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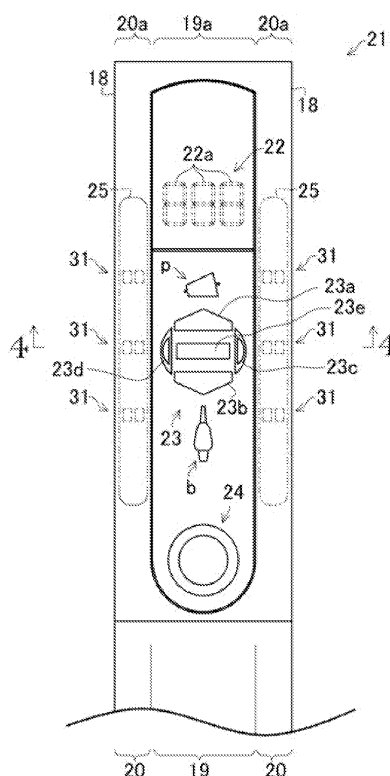
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(54) **Yarn Winding Machine and Textile Machine**

(57) A yarn winding machine (2) includes a first abnormal-state-indicating and restarting section (23b,60) and a second abnormal-state-indicating and restarting section (23a,60). The first abnormal-state-indicating and restarting section (23b,60) is switched from a normal state indication to an abnormal state indication at least when a malfunction has been caused by a yarn supply source (B), and is switched to the normal state indication and switches the yarn winding machine (2) from a stopped state to an operating state when being operated during the abnormal state indication. The second abnormal-state-indicating and restarting section (23a,60) is switched from a normal state indication to an abnormal state indication at least when a malfunction has been caused by a winding bobbin (Bf), and is switched to the normal state indication and switches the yarn winding machine (2) from the stopped state to the operating state when being operated during the abnormal state indication. By using the above-described structure, a mismatch between the required operation to be performed to the yarn winding machine to fix a malfunction and the operation performed to the yarn winding machine is prevented. Accordingly productivity of the yarn winding machine is improved.

FIG. 3



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding machine and a textile machine.

2. Description of the Related Art

[0002] As such kind of technology, German Published Patent Application No. 102006045237 discloses a yarn winding machine having a plurality of images (i.e., images 21 through 26) which are illuminated depending on a position at which a malfunction is generated. Another button is provided as a malfunction fixing button in the yarn winding machine.

[0003] Operators operating an automatic winder include an operating worker, who monitors whether or not a winding operation is performed in a good condition and performs simple operations to an operational failure of the winding operation, and a maintenance operating worker, who takes charge of an advanced repair when the yarn winding machine breaks down. In the following description, the operating worker will be referred to as an average operator and the maintenance operating worker will be referred to as an advanced operator. Further, malfunctions generated in the automatic winder include a malfunction which can be handled by the average operator and a malfunction which can be handled by the advanced operator.

[0004] The yarn winding machine disclosed in the above-described German Published Patent Application No. 102006045237 controls the images to be illuminated depending on a position at which a malfunction is generated; however, the yarn winding machine does not indicate strictly whether such a malfunction should be handled by the average operator or should be handled by the advanced operator instead. Accordingly, there was a case in which the average operator performed an inappropriate maintenance operation while he/she was not able to recognize accurately whether such a malfunction was the malfunction which he/she should handle or the malfunction which he/she should ask the advanced operator to handle. Therefore, in a structure of the yarn winding machine disclosed in German Published Patent Application No. 102006045237, a mismatch between the required operation to be performed to the yarn winding machine to fix such a malfunction and the operation performed to the yarn winding machine was generated. Consequently, productivity of the yarn winding machine was decreased.

[0005] Further, in the yarn winding machine disclosed in German Published Patent Application No. 102006045237, the average operator is required to sufficiently confirm which image is illuminated and to sufficiently recognize a required operation. However, since

in the structure of the yarn winding machine disclosed in German Published Patent Application No. 102006045237, the illuminating images, which indicate the position at which a malfunction is generated, and the malfunction fixing button are provided separately, there was a case in which the average operator performed an inappropriate maintenance operation to an inappropriate position while he/she was not able to accurately recognize a position at which a malfunction has been generated. Therefore, in the structure of the yarn winding machine disclosed in German Published Patent Application No. 102006045237, a mismatch between the required operation to be performed to the yarn winding machine to fix a malfunction and the operation performed to the yarn winding machine was generated. Consequently, productivity of the yarn winding machine was decreased.

SUMMARY OF THE INVENTION

[0006] The present invention has been made in view of the above-described points. It is a main object of the present invention to prevent a mismatch between the required operation to be performed to a yarn winding machine to fix a malfunction and the operation performed to the yarn winding machine so as to allow productivity of the yarn winding machine to be improved.

[0007] Problems to be solved by the present invention are as described above. Next, means for solving the problems and the effects thereof will be described.

[0008] According to an aspect of the present invention, a yarn winding machine, which unwinds a yarn from a yarn supply source and winds the unwound yarn around a winding bobbin, and which switches from an operating state to a stopped state due to generation of a malfunction, is configured as follows. That is, the yarn winding machine includes a first abnormal-state-indicating and restarting section and a second abnormal-state-indicating and restarting section. The first abnormal-state-indicating and restarting section is switched from a normal state indication to an abnormal state indication at least when a malfunction has been caused by a yarn supply source, and is switched to the normal state indication and switches the yarn winding machine from the stopped state to the operating state when being operated during the abnormal state indication. The second abnormal-state-indicating and restarting section is switched from a normal state indication to an abnormal state indication at least when a malfunction has been caused by a winding bobbin, and is switched to the normal state indication and switches the yarn winding machine from the stopped state to the operating state when being operated during the abnormal state indication.

[0009] As described above, malfunctions generated in an automatic winder include a malfunction which can be handled by an average operator and a malfunction which can be handled by an advanced operator. Accordingly, when coming across a malfunction of the yarn winding machine during a patrol, the averaged operator deter-

mines whether he/she should perform an operation for handling the malfunction or should ask the advanced operator to handle the malfunction depending on a malfunction. Since in the present invention, a malfunction caused by a yarn supply source and a malfunction caused by a winding bobbin are indicated by the first abnormal-state-indicating and restarting section and the second abnormal-state-indicating and restarting section, respectively, the average operator can accurately determine whether or not a malfunction can be handled by him/her.

[0010] Further, by providing each abnormal-state-indicating and restarting section with functions both to let the average operator recognize a malfunction and to release the stopped state of the operation of the yarn winding machine caused by the malfunction, when intending to restart the operation of the yarn winding machine, the average operator can recognize which one between a yarn supplying bobbin (a yarn supply source) and a winding bobbin has caused the malfunction. Therefore, before restarting the operation of the yarn winding machine, the average operator can ask himself/herself whether or not the operation performed by him/her matches the required operation to be performed to the yarn winding machine to fix the malfunction. Accordingly, since a mismatch between the required operation to be performed to the yarn winding machine to fix the malfunction and the operation performed to the yarn winding machine by the average operator is prevented, productivity of the yarn winding machine is improved.

[0011] Furthermore, confirming a malfunction, confirming whether or not operations performed by the operators are appropriate, and restarting the operation of the yarn winding machine can be carried out just by operating the abnormal-state-indicating and restarting sections; therefore, accuracy in the operations performed by the operators is improved.

[0012] The yarn winding machine is further configured as follows. That is, a position for the first abnormal-state-indicating and restarting section and the second abnormal-state-indicating and restarting section to be arranged corresponds to a running direction of a yarn which has been unwound from the yarn supply source and has been wound around the winding bobbin.

[0013] According to the above-described structure, since the position corresponds to the running direction of a yarn, the operators can easily recognize which one between a yarn supplying bobbin and a winding bobbin has caused a malfunction.

[0014] The yarn winding machine further includes a third abnormal-state-indicating and restarting section. That is, the third abnormal-state-indicating and restarting section is switched from a normal state indication to an abnormal state indication when a malfunction in the yarn winding machine has been caused by something other than a yarn supply source and a winding bobbin, and is switched to the normal state indication and switches the yarn winding machine from the stopped state to the operating state when being operated during the abnormal

state indication.

[0015] When an advanced operation for handling a malfunction such as a breakdown of the yarn winding machine is required, the average operator calls the advanced operator over to the yarn winding machine. In the present invention, a malfunction caused by a yarn supply source, a malfunction caused by a winding bobbin, and a malfunction caused by something other than a yarn supply source and a winding bobbin are indicated by the first abnormal-state-indicating and restarting section, the second abnormal-state-indicating and restarting section, and the third abnormal-state-indicating and restarting section, respectively. Accordingly, the average operator can determine whether a malfunction is the malfunction which he/she can handle or the malfunction which he/she should ask the advanced operator to handle.

[0016] Further, by providing each abnormal-state-indicating and restarting section with functions both to let the average operator recognize a malfunction and to release the stopped state of the operation of the yarn winding machine caused by the malfunction, when intending to restart the operation of the yarn winding machine, the average operator can recognize which one among a yarn supplying bobbin, a winding bobbin, and something other than a yarn supplying bobbin and a winding bobbin has caused the malfunction. Therefore, before restarting the operation of the yarn winding machine, the average operator can ask himself/herself whether or not the operation performed by him/her matches the required operation to be performed to the yarn winding machine to fix the malfunction. Accordingly, since a mismatch between the required operation to be performed to the yarn winding machine to fix the malfunction and the operation performed by the average operator is prevented, productivity of the yarn winding machine is improved.

[0017] Furthermore, confirming a range where an abnormal state is generated, confirming whether or not operations performed by the operators are appropriate, and restarting the operation of the yarn winding machine can be carried out just by operating the abnormal-state-indicating and restarting sections; therefore, accuracy in the operations performed by the operators is improved.

[0018] The yarn winding machine is further configured as follows. That is, the malfunction indicated by the first abnormal-state-indicating and restarting section include absence of a yarn supply source, and/or the malfunction indicated by the second abnormal-state-indicating and restarting section includes absence of a winding bobbin.

[0019] In the yarn winding machine with the above-described structure, the malfunction which can be handled by the average operator can be indicated more accurately.

[0020] The yarn winding machine is further configured as follows. That is, the third abnormal-state-indicating and restarting section is arranged between the first abnormal-state-indicating and restarting section and the second abnormal-state-indicating and restarting section.

[0021] According to the above-described structure,

since the third abnormal-state-indicating and restarting section is arranged between the first abnormal-state-indicating and restarting section and the second abnormal-state-indicating and restarting section, the operators can easily recognize the section with a malfunction.

[0022] The yarn winding machine is further configured as follows. That is, the first abnormal-state-indicating and restarting section is formed to indicate an upstream side of a yarn running direction. The second abnormal-state-indicating and restarting section is formed to indicate a downstream side of the yarn running direction.

[0023] According to the above-described structure, the average operator can recognize the section with a malfunction more intuitively.

[0024] A textile machine including a plurality of the yarn winding machines accomplishes the high operational rate.

[0025] According to another aspect of the present invention, a yarn winding machines include a spooling main body having a yarn supplying section which unwinds a yarn from a yarn supplying bobbin and supplies the yarn, a yarn-process executing section which performs a process on the yarn supplied from the yarn supplying section, and a winding section which winds the yarn processed by the yarn-process executing section into a package; a control section which controls the operation of the spooling main body; and an operation panel which operates the spooling main body. The control section includes a memory section which stores a plurality of characters including at least one character of a letter, a number, or a symbol. In the operation panel, an indicating section, which displays the plurality of characters stored in the memory section in a way in which the plurality of characters are arranged next to one another in the lateral direction, and a modification section, which modifies at least one of the plurality of characters displayed by the indicating section, are provided. The modification section includes a first input section and a second input section, arranged next to each other in the lateral direction, to select a position of at least one of the characters displayed by the indicating section to be modified, and a third input section and a forth input section, arranged next to each other in the longitudinal direction, to modify at least one character among the characters selected by the first input section and the second input section.

[0026] As described above, since the input section is provided for selecting at least one character among the plurality of characters to be modified, at least one character among the plurality of characters can be modified through a small number of inputs. In addition, a directional characteristic of the left is assigned to the first input section and a directional characteristic of the right is assigned to the second input section; therefore, the operators can intuitively recognize an operating method for making a selection among the plurality of characters arranged next to one another in the lateral direction. Further, a directional characteristic of the upward direction is assigned to the third input section and a directional characteristic

of the downward direction is assigned to the forth input section; therefore, the operators can intuitively recognize a modifying method, such as increasing or decreasing a number, or adjusting a position of a letter.

[0027] The yarn winding machine is further configured as follows. That is, the memory section stores at least one of a letter string consisting of three or more letters, a number string consisting of three or more numbers, or a symbol string consisting of three or more symbols. The indicating section displays at least one of the letter string, the number string, or the symbol string stored in the memory section, in a way in which such characters are arranged next to one another in the lateral direction.

[0028] An effect resulted by being capable of selecting one among the plurality of characters including at least one character of a letter, a number, or a symbol to be modified through the above-described small number of inputs is particularly useful when at least one of the letter string, the number string, or the symbol string is handled.

[0029] The yarn winding machine is further configured as follows. That is, the control section can selectively execute two modes, namely a normal winding mode in which the spooling main body performs a normal winding operation and a maintenance mode in which a component of the spooling main body is being maintained. When the first input section and the second input section are simultaneously pressed, the control section switches an execution mode between the normal winding mode and the maintenance mode.

[0030] That is, since it is not possible under a normal condition to press the first input section and the second input section simultaneously without being aware of such simultaneous operations, the present invention prevents the execution mode from being switched unintentionally.

[0031] The yarn winding machine is further configured as follows. That is, the first input section and the second input section are formed in a manner in which pressing the first input section and the second input section is made more difficult than pressing the third input section and the forth input section.

[0032] According to the above-described structure, the execution mode can be further prevented from being switched unintentionally.

[0033] The yarn winding machine is further configured as follows. That is, the first input section and the second input section are formed smaller than the third input section and the forth input section.

[0034] The yarn winding machine is further configured as follows. That is, a first concave portion where the first input section is located and a second concave portion where the second input section is located are formed in the operation panel.

[0035] The yarn winding machine is further configured as follows. That is, when the maintenance mode is selected and at least one of the first input section through the forth input section is pressed, the control section controls a component of the spooling main body based on at least one of the plurality of characters including at least

one character of a letter, a number, or a symbol stored in the memory section, and the pressed input section.

[0036] According to the above-described structure, when a maintenance work to the spooling main body is performed, the operators can freely set any component of the spooling main body to work.

[0037] The yarn winding machine is further configured as follows. That is, whenever the maintenance mode is selected and at least one of the first input section through the forth input section is pressed, the control section sets a component of the spooling main body to work using a predetermined unit based on at least one of the plurality of characters including at least one character of a letter, a number, or a symbol stored in the memory section, and the pressed input section.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] Fig. 1 is a perspective view of an automatic winder according to an embodiment of the present invention.

[0039] Fig. 2 is a front view of a winding unit.

[0040] Fig. 3 is a front view of an indication panel.

[0041] Fig. 4 is a sectional view taken in a direction of arrows along the 4-4 line of Fig. 3 and a perspective view of Fig. 3.

[0042] Fig. 5 is a plain view of the automatic winder.

[0043] Fig. 6 is a view illustrating an electrical configuration of the winding unit.

[0044] Fig. 7 illustrates a control flow in a control section of the winding unit.

[0045] Fig. 8 illustrates another control flow in the control section of the winding unit.

[0046] Fig. 9 illustrates another control flow in the control section of the winding unit.

[0047] Fig. 10 illustrates another control flow in the control section of the winding unit.

[0048] Fig. 11 illustrates the other control flow in the control section of the winding unit.

[0049] Fig. 12 is a view for describing an operation to modify the indication on a 7-segment indicator.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0050] A preferred embodiment of the present invention will be described below with references to the drawings.

[0051] As illustrated in Fig. 1, an automatic winder 1 (a textile machine) includes a plurality of winding units 2 (yarn winding machines), a main control device 3, and an automatic doffing device 4. Each winding unit 2 includes a spooling main body 5, which performs a winding operation of traversing a yarn Y from a yarn supplying bobbin B (a yarn supply source) and winding the yarn Y into a package P formed in a predetermined shape, and a supporting body 6, which supports the spooling main body 5. The main control device 3 sets a winding condi-

tion, or the like, of the plurality of winding units 2. In response to a doffing request signal transmitted from the winding units 2, the automatic doffing device 4 moves to the winding unit 2 which has transmitted the doffing request signal. The automatic doffing device 4 then collects the package P formed in the winding unit 2 and performs a predetermined yarn hooking operation by placing a new winding bobbin, around which no yarn has been wound, in the winding unit 2. For such purpose, each winding unit 2 and the automatic doffing device 4 are electrically connected to the main control device 3 such that an interactive communication can be carried out.

[0052] In the present embodiment, a yarn supplying section 100 unwinding the yarn Y from the yarn supplying bobbin B and supplying the yarn Y includes at least a peg 15 and an unwinding assisting device 9. The yarn-process executing section 101 performing a process on the yarn Y supplied from the yarn supplying section 100 includes at least a disc-type tension applying device 11, a splicer 12, a yarn clearer 13, and a waxing device 14. A winding section 102 winding the yarn Y processed by the yarn-process executing section 101 into a package P includes at least a cradle (not illustrated in the drawings) and a traverse drum 8. As illustrated in Fig. 2, the yarn supplying section 100, the yarn-process executing section 101, and the winding section 102 are arranged in this order from upstream to downstream with respect to a yarn running direction.

[0053] As illustrated in Fig. 2, the spooling main body 5 of the winding unit 2 includes the cradle, which holds a winding bobbin Bf, and the traverse drum 8, through which the yarn Y is traversed. In a yarn path between the yarn supplying bobbin B and the traverse drum 8, the unwinding assisting device 9, a yarn detecting sensor 10, the disc-type tension applying device 11, the splicer 12, the yarn clearer 13, and the waxing device 14 are arranged in this order from upstream of the yarn running direction (i.e. a yarn supplying bobbin B side). Further, the yarn supplying bobbin B is supported by the peg 15 capable of tilting. Furthermore, the supporting body 6 of the winding unit 2 includes a control section 60 for controlling the operation of the spooling main body 5 (refer to Fig. 6).

[0054] The cradle is arranged so as to be capable of rotating with respect to the traverse drum 8 and is caused to rotate by an increase of the diameter of the package P as the winding operation of the package P proceeds. The configuration of the cradle allows the package P and the traverse drum 8 to maintain a suitable contact with each other.

[0055] A spiral traverse groove 8a is formed on a peripheral surface of the traverse drum 8 and the yarn Y is traversed through the traverse groove 8a. A drum driving section 8b for rotating the traverse drum 8 (refer to Fig. 6) is provided at the traverse drum 8 and is electrically connected to the control section 60. Accordingly, the control section 60 can rotate the traverse drum 8 at a desired rotating speed through the control of the drum driving

section 8b. Further, the drum driving section 8b has a built-in drum rotation sensor 7a, which detects the progress of the winding operation. The control section 60 can count the number of rotational pulses transmitted from the drum rotation sensor 7a.

[0056] The peg 15 becomes vertical during the winding operation, as illustrated in Fig. 2, and tilts to the front side of the spooling main body 5 during the period when the yarn supplying bobbin B is being replaced. With such tilt, the peg 15 releases the yarn supplying bobbin B around which no yarn is wound after a yarn unwinding operation, and then receives a new yarn supplying bobbin B from a magazine (not illustrated in the drawings). A peg driving section 15b (refer to Fig. 6) is provided at the peg 15 and is electrically connected to the control section 60. Accordingly, the control section 60 can freely tilt the peg 15 through the control of the peg driving section 15b.

[0057] The unwinding assisting device 9 assists in the unwinding of the yarn Y by lowering a pipe covering a core of the yarn supplying bobbin B as the yarn Y is being unwound from the yarn supplying bobbin B. An unwinding assisting device driving section 9a (refer to Fig. 6) is provided in the unwinding assisting device 9 and is electrically connected to the control section 60. Accordingly, the control section 60 can freely control the unwinding assisting device 9 to move up and down, through the control of the unwinding assisting device driving section 9a.

[0058] The yarn detecting sensor 10 detects whether or not the yarn Y exists between the unwinding assisting device 9 and the disc-type tension applying device 11. The yarn detecting sensor 10 is electrically connected to the control section 60 and transmits a no-yarn signal to the control section 60 when the yarn Y cannot be detected between the unwinding assisting device 9 and the disc-type tension applying device 11.

[0059] The disc-type tension applying device 11 includes a pair of disc members 11a and 11a, which catch and hold the running yarn Y while rotating, thereby applies a predetermined tension to the yarn Y. The disc-type tension applying device 11 includes a disc-type tension applying device driving section 11b for rotating the disc members 11a and 11a (refer to Fig. 6). The disc-type tension applying device driving section 11b is electrically connected to the control section 60; therefore, the control section 60 can freely control the rotation of the disc members 11a and 11a through the control of the disc-type tension applying device driving section 11b. In addition, as an alternative other than the disc-type tension applying device 11 for applying the predetermined tension to the yarn Y, a gate-type device may also be adopted, for example.

[0060] When the yarn is cut after detecting a yarn defect or when a breakage occurs in the yarn, the splicer 12 splices the yarn Y in the yarn supplying bobbin B side with the yarn Y in the package P side. The splicer 12 includes a plurality of levers such as a yarn handling lever (not illustrated in the drawings). A series of movement of

the plurality of levers is driven by a cam system. The splicer 12 includes a splicer cam driving section 12a for setting the plurality of levers to work (refer to Fig. 6). Since the splicer cam driving section 12a is connected to the control section 60, the control section 60 can freely control the series of movement of the plurality of levers through the splicer cam driving section 12a.

[0061] The yarn clearer 13 is for detecting defects in the yarn Y. Processing a signal corresponding to the thickness of the yarn Y fed from the yarn clearer 13 by an appropriate analyzer allows yarn defects such as a slub or the like to be detected. Further, a cutter 13a, which cuts the yarn Y when a yarn defect is detected, is provided at the yarn clearer 13. Furthermore, the yarn clearer 13 includes a yarn running sensor which detects the running of the yarn Y (not illustrated in the drawings). The yarn running sensor is electrically connected to the control section 60, and transmits a yarn breakage signal to the control section 60 when the running of the yarn Y cannot be detected.

[0062] The waxing device 14 applies predetermined wax to the running yarn Y. The waxing device 14 includes a waxing residual amount sensor 14a electrically connected to the control section 60 (refer to Fig. 60), and transmits a signal to the control section 60 when a residual amount of wax becomes equal to or less than a predetermined value.

[0063] Below the splicer 12, a retie pipe 16 which sucks and captures the yarn Y from the yarn supplying bobbin B side and then guides the yarn Y from the yarn supplying bobbin B side to the splicer 12 is provided. And, above the splicer 12, a suction mouth 17 which sucks and catches the yarn Y from the package P side and then guides the yarn Y from the package P side to the splicer 12 is provided.

[0064] The retie pipe 16 includes a stepping-type retie pipe driving section 16a (refer to Fig. 6) and is arranged to be rotatable around a shaft 16c through the retie pipe driving section 16a. Since the retie pipe driving section 16a is connected to the control section 60, the control section 60 can freely rotate the retie pipe 16 through the retie pipe driving section 16a. Further, a retie pipe sensor 16b connected to the control section 60 (refer to Fig. 6) is provided at the retie pipe 16. For example, the retie pipe sensor 16b is optically formed, and transmits a yarn detection signal to the control section 60 when the yarn Y sucked into the pipe is detected.

[0065] In the same manner, the suction mouth 17 includes a stepping-type suction mouth driving section 17a (refer to Fig. 6) and is arranged to be rotatable around a shaft 17c through the suction mouth driving section 17a. The suction mouth driving section 17a is connected to the control section 60; therefore, the control section 60 can freely rotate the suction mouth 17 through the suction mouth driving section 17a. Further, a suction mouth sensor 17b is provided at the mouth 17. For example, the suction mouth sensor 17b is optically formed, and transmits a yarn detection signal to the control section 60 when

the yarn Y sucked into pipes is detected.

[0066] In the above-described structure, when the yarn is cut or when a breakage occurs in the yarn, the retie pipe 16 sucks and catches the yarn Y from the yarn supplying bobbin B side at a position illustrated in Fig. 2, moves radially around the shaft 16c from bottom to top, and guides the yarn Y to the splicer 12. At the same time, the mouth 17 moves radially around the shaft 17c from a position illustrated in Fig. 2 from bottom to top, sucks and catches the yarn Y from the package P which rotates in an opposite direction, rotates around the shaft 17c from top to bottom, and guides the yarn Y to the splicer 12. Accordingly, the splicer 12 splices such two yarns Y guided as described above with a predetermined splicing operation.

[0067] Next, the supporting body 6 will be described.

[0068] The supporting body 6 supports the spooling main body 5 and, as illustrated in Fig. 2, includes a pair of lateral sides 18 perpendicular to the direction A in which the winding units 2 are arranged with respect to one another, a front side 19, and a curved surface 20 connecting the lateral sides 18 to the front side 19 in a curved manner. An operation panel 21 formed to cover across the front side 19 and the curved surface 20 is provided in an upper portion of the supporting body 6.

[0069] As illustrated in Fig. 3, the operation panel 21 includes a front portion 19a corresponding to the front side 19 and a pair of curved portions 20a corresponding to the curved surface 20. A 7-segment indicator 22 with a 3-digit display, an operation button unit 23 (a second indicating section) laid out in a cross shape, and an operation switch 24 are provided in the front portion 19a in this order from top to bottom. Further, alarm lamps 25 (a first indicating section) are provided in the curved portions 20a.

[0070] The 7-segment indicator 22 indicates three characters including at least one of a letter, a number, or a symbol stored in a RAM 61 (Random Access Memory) included in the control section 60 illustrated in Fig. 6, under a state in which the three characters are arranged laterally next to one another. For such purpose, as illustrated in Fig. 3, the 7-segment indicator 22 is configured to have three 7-segment LEDs 22a arranged laterally next to one another. In the following, the characters including at least one of a letter, a number, or a symbol will be referred to as a character string.

[0071] The operation button unit 23 includes a top button 23a, a bottom button 23b, a right button 23c, a left button 23d, and a middle button 23e. As illustrated in Fig. 3, the top button 23a is arranged above the middle button 23e; the bottom button 23b is arranged below the middle button 23e; the right button 23c is arranged to the right of the middle button 23e; and the left button 23d is arranged to the left of the middle button 23e. That is, the bottom button 23b, the middle button 23e, and the top button 23a are arranged in this order from bottom to top. The top button 23a is arranged at a position indicating the upward direction; the bottom button 23b is arranged

at a position indicating the downward direction; the right button 23c is arranged at a position indicating the right; and the left button 23d is arranged at a position indicating the left. Further, the top button 23a is formed so as to have a directional characteristic indicating the upward direction. In the same manner, the bottom button 23b is formed so as to have a directional characteristic indicating the downward direction; the right button 23c is formed so as to have a directional characteristic indicating the right; and the left button 23d is formed so as to have a directional characteristic indicating the left. As illustrated in Fig. 6, each of the top button 23a, the bottom button 23b, the right button 23c, the left button 23d, and the middle button 23e is electrically connected to the control section 60, and each button transmits a signal to the control section 60 when being pressed. The top button 23a is connected to the control section 60 and has a built-in top lamp 23f in which the control section 60 controls illuminations. In the same manner, the bottom button 23b is connected to the control section 60 and has a built-in bottom lamp 23g in which the control section 60 controls illuminations. In the same manner, the middle button 23e is connected to the control section 60 and has a built-in middle lamp 23h in which the control section 60 controls illuminations. Further, as illustrated in (a) of Fig. 4, the right button 23c is arranged in a recess of a first concave portion 26a formed in the front side 19. The left button 23d is arranged in a recess of a concave portion 26b formed in the front side 19. Furthermore, the right button 23c and the left button 23d are formed smaller than the top button 23a, the bottom button 23b, and the middle button 23e in a front view illustrated in Fig. 3. The above-described structure makes it more difficult to press the right button 23c and the left button 23d than to press the top button 23a and the bottom button 23b. As described above, the first abnormal-state-indicating and restarting section includes the bottom button 23b and the control section 60; the second abnormal-state-indicating and restarting section includes the top button 23a and the control section 60; and the third abnormal-state-indicating and restarting section includes the middle button 23e and the control section 60.

[0072] The operation switch 24 is used to switch the operation of the spooling main body 5 ON and OFF. As illustrated in (b) of Fig. 4, the operation switch 24 is configured such that when switching the operation of the spooling main body 5 OFF, a movable section 27 of the operation switch 24 is held and pulled out such that the movable section 27 protrudes from the front side 19. Meanwhile, when switching the operation of the spooling main body 5 ON, the movable section 27 is retracted in an opposite direction from the direction in which the movable section 27 protrudes. Further, an exposed portion 27a of the movable section 27, which is exposed when the operation of the spooling main body 5 is OFF, has been colored in yellow in the present embodiment. That is, the movable section 27 is almost unnoticeable when the operation of the spooling main body 5 is ON, and the

movable section 27 is noticeable only when the operation of the spooling main body 5 is OFF. Furthermore, by rotating the movable section 27 which is protruding, the operation switch 24 prevents the movable section 27 from receding in the opposite direction from the direction in which the movable section 27 protrudes. Owing to such a rotating-type lock mechanism, the operation of the spooling main body 5 cannot be switched on by only pressing the movable section 27.

[0073] The alarm lamp 25 indicates an operational state of the winding unit 2. The alarm lamp 25 is provided close to the operation button unit 23 as illustrated in Fig. 3. A process of forming tiny concavities and convexities on a surface of the alarm lamp 25 is carried out (or a sheet with a light-diffusing effect is put on the surface of the alarm lamp 25), and the alarm lamp 25 is curved in a sectional view illustrated in (a) of Fig. 4. Further, the alarm lamp 25 includes a translucent resin cover 28 and an alarm lamp unit 31 stored in the translucent resin cover 28 (refer to Fig. 3). The alarm lamp unit 31 includes a blue alarm lamp 29 and a red alarm lamp 30 which are electrically connected to the control section 60 (refer to Fig. 6). Moreover, the above-described "operational state of the winding unit 2", for example, includes a state in which the package P is in a fully wound state, a state in which the package P comes close to the fully wound state, and a state requiring a maintenance work since a malfunction has occurred in the yarn-process executing section 101. Meanwhile, such a fully wound state indicates that a winding diameter of the package P has reached a diameter of the package P which represents that the winding operation has been completed. Such a diameter of the package P, which represents the completion of the winding operation, has been previously set before the start of the winding operation. Further, by selectively controlling the on/off or flashing of the blue alarm lamp 29 and the red alarm lamp 30, the alarm lamp 25 can change its indicating style depending on the different operational states of the winding unit 2. Meanwhile, the colors of the alarm lamps included in the alarm lamp unit 31 are not limited to blue and red, as long as the indicating style can be changed. For example, a green alarm lamp or the like may be adopted.

[0074] Further, as illustrated in Fig. 3, a picture p of the package P is printed in the vicinity of the top button 23a of the operation button unit 23. In the same manner, a picture b of the yarn supplying bobbin B is printed in the vicinity of the bottom button 23b.

[0075] The control section 60 includes a Central Processing Unit (CPU) which is an arithmetic processing unit, a Read Only Memory (ROM) storing a control program executed by the CPU and data used by the control program, and the RAM 61 storing data temporarily when the program is executed. The control program stored in the ROM is read by the CPU and is executed by the CPU, which causes the control program to carry out the control flows illustrated in Fig. 7 through Fig. 11 with the use of hardware such as the CPU. In the following, the operation

of the winding unit 2 according to the control flows illustrated in Fig. 7 through Fig. 11 will be described. Further, the control section 60 can selectively execute two modes, namely a normal winding mode in which the spooling main body 5 performs a normal winding operation and a maintenance mode for maintaining each component of the spooling main body 5. The normal winding mode is stored in the ROM as a control program and corresponds to the control flows illustrated in Fig. 7 through Fig. 9 and Fig. 11. In the same manner, the maintenance mode is stored in the ROM as a control program and corresponds to the control flow illustrated in Fig. 10.

[0076] As illustrated in Fig. 7, when the power of the automatic winder 1 is turned on (S300), the spooling main body 5 starts winding the yarn Y (S340).

[0077] In the normal winding mode, the control section 60 calculates the winding diameter of the package P based on the number of rotational pulses received from the drum rotation sensor 7a. When determining that the winding diameter of the package P reaches a predetermined value (e.g., 90 percent of the winding diameter of the package P representing a fully wound yarn) (S350: YES), the control section 60 proceeds to the control flow illustrated in Fig. 8 (S355). The control section 60 then determines whether or not the calculated winding diameter of the package P reaches the winding diameter of the package P representing a fully wound yarn (S500). When determining that the calculated winding diameter reaches the winding diameter of the package P representing a fully wound yarn (S500: YES), the control section 60 stops the operation of the spooling main body 5 in the winding unit 2 (S510), turns on the blue alarm lamp 29 (S520), and transmits a doffing request signal to the main control device 3 (S530). In response, the automatic doffing device 4 performs a doffing operation (S540). When the doffing operation is completed and preparation for restarting the operation of the spooling main body 5 is ready, the control section 60 turns off the blue alarm lamp 29 (S550), restarts the operation of the spooling main body 5 in the winding unit 2 (S560), and returns to the control flow illustrated in Fig. 7. On the other hand, when determining that the calculated winding diameter of the package P does not reach the winding diameter of the package P representing a fully wound yarn (S500: NO), the control section 60 starts to flash the blue alarm lamp 29 (S570) and returns to the control flow illustrated in Fig. 7 without stopping the operation of the spooling main body 5 in the winding unit 2. Accordingly, when the winding diameter of the package P comes close to the winding diameter of the package P representing a fully wound yarn, the alarm lamp 25 starts to flash blue first. Then, when the winding diameter of the package P reaches the winding diameter of the package P representing a fully wound yarn, the alarm lamp 25 is switched to blue illuminations. And when the doffing operation is completed, the alarm lamp 25 is turned off.

[0078] Further, in the normal winding mode, the control section 60 monitors each sensor of the spooling main

body 5. When determining that a malfunction has occurred (S360: YES), the control section 60 proceeds to the control flow illustrated in Fig. 9 (S365). The control section 60 then stops the operation of the spooling main body 5 (S700), and calls over an average operator by turning on the red alarm lamp 30 as illustrated in (b) of Fig. 4 (S710). At the same time, the control section 60 displays with the 7-segment indicator 22 the character string corresponding to the occurred malfunction (S720).

[0079] At the same time, when the malfunction has been caused by the winding bobbin Bf (S730: X), the control unit 60 controls an abnormal state indication to be indicated by turning on the top lamp 23f (S740) and waits to receive a signal from the top button 23a (S750: NO). The malfunction caused by the winding bobbin Bf, for example, includes cases in which the yarn Y cannot be caught even when the suction mouth 17 is controlled to perform a predetermined yarn sucking and catching operation, and in which the winding bobbin Bf is not supplied at a position for the cradle to hold the winding bobbin Bf (absence of a winding bobbin). The average operator called over to the winding unit 2 observes which one among the top button 23a, the middle button 23e, and the bottom button 23b is illuminated, thereby determines the specific malfunction, and performs a corresponding procedure for handling such malfunction. That is, by recognizing that the top button 23a is illuminated, the average operator recognizes that the malfunction has been caused by the winding bobbin Bf and determines that he/she should perform an operation corresponding to such a malfunction. Then, by focusing the checking on the vicinity of the winding bobbin Bf, the average operator determines a specific operation necessary for fixing such a malfunction and performs the necessary operation. For example, if it is difficult for the suction mouth 17 to catch a yarn end of the yarn Y in the package P side, the average operator moves the yarn end of the yarn Y to a position where the yarn end of the yarn Y can be easily caught. Further, when a defective package, in which the form of the winding is defective, is formed on the winding bobbin Bf, the average operator removes the defective package and replaces the defective package with a new winding bobbin. When the winding bobbin Bf is not supplied at the position for the cradle to hold the winding bobbin Bf, the average operator places on the cradle a winding bobbin around which no yarn is wound. When the above-described operation is completed, the average operator presses the illuminating top button 23a. Consequently, the top button 23a is switched from an illuminating state (an abnormal state indication) to an illuminations stopped state (a normal state indication). Then, when receiving the signal from the top button 23a (S750: YES), the control section 60 restarts the operation of the spooling main body 5 (S800) and returns to the control flow illustrated in Fig. 7.

[0080] In the same manner, when the malfunction has been caused by something other than the yarn supplying bobbin B and the winding bobbin Bf (S730: Y), the control

section 60 controls an abnormal state indication to be indicated by turning on the middle lamp 23h (S760) and waits to receive a signal from the middle button 23e (S770: NO). A malfunction in the winding unit 2, which has been caused by something other than the yarn supplying bobbin B and the winding bobbin Bf, for example, includes cases in which a component such as the yarn detecting sensor 10 or the drum rotation sensor 7a included in the winding unit 2 breaks down, and a voltage supplied to the winding unit 2 is not appropriate. In addition, the above-described malfunction includes cases in which a component such as the splicer 12 or the unwinding assisting device 9 included in the winding unit 2 has a maladjustment or a defective setting, the residual amount of wax provided in the waxing device 14 in the winding unit 2 becomes equal to or less than the predetermined value, the splicer 12 fails to perform the splicing operation three consecutive times, and the like. Further, by recognizing that the middle button 23e is illuminated, the average operator called over to the winding unit 2 recognizes that the malfunction has been caused by something other than the yarn supplying bobbin B and the winding bobbin Bf and determines that he/she should ask an advanced operator to handle such a malfunction. Subsequently, the advanced operator called over to the winding unit 2 by the average operator completes the appropriate operation corresponding to such a malfunction and presses the illuminating middle button 23e. Consequently, the middle button 23e is switched from an illuminating state (an abnormal state indication) to an illuminations stopped state (a normal state indication). Then, when receiving the signal from the middle button 23e (S770: YES), the control section 60 restarts the operation of the spooling main body 5 (S800) and returns to the control flow illustrated in Fig. 7.

[0081] In the same manner, when the malfunction has been caused by the yarn supplying bobbin (S730: Z), the control unit 60 controls an abnormal state indication to be indicated by turning on the bottom lamp 23g (S780) and waits to receive a signal from the bottom button 23b (S790: NO). The malfunction caused by the yarn supplying bobbin B, for example, includes a case in which the retie pipe 16 fails to catch the yarn Y in the yarn supplying bobbin B side. In addition, the above-described malfunction includes cases in which the yarn supplying bobbin B has defects, and the yarn winding bobbin B is not supplied at a position for the yarn to be unwound in the yarn supplying section 100 (absence of a yarn supply bobbin). Then, by recognizing that the bottom button 23b is illuminated, the average operator called over to the winding unit 2 recognizes that the malfunction has been caused by the yarn supplying bobbin B and determines that he/she should perform an operation corresponding to such a malfunction. Further, by focusing the checking on the vicinity of the yarn supplying bobbin B, the average operator determines a specific operation necessary for fixing such a malfunction and performs the necessary operation. For example, the average operator checks the

yarn supplying bobbin B, and then replaces the yarn supplying bobbin B with a new yarn supplying bobbin B if necessary. When the above-described operation is completed, the average operator presses the illuminating bottom button 23b. Consequently, the bottom button 23b is switched from an illuminating state (an abnormal state indication) to an illuminations stopped state (a normal state indication). Then, when receiving the signal from the bottom button 23b (S790: YES), the control section 60 restarts the operation of the spooling main body 5 (S800) and returns to the control flow illustrated in Fig. 7.

[0082] Meanwhile, there is also a case in which the advanced operator cannot specify which portion or which component in the winding unit 2 has caused the malfunction. In such a case, by pressing the appropriate buttons, namely the right button 23c and the left button 23d in the operation panel 21 in the winding unit 2, simultaneously (S810: YES, S820: YES, and S830: YES), the advanced operator switches the mode executed by the control section 60 from the normal winding mode to the maintenance mode. That is, when the control section 60 turns on the top lamp 23f (S740) and waits to receive the signal from the top button 23a (S750: NO), when the control section 60 turns on the middle lamp 23h (S760) and waits to receive the signal from the middle button 23e (S770: NO), or when the control section 60 turns on the bottom lamp 23g (S780) and waits to receive the signal from the bottom button 23b (S790: NO), if signals are simultaneously received from the left button 23d and the right button 23c (S810: YES, S820: YES, and S830: YES), the control section 60 switches the execution mode from the normal winding mode to the maintenance mode. In other words, the control section 60 proceeds to the control flow illustrated in Fig. 10.

[0083] When signals are received simultaneously from the right button 23c and the left button 23d in the normal winding mode illustrated in Fig. 7 (S370: YES) or when signals are received simultaneously from the right button 23c and the left button 23d in the normal winding mode illustrated in Fig. 9 (S810: YES, S820: YES, and S830: YES), the control section 60 proceeds to the control flow illustrated in Fig. 10 (S375). The control section 60 then stops the operation of the spooling main body 5 (S900), starts the maintenance mode and establishes a state which allows a character string to be inputted for specifying the object of maintenance (S910), and waits to receive the signal from the middle button 23e (S915). The object of maintenance, for example, includes the suction mouth 17, the retie pipe 16, the unwinding assisting device 9, the splicer 12, the peg 15, the disc-type tension applying device 11, and the traverse drum 8. Then, the advanced operator inputs the character string specifying the object of maintenance into the control section 60 through the operation button unit 23. It is assumed herein that the object of maintenance is the retie pipe 16, "E75" is stored in the RAM61, the character string specifying the retie pipe 16 is "F84", the control unit 60 displays "E75" stored in the RAM61 through the 7-segment indi-

cator 22, and the "7" placed in the second digit is flashing so as to indicate the target to be modified, as illustrated in Fig. 12. In such a state, the advanced operator presses the top button 23a once. By incrementing a character (i.e., a letter, a number, or a symbol) placed in the flashing second digit of the 3-digit character string stored in the RAM61, the control section 60, which has received the signal from the top button 23a, changes the displayed contents in the 7-segment indicator 22 from "E75" to "E85". Incrementing herein means that, in terms of numbers, 1 is added and, in terms of letters, a letter advances to the next letter in the English alphabetical order.

[0084] Next, the advanced operator presses the right button 23c once to modify the character (i.e., a letter, a number, or a symbol) placed in the first digit of the 3-digit character string stored in the RAM61. The control section 60 which has received the signal from the right button 23c flashes the "5" placed in the first digit to again specify the target to be modified. In such a state, the advanced operator presses the bottom button 23b once. By decrementing the character placed in the flashing first digit of the 3-digit character string stored in the RAM61, the control section 60, which has received the signal from the bottom button 23b, changes the displayed contents in the 7-segment indicator 22 from "E85" to "E84". Decrementing herein means that, in terms of numbers, 1 is subtracted and, in terms of letters, a letter goes back to the previous letter in the English alphabetical order.

[0085] Next, the advanced operator presses the right button 23c once again to modify the character (i.e., a letter, a number, or a symbol) placed in the third digit of the 3-digit character string stored in the RAM61. The control section 60 which has received the signal from the right button 23c flashes "E" placed in the third digit to again specify the target to be modified. In such a state, the advanced operator presses the top button 23a once. By incrementing the character placed in the flashing third digit of the 3-digit character string stored in the RAM61, the control section 60, which has received the signal from the top button 23a, changes the displayed contents in the 7-segment indicator 22 from "E84" to "F84".

[0086] As described above, after inputting the character string "F84" specifying the retie pipe 16 as the object of maintenance into the control section 60 through the operation button unit 23, the advanced operator presses the middle button 23e (S915: YES). Pressing the middle button 23e herein indicates that the above-described inputting has been completed. When receiving the signal from the middle button 23e, the control section 60 determines whether or not signals have been received from the top button 23a, the bottom button 23b, the right button 23c, and the left button 23d by scanning each button one by one (S920 through S950). In such a state, if the top button 23a is pressed and held (S920: YES), the control section 60 repeatedly executes upward movement (S925). If the object of maintenance is the retie pipe 16, the upward movement turns into an upward rotational movement of a predetermined angle of the retie pipe 16

(e.g., 2 degrees). Accordingly, by repeatedly executing the upward rotational movement of the predetermined angle, the control section 60 rotates the retie pipe 16 upward. Further, when the top button 23a is pressed just once (S920: YES), the control section 60 executes the upward movement just once (S925). That is, the control section 60 rotates the retie pipe 16 only the predetermined angle upward.

[0087] In the same manner, if the bottom button 23b is pressed and held (S930: YES), the control section 60 repeatedly executes downward movement (S935). If the object of maintenance is the retie pipe 16, the downward movement turns into a downward rotational movement of a predetermined angle of the retie pipe 16 (e.g., 2 degrees). Accordingly, by repeatedly executing the downward rotational movement of the predetermined angle, the control section 60 rotates the retie pipe 16 downward. Further, when the bottom button 23b is pressed just once (S930: YES), the control section 60 executes the downward movement just once (S935). That is, the control section 60 rotates the retie pipe 16 only the predetermined angle downward.

[0088] As described above, by freely controlling such rotational movement of the retie pipe 16, the specific malfunction associated with the movement of the retie pipe 16 can be easily determined.

[0089] Then, when the specific malfunction has been determined and the necessary repair has been completed, the advanced operator presses the right button 23c and the left button 23d simultaneously so as to terminate the maintenance mode and to restart the operation of the spooling main body 5. Accordingly, the control section 60 receives the signals simultaneously from the right button 23c and the left button 23d (S960: YES), restarts the operation of the spooling main body 5 (S970), terminates the maintenance mode, and proceeds to E illustrated in Fig. 7.

[0090] In the above-described maintenance mode, it is assumed that the object of maintenance is the retie pipe 16. The retie pipe 16 may be replaced with, for example, the suction mouth 17, the unwinding assisting device 9, the splicer 12, the peg 15, the disc-type tension applying device 11, and the traverse drum 8 as the object of maintenance.

[0091] That is, when the object of maintenance is the suction mouth 17, the upward movement illustrated in Fig. 10 turns into an upward rotational movement of the suction mouth 17 and the downward movement illustrated in Fig. 10 turns into a downward rotational movement of the suction mouth 17. In the same manner, when the object of maintenance is the unwinding assisting device 9, the upward movement turns into a rising movement of the unwinding assisting device 9 and the downward movement turns into a lowering movement of the unwinding assisting device 9. When the object of maintenance is the splicer 12, a rightward movement turns into an opening movement of the yarn handling lever and a leftward movement turns into a closing movement of the

yarn handling lever. When the object of maintenance is the peg 15, the rightward movement turns into a movement to tilt the peg 15 to the front side and the leftward movement turns into a movement to move the peg 15 back from such a tilted state. When the object of maintenance is the disc-type tension applying device 11, the rightward movement and the leftward movement correspond to a forward rotational direction and a backward rotational direction of the disc members 11a and 11a, respectively. When the object of maintenance is the traverse drum 8, the upward movement increases rotational speed of the traverse drum 8 and the downward movement decreases the rotational speed of the traverse drum 8. As described above, the upward movement, the downward movement, the rightward movement, and the leftward movement, or the top button 23a, the bottom button 23b, the right button 23c, and the left button 23d associate a direction in which a distinct movement of each component of the spooling main body 5 is generated with a directional characteristic of each button arranged in the cross shape. Accordingly, the operators can imagine the distinctive movement of each component intuitively. That is, the top button 23a and the bottom button 23b correspond to up-and-down movements of a component or increasing and decreasing the moving speed of a component. Further, the right button 23c and the left button 23d correspond to horizontal movements of a component or posterior-anterior movements of a component.

[0092] When receiving the signal from the bottom button 23b in the normal winding mode illustrated in Fig. 7 (S380: YES), the control section 60 proceeds to the control flow illustrated in Fig. 11 (S385). The control section 60 then stops the operation of the spooling main body 5 as illustrated in Fig. 11 (S1000), releases the yarn supplying bobbin B by tilting the peg driving section 15b or the like and replaces the yarn supplying bobbins B by controlling the peg 15 to hold a new yarn supplying bobbin (S1010), restarts the operation of the spooling main body 5 (S1020), and returns to the control flow illustrated in Fig. 7.

[0093] Meanwhile, there may be a case when the advanced operator needs to stop the operation of the spooling main body 5 for maintenance. In such a case, all that the advanced operator needs to do is to switch the movable section 27 of the operation switch 24 from a receding state to a protruding state. In such a case, by switching the movable section 27 of the operation switch 24 back to the receding state, the advanced operator terminates the maintenance mode and restarts the operation of the spooling main body 5.

[0094] While a preferred embodiment of the present invention has been described as above, in the above-described embodiment, the second indicating section includes at least the top button 23a, the middle button 23e, and the bottom button 23b.

[0095] In the above-described embodiment, the alarm lamp 25 capable of indicating the operational state of the

winding unit 2 is, for example, provided on the curved surface 20 of the supporting body 6 as illustrated in Fig. 3, (a) and (b) of Fig. 4., and Fig. 5. Providing the curved surface 20 of the supporting body 6 with the alarm lamp 25 capable of indicating the operational state of the winding unit 2 as described above allows the average operator, who is far away from the winding unit 2 in the direction in which the winding units 2 are arranged next to one another as illustrate in Fig. 5, to recognize the operational state of the winding unit 2 easily. Further, even when the winding unit 2, in which the operational state is indicated by the alarm lamp 25, is located in front of the average operator, providing the curved surface 20 of the supporting body 6 with the alarm lamp 25 as described above still allows the average operator to recognize the operational state of winding unit 2. Further, since the alarm lamp 25 is curved without having any sharp angles as described above, the operators can recognize the operational state of the yarn winding unit 2 both when they are on a side of the yarn winding unit 2 and when they are in front of the yarn winding unit 2. Furthermore, the shape, in which the alarm lamp 25 is curved without having any sharp angles, presents a softer image to the average operator such that the average operator becomes familiar with the alarm lamp 25 easily.

[0096] In the above-described embodiment the alarm lamp 25 is provided on the curved surface 20 of the supporting body 6. However, as long as the average operator, who is far away from the winding unit 2, can see and recognize the operational state of the winding unit 2 immediately, the position of the alarm lamp 25 is not limited to the curved surface 20 of the supporting body 6. For example, the alarm lamp 25 may be provided on the lateral sides 18 of the supporting body 6 in the winding unit 2. Alternatively, the alarm lamp 25 may be provided on both the lateral sides 18 of the supporting body 6 and the front side 19 thereof in the winding unit 2, or the alarm lamp 25 may be provided integrally on both the lateral sides 18 of the supporting body 6 and the front side 19 thereof in the winding unit 2. As described above, by providing both the lateral sides 18 of the supporting body 6 and the front side 19 thereof with the alarm lamp 25 integrally, the alarm lamp 25 is provided in a large range extending continuously to both the lateral sides 18 of the supporting body 6 and the front side 19 thereof; therefore, the ability to draw attention of the average operator is improved.

[0097] Further, in the above-described embodiment, as illustrated in Fig. 3, Fig. 6, Fig. 8, and Fig. 9, the alarm lamp 25 is, for example, capable of changing its indicating style depending on the operational state of the winding unit 2. In the above-described embodiment, the above-described "indicating style" includes illuminations of the alarm lamp 25 and the flashing of the alarm lamp 25, or colors of the illuminating alarm lamp 25. According to the above-described structure, the average operator can recognize and distinguish different operational states of the winding unit 2 via the alarm lamp 25.

[0098] Further, in the above-described embodiment, the operational state of the winding unit 2 includes a state which requires maintenance work to the winding unit 2. As illustrated in Fig. 3, (b) of Fig. 4, and Fig. 6, the operation button unit 23 (particularly, the top button 23a, the middle button 23e, and the bottom button 23b) indicating the necessary maintenance work to the winding unit 2 is, for example, provided on the front side 19 of the supporting body 6. Further, as illustrated in Fig. 3, the alarm lamp 25 is provided near the operation button unit 23. According to the above-described structure, the average operator, who has been guided by the alarm lamp 25 to the winding unit 2 that requires the maintenance work from the average operator, can recognize the necessary maintenance work via the operation button unit 23 without having to considerably vary his or her viewing direction, as illustrated in (b) of Fig. 4. Furthermore, a visually synergistic effect is generated by a combination of the indication of the alarm lamp 25 and the indication of the operation button unit 23; therefore, the ability to draw the attention of the average operator is further improved.

[0099] Further, in the above-described embodiment, as illustrated in Fig. 3 and (b) of Fig. 4, the operation switch 24 for switching the operation of the spooling main body 5 ON and OFF is provided on the front side 19 of the supporting body 6. As illustrated in (b) of the Fig. 4, the operation switch 24 is configured such that when switching the operation of the spooling main body 5 OFF, the movable section 27 is projected from the front side 19. Meanwhile, when switching the operation of the spooling main body 5 ON, the movable section 27 is retracted in the opposite direction from the direction in which the movable section 27 is projected. The exposed portion 27a of the movable section 27, which is exposed when the operation of the spooling main body 5 is OFF, has been colored. In the above-described structure, when a malfunction has occurred and the operation of the yarn winding unit 2 cannot continue or when the maintenance work has not been completed and it is necessary for the operator to leave the winding unit 2, the advanced operator may force the operation of the spooling main body 5 in the winding unit 2 to stop, through the operation switch 24. In such a case, since the exposed portion 27a of the movable section 27 is colored and exposed from the front side 19 of the supporting body 6, the average operator can easily recognize that the operation of the spooling main body 5 in the winding unit 2 has been intentionally stopped. Accordingly, it is possible to prevent the inadvertent restart of the operation of the yarn winding unit 2. Further, the operation of the spooling main body 5 may also automatically turn into a stopped state, i.e. not through the use of the operation switch 24. Since such a case is different from the case in which the advanced operator forces the operation of the winding unit 2 to stop, the colored exposed portion 27a of the movable section 27 is not exposed from the front side 19 of the supporting body 6. Accordingly, when the operation of the spooling main body 5 is in the stopped state, it is

possible to determine visually and easily whether or not the stopped state is intentionally caused by the advanced operator.

[0100] Further, in the above-described embodiment as illustrated in Fig. 3, Fig. 4, and Fig. 6, the top button 23a, the middle button 23e, and the bottom button 23b are, for example, provided. Then, as illustrated in Fig. 9, (1) when a malfunction has been caused by the yarn supplying bobbin B, the control section 60 stops the operation of the spooling main body 5, controls the bottom button 23b to be illuminated, and then restarts the operation of the spooling main body 5 when receiving the signal from the bottom button 23b, (2) when a malfunction has been caused by something other than the yarn supplying bobbin B and the winding bobbin Bf, the control section 60 stops the operation of the spooling main body 5, controls the middle button 23e to be illuminated, and then restarts the operation of the spooling main body 5 when receiving the signal from the middle button 23e, and (3) when a malfunction has been caused by the winding bobbin Bf, the control section 60 stops the operation of the spooling main body 5, controls the top button 23a to be illuminated, and then restarts the operation of the spooling main body 5 when receiving the signal from the top button 23a. As described above, by providing the top button 23a, the bottom button 23b, and the middle button 23e with functions both to let the average operator recognize the malfunction and to release the stopped state of the operation of the spooling main body 5 resulted from the malfunction, when intending to restart the operation of the spooling main body 5, the average operator can recognize which one among the yarn supplying bobbin B, the winding bobbin Bf, and something other than the yarn supplying bobbin B and the winding bobbin Bf has caused the malfunction. Therefore, the average operator can accurately recognize whether the malfunction can be handled by him/her or should be handled by the advanced operator instead. Further, before restarting the operation of the spooling main body 5, the average operator can ask himself/herself whether or not the operation performed by him/her matches the required operation to be performed to the yarn winding machine to fix an error. Accordingly, since a mismatch between the required operation to be performed to the yarn winding machine to fix the error and the operation performed by the average operator is prevented, productivity of the winding unit 2 is improved.

[0101] Further, as illustrated in Fig. 2, the yarn supplying section 100 in which the yarn supplying bobbin B is arranged, the yarn-process executing section 101, and the winding section 102 in which the winding bobbin Bf is arranged, are, for example, arranged in this order from bottom to top. In the same manner, as illustrated in Fig. 3 and (b) of Fig. 4, the bottom button 23b, the middle button 23e, and the top button 23a are, for example, arranged in this order from bottom to top. According to the above-described structure, since the position for each of the above-described sections corresponds to the position for each of the above-described buttons, the average

operator can easily determine the section with the malfunction.

[0102] Further, as illustrated in Fig. 3 and (b) of Fig. 4, the bottom button 23b is formed to indicate a downward direction (an upstream side of the running direction of the yarn Y) and the top button 23a is formed to indicate an upward direction (a downstream side of the running direction of the yarn Y), for example. In the above-described structure, the average operator can determine the section with the malfunction more intuitively.

[0103] Since the winding unit 2 included in the automatic winder 1 excels in productivity as described above, the automatic winder 1 with a high production rate is accomplished.

[0104] Further, in the above-described embodiment, as illustrated in Fig. 6, the control section 60, for example, includes the RAM 61 storing a plurality of characters. The 7-segment indicator 22 is provided for displaying the characters stored in the RAM61 in a way that the characters are arranged next to one another in the lateral direction. And the operation button unit 23 for modifying the characters stored in the RAM61 is provided. The operation button unit 23 includes the right button 23c, which is arranged at a position indicating the right, and the left button 23d, which is arranged at a position indicating the left, so as to enable selection of characters to be modified among the characters stored in the RAM61. The operation button unit 23 also includes the top button 23a arranged at a position indicating an upward direction and the bottom button 23b arranged at a position indicating a downward direction, so as to enable modification of the characters selected through the right button 23c and the left button 23d out of the characters stored in the RAM61. As described above, providing such an input means for selecting the characters to be modified (the input means corresponds to the right button 23c and the left button 23d) allows the characters to be modified by a small number of input means.

[0105] Further, the above-described RAM61 stores the 3-digit character string. As illustrated in Fig. 12, the 7-segment indicator 22 displays the 3-digit character string in a way that each digit of the 3-digit character string stored in the RAM61 is arranged next to one another in a lateral direction. When the character string including three or more digits are handled as described above, the above-described effect is especially useful since the plurality of characters can be modified by a small number of input times.

[0106] Further, as illustrated in Fig. 7 through Fig. 9, Fig. 11 and Fig. 10, for example, the control section 60 can selectively execute the two modes, namely the normal winding mode in which the spooling main body 5 performs the normal winding operation and the maintenance mode for maintaining components of the spooling main body 5. As illustrated in Fig. 7, Fig. 9, and Fig. 10, when the right button 23c and the left button 23d are pressed simultaneously, the control section 60 switches the execution mode between the normal winding mode

and the maintenance mode. That is, since it is not possible under a normal condition to press the right button 23c and the left button 23d simultaneously without being aware of such simultaneous operation, such a configuration prevents the execution mode from being unintentionally switched.

[0107] Further, as illustrated in Fig. 3 and (a) of Fig. 4, for example, since the right button 23c and the left button 23d are formed smaller and located in a concave portion 26, such a configuration makes them more difficult to be pressed than the top button 23a and the bottom button 23b. The above-described structure can further prevent the execution mode from being unintentionally switched.

[0108] Further, as illustrated in Fig. 10, for example, when the maintenance mode is selected and at least one of the top button 23a, the bottom button 23b, the right button 23c, and the left button 23d is pressed, the control section 60 sets a component of the spooling main body 5 to work based on the character string stored in the RAM61 and the pressed button. According to the above-described structure, when maintenance work to the spooling main body 5 is performed, the advanced operator can freely set any component to work.

[0109] Further, as illustrated in Fig. 10, for example, every time the maintenance mode is selected, and at least one of the top button 23a, the bottom button 23b, the right button 23c, and the left button 23d is pressed, the control section 60 sets a component of the spooling main body 5 to work using a predetermined unit based on the character string stored in the RAM61 and the pressed button. The above-described structure allows a fully tuned maintenance work to be performed on any component.

[0110] While a preferred embodiment of the present invention has been described as above, the above-described embodiment can also be modified and carried out as follows.

[0111] That is, in the normal winding mode illustrated in Fig. 7, for example, when the package P is released for any reason and there is a need to replace it with a new winding bobbin Bf, the control section 60 may flash the top lamp 23f instead of turning on the top lamp 23f as in S740 illustrated in Fig. 9. As described above, providing variations to an indicating style of the top lamp 23f allows precise instructions to be given to the average operator.

[0112] In the same manner, in the normal winding mode illustrated in Fig. 7, for example, when the yarn supplying bobbin B is released for any reason and there is a need to replace it with a new yarn supplying bobbin Bf, the control section 60 may flash the bottom lamp 23g instead of turning on the bottom lamp 23g as in S780 illustrated in Fig. 9. As described above, providing variations to an indicating style of the bottom lamp 23g allows precise instructions to be given to the average operator. Similarly, variations may be provided to an indicating style of the middle button 23e.

[0113] Further, the lengths of different yarn supplying

bobbins B differ slightly from each other in the longitudinal direction. Accordingly, it is preferable to have the original position of the vertical movement of the unwinding assisting device 9 adjustable depending on the length of the yarn supplying bobbin B in the longitudinal direction. Therefore, in the maintenance mode illustrated in Fig. 10 with the unwinding assisting device 9 as the object of maintenance (S910), a control such as inputting the original position of vertical movement of the unwinding assisting device 9, moving up the original position (S925) by pressing the top button 23a (S920), and moving down the original position (S935) by pressing the bottom button 23b (S930) also becomes effective.

[0114] Further, in the above-described embodiment, although the alarm lamp 25 adopts a combination of the blue alarm lamp 29 and the red alarm lamp 30, a green lamp may be used instead of the blue alarm lamp 29.

[0115] As a driving section, a variety of driving devices such as a motor and an air cylinder can be used, for example.

[0116] Further, in the above-described embodiment, the control section 60 switches the execution mode by pressing the right button 23c and the left button 23d simultaneously. However, the control section 60 may, alternatively, switch the execution mode when any one of the right button 23c and the left button 23d is pressed. Further, the control section 60 may also switch the execution mode when one of the right button 23c and the left button 23d has been pressed and the other is pressed thereafter.

[0117] Further, a mode switched from the normal winding mode by pressing the right button 23c and the left button 23d simultaneously is not limited to the maintenance mode. For example, the mode may be switched to a yarn defect sample mode disclosed in Japanese Unexamined Patent Application Publication No. 2004-352465 or an input-output device functional check mode disclosed in Japanese Unexamined Patent Application Publication No. 2003-11254.

[0118] Further, in the above-described embodiment, the character string such as "E85", "F84" or the like is displayed by the 7-segment indicator 22; however, a string including a combination of letters, numbers, and symbols, such as "**77" or "**7E" is also acceptable. Therefore, the character string is not limited to a string consisting of letters and numbers. Further, a string consisting only of numbers such as "777" or a string consisting only of letters such as "EFG" may also be displayed.

[0119] Further, since the yarn supplying bobbin B which supplies the yarn Y to the winding unit 2 of the automatic winder 1 is described as a yarn supply source in the above-described embodiment, the yarn supply source is not limited to the yarn supplying bobbin B. Instead of the yarn supplying bobbin B supplying a yarn to the automatic winder 1, a can or the like, in which a sliver supplied to each unit of a spinning frame is accumulated, may be used as a yarn supply source, for example.

[0120] Further, in the above-described embodiment,

the illuminating state of the top button 23a, the middle button 23e, or the bottom button 23b has been referred to as the abnormal state indication, and the illuminations stopped state thereof has been referred to as the normal state indication. However, if the abnormal state indication can be differentiated from the normal state indication, the indication style of the abnormal state indication and the normal state indication is not limited to the indication style described in the above-described embodiment. For example, the abnormal state indication can be differentiated from the normal state indication by switching the indication style between illuminations of the top button 23a, the middle button 23e, and/or the bottom button 23b and flashing thereof. Further, the abnormal state indication also can be differentiated from the normal state indication by illuminating each of the top button 23a, the middle button 23e, and the bottom button 23b in a different color.

Claims

1. A yarn winding machine (2), which unwinds a yarn (Y) from a yarn supply source (B) and winds the unwound yarn (Y) around a winding bobbin (Bf), and which switches from an operating state to a stopped state due to generation of a malfunction, **characterized by** comprising a first abnormal-state-indicating and restarting section (23b,60), and a second abnormal-state-indicating and restarting section (23a,60), wherein at least when a malfunction has been caused by a yarn supply source (B), the first abnormal-state-indicating and restarting section (23b,60) is switched from a normal state indication to an abnormal state indication, and when the first abnormal-state-indicating and restarting section (23b, 60) is operated during the abnormal state indication, the first abnormal-state-indicating and restarting section (23b,60) is switched to the normal state indication, and switches the yarn winding machine (2) from the stopped state to the operating state, wherein at least when a malfunction has been caused by a winding bobbin (Bf), the second abnormal-state-indicating and restarting section (23a,60) is switched from a normal state indication to an abnormal state indication, and when the second abnormal-state-indicating and restarting section (23a, 60) is operated during the abnormal state indication, the second abnormal-state-indicating and restarting section (23a,60) is switched to the normal state indication, and switches the yarn winding machine (2) from the stopped state to the operating state.
2. The yarn winding machine (2) according to claim 1, **characterized in that** a position for the first abnormal-state-indicating and restarting section (23b,60)

and the second abnormal-state-indicating and restarting section (23a,60) to be arranged corresponds to a running direction of the yarn (Y) which has been unwound from the yarn supply source (B) and has been wound around the winding bobbin (Bf).

3. The yarn winding machine (2) according to claim 1 or claim 2, **characterized by** further comprising a third abnormal-state-indicating and restarting section (23e,60), wherein when a malfunction has been caused by something other than a yarn supply source (B) and a winding bobbin (Bf), the third abnormal-state-indicating and restarting section (23e,60) is switched from a normal state indication to an abnormal state indication, and when the third abnormal-state-indicating and restarting section (23e, 60) is operated during the abnormal state indication, the third abnormal-state-indicating and restarting section (23e,60) is switched to the normal state indication, and switches the yarn winding machine (2) from the stopped state to the operating state.
4. The yarn winding machine (2) according to any one of claim 1 through claim 3, **characterized in that** the malfunction indicated by the first abnormal-state-indicating and restarting section (23b,60) includes absence of a yarn supply source (B), and/or the malfunction indicated by the second abnormal-state-indicating and restarting section (23a,60) includes absence of a winding bobbin (Bf).
5. The yarn winding machine (2) according to claim 3 or claim 4, **characterized in that** the third abnormal-state-indicating and restarting section (23e,60) is arranged between the first abnormal-state-indicating and restarting section (23b,60) and the second abnormal-state-indicating and restarting section (23a, 60) .
6. The yarn winding machine (2) according to any one of claim 1 through claim 5, **characterized in that** the first abnormal-state-indicating and restarting section ((23b,60) is formed to indicate an upstream side of the running direction of the yarn (Y) and the second abnormal-state-indicating and restarting section (23a, 60) is formed to indicate a downstream side of the running direction of the yarn (Y).
7. A textile machine (1) comprising a plurality of the yarn winding machines (2) according to any one of claim 1 through claim 6.

FIG. 2

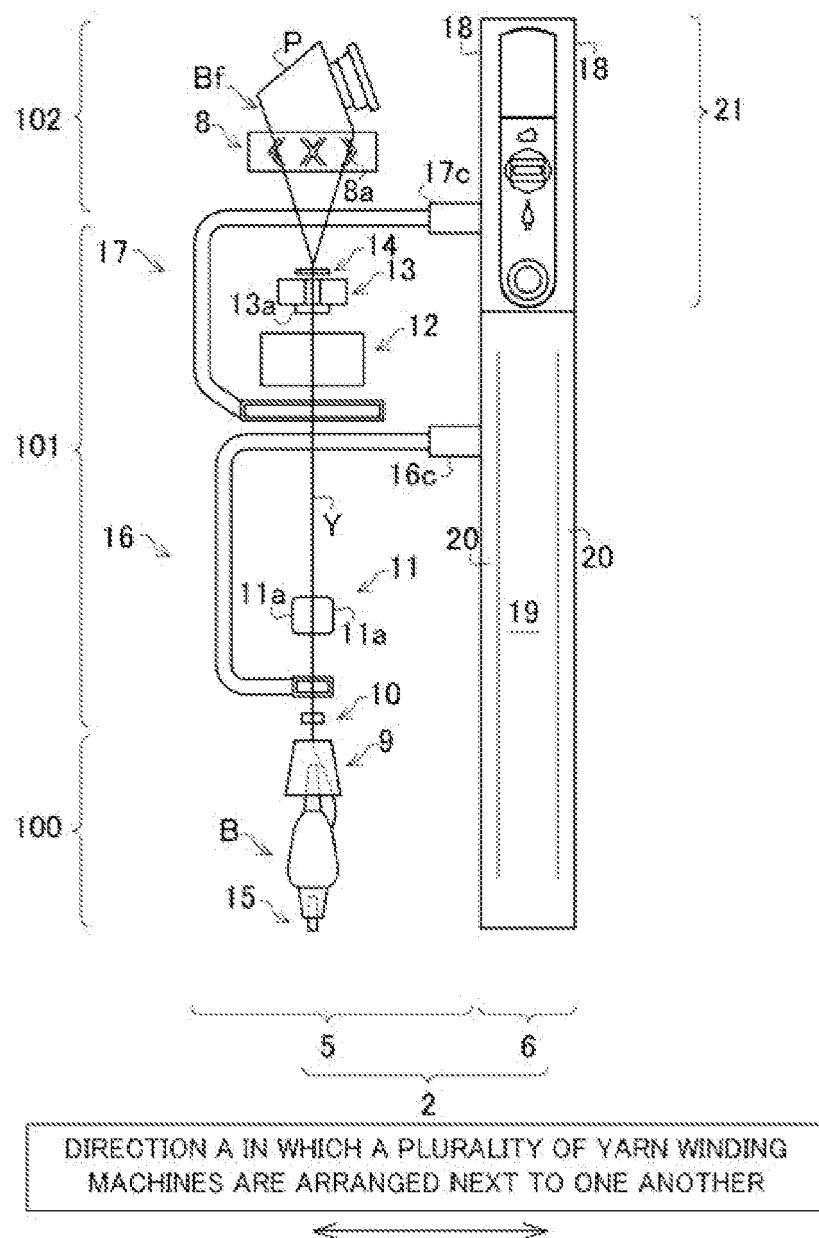


FIG. 3

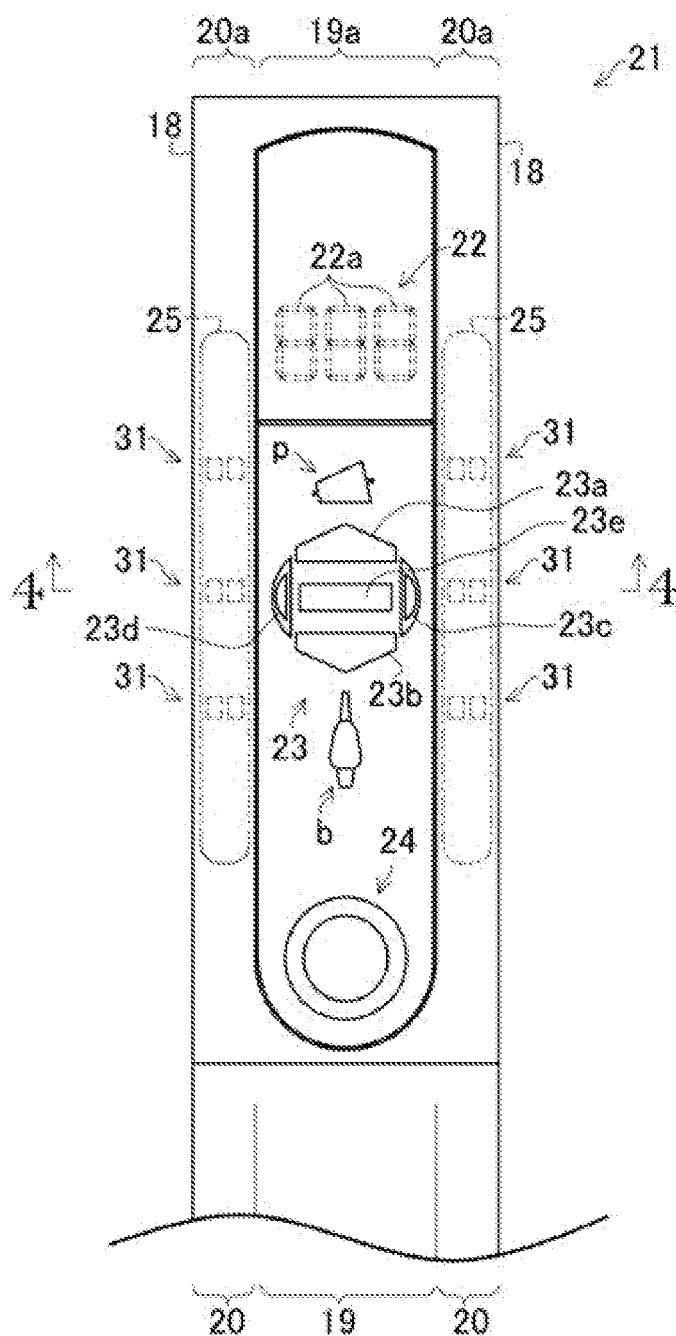


FIG. 4

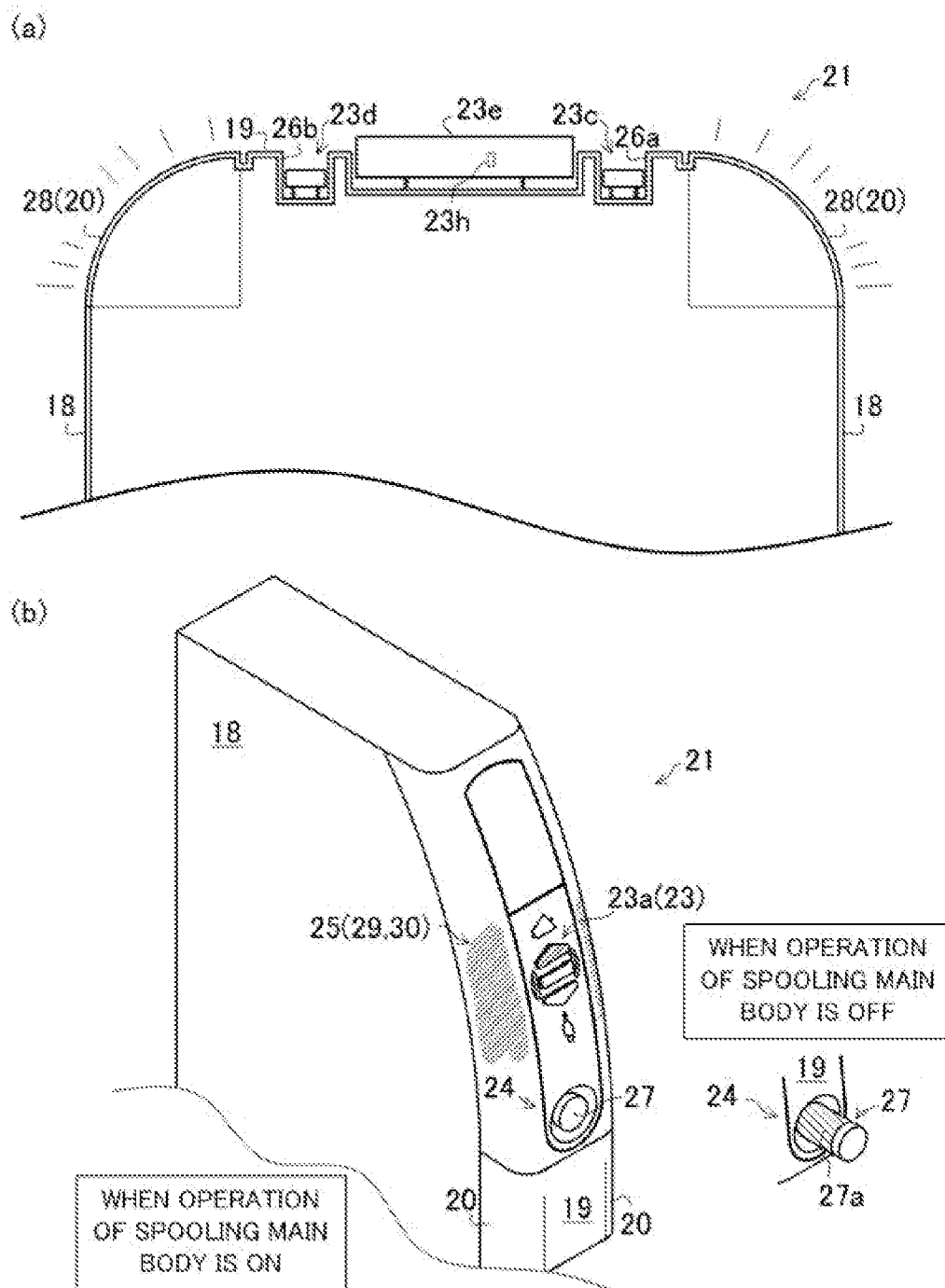


FIG. 5

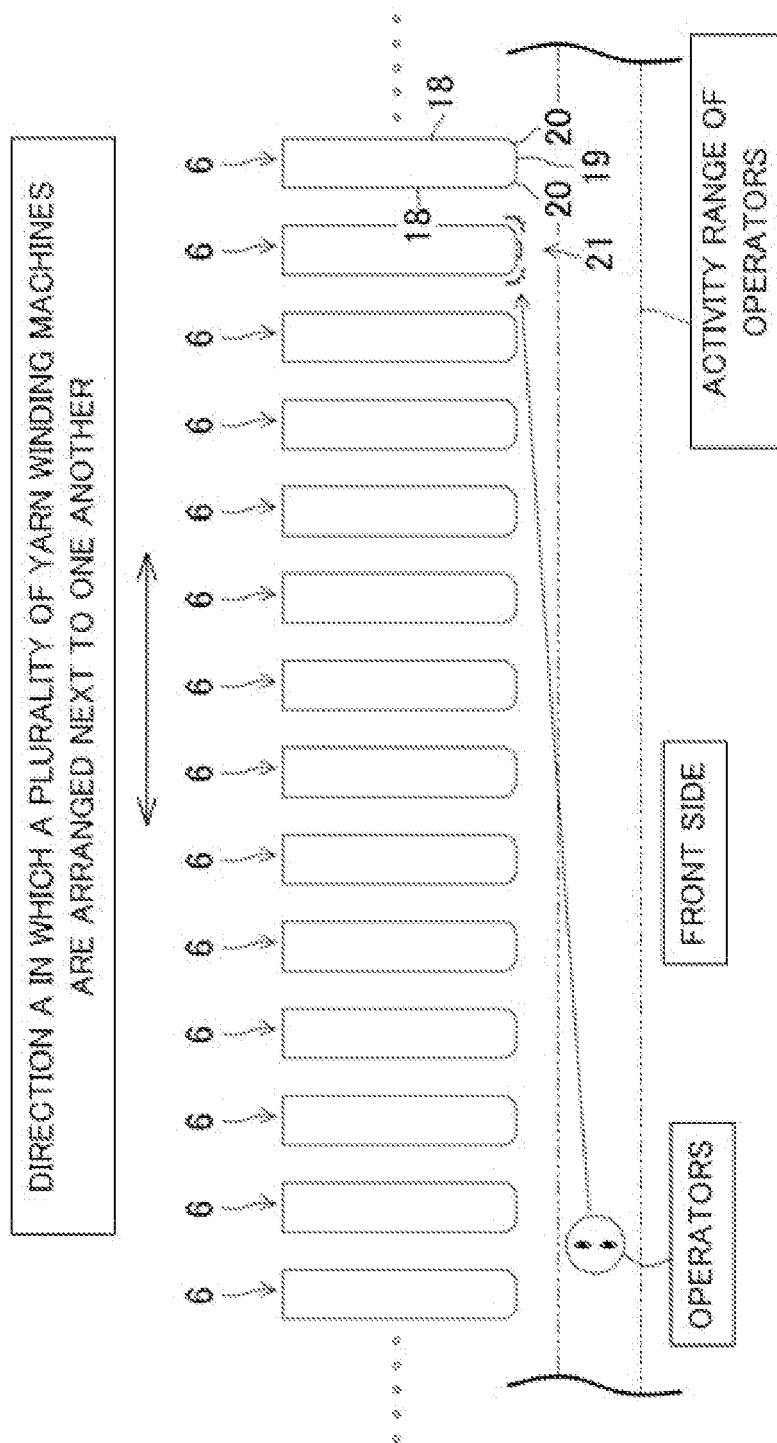


FIG. 6

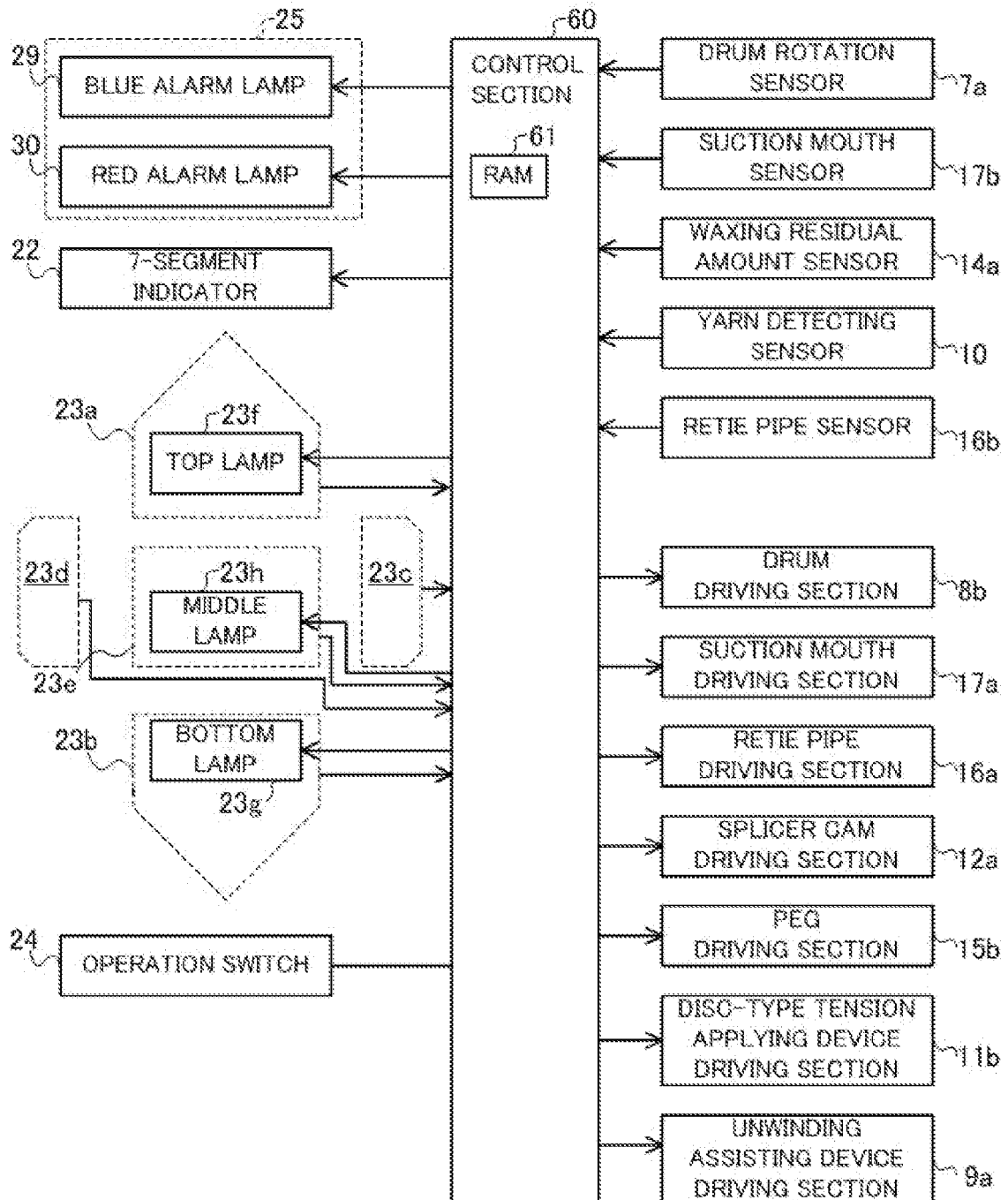


FIG. 7

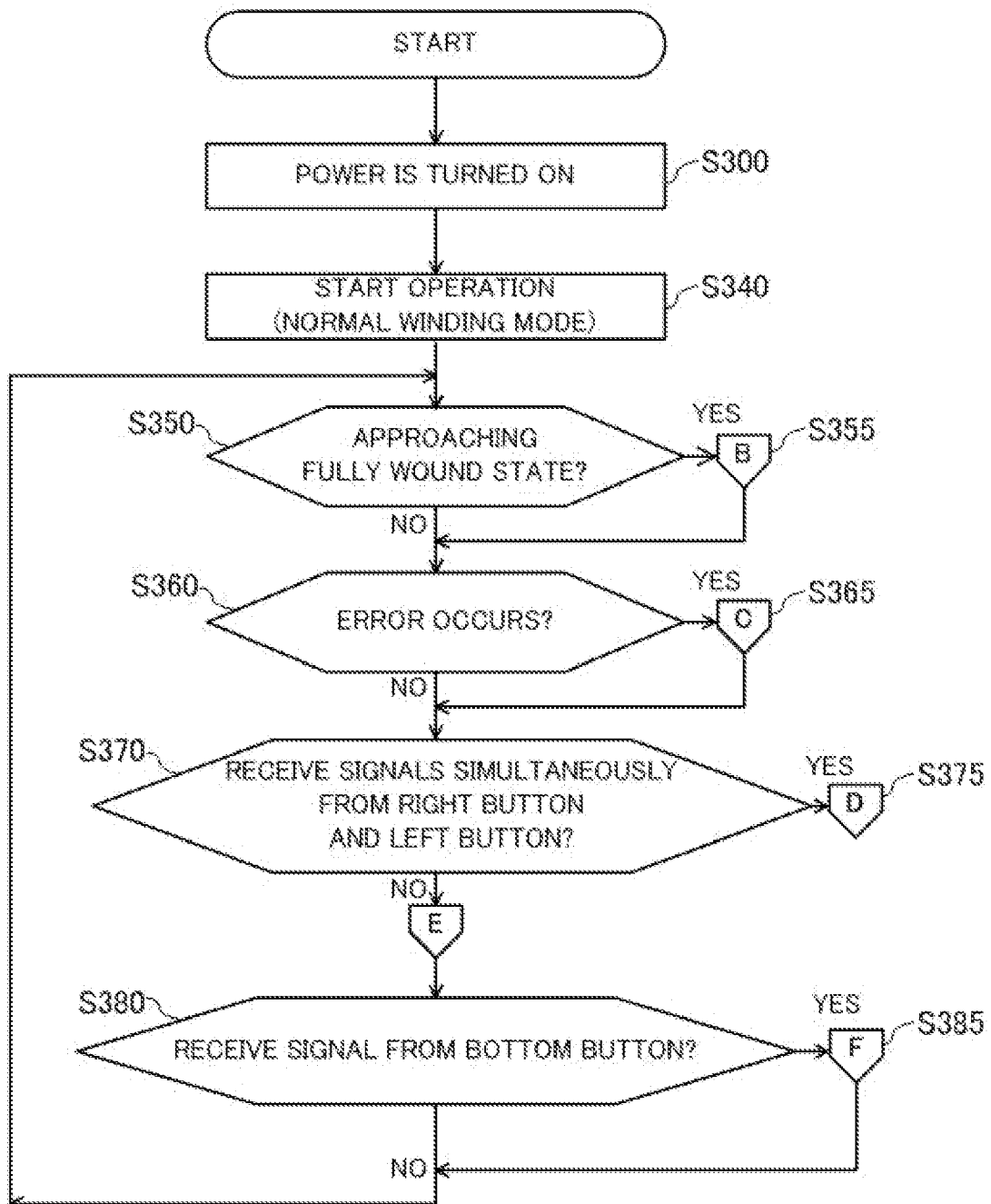


FIG. 8

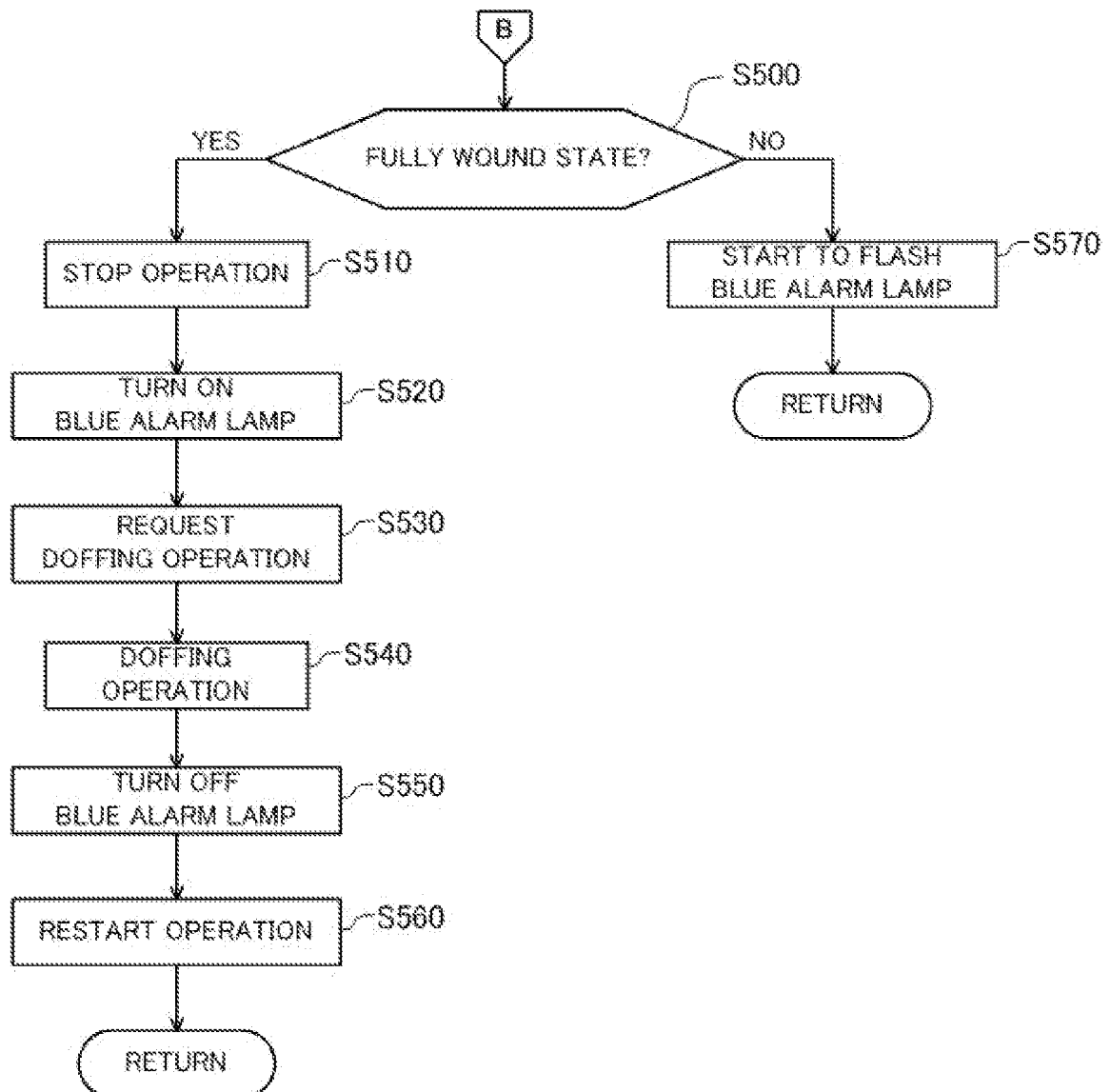


FIG. 9

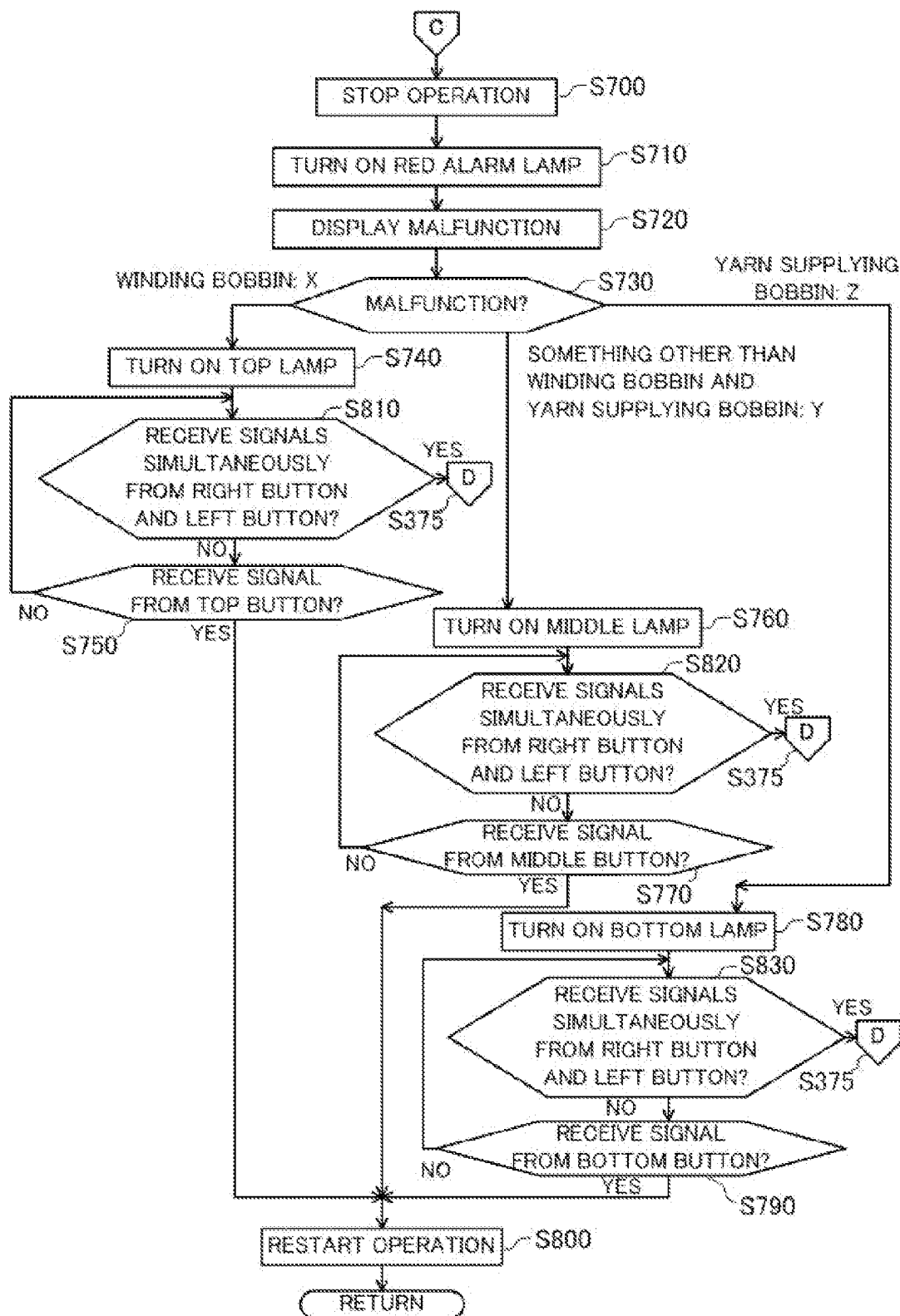


FIG. 10

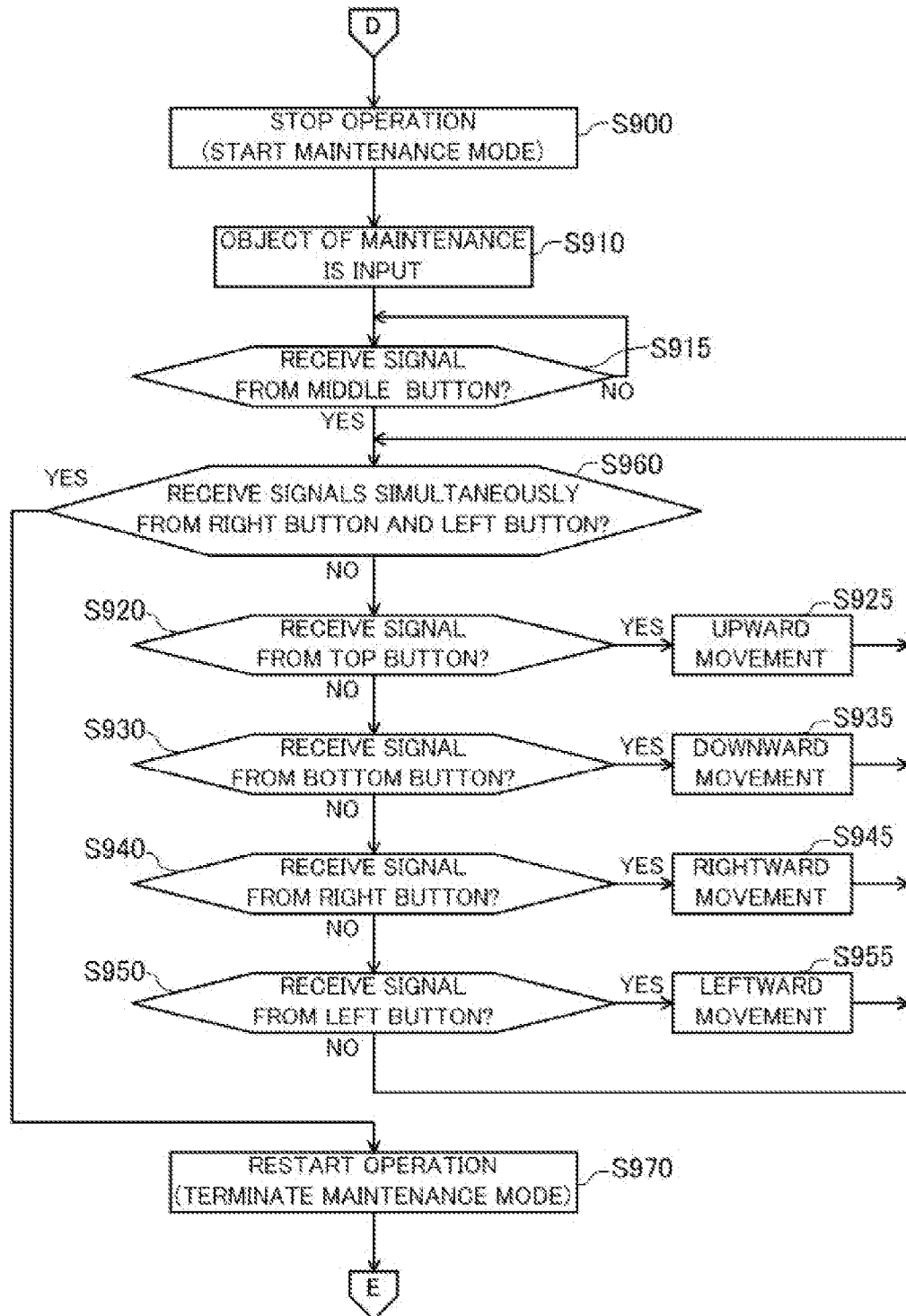


FIG. 11

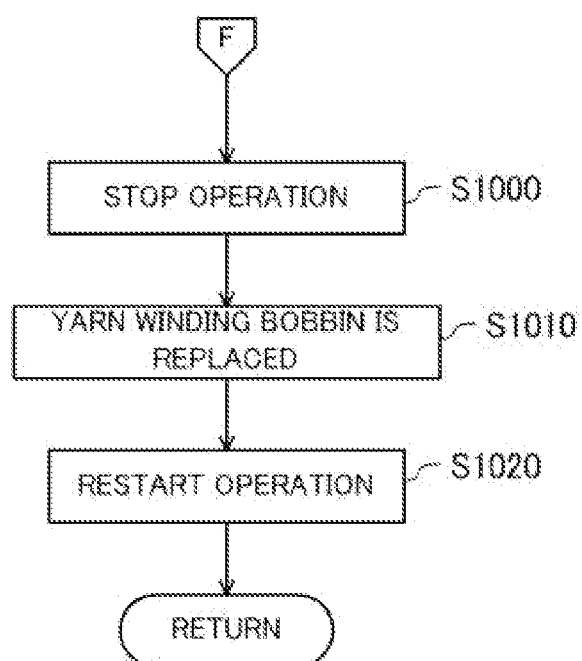
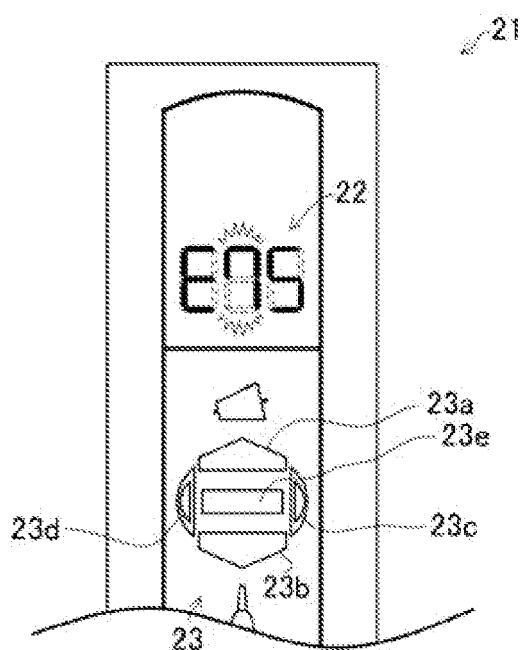


FIG. 12



REFERENCES CITED IN THE DESCRIPTION

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- JP 2004352465 A [0117]
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