control section 23 maintains the current output frequency (S7), and where the output frequency is not equal to the maximum value, the control section 23 controls the inverter 19 such that the output frequency is increased by 1 Hz (S8). The increase in the output frequency of the inverter 19 increases the rotation speed of the motor 18 and thus the negative pressure supplied to the winding unit 1 increases by the blower 17. The control section 23 then saves the changed output frequency and the calculated MUP value to the memory 24 (S9), and allows the timer to start clocking again.

[0033] Then, where the compared MUP value is smaller than or the same as the last value (NO in S5), the control section 23 checks whether or not the current output frequency of the inverter 19 is equal to the minimum value preset in the control section 23 (S10). Where the output frequency is equal to the minimum value, the control section 23 maintains the current output frequency (S11), and where the output frequency is not equal to the maximum value, the control section 23 controls the inverter 19 such that the output frequency is reduced by 1 Hz (S12). The decrease in the output frequency of the inverter 19 reduces the rotation speed of the motor 18 and thus the negative pressure supplied to the winding unit 1 by the blower 17 is reduced. The control section 23 then saves the changed output frequency and the calculated MUP value to the memory 24 (S9), and allows the timer to start clocking again. The saved output frequency is used as an initial value for the next starting of the blower system, and the MUP value is used as the last value for the next comparison.

[0034] A description will be given of a second embodiment of an automatic winder to which the method for controlling the blower motor according to the present invention is applied. The configuration of the automatic winder is the same as that of the first embodiment, and the description of the configuration is thus omitted. In the second embodiment, a preset threshold is compared with the calculated MUP value to control the output frequency of the inverter 19 on the basis of the comparison result.

[0035] The method for controlling the blower motor ac-

cording to the second embodiment of the present invention will be described with reference to Figure 5. When the automatic winder is powered on, the control section 23 reads the output frequency of the inverter 19 saved in a memory 25 (S13). That is, when the power supply is turned on, the motor 18 for the blower 17 is supplied with power at the last output frequency of the inverter 19. When the yarn winding operation is started, the timer is actuated to start clocking (S14). Once the set time for the winding operation elapses (YES in S15), the control section 23 reads data recorded in the operating winding unit 1. The control section 23 then calculates the MUP value on the basis of the data acquired and compares the MUP value with the preset threshold value saved in the memory 24 (S16). Where the compared MUP value is greater than the last value (YES in S17), the control section 23 checks whether or not the current output frequency of the inverter 19 is equal to the maximum value preset in the control section 23 (S18). Where the output frequency is equal to the maximum value, the control section 23 maintains the current output frequency (S19). Where the output frequency is not equal to the maximum value, the control section 23 controls the inverter 19 such that the output frequency is increased by 1 Hz (S20). The increase in the output frequency of the inverter 19 increases the rotation speed of the motor 18 and thus the negative pressure supplied to the winding unit 1 is increased by the blower 17. The control section 23 then saves the changed output frequency to the memory 24 (S21), and allows the timer to start clocking again.

[0036] Then, where the compared MUP value is smaller than or the same as the last value (NO in S17), the control section 23 checks whether or not the current output frequency of the inverter 19 is equal to the minimum value preset in the control section 23 (S22). Where the output frequency is equal to the minimum value, the control section 23 maintains the current output frequency (S23), and where the output frequency is not equal to the minimum value, the control section 23 controls the inverter 19 such that the output frequency is reduced by 1 Hz (S24). The decrease in the output frequency of the inverter 19 reduces the rotation speed of the motor 18 and thus the negative pressure supplied to the winding unit 1 is reduced by the blower 17. The control section 23 then saves the changed output frequency to the memory 24 (S21), and allows the timer to start clocking again. The output frequency saved in S21 is used as an initial value for the next starting of the blower system.

[0037] As described above, the output frequency of the inverter 19 is controlled on the basis of the upper yarn end leading mistake rate so as to control the rotation speed of the motor 18. Then, since the upper yarn end leading mistake rate is conventionally calculated utilizing the data managed by the winding unit 1 itself, the control section 23 can determine whether or not the winding unit 1 is supplied with the appropriate negative pressure without the need for an additional device such as a pressure sensor. Therefore, the present invention eliminates the

need for a sensor and enables a reduction in the costs of the automatic winder and facilitation of maintenance of the automatic winder.

[0038] The control section 23 calculates the upper yarn end leading mistake rate of the winding unit 1 every set time, and the control section 23 then compares the calculated rate with the last calculated upper yarn end leading mistake rate or the preset threshold value, which serves as a reference. Where the calculated upper yarn end leading mistake rate is greater than the last calculated value or the threshold value, the control section 23 can determine that an insufficient negative pressure is being supplied to prevent the suction mouth 13 from performing a proper upper yarn end leading operation. In this case, the control section 23 controllably increases the output frequency of the inverter 19 and thus the rotation speed of the motor 18 so as to increase the negative pressure generated by the blower 17. Where the calculated upper yarn end leading mistake rate is smaller than the last calculated value or the threshold value, the control section 23 can determine that a sufficient negative pressure is being supplied to allow the suction mouth 13 to perform the proper upper yarn end leading operation. In this case, the control section 23 controllably reduces the output frequency of the inverter 19 and thus the rotation speed of the motor 18 so as to reduce the negative pressure generated by the blower 17. In this manner, the output frequency of the inverter 19 is controlled so as to increase or reduce the negative pressure as required according to the operating status of the winding unit 1. Thus, the power consumed by the motor 18 can be reduced. This contributes to saving energy consumed by the automatic winder.

[0039] In addition, when the maximum and minimum values are set for the output frequency of the inverter 19, the minimum value of the negative pressure to be supplied can be specified. Furthermore, the rotation speed of the motor 18 can be prevented from increasing beyond the appropriate range of the output characteristics of the blower 17. Additionally, the rotation speed of the blower 17 is prevented from decreasing or increasing abnormally. The reliability of the blower system 2 obtained can thus be improved.

[0040] While the present invention has been described with respect to preferred embodiments thereof, it will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other than those specifically set out and described above. Accordingly, it is intended by the appended claims to cover all modifications of the present invention that fall within the true spirit and scope of the invention.

Claims

1. A method for controlling a blower motor (18) for a blower system (2) that supplies a negative pressure

used for a yarn splicing operation, to a plurality of winding units having a yarn splicing function, the method being **characterized in that**:

number of yarn splicing operations in each of the winding units (1) and number of failures in yarn splicing are counted to calculate mistake rate (MUP) of the whole system, and an output frequency of an inverter (19) supplying power to the blower motor (18) is controllably increased or reduced on the basis of the mistake rate (MUP).

2. A method for controlling a blower motor (18) according to Claim 1, **characterized in that** the blower system (2) includes an intake duct (16) comprising a plurality of manifolds (20) connected to the respective winding units (1), a blower (17) connected to one end of the intake duct (16) to generate a negative pressure, the blower motor (18) rotationally driving the blower (17), and an inverter (19) supplying power to the blower motor (18), and a rotation speed of said blower motor (18) is controlled by the output frequency of the inverter (19) supplying power to the blower motor (18), and **in that** the winding unit (1) comprises a yarn cutting device cutting a yarn when a yarn defect is detected, a yarn splicing device (8) performing an operation of splicing a lower yarn end and an upper yarn end formed by the yarn cutting operation, and a suction mouth (13) utilizing a negative pressure generated by the blower (17) to suck, catch, and deliver the upper yarn end to the yarn splicing device (8), and the method comprises a mistake rate calculating step of acquiring the number of yarn splicing operations in each of the winding units (1) and the number of failures in yarn splicing to calculate an upper yarn end leading mistake rate (MUP) of the whole system on the basis of the number of operations and the number of failures, and a frequency changing step of controllably increasing or reducing the output frequency of the inverter (19) on the basis of the upper yarn end leading mistake rate (MUP) calculated in the mistake rate calculating step.

3. A method for controlling the blower motor (18) according to Claim 2, **characterized in that** in the mistake rate calculating step, the upper yarn end leading mistake rate (MUP) is calculated every set time and stored in a storage section (24), and in the frequency changing step, the last upper yarn end leading mistake rate stored in the storage section (24) is read, and where the calculated upper yarn end leading mistake rate (MUP) is higher than the read upper yarn end leading mistake rate, the output frequency of the inverter (19) is increased, and where the calculated upper yarn end leading mistake rate (MUP) is the same as or lower than the read upper yarn end leading mistake rate, the output frequency of said

inverter (19) is reduced.

4. A method for controlling the blower motor (18) according to Claim 2, **characterized in that** in the mistake rate calculating step, the upper yarn end leading mistake rate (MUP) is calculated every set time, and in the frequency changing step, the calculated upper yarn end leading mistake rate (MUP) is compared with a preset threshold value, and where the calculated upper yarn end leading mistake rate (MUP) is higher than the threshold value, the output frequency of the inverter (19) is increased, and where the calculated upper yarn end leading mistake rate is the same as or lower than the threshold value, the output frequency of said inverter (19) is reduced.
5. A method for controlling the blower motor (18) according to any one of Claims 2 to 4, **characterized in that** in the frequency changing step, the output frequency of the inverter (19) is varied within a range between a preset maximum value and a preset minimum value.
6. A blower system (2) supplying a negative pressure to a plurality of winding units (1) forming an automatic winder, the system being **characterized by** comprising an intake duct (16) including a plurality of manifolds (20) connected to the respective winding units (1), a blower (17) connected to one end of the intake duct (16) to generate a negative pressure, a blower motor (18) rotationally driving the blower (17), an inverter (19) supplying power to the blower motor (18), and a control section (23) controlling a rotation speed of the blower motor (18) by controllably increasing or reducing an output frequency of the inverter (19), and in that the winding unit (1) comprises a yarn cutting device cutting a yarn when a yarn defect is detected, a yarn splicing device (8) performing an operation of splicing a lower yarn end and an upper yarn end formed by the yarn cutting operation, and a suction mouth (13) utilizing a negative pressure generated by the blower (17) to suck, catch, and deliver the upper yarn end to the yarn splicing device (8) and in that the control section (23) acquires number of yarn splicing operations in each of the winding units (1) and number of failures in yarn splicing to calculate an upper yarn end leading mistake rate (MUP) of the whole system on the basis of the number of operations and the number of failures, and controllably increases or reduces the output frequency of the inverter (19) on the basis of the upper yarn end leading mistake rate (MUP).
7. A blower system (2) according to Claim 6, **characterized by** further comprising a storage section (24) storing the upper yarn end leading mistake rate (MUP) calculated every set time by the control section (23), and in that when the upper yarn end leading

mistake rate (MUP) is calculated, the control section (23) reads the last upper yarn end leading mistake rate stored in the storage section (24), and the control section (23) increases the output frequency of said inverter (19) where the calculated upper yarn end leading mistake rate (MUP) is higher than the read upper yarn end leading mistake rate, and reduces the output frequency of the inverter (19) where the calculated upper yarn end leading mistake rate (MUP) is the same as or lower than the read upper yarn end leading mistake rate.

8. A blower system (2) according to Claim 6, **characterized by** further comprising a storage section (24) storing a preset threshold value, and when the upper yarn end leading mistake rate is calculated, the control section (23) compares the calculated upper yarn end leading mistake with a threshold value stored in the storage section (24), and the control section (23) increases the output frequency of said inverter (19) where the calculated upper yarn end leading mistake rate (MUP) is higher than the threshold value, and reduces the output frequency of the inverter (19) where the calculated upper yarn end leading mistake rate (MUP) is the same as or lower than the threshold value.
9. A blower system (2) according to any one of Claims 6 to 8, **characterized in that** the control section (23) varies the output frequency of the inverter (19) within a range between a preset maximum value and a preset minimum value.

FIGURE 1

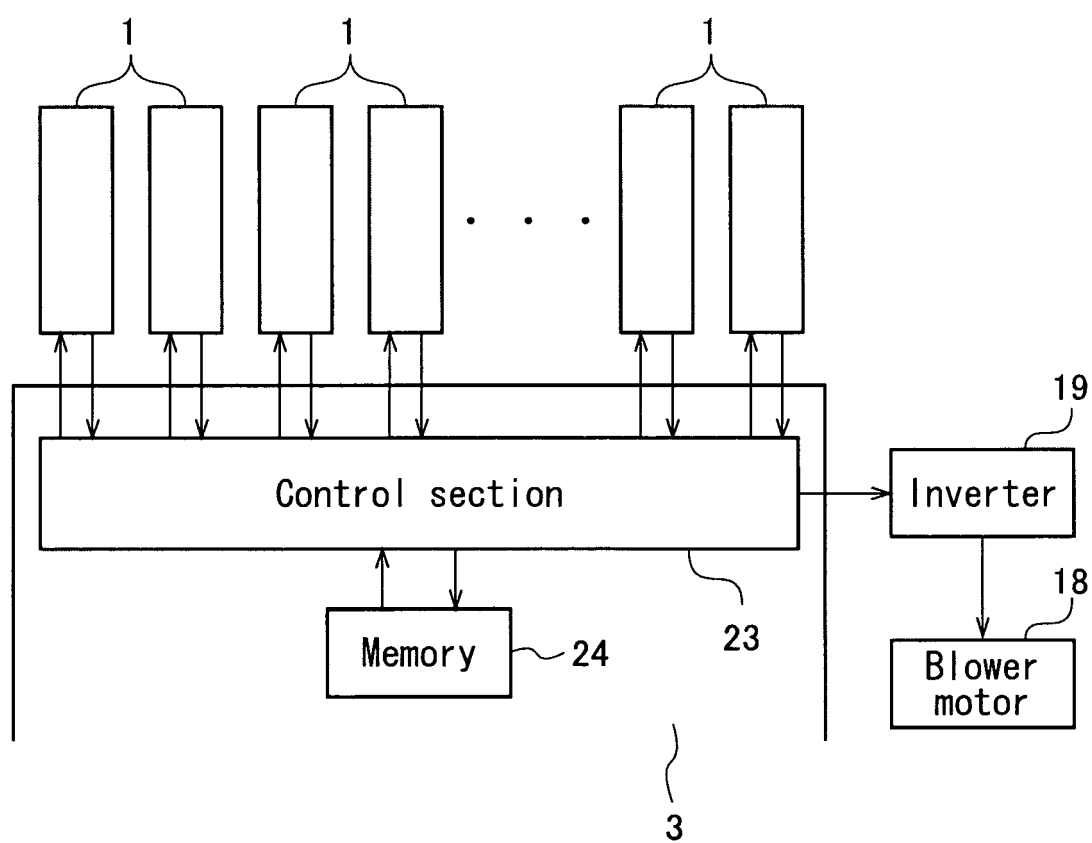


FIGURE 2

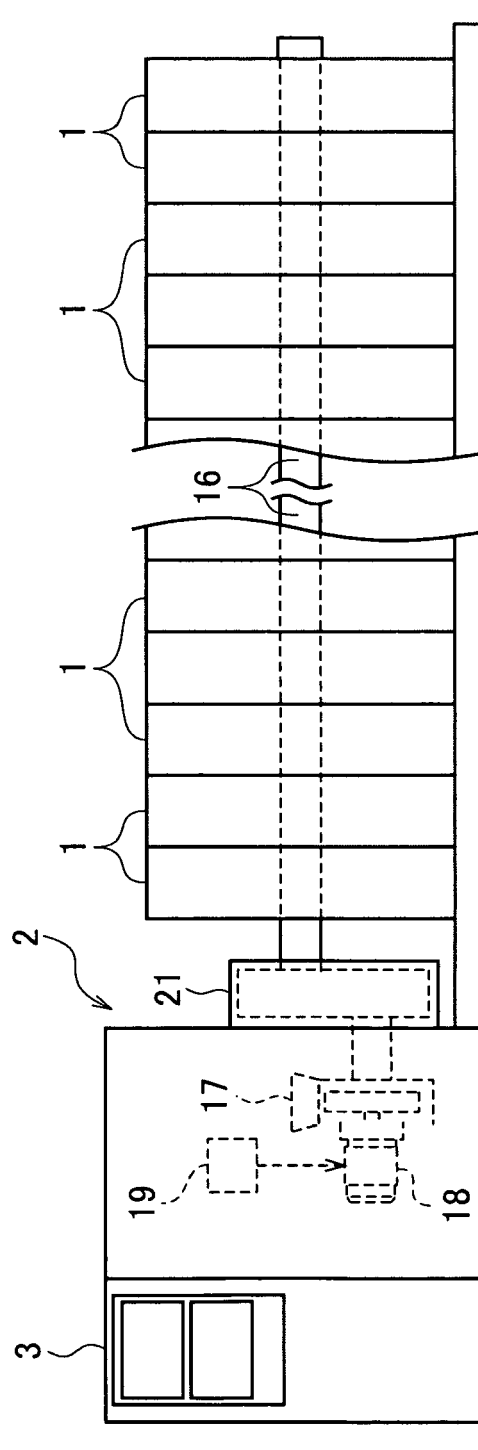


FIGURE 3

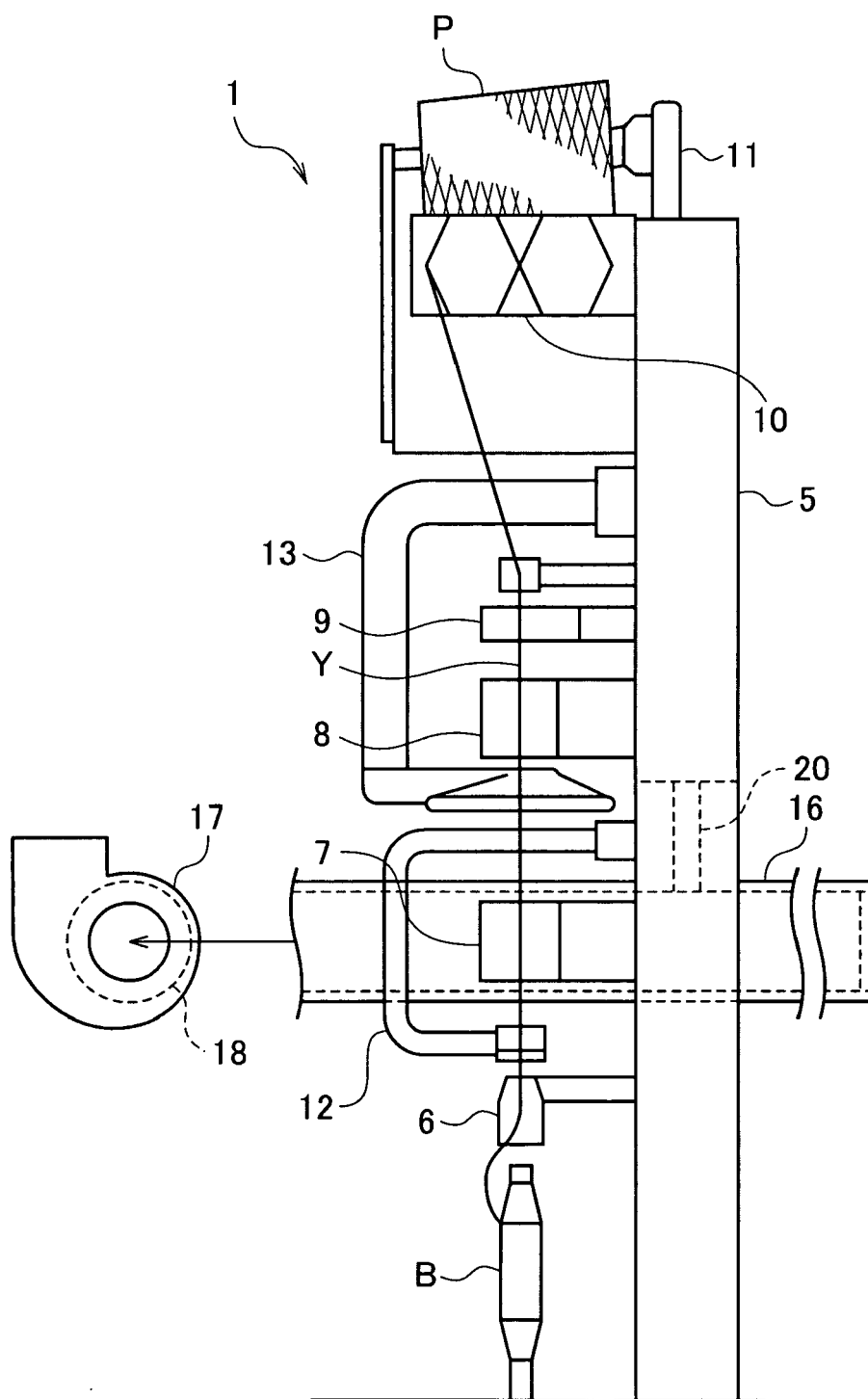


FIGURE 4

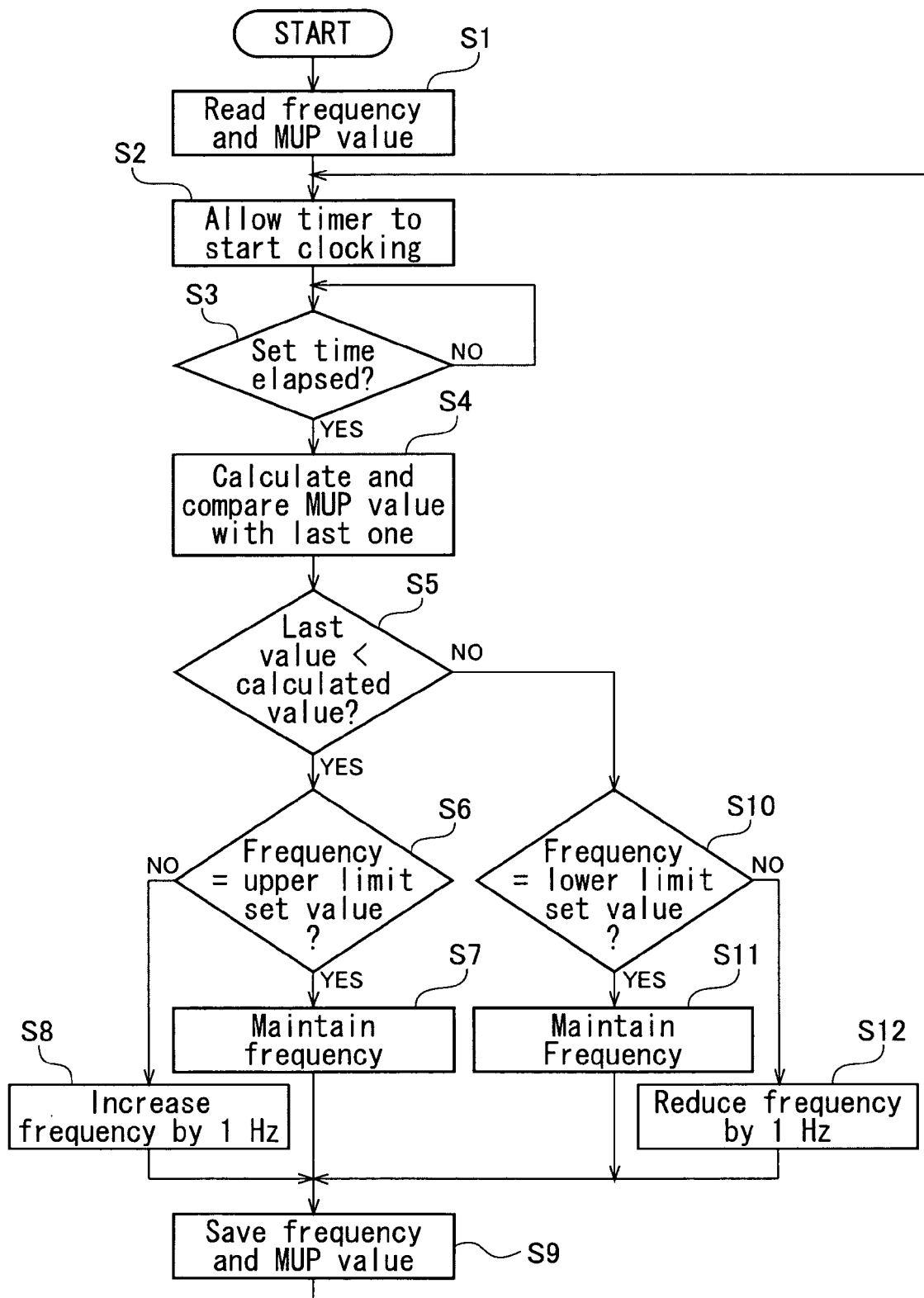
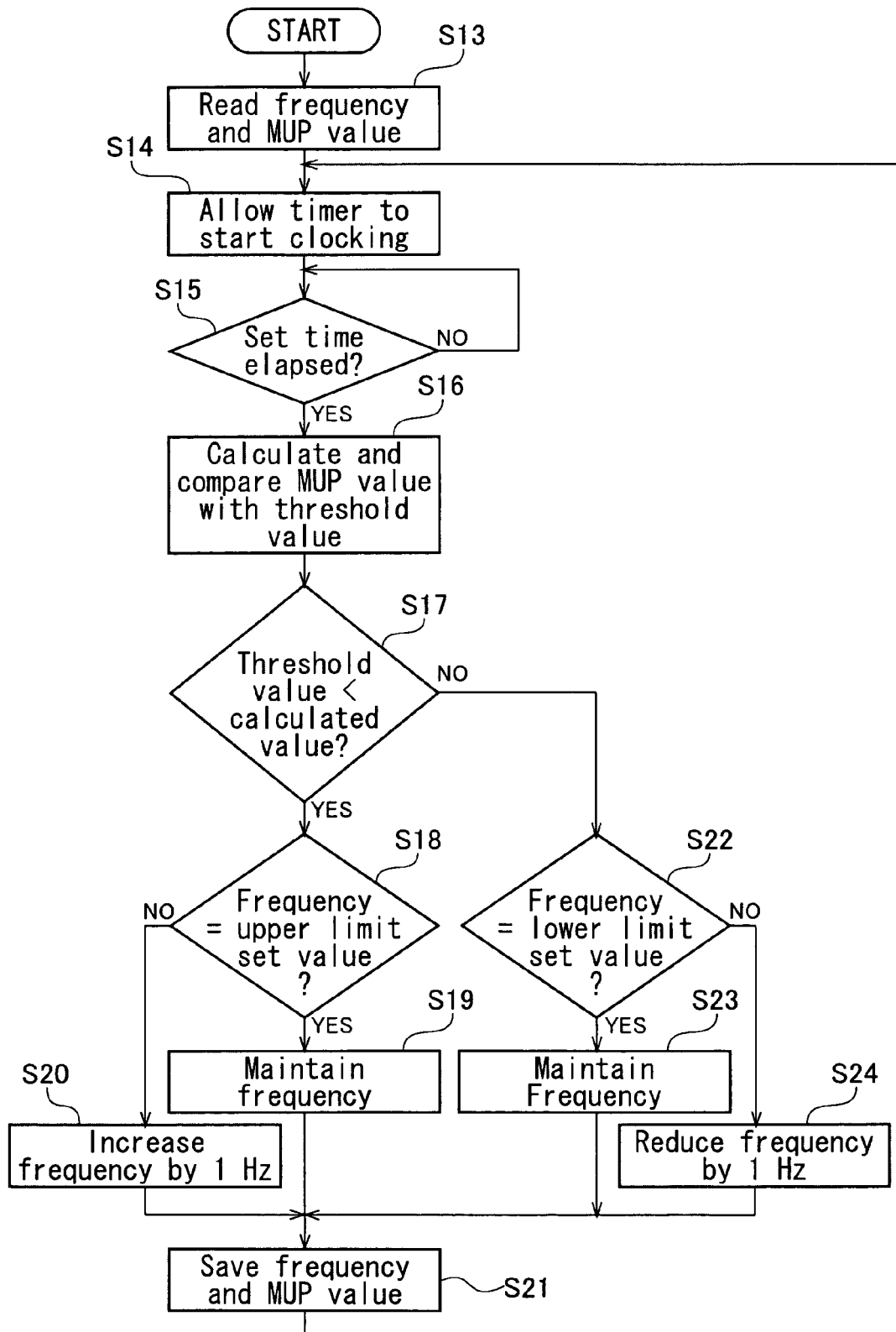


FIGURE 5



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2040759 A [0003] [0004] [0016]