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(54) YARN WINDING DEVICE WITH CIRCUIT BOARD

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EP 2 436 633 B1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a circuit board and a yarn winding device including the circuit board.

2. Description of Related Art

[0002] A yarn winding device such as an automatic winder has a plurality of unit frames. The unit frame has a box shape, and supports a cradle, a winding drum, a yarn joining device, a yarn guiding device, or the like. Referring to the yarn winding device, in view of improvement in productivity of a package, it is desired to further increase a winding speed for winding a yarn onto a winding bobbin.

[0003] However, in the yarn winding device, since the package is wound by being rotated at a high speed, a vibration tends to be generated on the unit frame. When the vibration generated on the unit frame is excessively increased, an electronic component provided in the unit frame receives an impact, whereby a life of the electronic component is shortened. Moreover, a leg of the electronic component attached to a printed board may be broken and the electronic component may be detached from the printed board. In this case, the yarn winding device does not operate normally. In other words, a winding operation of the yarn winding device is stopped. Consequently, the yarn winding device cannot restart the winding operation until an operator carries out a recovery operation. Moreover, an operation for attaching the printed board is complicated and a long period of time is required for the operation.

[0004] In view of the above problems, the conventional automatic winder may employ control for setting a winding speed to a low speed (so-called touch winding) at a winding start, releasing the touch winding when a package has thickened to some degree, and performing acceleration processing up to an upper limit speed.

[0005] However, since a winding bobbin or a yarn winding device body has an individual difference, a winding speed at which a vibration exceeding a tolerance is generated differs depending on respective yarn winding devices. In this respect, referring to the conventional control, a uniform touch winding speed or upper limit speed has been used for a plurality of yarn winding devices which is provided. Therefore, for the touch winding speed and the upper limit speed, it is necessary to set a low winding speed with an estimation of a great margin in such a manner that a vibration is not generated in any yarn winding device. For this reason, it is impossible to effectively utilize a capability of the yarn winding device as a whole automatic winder. Consequently, it is hard to increase production efficiency for a package.

[0006] In this respect, Japanese Unexamined Utility Model Publication No. H2-43876 discloses a structure in which a vibration is detected by an abnormal vibration detector (vibration detecting sensor) provided in a cradle and winding of a package is stopped when a vibration regarded to be an abnormality is generated. Moreover, Japanese Unexamined Patent Publication No. H6-127833 discloses a structure in which an abnormality of a cradle is diagnosed by an acceleration sensor (vibration detecting sensor) provided in the cradle.

[0007] A yarn winding device disclosed in Japanese Unexamined Patent Publication No. 2009-208880 has a strain gauge (vibration detecting sensor) attached to a cradle and detects a strength of a vibration of the cradle through the strain gauge. The yarn winding device controls the number of rotations of a package based on an output from the strain gauge.

[0008] In the yarn winding devices described in Japanese Unexamined Utility Model Publication No. H2-43876, Japanese Unexamined Patent Publication Nos. H6-127833 and 2009-208880, since the vibration detecting sensor is provided in the cradle, the vibration detecting sensor may not be resistant to the abnormal vibration of the cradle. More specifically, the following description will be given.

[0009] A control board for controlling a winding operation is provided inside a unit frame. Furthermore, a vibration detecting sensor provided in the cradle and the control board are connected to each other through a signal wire.

[0010] In the yarn winding device having the above structure, a package is rotated at a high speed. Therefore, with the structure in which the vibration detecting sensor is provided in the cradle, the vibration detecting sensor directly receives a great vibration from the cradle, and the vibration detecting sensor itself may be broken. Moreover, since a noise tends to enter an analog value that is a result of detection obtained by the vibration detecting sensor, it is also necessary to provide a noise filter as a countermeasure.

[0011] Moreover, in the conventional yarn winding device, since the signal wire for connecting the vibration detecting sensor to the control board is long, a time lag is made in signal processing for detecting an abnormality through the control board in some cases. In this case, processing corresponding to a result of detection of an abnormal vibration in the cradle cannot be executed in a proper timing.

[0012] The yarn winder disclosed in US 5,900,553 has a vibration pickup sensor attached on the outside of the winder frame.

[0013] The spun yarn winding machine disclosed in JP63-203814 has a vibration sensor attached to the tip of the frame.

BRIEF SUMMARY OF THE INVENTION

[0014] An object of the present invention is to quickly detect an abnormal vibration of a winding section in the

yarn winding device.

[0015] A plurality of modes will be described below as means for solving the problems. These modes can be optionally combined if necessary.

[0016] A circuit board for a yarn winding device according to an aspect of the present invention includes a circuit board body and a vibration detecting chip provided on the circuit board body.

[0017] In the circuit board, by providing the vibration detecting chip on the circuit board body, it is possible to immediately detect a vibration of the yarn winding device. As a result, in the case where the vibration is generated, it is possible for the circuit board to decrease a winding speed or to interrupt a winding operation if necessary. Accordingly, it is possible to prevent an electronic component of the yarn winding device from being damaged by a vibration, and being detached from the circuit board body.

[0018] Moreover, since it is not necessary to newly dispose a special board for detecting a vibration, the number of components can be reduced.

[0019] The circuit board may further include a signal processing section. The signal processing section is provided on the circuit board body and serves to process a result of detection which is obtained from the vibration detecting chip.

[0020] In the circuit board, it is possible to accurately detect a vibration generated in the yarn winding device through the vibration detecting chip. The reason is that the vibration detecting chip and the signal processing section are provided on the circuit board body and a deterioration in a signal is thus caused with difficulty.

[0021] A yarn winding device according to another aspect of the present invention includes a yarn feeding section, a winding section, a frame, and a vibration detecting section. The yarn feeding section feeds a spun yarn. The winding section winds the spun yarn fed from the yarn feeding section. The frame supports the winding section. The vibration detecting section is provided in the frame.

[0022] In the yarn winding device described above, the vibration detecting section can accurately detect a vibration generated in the winding section. The reason is that, since the vibration detecting section is provided in the frame, the vibration generated in the winding section is transmitted through the frame, and therefore, the vibration detecting section is not directly affected by the vibration generated in the winding section.

[0023] The yarn winding device may further include the circuit board body. The circuit board body is supported on the frame and is provided with the vibration detecting section.

[0024] In the yarn winding device described above, the vibration detecting section can accurately detect the vibration generated in the winding section. The reason is that, since the vibration detecting section is provided on the circuit board body in the frame, the vibration generated in the winding section is transmitted through the frame, and therefore, the vibration detecting section is not directly affected by the vibration generated in the winding section.

[0025] The yarn winding device may further include a winding control section. The winding control section is provided on the circuit board body and serves to control the winding operation of the winding section. The winding control section controls the winding operation of the winding section based on a result of detection which is obtained from the vibration detecting section.

[0026] In the above yarn winding device, the winding section can immediately carry out the winding operation depending on the result of the detection which is obtained from the vibration detecting section. The reason is that, since the vibration detecting section and the winding control section are provided on the circuit board body, the winding control section can quickly acquire the result of the detection which is obtained from the vibration detecting section.

[0027] The yarn winding device may further include an operation panel and an operation control section. The operation panel is provided on a surface of the frame. The operation control section is provided on the circuit board body and serves to process a result of operation which is obtained from the operation panel. The circuit board body is disposed in proximity to the operation panel.

[0028] In the above yarn winding device, the vibration detecting section can quickly detect a vibration transmitted from the winding section to the frame. The reason is that the circuit board body provided with the vibration detecting section is disposed in proximity to the operation panel.

[0029] The yarn winding device may further include a support member provided on a surface inside the frame. The circuit board body is supported on the frame through the support member.

[0030] In the above yarn winding device, the circuit board body can be supported on the frame in a stable posture through the support member. As a result, the vibration detecting section can more accurately detect a vibration transmitted from the winding section through the frame.

[0031] The yarn winding device may further include a yarn defect detecting section, a cutting section, a yarn joining section, an upper yarn guiding section and a lower yarn guiding section. The yarn defect detecting section detects a yarn defect of a spun yarn to be wound by the winding section. The cutting section cuts the spun yarn when the yarn defect is detected by the yarn defect detecting section. The yarn joining section joins a yarn end from the winding section and a yarn end from the yarn feeding section. The upper yarn guiding section guides the yarn end from the winding section to a yarn joining device. The lower yarn guiding section guides the yarn end from the yarn feeding section to the yarn joining device. The yarn defect detecting section, the cutting section, the yarn joining section, the upper yarn guiding section, and the lower yarn guiding section are supported

on an outside of the frame.

[0032] In the above yarn winding device, it is possible to detect, through the vibration detecting section, a vibration generated in the yarn winding device for winding a yarn while removing the yarn defect of the yarn. As a result, the yarn winding device can suppress an abnormal vibration, thereby winding a package through the winding section. Therefore, it is possible to efficiently wind a package of high quality.

[0033] The yarn feeding section may have a draft section and a pneumatic spinning section. The draft section drafts a sliver. The pneumatic spinning section applies twists to the sliver drafted by the draft section with air. The draft section and the pneumatic spinning section are supported on the outside of the frame.

[0034] It is possible to detect, through the vibration detecting section, a vibration generated in the above yarn winding device for forming a spun yarn from the sliver and winding the spun yarn. As a result, the yarn winding device can suppress an abnormal vibration to wind a package through the winding section. Therefore, it is possible to efficiently wind a package of high quality.

[0035] The circuit board and the winding device according to the present invention can accurately detect the abnormal vibration of the winding section.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036]

FIG. 1 is a schematic view illustrating a yarn winding unit provided in an automatic winder according to an embodiment of the present invention;

FIG. 2 is a perspective view illustrating an upper part of a unit frame;

FIG. 3 is a block diagram illustrating a control structure of the yarn winding unit;

FIG. 4 is a block diagram illustrating a circuit board;

FIG. 5 is a schematic perspective view illustrating a state in which the circuit board is attached to the unit frame; and

FIG. 6 is a flowchart for explaining a yarn winding speed control in the yarn winding unit.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

(1) Whole Yarn Winding Unit

[0037] With reference to FIG. 1, description will be given to a yarn winding unit (yarn winding device) constituting an automatic winder. FIG. 1 is a schematic view illustrating a yarn winding unit provided in an automatic winder according to an embodiment of the present invention. For example, the automatic winder includes a plurality of yarn winding units 1, a machine control device (not illustrated) for setting a large number of winding conditions of the yarn winding units 1 or the like, and an automatic doffing device (not illustrated), for example. The automatic doffing device is moved to the yarn winding unit 1 generating a doffing request signal and collects a package 205, and attaches a new winding bobbin 203 to the yarn winding unit 1, thereby executing a predetermined yarn hooking operation. The winding bobbin 203 is a member serving as a core of the package 205 and is formed by paper or plastic.

[0038] The yarn winding unit 1 has a yarn winding body 5 and a unit frame 7. The yarn winding body 5 carries out a winding operation for rewinding a yarn 207 (spun yarn) of a yarn feeding bobbin 201 as the package 205 having a predetermined shape while traversing the yarn 207.

[0039] The unit frame 7 supports the yarn winding body 5. A unit control section 101 (which will be described below) for controlling an operation of the yarn winding body 5 is provided in the unit frame 7.

(2) Yarn Winding Body

[0040] The yarn winding unit 1 is a device for winding the yarn 207 unwound from the yarn feeding bobbin 201 around the winding bobbin 203 while traversing the yarn 207, thereby forming the package 205 having a predetermined length and a predetermined shape. The yarn winding body 5 has a yarn feeding section 11, a yarn processing execution section 13, and a winding section 15.

[0041] The yarn feeding section 11 is a device for unwinding and feeding the yarn 207 from the yarn feeding bobbin 201. The yarn feeding section 11 is of a bobbin tray type and the yarn feeding bobbin 201 is sequentially fed to the yarn feeding section 11 of each yarn winding unit 1 in a state fixed to a tray. The yarn feeding section 11 has an unwinding assisting device 19. The unwinding assisting device 19 has a regulating member 20. The yarn processing execution section 13 is a device for processing the yarn 207 fed from the yarn feeding section 11. The yarn processing execution section 13 has a gate type tension applying device 21, a splicer 23 (a yarn joining section), and a yarn clearer 25 (a yarn defect detecting section).

[0042] The winding section 15 is a device for winding the yarn 207 processed by the yarn processing execution section 13 into the package 205. The winding section 15 has a cradle 29 holding the winding bobbin 203 and a traverse drum 31 for traversing the yarn 207.

[0043] As illustrated in FIG. 1, the yarn feeding section 11, the yarn processing execution section 13, and the winding section 15 are disposed in this order from upstream toward downstream in a yarn traveling direction. For this reason, in a yarn traveling path between the yarn feeding bobbin 201 and the traverse drum 31, the following devices are disposed in order from the upstream (the yarn feeding bobbin 201 side) in the yarn traveling direction. That is, the unwinding assisting device 19, the gate type tension applying device 21, the splicer 23, and the

yarn clearer 25 are disposed.

[0044] The cradle 29 has such a structure that the winding bobbin 203 can be supported rotatably. The cradle 29 is constituted rotatably with respect to the traverse drum 31 and a diameter of the package 205 is increased with a progress of the winding operation of the package 205 so that the cradle 29 is rotated. By the structure of the cradle 29, a suitable contact between the package 205 and the traverse drum 31 is maintained.

[0045] A spiral traverse groove 31a is formed on a peripheral surface of the traverse drum 31, and the yarn 207 is traversed by the traverse groove 31a. A drum driving motor 97 for rotating the traverse drum 31 and a motor control section 99 (which will be described below) are connected to the traverse drum 31.

[0046] Moreover, a drum rotating sensor 71 (for example, an encoder) as a sensor for detecting the progress of the winding operation is provided on a rotating shaft of the drum driving motor 97. The unit control section 101 can acquire a rotating speed of the traverse drum 31 by counting the number of rotating pulses transmitted from the drum rotating sensor 71.

[0047] The unwinding assisting device 19 is a device for moving down the regulating member 20 covering a core tube in conjunction with the unwinding of the yarn fed from the yarn feeding bobbin 201, thereby assisting the unwinding of the yarn fed from the yarn feeding bobbin 201. The regulating member 20 comes in contact with a balloon formed in an upper part of the yarn feeding bobbin 201 by a rotation of the yarn unwound from the yarn feeding bobbin 201 and a centrifugal force, and assists the unwinding of the yarn by applying a proper tension to the balloon.

[0048] In order to drive the unwinding assisting device 19, a first driving section 75 is provided. The first driving section 75 moves the unwinding assisting device 19 upward and downward based on a driving signal sent from the unit control section 101.

[0049] The gate type tension applying device 21 serves to apply a predetermined tension to the traveling yarn 207. The gate type tension applying device 21 includes a fixed comb tooth and a movable comb tooth. In order to drive the movable comb tooth of the gate type tension applying device 21, a second driving section 77 is provided. The second driving section 77 is a rotary type solenoid, for example, and can switch a state in which the comb teeth are engaged with each other and a state in which they are released from each other.

[0050] The splicer 23 is a device for joining the yarn 207 from the yarn feeding bobbin 201 and the yarn 207 from the package 205 in yarn breakage, yarn cut, or the like. The splicer 23 includes a plurality of levers such as yarn handlers (not illustrated), and a series of operations of the levers is driven by a cam system. In order to operate the levers of the splicer 23, a third driving section 79 is provided. The third driving section 79 drives the levers of the splicer 23 based on a driving signal sent from the unit control section 101.

[0051] The yarn clearer 25 is a device for detecting a defect of the yarn 207. A signal corresponding to a thickness of the yarn 207 fed from the yarn clearer 25 is processed by a proper analyzer so that a yarn defect such as a slub is detected. Moreover, the yarn clearer 25 is provided with a cutter 25a (cutting section) for yarn cutting in the detection of the yarn defect. Furthermore, a yarn traveling sensor 81 (FIG. 3) is provided to detect traveling of the yarn 207 in the yarn clearer 25. The yarn traveling sensor 81 transmits a yarn cut signal to the unit control section 101 when the traveling of the yarn 207 cannot be detected.

[0052] A lower yarn guiding pipe 35 (lower yarn guiding section) for sucking and catching the yarn 207 from the yarn feeding bobbin 201 and guiding the yarn 207 to the splicer 23 is provided on a lower side of the splicer 23, and an upper yarn guiding pipe 37 (upper yarn guiding section) for sucking and catching the yarn 207 from the package 205 and guiding the yarn 207 to the splicer 23 is provided on an upper side of the splicer 23.

[0053] The lower yarn guiding pipe 35 is rotatably attached to the unit frame 7 around a shaft 35a, and a suction port 36 is provided on the tip. The upper yarn guiding pipe 37 is rotatably attached to the unit frame 7 around a shaft 37a, and a suction mouth 38 is provided on the tip. A negative pressure source is connected to the lower yarn guiding pipe 35 and the upper yarn guiding pipe 37. Consequently, a suction flow can be generated in the suction port 36 and the suction mouth 38.

[0054] In order to drive the lower yarn guiding pipe 35, a fourth driving section 85 of a stepping type is provided. The fourth driving section 85 can drive the lower yarn guiding pipe 35 to swing around the shaft 35a. The fourth driving section 85 swings the lower yarn guiding pipe 35 based on a driving signal sent from the unit control section 101. Moreover, the lower yarn guiding pipe 35 is provided with a lower yarn guiding pipe sensor 87 to be connected to the unit control section 101. The lower yarn guiding pipe sensor 87 is constituted as an optical type, for example, and transmits a yarn detecting signal to the unit control section 101 if the yarn 207 sucked into the pipe is detected.

[0055] Similarly, a fifth driving section 91 of a stepping type is provided in order to drive the upper yarn guiding pipe 37. The fifth driving section 91 can drive the upper yarn guiding pipe 37 to be swung around the shaft 37a. The fifth driving section 91 can swing the upper yarn guiding pipe 37 based on the driving signal sent from the unit control section 101. Moreover, the upper yarn guiding pipe 37 is provided with the upper yarn guiding pipe sensor 93. The upper yarn guiding pipe sensor 93 is constituted as an optical type, for example, and transmits a yarn detecting signal to the unit control section 101 if the yarn 207 sucked into the pipe is detected.

[0056] With this structure, in the yarn breakage or yarn cut, the lower yarn guiding pipe 35 sucks and catches the yarn 207 from the yarn feeding bobbin 201 at a position illustrated in FIG. 1, and is swung in an upward

direction around the shaft 35a to guide the yarn 207 to the splicer 23. At the same time, the upper yarn guiding pipe 37 is swung in the upward direction around the shaft 37a from the position illustrated in FIG. 1, sucks and catches the yarn 207 from the package 205 which is rotated reversely, and furthermore, is swung in a downward direction around the shaft 37a to guide the yarn 207 to the splicer 23. Then, the splicer 23 joins two yarns 207 thus guided by a predetermined yarn joining operation.

(3) Unit Frame

[0057] Next, the unit frame 7 will be described with reference to FIG. 2. FIG. 2 is a perspective view illustrating an upper part of the unit frame.

[0058] The unit frame 7 has the structure for supporting the yarn winding body 5 as described above, and has a pair of side surfaces 41 which are orthogonal to a direction in which the yarn winding unit 1 is arranged, a front surface 43, and a curved surface 45 for connecting the side surface 41 and the front surface 43 to be curved, as illustrated in FIG. 2. An operation panel 47 is formed across the front surface 43 and the curved surface 45 in the upper part of the unit frame 7. The curved surface 45 is not required to be formed in the unit frame 7.

[0059] The operation panel 47 includes a front surface section 47a corresponding to the front surface 43 and a pair of curved sections 47b corresponding to the curved surface 45. The front surface section 47a is provided with a display section 49, an operation button unit 51 having a cross-shaped layout, and an operation switch 53 in this order from top to bottom. The display section 49 is a device for laterally arranging and displaying three characters or numerals stored in a RAM (Random Access Memory) provided in the unit control section 101. The operation button unit 51 is constituted by a plurality of buttons. Each of the buttons is electrically connected to a controller 107, and when each of the buttons is pressed down, a signal is transmitted to the controller 107. The operation switch 53 serves to switch the operations of the yarn winding body 5 between driving and stopping.

(4) Unit Control Section

[0060] The unit control section 101 will be described with reference to FIG. 3. FIG. 3 is a block diagram illustrating a control structure of the yarn winding unit. The unit control section 101 includes a CPU (Central Processing Unit) that is an arithmetic processing unit, a ROM (Read Only Memory) for storing a control program to be executed by the CPU and data to be used in the control program, and a RAM for temporarily storing data in execution of the program. When the control program stored in the ROM is read into the CPU and is executed over the CPU, the control program implements control by using hardware such as the CPU.

[0061] Description will be given to a physical structure and arrangement of the unit control section 101. The unit control section 101 includes a circuit board 105. The circuit board 105 has a circuit board body 105a, a controller 107 constituted by a CPU, a vibration detecting chip 109 (vibration detecting section), and a signal processing section 111. The controller 107, the vibration detecting chip 109, and the signal processing section 111 are disposed on the circuit board body 105a. FIG. 4 illustrates a block structure of the circuit board 105. More specifically, the vibration detecting chip 109 and the signal processing section 111 are illustrated on the circuit board body 105a.

[0062] As described above, the controller 107 is connected to a plurality of input/output devices and executes various control operations. The controller 107 has a winding control function for controlling the winding operation of the winding section 15, and controls the winding operation of the winding section 15 based on a result of detection which is obtained from the vibration detecting chip 109. The controller 107 further has an operation control function for processing a result of operation obtained from the operation panel 47.

[0063] The vibration detecting chip 109 is a shock sensor which functions as a vibration detecting section and a single chip provided on the circuit board 105 in the embodiment. The signal processing section 111 amplifies a detecting signal (vibration strength signal) sent from the vibration detecting chip 109 through an amplifier, and then transmits the amplified signal to the controller 107, for example. The controller 107 compares the vibration strength signal with a reference value.

[0064] The vibration detecting chip 109, the signal processing section 111, and the controller 107 are provided on the circuit board body 105a as described above. Accordingly, a signal transmission time required from the vibration detecting chip 109 to the signal processing section 111 is short. As a result, a time required from the detection of the vibration through the vibration detecting chip 109 to the processing for the result of the detection through the signal processing section 111 is shortened. Furthermore, the controller 107 can accurately acquire the result of the detection which is obtained from the vibration detecting chip 109. As a result, the controller 107 can accurately control the winding section 15. Moreover, the winding section 15 can immediately carry out the winding operation corresponding to the result of the detection which is obtained from the vibration detecting chip 109. Conventionally, a signal wire from the vibration detecting section to the control section has been long. For this reason, a time lag has sometimes occurred in the signal processing for detecting the vibration through the control section. In such cases, processing corresponding to the result of the detection of the abnormal vibration in the cradle cannot be carried out in a proper timing.

[0065] The circuit board 105 is provided in the unit frame 7 and the circuit board body 105a is supported on the unit frame 7. With reference to FIG. 5, description will be given to a structure in which the circuit board 105 is actually attached to the unit frame 7. As illustrated in FIG.

5, the unit frame 7 has a plate-shaped support member 61. A plurality of studs 63 are provided on a plane inside the support member 61. The stud 63 is formed separately from or integrally with the support member 61 and is extended vertically from the plane of the support member 61. A screw hole (not illustrated) is formed on a tip of the stud 63. The circuit board 105 is supported on the studs 63, and furthermore, a screw (not illustrated) penetrates through the circuit board 105 and is thus screwed into the screw hole of the stud 63 so that the circuit board body 105a is fixed to the stud 63.

[0066] Thus, the circuit board 105 is provided apart from the winding section 15 of the yarn winding unit 1. Therefore, the vibration detecting chip 109 is not directly affected by a vibration in the winding section 15. Therefore, the vibration detecting chip 109 can accurately detect a vibration generated in the yarn winding unit 1. Moreover, the circuit board body 105a is supported on the unit frame 7 in a stable posture by means of the stud 63. Therefore, the vibration detecting chip 109 can detect a vibration transmitted from the winding section 15 through the unit frame 7 more accurately.

[0067] The circuit board 105 is disposed in proximity to the operation panel 47. With reference to FIG. 2, description will be given to a specific place in which the circuit board 105 is to be disposed. The circuit board 105 is disposed in a first section 211 provided below the operation panel 47. As another example, the circuit board 105 is disposed in a second section 213 at a rear side of a display section 49 in an upper part of the operation panel 47.

[0068] The circuit board 105 including the vibration detecting chip 109 is provided in proximity to the surface of the unit frame 7. Therefore, the vibration detecting chip 109 can quickly detect a vibration transmitted from the winding section 15 to the unit frame 7.

(5) Motor Control Section

[0069] The motor control section 99 can rotate the traverse drum 31 in a predetermined number of rotations. The motor control section 99 is constituted by hardware including a CPU, a RAM, a ROM, and the like, and a program stored in the ROM, for example. The motor control section 99 controls rotation or stopping of the drum driving motor 97 based on a signal sent from the unit control section 101.

[0070] The motor control section 99 includes an accelerating section 99a for transmitting an accelerating signal to the drum driving motor 97, and a decelerating section 99b for transmitting a decelerating signal to the drum driving motor 97. The motor control section 99 controls acceleration of the drum driving motor 97 by the accelerating section 99a or controls deceleration of the drum driving motor 97 by the decelerating section 99b based on a result of comparison which is obtained from the controller 107.

(6) Yarn Winding Speed Control

[0071] Next, a flow of yarn winding speed control will be described with reference to FIG. 6. FIG. 6 is a flowchart for explaining the yarn winding speed control in the yarn winding unit. The following operation is a control operation to be mainly carried out by the controller 107. First of all, when a new winding bobbin 203 is set in the cradle 29, a yarn is hooked on the winding bobbin 203 by a yarn hooking device (not illustrated) so that winding is started.

[0072] After the winding is started, the controller 107 of the unit control section 101 transmits a signal to the motor control section 99 to increase the winding speed until a predetermined speed (touch winding setting speed) which is lower than a normal speed is reached (step S1).

[0073] If the winding speed reaches the touch winding setting speed, touch winding control is started. Specifically, first of all, the controller 107 compares the vibration strength signal subjected to signal processing through the signal processing section 111 with a predetermined value (step S2). If the vibration strength signal is equal to or smaller than the predetermined value, it is determined that there is room for increasing the winding speed and acceleration processing is executed (steps S3 to S5). If the vibration strength signal is greater than the predetermined value, deceleration processing is executed to set the strength of the vibration to be equal to or smaller than the predetermined value (steps S6 to S8).

[0074] If the predetermined value to be used for the comparison in the determination in step S2 is excessively great, the vibration of the cradle 29 is increased so that an electronic component provided on the circuit board 105 or the like is damaged by the vibration. On the contrary, if the predetermined value is excessively small, it is impossible to increase the winding speed greatly. For this reason, a productivity of the yarn winding unit 1 is reduced. Accordingly, a proper value is previously set to be the predetermined value in consideration of the circumstances described above.

[0075] Steps S3 to S5 indicate the processing for accelerating the winding speed and correspond to the function of the accelerating section 99a. In other words, if the vibration strength signal is equal to or smaller than the predetermined value in the determination in step S2, processing for increasing the winding speed of the drum driving motor 97 by a predetermined speed is repeated until the vibration strength signal is greater than the predetermined value (steps S3 and S4). If the vibration strength signal is greater than the predetermined value, a rotating speed of the drum driving motor 97 is decelerated to a last rotating speed (that is, a rotating speed at which the vibration strength signal determined to be equal to or smaller than the predetermined value) (step S5) and the acceleration processing is ended.

[0076] Steps S6 to S8 indicate the processing for decelerating the winding speed and correspond to the function of the decelerating section 99b. In other words, if the

vibration strength signal is greater than the predetermined value in the determination in step S2, processing for decreasing the rotating speed of the drum driving motor 97 by a predetermined speed is repeated until the vibration strength signal is equal to or smaller than the predetermined value (steps S6 and S7). If the vibration strength signal is equal to or smaller than the predetermined value, the rotating speed of the drum driving motor 97 is maintained as it is (step S8) and the deceleration processing is ended.

[0077] If either of the acceleration processing and the deceleration processing is executed, the end of the winding operation is determined when the processing has ended (step S9). In this processing, it is checked whether a winding length at a winding start of the yarn around the empty winding bobbin 203 has reached a predetermined length or not. If the winding length is equal to or greater than the predetermined length, it implies a completion of the package 205, and processing for ending the winding is executed so that the flow is ended. If the winding length is smaller than the predetermined length, the processing returns to step S2, and the winding operation is continued.

[0078] When the processing returns to step S2, the controller 107 checks the strength of the vibration again and compares the strength with a predetermined strength, and carries out the acceleration processing or the deceleration processing depending on the result of the comparison. In the package 205, generally, a rotation is gradually stabilized when the yarn is wound thickly. Therefore, even for a winding speed which conventionally cannot be implemented because the strength of the vibration exceeds the predetermined value, if the acceleration to the winding speed was carried out again after a package diameter is increased, the strength of the vibration is likely to be maintained at the predetermined value or less. As a result, the processings of steps S2 to S9 are repeated so that the winding speed can be gradually increased from the touch winding setting speed along with the thickening of the package 205.

[0079] The loop of steps S2 to S9 can be continuously executed not only at an initial stage of the winding operation, i.e., a touch winding period, but also after arrival of a normal winding speed. The normal winding speed represents a target winding speed to be input through a manipulation of an input device (not illustrated) by an operator at the start of the winding.

(7) Feature

[0080] The above embodiment can be expressed as follows.

(A) The circuit board 105 for the yarn winding unit 1 includes the circuit board body 105a, and the vibration detecting chip 109 provided on the circuit board body 105a.

[0081] The circuit board 105 has the vibration detecting chip 109 provided on the circuit board body 105a. Consequently, it is possible to immediately detect the vibration of the yarn winding unit 1. As a result, in the case in which the vibration is generated, it is possible to decrease the winding speed or to interrupt the winding operation if necessary. Accordingly, it is possible to prevent the electronic component of the yarn winding unit 1 from being damaged by the vibration and being detached from the circuit board body 105a. Moreover, since it is not necessary to newly dispose a special board for detecting a vibration, the number of the components can be reduced.

(B) The yarn winding unit 1 further includes the signal processing section 111. The signal processing section 111 is provided on the circuit board body 105a and serves to process a result of detection which is obtained from the vibration detecting chip 109.

[0082] In the circuit board 105, the vibration detecting chip 109 can accurately detect a vibration generated in the yarn winding unit 1. The reason is that the vibration detecting chip 109 and the signal processing section 111 are provided on the circuit board body 105a and a deterioration in a signal is unlikely to occur.

(C) The yarn winding unit 1 includes the yarn feeding section 11, the winding section 15, the unit frame 7 (frame), and the vibration detecting chip 109. The yarn feeding section 11 feeds the yarn 207. The winding section 15 winds the yarn 207 fed from the yarn feeding section 11. The unit frame 7 supports the winding section 15. The vibration detecting chip 109 is provided in the unit frame 7.

[0083] In the yarn winding unit 1 according to this embodiment, the vibration detecting chip 109 can accurately detect the vibration generated in the winding section 15. The reason is that the vibration detecting chip 109 is provided in the unit frame 7. In other words, the vibration generated in the winding section 15 is transmitted through the unit frame 7. For this reason, the vibration detecting chip 109 is not directly affected by the vibration generated in the winding section 15.

[0084] The yarn winding unit 1 further includes the circuit board body 105a. The circuit board body 105a is supported on the unit frame 7 and is provided with the vibration detecting chip 109.

[0085] In the yarn winding unit 1 according to this embodiment, the vibration detecting chip 109 can accurately detect the vibration generated in the winding section 15. The reason is that the vibration detecting chip 109 is provided on the circuit board body 105a in the unit frame 7. In other words, the vibration generated in the winding section 15 is transmitted through the unit frame 7, and therefore, the vibration detecting chip 109 is not directly affected by the vibration generated in the winding section 15.

(D) The controller 107 of the circuit board 105 further has a winding control function for controlling the winding operation of the winding section 15. The controller 107 controls the winding operation of the winding section 15 based on the result of the detection which is obtained from the vibration detecting chip 109. In the yarn winding unit 1 according to this embodiment, the controller 107 can quickly control the winding section 15. In other words, the winding section 15 can immediately carry out the winding operation depending on the result of the detection which is obtained from the vibration detecting chip 109. The reason is that the vibration detecting chip 109 and the controller 107 are provided on the circuit board body 105a, and therefore, the controller 107 can quickly acquire the result of the detection which is obtained from the vibration detecting chip 109.

(E) The yarn winding unit 1 further includes the operation panel 47 provided on the surface of the unit frame 7. The controller 107 is provided on the circuit board body 105a and has a function for processing the result of the operation sent from the operation panel 47. The circuit board 105 is disposed in proximity to the operation panel 47.

In the yarn winding unit 1 according to this embodiment, the vibration detecting chip 109 can quickly detect a vibration transmitted from the winding section 15 to the unit frame 7. The reason is that the circuit board body 105a provided with the vibration detecting chip 109 is disposed in proximity to the surface of the unit frame 7.

(F) The yarn winding unit 1 further includes the stud 63 provided on the surface inside the unit frame 7. The circuit board body 105a is supported on the unit frame 7 through the stud 63. In the yarn winding unit 1 according to this embodiment, it is possible to support the circuit board body 105a on the unit frame 7 in a stable posture by the stud 63. As a result, the vibration detecting chip 109 can more accurately detect a vibration transmitted from the winding section 15 through the unit frame 7.

(G) The yarn winding unit 1 further includes the yarn clearer 25, the splicer 23, the upper yarn guiding pipe 37, and the lower yarn guiding pipe 35. The yarn clearer 25 detects a yarn defect of the yarn 207 to be wound by the winding section 15, and furthermore, cuts the yarn 207 if the yarn defect is detected. The splicer 23 joins the yarn end from the winding section 15 and the yarn end from the yarn feeding section 11. The upper yarn guiding pipe 37 guides the yarn end from the winding section 15 to the splicer 23. The lower yarn guiding pipe 35 guides the yarn end from the yarn feeding section 11 to the splicer 23. The yarn clearer 25, the splicer 23, the upper yarn guiding pipe 37, and the lower yarn guiding pipe 35 are supported at the outside of the unit frame 7.

[0086] In the yarn winding unit 1 according to this embodiment, the vibration detecting chip 109 can detect a vibration generated in the yarn winding device for winding a spun yarn while unwinding a yarn defect of the spun yarn. As a result, the yarn winding unit 1 can suppress an abnormal vibration, thereby winding the package 205 through the winding section 15. Thus, it is possible to efficiently wind a package of high quality.

(8) Other Embodiments

[0087] Although the embodiment according to the present invention has been described above, the present invention is not limited to the above embodiment but various changes can be made without departing from the gist of the invention. In particular, it is possible to optionally combine the embodiments and variants described herein if necessary.

(a) Although the vibration detecting chip is provided on the circuit board in the above embodiment, the present invention is not limited to the embodiment as long as the vibration detecting chip is provided in the unit frame. If the vibration detecting chip is simply provided in the unit frame, the vibration generated in the winding section is transmitted to the vibration detecting chip through the unit frame so that the vibration detecting chip can detect the vibration without being directly affected by the vibration generated in the winding section.

(b) Although the vibration detecting sensor is described as a single chip in the above embodiment, the present invention is not limited to such an embodiment. For example, a shock sensor, an amplifier, and a peripheral circuit may be formed into a single chip.

(c) Although nothing is provided between the yarn clearer and the traverse drum in the above embodiment, it is also possible to provide a yarn accumulating section and/or a waxing device between the yarn clearer and the traverse drum.

(d) Although the traverse drum is employed as a device for traversing a yarn with respect to a package in the above embodiment, the present invention is not limited to such an embodiment. For example, it is also possible to employ an arm-type traverse device provided with an arm having a yarn guide on the tip and oscillates at a high speed while holding a yarn by the yarn guide. Furthermore, it is also possible to employ a belt-type traverse device which includes a toothed belt, a yarn guide provided in the toothed belt, and a motor for reciprocating the toothed belt.

(e) Referring to the detection as to whether a strength of a vibration is equal to or smaller than a predetermined value or not (within tolerance or not), in place of a structure in which a strength of a vibration is simply compared with a predetermined value, for example, it is possible to employ a structure in which

a frequency analysis of a vibration strength signal is carried out to compare a specific frequency component with a predetermined strength.

(f) If a strength of a vibration is greater than a predetermined value, deceleration processing is executed. On the other hand, it is also possible to employ a structure in which acceleration processing is not executed if the strength of the vibration is equal or smaller than the predetermined value. In this case, since control (acceleration control) in such a direction as to increase a vibration is not carried out, the structure is suitable for the case in which an increase in a life of the electronic component provided on the circuit board is demanded.

(g) It is possible to properly set, by an operator, whether or not each of the acceleration processing and the deceleration processing is executed or whether or not the deceleration processing is executed after the end of the touch winding. This structure is advantageous in that proper winding speed control can be carried out depending on a situation.

(h) An operator can properly set the set strength of the vibration and the touch winding end condition. This structure is advantageous in that the condition can be flexibly changed depending on a situation in which an automatic winder is disposed or the like.

(i) Referring to the comparison with the set strength through the controller, it is also possible to decide that the strength of the vibration detected by the vibration detecting section exceeds the set strength when the strength of the vibration exceeds the set strength for a moment. Alternatively, it is also possible to decide that the strength of the vibration exceeds the set strength if the state in which the strength of the vibration exceeds the set strength is maintained for a predetermined period of time.

(j) Although the unit control section does not execute the acceleration control and the deceleration control corresponding to the vibration of the cradle until the touch winding setting speed is reached in the above embodiment, the acceleration control and/or the deceleration control may also be executed for this period. Moreover, it is possible to properly carry out a selection for the period in which the acceleration control and the deceleration control are to be executed at this time.

(k) In the above embodiment, it is assumed that the acceleration control can be continuously executed even after the normal winding speed is reached. However, after the normal winding speed is reached, it is also possible to maintain a target winding speed, thereby carrying out the winding operation continuously without executing the acceleration control and the deceleration control corresponding to the strength of the vibration of the cradle. Alternatively, it is also possible to previously set a maximum winding speed of the automatic winder and to carry out the acceleration control of the winding speed corresponding to the strength of the vibration of the cradle within such a range that the winding speed is equal to or lower than the maximum winding speed at which the winding can be performed even after the normal winding speed is reached.

(l) The structure according to the above embodiment is not limited to the automatic winder, and can be applied to other yarn winding devices such as a fine spinning machine. In this case, the yarn feeding section 11 has a draft section and a pneumatic spinning section. The draft section drafts a sliver. The pneumatic spinning section applies twists, with air, to the sliver drafted by the draft section. The draft section and the pneumatic spinning section are supported on the outside of the unit frame 7.

[0088] By the vibration detecting chip 109, it is possible to detect a vibration generated in the yarn winding unit 1 for forming a spun yarn from the sliver to wind the spun yarn. As a result, the yarn winding unit 1 can suppress an abnormal vibration, and wind the package 205 through the winding section 15. Therefore, it is possible to efficiently wind a package of high quality.

(m) Although the gate-type tension applying device is used in the embodiment, the present invention is not limited to such an embodiment. For example, it is also possible to use a disk-type tension applying device. The disk-type tension applying device includes a pair of disk members and holds a yarn therebetween while rotating the disk members, thereby applying a predetermined tension to the traveling yarn.

[0089] The present invention can be widely applied to a circuit board and a yarn winding device including the circuit board.

Claims

1. A yarn winding device (1) comprising:

   a yarn feeding section (11) for feeding a spun yarn (207);
   a winding section (15) for winding the spun yarn (207) fed from the yarn feeding section (11);
   a frame (7) for supporting the winding section (15); and
   a vibration detecting section (109) provided in the frame (7), **characterized by** further comprising a circuit board body (105a) supported on the frame (7) and provided with the vibration detecting section (109).

2. The yarn winding device (1) according to claim 1, **characterized by** further comprising a winding control section (107) provided on the circuit board body

(105a) for controlling a winding operation of the winding section (15), wherein
the winding control section (107) controls the winding operation of the winding section (15) based on a result of detection which is obtained from the vibration detecting section (109).

3. The yarn winding device (1) according to claim 1 or 2, **characterized by** further comprising:

an operation panel (47) provided on a surface of the frame (7); and
an operation control section (107) provided on the circuit board body (105a) for processing a result of operation which is obtained from the operation panel (47), wherein
the circuit board body (105a) is disposed in proximity to the operation panel (47).

4. The yarn winding device (1) according to any of claims 1 to 3, **characterized by** further comprising a support member (61) provided on a surface inside the frame (7), wherein
the circuit board body (105a) is supported on the frame (7) through the support member (61).

5. The yarn winding device (1) according to any of claims 1 to 4, **characterized by** further comprising:

a yarn defect detecting section (25) for detecting a yarn defect of the spun yarn (207) wound by the winding section (15);
a cutting section (25a) for cutting the spun yarn (207) when the yarn defect is detected by the yarn defect detecting section;
a yarn joining section (23) for joining a yarn end from the yarn winding section and a yarn end from the yarn feeding section;
an upper yarn guiding section (37) for guiding the yarn end from the winding section to the yarn joining device; and
a lower yarn guiding section (35) for guiding the yarn end from the yarn feeding section to the yarn joining device, wherein
the yarn defect detecting section (25), the cutting section (25a), the yarn joining section (23), the upper yarn guiding section (37), and the lower yarn guiding section (35) are supported on an outside of the frame (7).

6. The yarn winding device according to any of claims 1 to 5, **characterized in that**
the yarn feeding section has
a draft section for drafting a sliver, and
a pneumatic spinning section for applying twists, with air, to the sliver drafted by the draft section, and
the draft section and the pneumatic spinning section is supported on the outside of the frame.

Patentansprüche

1. Garnwickelvorrichtung (1), umfassend:

einen Garn-Zufuhrabschnitt (11) zum Zuführen eines gesponnenen Garns (207);
einen Wickelabschnitt (15) zum Wickeln des gesponnenen Garns (207), welches von dem Garn-Zufuhrabschnitt (11) zugeführt wird;
einen Rahmen (7) zum Tragen des Wickelabschnitts (15); und
einen Vibrations-Detektionsabschnitt (109), welcher in dem Rahmen (7) bereitgestellt ist, **dadurch gekennzeichnet, dass** sie ferner einen Schaltungsplatinenkörper (105a) umfasst, welcher an dem Rahmen (7) getragen und mit dem Vibrations-Detektionsabschnitt (109) bereitgestellt ist.

2. Garnwickelvorrichtung (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** sie ferner einen Wickel-Steuer-/Regelabschnitt (107) umfasst, welcher an dem Schaltungsplatinenkörper (105a) zum Steuern/Regeln eines Wickelbetriebs des Wickelabschnitts (15) bereitgestellt ist, wobei der Wickel-Steuer-/Regelabschnitt (107) den Wickelbetrieb des Wickelabschnitts (15) auf Grundlage eines Detektionsergebnisses steuert/regelt, welches von dem Vibrations-Detektionsabschnitt (109) erhalten wird.

3. Garnwickelvorrichtung (1) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** sie ferner umfasst:

ein Betriebspaneel (47), welches an einer Fläche des Rahmens (7) bereitgestellt ist; und
einen Betriebs-Steuer-/Regelabschnitt (107), welcher an dem Schaltungsplatinenkörper (105a) zum Prozessieren eines Betriebsergebnisses bereitgestellt ist, welches von dem Betriebspaneel (47) erhalten wird, wobei
der Schaltungsplatinenkörper (105a) nahe zu dem Betriebspaneel (47) angeordnet ist.

4. Garnwickelvorrichtung (1) nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** sie ferner ein Trageelement (61) umfasst, welches an einer Fläche innerhalb des Rahmens (7) bereitgestellt ist, wobei
der Schaltungsplatinenkörper (105a) an dem Rahmen (7) durch das Trageelement (61) getragen ist.

5. Garnwickelvorrichtung (1) nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** sie ferner umfasst:

einen Garndefekt-Detektionsabschnitt (25) zum Detektieren eines Garndefekts des gesponnenen Garns (207), welches von dem Wickelab-

schnitt (15) gewickelt wird;
einen Schneidabschnitt (25a) zum Schneiden des gesponnenen Garns (207), wenn der Garndefekt von dem Garndefekt-Detektionsabschnitt detektiert wird;
einen Garn-Verbindungsabschnitt (23) zum Verbinden eines Garnendes von dem Garn-Wickelabschnitt und eines Garnendes von dem Garn-Zufuhrabschnitt;
einen oberen Garn-Führungsabschnitt (37) zum Führen des Garnendes von dem Wickelabschnitt zu der Garn-Verbindungsvorrichtung; und
einen unteren Garn-Führungsabschnitt (35) zum Führen des Garnendes von dem Garn-Zufuhrabschnitt zu der Garn-Verbindungsvorrichtung, wobei
der Garndefekt-Detektionsabschnitt (25), der Schneidabschnitt (25a), der Garn-Verbindungsabschnitt (23), der obere Garn-Führungsabschnitt (37) und der untere Garn-Führungsabschnitt (35) an einer Außenseite des Rahmens (7) getragen sind.

6. Garnwickelvorrichtung nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass**
der Garn-Führungsabschnitt einen Ziehabschnitt zum Ziehen eines Vorbandes und einen pneumatischen Spinnabschnitt zum Einwirken von Verdrehungen mit Luft auf das von dem Ziehabschnitt gezogene Vorband umfasst, und
der Ziehabschnitt und der pneumatische Spinnabschnitt an der Außenseite des Rahmens getragen sind.

Revendications

1. Dispositif de bobinage de fil (1), comprenant :

une section d'alimentation en fil (11) destinée à l'alimentation en filé (207) ;
une section de bobinage (15) destinée au bobinage du filé (207) délivré par la section d'alimentation en fil (11) ;
un châssis (7) destiné à supporter la section de bobinage (15) ; et
une section de détection de vibration (109) prévue dans le châssis (7), **caractérisé en ce qu'**il comprend en outre un corps de carte de circuit imprimé (105a) supporté sur le châssis (7) et doté de la section de détection de vibration (109).

2. Dispositif de bobinage de fil (1) selon la revendication 1, **caractérisé en ce qu'**il comprend en outre une section de commande de bobinage (107) prévue sur le corps de carte de circuit imprimé (105a) pour commander une opération de bobinage de la section de bobinage (15), dans lequel
la section de commande de bobinage (107) commande l'opération de bobinage de la section de bobinage (15) sur la base d'un résultat de détection qui est obtenu en provenance de la section de détection de vibration (109).

3. Dispositif de bobinage de fil (1) selon la revendication 1 ou 2, **caractérisé en ce qu'**il comprend en outre :

un panneau d'opération (47) prévu sur une surface du châssis (7) ; et
une section de commande d'opération (107) prévue sur le corps de carte de circuit imprimé (105a) pour traiter un résultat d'opération qui est obtenu en provenance du panneau d'opération (47), dans lequel
le corps de carte de circuit imprimé (105a) est disposé à proximité du panneau d'opération (47).

4. Dispositif de bobinage de fil (1) selon l'une quelconque des revendications 1 à 3, **caractérisé en ce qu'**il comprend en outre un organe de support (61) prévu sur une surface à l'intérieur du châssis (7), dans lequel
le corps de carte de circuit imprimé (105a) est supporté sur le châssis (7) par l'intermédiaire de l'organe de support (61).

5. Dispositif de bobinage de fil (1) selon l'une quelconque des revendications 1 à 4, **caractérisé en ce qu'**il comprend en outre :

une section de détection de défaut de fil (25) destinée à la détection d'un défaut de fil sur le filé (207) bobiné par la section de bobinage (15) ;
une section de coupe (25a) destinée à la coupe du filé (207) lorsque le défaut de fil est détecté par la section de détection de défaut de fil ;
une section de jonction de fil (23) destinée à joindre une extrémité de fil de la section de bobinage de fil et une extrémité de fil de la section d'alimentation en fil ;
une section de guidage de fil supérieure (37) destinée au guidage de l'extrémité de fil de la section de bobinage au dispositif de jonction de fil ; et
une section de guidage de fil inférieure (35) destinée au guidage de l'extrémité de fil de la section d'alimentation en fil au dispositif de jonction de fil, dans lequel
la section de détection de défaut de fil (25), la section de coupe (25a), la section de jonction de fil (23), la section de guidage de fil supérieure

(37) et la section de guidage de fil inférieure (35) sont supportées sur un extérieur du châssis (7).

6. Dispositif de bobinage de fil selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** la section d'alimentation en fil a
une section d'étirement destinée à l'étirement d'un ruban, et
une section de filage pneumatique destinée à l'application de torsions, avec de l'air, au ruban étiré par la section d'étirement, et
la section d'étirement et la section de filage pneumatique sont supportées sur l'extérieur du châssis.

FIG. 1

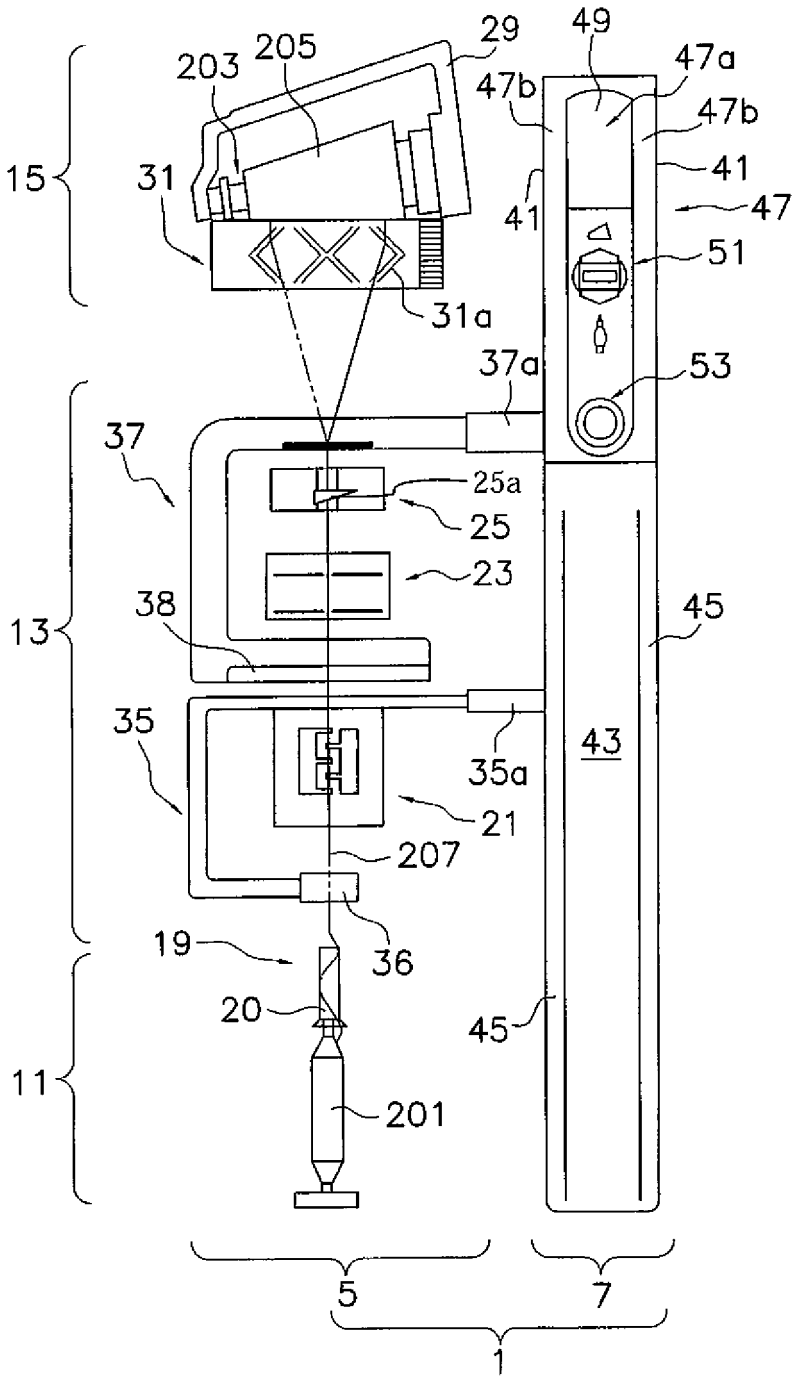

15
13
11
5
7
1
29
203
205
31
31a
49
47a
47b
47b
41
41
47
51
53
37a
37
25a
25
23
38
45
35
35a
43
21
207
36
19
20
45
201

FIG. 2

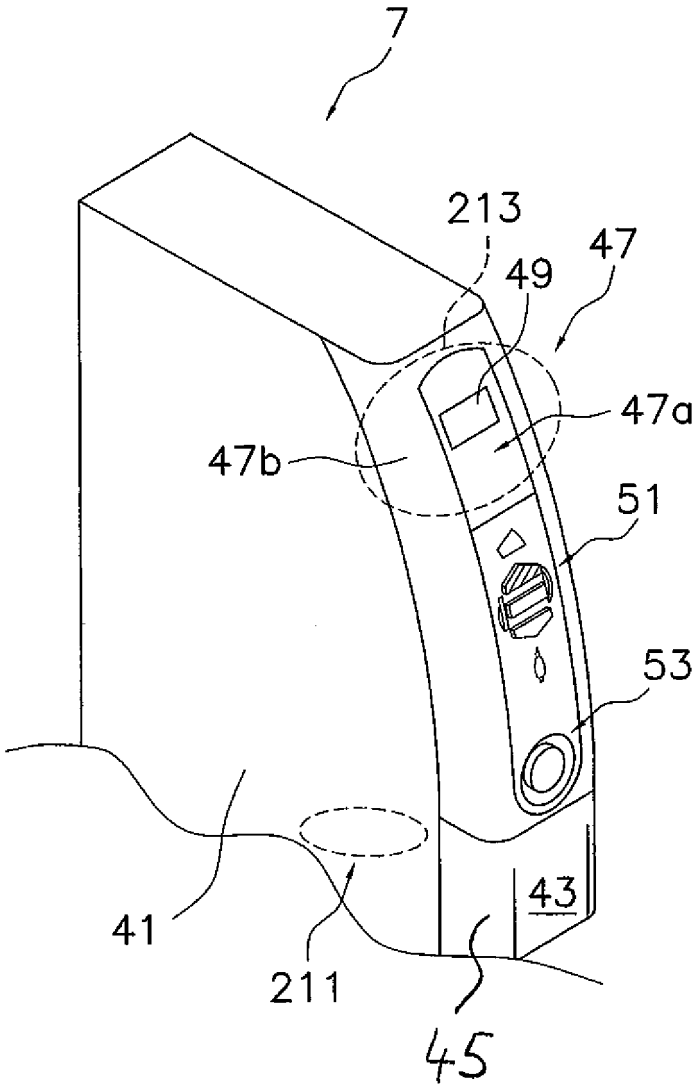


FIG. 3

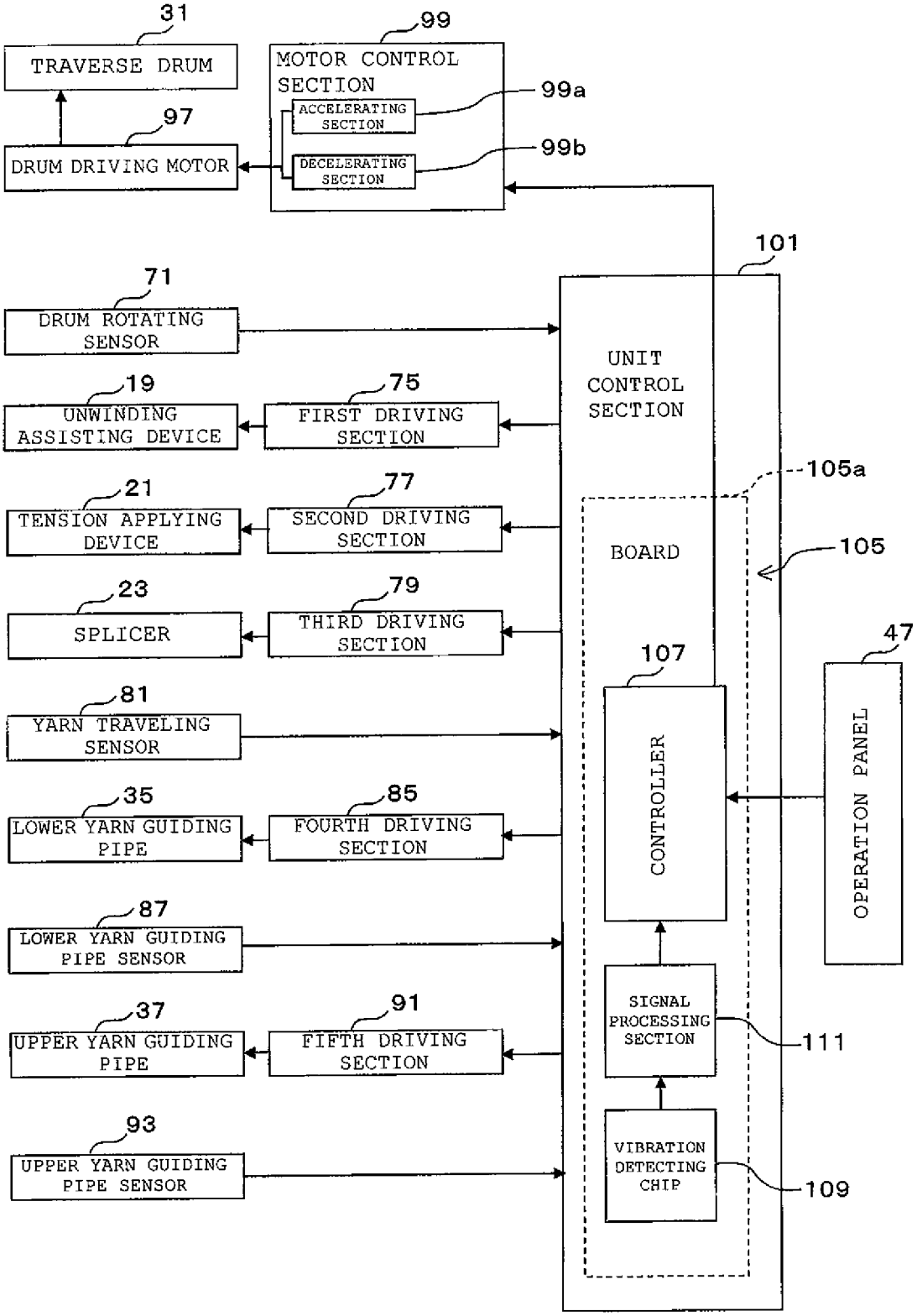

31
TRAVERSE DRUM
97
DRUM DRIVING MOTOR
99
MOTOR CONTROL SECTION
ACCELERATING SECTION
99a
DECELERATING SECTION
99b
101
71
DRUM ROTATING SENSOR
UNIT CONTROL SECTION
19
UNWINDING ASSISTING DEVICE
75
FIRST DRIVING SECTION
105a
21
TENSION APPLYING DEVICE
77
SECOND DRIVING SECTION
BOARD
105
23
SPLICER
79
THIRD DRIVING SECTION
47
107
81
YARN TRAVELING SENSOR
CONTROLLER
OPERATION PANEL
35
LOWER YARN GUIDING PIPE
85
FOURTH DRIVING SECTION
87
LOWER YARN GUIDING PIPE SENSOR
SIGNAL PROCESSING SECTION
111
37
UPPER YARN GUIDING PIPE
91
FIFTH DRIVING SECTION
VIBRATION DETECTING CHIP
109
93
UPPER YARN GUIDING PIPE SENSOR

FIG. 4

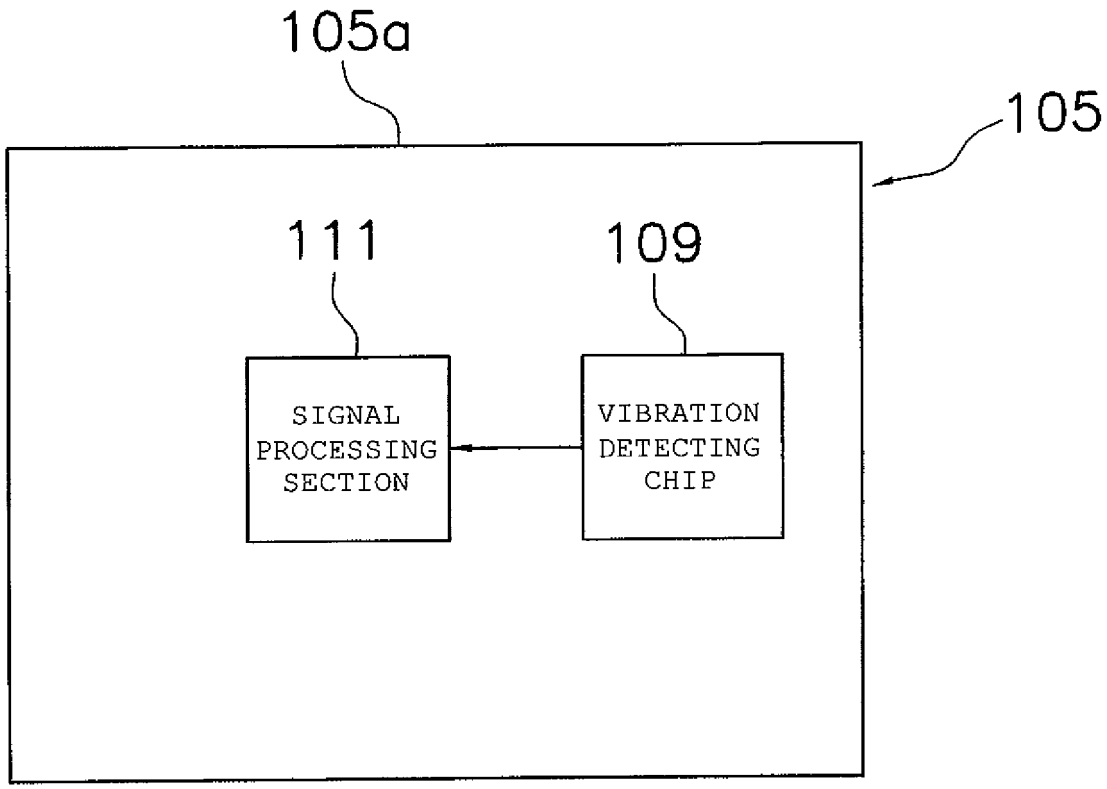

105a
105
111
109
SIGNAL PROCESSING SECTION
VIBRATION DETECTING CHIP

FIG. 5

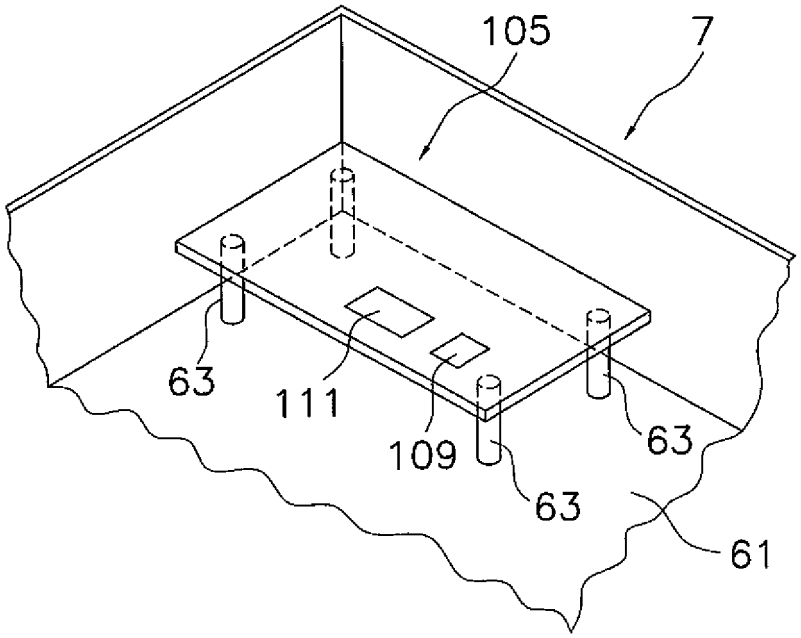
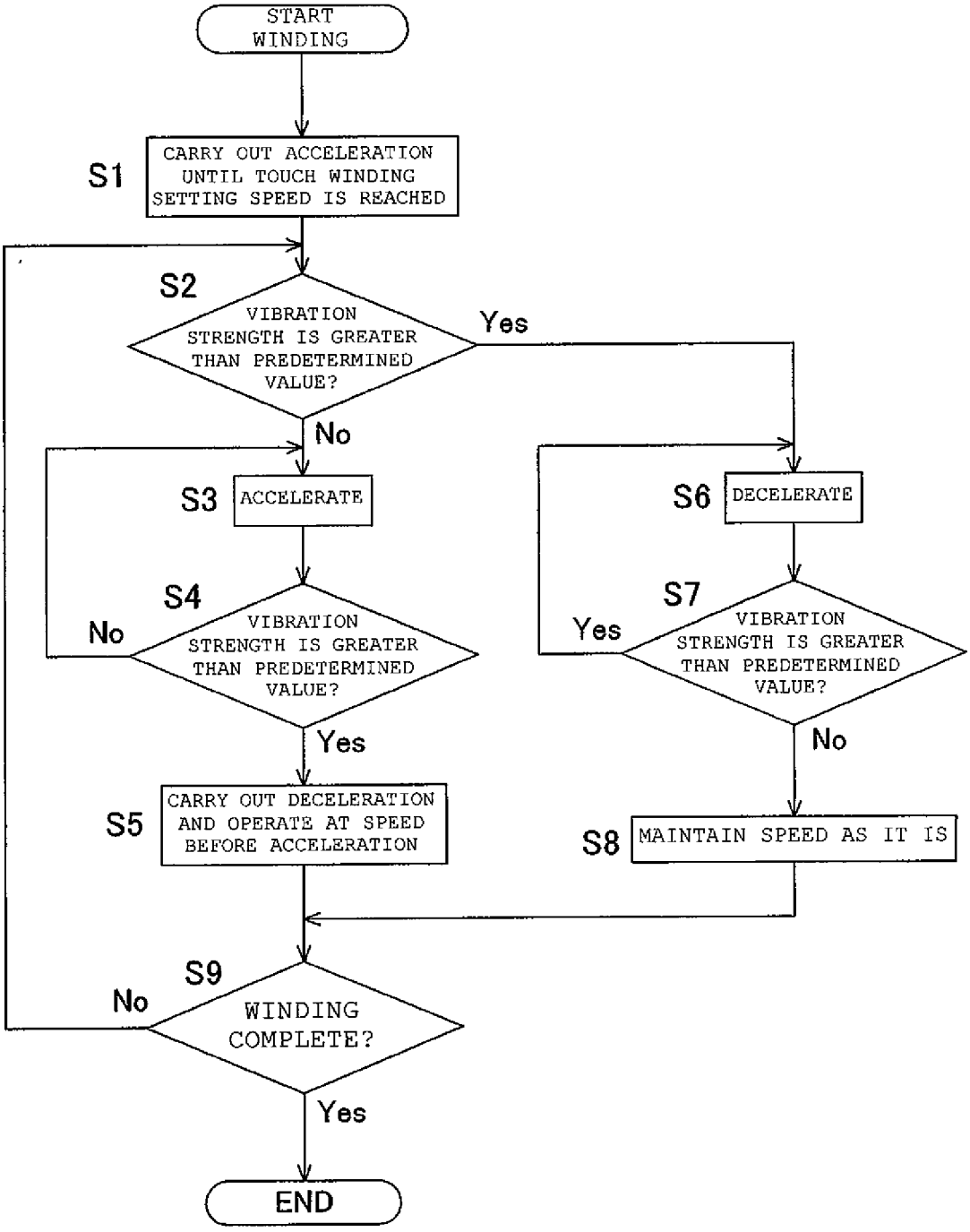


FIG. 6


START WINDING
S1
CARRY OUT ACCELERATION UNTIL TOUCH WINDING SETTING SPEED IS REACHED
S2
VIBRATION STRENGTH IS GREATER THAN PREDETERMINED VALUE?
Yes
No
S3
ACCELERATE
S4
VIBRATION STRENGTH IS GREATER THAN PREDETERMINED VALUE?
No
Yes
S5
CARRY OUT DECELERATION AND OPERATE AT SPEED BEFORE ACCELERATION
S6
DECELERATE
S7
VIBRATION STRENGTH IS GREATER THAN PREDETERMINED VALUE?
Yes
No
S8
MAINTAIN SPEED AS IT IS
S9
WINDING COMPLETE?
No
Yes
END

REFERENCES CITED IN THE DESCRIPTION

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