

Description

TECHNICAL FIELD

[0001] The present invention chiefly relates to a bobbin holder that holds a plurality of bobbins for winding yarn aligned in an axial direction.

BACKGROUND ART

[0002] PTL 1 is Japanese Patent Application Publication No. 2013-193819.

[0003] PTL 1 discloses a yarn winder that winds yarn on a bobbin held by a bobbin holder to form a package. The bobbin holder of PLT 1 includes a rotary shaft, a rotary tube, and a sleeve. A drive shaft of an electric motor is connected to one end of the rotary shaft, and the rotary shaft is rotationally driven by the electric motor. The rotary tube is arranged at the radially outer side of the rotary shaft. One end of the rotary tube is attached to a flange installed to the rotary shaft. The sleeve is arranged at the other end of the rotary tube. More particularly, the sleeve is fitted between a support member of the bobbin holder and the rotary tube. The sleeve receives and absorbs the vibration of the rotary tube. In this manner, the vibration of the bobbin holder is reduced.

SUMMARY OF THE INVENTION

[0004] In recent years, an influence of the vibration of the bobbin holder has become more significant due to an increase of the number of bobbins held in the bobbin holder or an increase of a speed of a yarn winding. In this regards, in the configuration of the bobbin holder of PTL 1, the rotary shaft (core member) and the rotary tube are connected at only two points: the flange and the sleeve. Therefore, when a longer rotary shaft is used as the number of the bobbins increases, the unsupported portion of the rotary shaft becomes longer. As a result, the rotary shaft is deformed at the unsupported portion, causing excessive vibration or a mode of vibration with an antinode present at the unconnected point of the rotary shaft. As a result, excessive vibration may occur in the bobbin holder.

[0005] The present invention is made in view of the situation described above and its main purpose is to provide a bobbin holder which can more robustly suppress excessive vibration.

[0006] The problem to be solved by the present invention is as described above. The means to solve this problem and the effects thereof will be described below.

[0007] A first aspect of the present invention provides a bobbin holder with a configuration described below. That is, the bobbin holder includes a holder body, a core member, and an intermediate supporter. The holder body includes a cylindrical portion and holds a plurality of bobbins used for winding yarn aligned in an axial direction. The core member is arranged inside the cylindrical por-

tion of the holder body and a first end portion and a second end portion of the core member in an axial direction is supported by the holder body. The intermediate supporter is arranged at a position which is radially inside the cylindrical portion, radially outside the core member, and between the first end portion and the second end portion so that the holder body supports the core member.

[0008] With this configuration, since the core member is supported by the holder body at an intermediate portion in addition to the first end portion and the second end portion, the vibration caused due to the deformation of the core member or the vibration with an antinode present at an intermediate point of the core member is reduced. As a result, excessive vibration of the bobbin holder is suppressed more robustly.

[0009] In the bobbin holder described above, it is preferable to arrange a plurality of the intermediate supporter along the axial direction.

[0010] This allows the total length of the portions of the core member that are not supported by the holder body to be short, so that the excessive vibration of the bobbin holder can be suppressed even more robustly.

[0011] In the bobbin holder described above, it is preferable to arrange the intermediate supporter at the center of the core member in the axial direction or at a position where distance from the center is within 30 percent of the length of the core member.

[0012] This allows the holder body to support a portion of the core member prone to be deformed and a portion of the core member prone to include an antinode of vibration. Therefore, excessive vibration of the bobbin holder is suppressed even more robustly.

[0013] In the bobbin holder described above, it is preferable to include a configuration as follows. That is, the intermediate supporter includes a base member and an O-ring. The base member is ring-shaped and includes a recess formed along a circumferential direction. The O-ring is attached to the recess of the base member.

[0014] Installing the O-ring allows the intermediate supporter to cling to the holder body or to the core member, so that vibration caused due to looseness is less likely to occur. In addition, if the O-ring is arranged alone between the holder body and the core member, vibration due to deformation of the O-ring may occur. By installing the base member, the deformation of the O-ring is moderated, so the vibration due to the deformation of the O-ring is less likely to occur.

[0015] In the bobbin holder described above, it is preferable to arrange a plurality of the O-ring along the axial direction at the intermediate supporter.

[0016] This allows the posture of the core member to be stabilized more firmly compared to when a single O-ring is arranged in the axial direction, so that excessive vibration of the bobbin holder is suppressed even more robustly.

[0017] In the bobbin holder described above, it is preferable to include a configuration as follows. That is, the

intermediate supporter includes an inner O-ring and an outer O-ring as the O-rings. The inner O-ring is arranged in contact with the core member and the base member. The outer O-ring is arranged in contact with the cylindrical portion of the holder body and the base member.

[0018] In this manner, the O-rings are arranged at both the side of the core member and the side of the holder body, so that vibration caused due to looseness is less likely to occur.

[0019] In the bobbin holder described above, it is preferable to include a configuration as follows. That is, the bobbin holder includes a retaining structure that retains the bobbins on the holder body. The retaining structure includes a protruding piece and sliding pieces. The protruding piece is arranged at the holder body and can protrude radially outward from the holder body. The sliding pieces are arranged at the core member and press the protruding piece radially outward by sliding along the axial direction. The intermediate supporter is arranged between the sliding pieces in the axial direction.

[0020] Placing the intermediate supporter between the sliding pieces allows the bobbin holder to include the bobbin retaining structure and the intermediate supporter at the same time.

[0021] A second aspect of the present invention provides a yarn winder that includes the bobbin holder as described above and a drive unit. The drive unit rotationally drives the bobbin holder to wind elastic yarn on each of bobbins held by the bobbin holder.

[0022] This allows the yarn winder wherein excessive vibration of the bobbin holder is suppressed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

FIG. 1 is a front view of a yarn winder according to one embodiment of the present invention.

FIG. 2 is a side view of a yarn winder.

FIG. 3 is a block diagram of a yarn winder.

FIG. 4 is a side view of a bobbin holder.

FIG. 5 is a cross-sectional view of a bobbin holder that is not holding a bobbin.

FIG. 6 is a cross-sectional view of a bobbin holder that is holding a bobbin.

FIG. 7 is a cross-sectional perspective view of an intermediate supporter.

FIG. 8 is a graph showing vibration values of a bobbin holder with an intermediate supporter and a bobbin holder without an intermediate supporter.

FIG. 9 is a side view of a bobbin holder according to a modification.

FIG. 10 is a graph showing vibration values of a bobbin holder with one intermediate supporter and a bobbin holder with two intermediate supporters.

EMBODIMENT FOR CARRYING OUT THE INVENTION

[0024] An embodiment of the present invention will be described below with reference to the drawings. FIG. 1 is a front view of a yarn winder 1 according to one embodiment of the present invention. FIG. 2 is a side view of the yarn winder 1. FIG. 3 is a block diagram of the yarn winder 1. In the following description, upstream or downstream in a yarn running direction may simply be referred to as "upstream" or "downstream."

[0025] An unillustrated spinning machine is arranged upstream of the yarn winder 1 illustrated in FIG.

[0026] 1. The spinning machine produces a yarn 93 and supplies it to the yarn winder 1. The yarn winder 1 winds the yarn 93 on a bobbin 91 set on a bobbin holder 41 to produce a package 94. The yarn 93 is an elastic yarn, such as spandex, or a synthetic yarn, such as nylon or polyester. The type of the yarn 93 is not limited to them.

[0027] As shown in FIG. 2, the yarn winder 1 is supplied with a plurality of the yarns 93 aligned in an axial direction of the bobbin holder 41. A plurality of the bobbins 91 are arranged along the axial direction of the bobbin holder 41. The yarn winder 1 winds each yarn 93 on the corresponding bobbin 91 to produce the packages 94.

[0028] The yarn winder 1 will be described in detail below. As shown in FIG. 1, the yarn winder 1 includes a frame 11, a first housing 20, a second housing 30, and a turret plate (a bobbin holder moving mechanism) 40.

[0029] The frame 11 is a member that holds components of the yarn winder 1. The first housing 20 and the second housing 30 are attached to the frame 11.

[0030] A traverse apparatus 21 is attached to the first housing 20. As a traverse guide 23 that is described later reciprocates in a winding width direction (the axial direction of the bobbin holder 41) being engaged with the yarn 93, the traverse apparatus 21 traverses the yarn 93 that is fed downstream. With this traversing operation of the yarn 93, a yarn layer is formed on the bobbin 91. As shown in FIG. 3, the traverse apparatus 21 includes a traverse cam 22 and the traverse guide 23.

[0031] The traverse cam 22 is a roller-shaped member arranged parallel to the bobbin holder 41. A spiral cam groove is formed on the outer peripheral surface of the traverse cam 22. The traverse cam 22 is rotationally driven by a traverse motor 51.

[0032] The traverse motor 51 is controlled by a control apparatus 50. The traverse guide 23 is a member that engages with the yarn 93. The distal end of the traverse guide 23 includes, for example, a substantially U-shaped guide portion that engages with the yarn 93 by pinching the yarn 93 in the winding width direction. The proximal end of the traverse guide 23 is positioned in the cam groove of the traverse cam 22. This configuration allows the traverse cam 22 to be rotationally driven and that enable the traverse guide 23 to reciprocate in the winding width direction.

[0033] The control apparatus 50 is configured as a known computer and includes a CPU, a RAM, a SSD,

and the like. The CPU is a type of a processor. The SSD stores programs and data for controlling the yarn winder 1 in advance. The control apparatus 50 can perform various controls on the yarn winder 1 by loading programs stored in the SSD into the RAM and executing them by the CPU. Another storage device, such as a HDD or a flash memory, may be used instead of the SSD.

[0034] A contact roller 31 is rotatably attached to the second housing 30. The contact roller 31 is rotationally driven by a contact roller motor 52. The contact roller 31 is attached to the second housing 30 by an arm which is not shown in the drawings. The swinging movement of this arm allows the vertical movement of the contact roller 31 relative to the second housing 30. Although the contact roller 31 of the present embodiment moves downward under its own weight, the contact roller 31 may be driven downward and upward by an actuator, such as cylinder.

[0035] The contact roller 31 is positioned downstream of the traverse guide 23 in the yarn running direction. The contact roller 31 rotates keeping contact with the yarn layer of the package 94 at a predetermined pressure while the yarn 93 is being wound in order to feed the yarn 93 from the traverse guide 23 to the yarn layer of the package 94 and to adjust the shape of the yarn layer of the package 94. The contact roller motor 52 may be omitted and the contact roller 31 is rotated by the package 94.

[0036] An operation panel 32 is arranged on the second housing 30. The operation panel 32 is a device operated by an operator. The operator gives an instruction to the yarn winder 1 by operating the operation panel 32. Examples of the instruction given by the operator include starting winding, stopping winding, turning on/off the function of driving the contact roller 31 in the vertical direction, and changing a winding condition.

[0037] The turret plate 40 is a disk-shaped member. The turret plate 40 is rotatably attached to the frame 11. The axis of rotation of the turret plate 40 is positioned at the center of a circular face of the turret plate 40. The turret plate 40 is rotationally driven by a turret motor 53 shown in FIG. 3. The turret motor 53 is controlled by the control apparatus 50.

[0038] The bobbin holder 41 is installed at each of two positions within the turret plate 40 facing each other across the center of the circular face. A plurality of the bobbins 91 aligned in the axial direction can be attached to each bobbin holder 41. When the turret plate 40 is rotated, the positions of the two bobbin holders 41 are changed. As shown in FIG. 1, there are two positions for the bobbin holder 41: a winding position and a standby position. The yarn winder 1 winds the yarns 93 on the bobbins 91 attached to the bobbin holder 41 in the winding position to produce the packages 94. Another apparatus may be used instead of the turret plate 40 if it can change the positions of the two bobbin holders 41.

[0039] The two bobbin holders 41 are rotatably attached to the turret plate 40 with the axial positions of the bobbin holders 41 as the rotation center. As shown

in FIG. 3, a bobbin holder motor (a drive unit) 54 is attached to each of the two bobbin holders 41. The bobbin holder 41 is rotationally driven by the bobbin holder motor 54. The bobbin holder motors 54 are controlled by the control apparatus 50.

[0040] The yarn winder 1 includes a support arm 43 that supports one end (an end opposite the turret plate 40) of the bobbin holder 41 in the winding position in the axial direction. In this manner, the posture of the bobbin holder 41 is stabilized since both ends of the bobbin holder 41 are supported by the turret plate 40 and the support arm 43. The support arm 43 is not an essential component and may be omitted.

[0041] The yarn winder 1 winds a predetermined amount of the yarn 93 on each of the bobbins 91 attached to the bobbin holder 41 in the winding position. When the packages 94 are fully wound, the turret plate 40 rotates to switch the positions of the bobbin holders 41. Then, the fully wound packages 94 of the bobbin holder 41 in the standby position are collected and the yarns 93 start to be wound on the bobbins 91 of the bobbin holder 41 in the winding position. The new bobbins 91 are attached to the bobbin holder 41 from which the packages 94 have been collected.

[0042] The detailed structure of the bobbin holder 41, particularly the structure for suppressing excessive vibration generated in the bobbin holder 41, will be described below with reference to the FIG. 4 through FIG. 7. In the following description, the axial direction of the bobbin holder 41 will be simply referred to as the axial direction. In the axial direction, the side closer to the turret plate 40 will be referred to as a proximal side, and the opposite side (a side closer to the support arm 43) will be referred to as a distal side.

[0043] As shown in FIG. 4, the bobbin holder 41 includes a holder body 61, a core member 62, a biasing member 63, and a connecting member 64. The material that comprises the bobbin holder 41 is, for example, aluminum or iron and it may be resin.

[0044] The holder body 61 includes a first attaching portion 61a, a second attaching portion 61b, and a cylindrical portion 61c. The first attaching portion 61a is the proximal end portion of the holder body 61. As described below, the core member 62 is attached to the first attaching portion 61a. The second attaching portion 61b is the distal end portion of the holder body 61. As described below, the core member 62 is attached to the second attaching portion 61b. The cylindrical portion 61c is a cylindrical portion located between the first attaching portion 61a and the second attaching portion 61b in the axial direction. The core member 62 is arranged radially inside the cylindrical portion 61c. The bobbin 91 is held by a retaining structure 70, which is described below, radially outside the cylindrical portion 61c.

[0045] The core member 62 is a solid member whose cross section is circular. A first end portion 62a, which is the proximal end portion of the core member 62, is fixed to the first attaching portion 61a of the holder body 61 by

the connecting member 64. This allows the first attaching portion 61a and the core member 62 to integrally rotate. In the present embodiment, the core member 62 is arranged in such a way that it can slide in the axial direction with respect to the holder body 61. A second end portion 62b, which is the distal end portion of the core member 62, is fixed to the second attaching portion 61b with the biasing member 63 attached between them. The core member 62 is pressed toward the proximal side with respect to the holder body 61 by the biasing force of the biasing member 63. The first end portion 62a and the second end portion 62b include not only the ends of the core member 62 but also adjacent portions of the ends.

[0046] The rotational drive force generated by the bobbin holder motor 54 described above is transmitted to the first attaching portion 61a of the holder body 61. In this manner, the core member 62 is rotationally driven. The rotational drive force generated by the bobbin holder motor 54 may also directly be transmitted to the core member 62.

[0047] The configurations and the shapes of the holder body 61 and the core member 62 described above are disclosed just as examples and they may be changed depending on circumstances. For example, the holder body 61 and core member 62 may be arranged in such a manner that they cannot slide. The core member 62 may be a hollow member (i.e., a circular pipe).

[0048] The retaining structure 70 for retaining the bobbin 91 on the cylindrical portion 61c of the holder body 61 will be described below, mainly with reference to the FIG. 5 and FIG. 6. As shown in FIG. 5 and FIG. 6, the retaining structure 70 includes through holes 71, protruding pieces 72, contacting members 73, sliding pieces 74, and springs 75.

[0049] The through hole 71 is a hole that passes through the cylindrical portion 61c. The axial direction of the through hole 71 and the radial direction of the cylindrical portion 61c are the same. A plurality of the through holes 71 are formed aligned in the circumferential direction. For one bobbin 91, two through holes 71 are formed in the axial direction. The number and layout of the through holes 71 of the present embodiment are disclosed just as examples and the through hole 71 may be arranged differently in number or layout from the present embodiment.

[0050] The protruding piece 72 is inserted into the through hole 71 and is movable with respect to the through hole 71. The direction of movement of the protruding piece 72 is the same direction as the axial direction of the through hole 71 and the radial direction of the cylindrical portion 61c.

[0051] The contacting member 73 is attached to the outer surface of the protruding piece 72 in the radial direction. The contacting member 73 is made of, for example, rubber, urethane, or soft resin and is elastically deformable. As the protruding piece 72 slides radially outward, the contacting member 73 presses the inner surface of the bobbin 91 radially outward. This allows the bobbin

91 to be retained on the cylindrical portion 61c. The contacting member 73 is not an essential component and the protruding piece 72 may directly press the inner surface of the bobbin 91.

[0052] The sliding pieces 74 are attached to the core member 62. As the core member 62 slides in the axial direction, the sliding piece 74 also slides in the axial direction integrally with the core member 62. The sliding piece 74 is arranged at a position corresponding to the protruding piece 72. More precisely, the inner surface of the protruding piece 72 in the radial direction contacts with the outer surface of the sliding piece 74 in the radial direction. The spring 75 is arranged between adjacent sliding pieces 74.

[0053] An inclined face that is inclined with respect to the axial direction is formed on the inner side of the protruding piece 72 in the radial direction. Another inclined face corresponding to the inclined face of the protruding piece 72 is formed on the outer side of the sliding piece 74 in the radial direction. As described above, the inclined face of the protruding piece 72 contacts with the inclined face of the sliding piece 74. With this configuration, as the sliding piece 74 slides in the axial direction (more precisely, toward the proximal side) together with the core member 62, the protruding piece 72 is pressed outward in the radial direction. As a result, as shown in FIG. 6, the protruding piece 72 moves radially outward and the contacting member 73 presses the inner surface of the bobbin 91 radially outward. In this manner, the bobbin 91 is retained on the bobbin holder 41.

[0054] As described above, the core member 62 is pressed toward the proximal side in the axial direction by the biasing member 63. Thus, the bobbin 91 is retained on the bobbin holder 41 without using power of an actuator. The bobbin 91 can be released by sliding the core member 62 toward the distal side by an actuator (e.g., a cylinder or a motor), which is not shown in the drawings.

[0055] The retaining structure 70 of the present embodiment is disclosed just as an example and the bobbin 91 may be retained on the bobbin holder 41 by a retaining structure different from the present embodiment.

[0056] The excessive vibration generated in the bobbin holder 41 and the configuration for suppressing this vibration will be described below.

[0057] To achieve high production efficiency, the yarn winder 1 of the present embodiment winds the yarns 93 on a large number of the bobbins 91 at the same time. Therefore, the length of the bobbin holder 41 of the present embodiment in the axial direction is extremely long. On the other hand, if the core member 62 is supported by the holder body 61 only at the first end portion 62a and the second end portion 62b, various modes of vibration may be generated because of the long length of the portion that is not supported by the holder body 61. For example, a mode of vibration with an antinode of the vibration present at the intermediate portion (e.g., the center point) of the core member 62 in the longitudinal direction may be generated. Vibration of this mode is not

conventionally expected. Therefore, if no measures are taken against this vibration, excessive vibration can be generated in the bobbin holder 41 depending on the rotation speed of the bobbin holder 41. Furthermore, when the length of the bobbin holder 41 in the axial direction is exceedingly long, the intermediate portion of the core member 62 in the longitudinal direction can easily be deformed due to various factors. For example, the core member 62 can be deformed by the reaction force that acts in response to the force of the protruding piece 72 of the retaining structure 70 pressing the bobbin 91. If the core member 62 is deformed, natural frequency changes and excessive vibration can be generated in the bobbin holder 41 depending on the rotation speed of the bobbin holder 41.

[0058] To suppress these excessive vibration, the bobbin holder 41 of the present embodiment includes one intermediate supporter 80 as shown in FIG. 5 to 7. The intermediate supporter 80 is a member for making the holder body 61 support the intermediate portion of the core member 62. As shown in FIG. 4, the intermediate supporter 80 is arranged at the central portion of the core member 62. The central portion consists of the center of the core member 62 in the axial direction and a region where the distance from the center is within 30 percent of the length of the core member 62. Since the excessive vibration described above tends to occur starting from the center of the core member 62, arranging the intermediate supporter 80 at the central portion allows the excessive vibration to be suppressed more robustly.

[0059] As described above, the retaining structure 70 (particularly, the sliding piece 74) is arranged between the cylindrical portion 61c and the core member 62. Accordingly, the intermediate supporter 80 is positioned avoiding the sliding piece 74. Specifically, as shown in FIG. 5 or FIG. 6, in the area where the intermediate supporter 80 is arranged, the sliding piece 74 is divided into two pieces in the axial direction and the intermediate supporter 80 is arranged between these two sliding pieces 74. This allows the intermediate supporter 80 to be compatible with the retaining structure 70. Furthermore, the intermediate supporter 80 is in contact with the sliding piece 74 via the spring 75 or directly. Therefore, the intermediate supporter 80 is configured to receive force from the sliding piece 74 and slide together with the sliding piece 74 in the axial direction.

[0060] The intermediate supporter 80 includes a base member 81. The base member 81 is a ring-shaped member. The base member 81 is arranged at a position which is radially inside the cylindrical portion 61c and radially outside the core member 62. That is, the outside diameter of the base member 81 is substantially the same as the inside diameter of the cylindrical portion 61c and the inside diameter of the base member 81 is substantially the same as the outside diameter of the core member 62.

[0061] The base member 81 includes a first inner recess 81a, a second inner recess 81b, a first outer recess 81c and a second outer recess 81d. The first inner recess

81a and the second inner recess 81b are recesses formed on the radially inner surface of the base member 81 and aligned along the axial direction. The first outer recess 81c and the second outer recess 81d are recesses formed on the radially outer surface of the base member 81 and aligned along the axial direction.

[0062] A first inner O-ring 82a is arranged in the first inner recess 81a and a second inner O-ring 82b is arranged in the second inner recess 81b. The first inner O-ring 82a and the second inner O-ring 82b contact the base member 81 and the core member 62. This enhances the contact between the intermediate supporter 80 and the core member 62.

[0063] A first outer O-ring 82c is arranged in the first outer recess 81c and a second outer O-ring 82d is arranged in the second outer recess 81d. The first outer O-ring 82c and the second outer O-ring 82d contact the base member 81 and the cylindrical portion 61c. This enhances the contact between the intermediate supporter 80 and the cylindrical portion 61c.

[0064] In the intermediate supporter 80 of the present embodiment, the core member 62 and the cylindrical portion 61c are less likely to become loose in the radial direction since the O-rings are arranged on both the radially inner surface and the radially outer surface of the intermediate supporter 80. Furthermore, in the intermediate supporter 80 of the present embodiment, the O-rings are arranged along the axial direction. More particularly, the first inner O-ring 82a and the second inner O-ring 82b (i.e., a plurality of the O-rings) are arranged on one intermediate supporter 80 and aligned along the axial direction and the first outer O-ring 82c and the second outer O-ring 82d (i.e., a plurality of the O-rings) are arranged on one intermediate supporter 80 and aligned along the axial direction. As a result, vibration of the core member 62 or of the cylindrical portion 61c with the O-ring as the center can be suppressed. In the present embodiment, a plurality of the O-rings are arranged on both the radially inner surface and the radially outer surface of one intermediate supporter 80. The layout of the O-rings in the present embodiment is disclosed just as an example and can be modified as follows. For example, one or more O-rings may be arranged on the radially inner surface of one intermediate supporter 80. One or more O-rings may be arranged on the radially outer surface of one intermediate supporter 80. Only one O-ring may be arranged on each of the radially inner surface and the radially outer surface of one intermediate supporter 80. One or more O-rings may be arranged on only one of the radially inner surface and the radially outer surface of one intermediate supporter 80.

[0065] The effect of the intermediate supporter 80 will be described below with reference to FIG. 8.

[0066] FIG. 8 shows a graph that illustrates the change in the vibration values of the bobbin holder 41 that includes the intermediate supporter 80 and of the bobbin holder 41 that does not include the intermediate supporter 80 when the rotation speeds of the bobbin holders 41

are increased. The vibration value is the total displacement resulting from the vibration of the bobbin holder 41 per unit time. For example, the higher the vibration frequency or the higher the amplitude, the higher the vibration values.

[0067] As shown in FIG. 8, the vibration value of the bobbin holder 41 without the intermediate supporter 80 significantly increases when the rotation speed of the bobbin holder 41 exceeds a specific value. This is due to the excessive vibration described above occurring. On the other hand, the vibration value of the bobbin holder 41 with the intermediate supporter 80 remains low even after the rotation speed exceeds the specific value. The above demonstrates that the excessive vibration can be suppressed by arranging the intermediate supporter 80.

[0068] Next, a modification of the above embodiment will be described with reference to FIGS. 9 and 10. In the description of the present modification, the components identical or similar to those of the above-described embodiment may be marked with the same reference signs in the drawings and the description thereof may be omitted.

[0069] While the bobbin holder 41 of the above embodiment includes only one intermediate supporter 80, a bobbin holder 41 of the present modification includes two intermediate supporters 80. One of the intermediate supporters 80 is arranged at a proximal side and the other is arranged at a distal side of the center of the core member 62 in the axial direction.

[0070] By arranging two intermediate supporter 80, the distance between the supported points of the core member 62 becomes short. Therefore, the generation of various modes of vibration can be suppressed. When installing the intermediate supporter 80 by inserting it between the cylindrical portion 61c and the core member 62, the longer the distance between the position to install it and the axial end of the cylindrical portion 61c is, the more difficult the operation of installing the intermediate supporter 80 is likely to be. In this regard, in the present modification, the distance from the axial end of the cylindrical portion 61c to the position where the intermediate supporter 80 is installed is shorter than in the above embodiment. Therefore, the operation of installing the intermediate supporter 80 can be easier.

[0071] FIG. 10 shows a graph that illustrates the change in the vibration values of the bobbin holder 41 of the above embodiment that includes one intermediate supporter 80 and of the bobbin holder 41 of the present modification that includes two intermediate supporter 80 when the rotation speeds of the bobbin holders 41 are increased. As shown in FIG. 10, the vibration value can be reduced by installing two intermediate supporter 80 compared to the case where the only one intermediate supporter 80 is installed. Furthermore, the rotation speed of the bobbin holder 41 at which the vibration value reaches a first peak is different between the case with one intermediate supporter 80 and the case with two intermediate supporter 80. Therefore, the number of the in-

termediate supporter 80 may be selected in order to lower the vibration value at a rotation speed that is frequently used.

[0072] As described above, the bobbin holder 41 of the present embodiment includes the holder body 61, the core member 62, and the intermediate supporter 80. The holder body 61 includes the cylindrical portion 61c and holds a plurality of the bobbins 91 used for winding yarn 93 aligned in the axial direction. The core member 62 is arranged inside the cylindrical portion 61c of the holder body 61 and the first end portion 62a and the second end portion 62b of the holder body 61 in the axial direction is supported by the holder body 61. The intermediate supporter 80 is arranged at a position which is radially inside the cylindrical portion 61c, radially outside the core member 62, and between the first end portion 62a and the second end portion 62b so that the holder body 61 supports the core member 62.

[0073] With this configuration, since the core member 62 is supported by the holder body 61 at an intermediate portion in addition to the first end portion 62a and the second end portion 62b, the vibration caused due to the deformation of the core member 62 and or the vibration with an antinode present at an intermediate point of the core member 62 is reduced. As a result, excessive vibration of the bobbin holder 41 is suppressed more robustly.

[0074] In the bobbin holder 41 of the modification, a plurality of the intermediate supporter 80 is arranged along the axial direction.

[0075] This allows the total length of portions of the core member 62 that are not supported by the holder body 61 to be short, so that the excessive vibration of the bobbin holder 41 is suppressed more robustly.

[0076] In the bobbin holder 41 of the present embodiment, the intermediate supporter 80 is arranged at the center of the core member 62 in the axial direction or at a position where distance from the center is within 30 percent of the length of the core member 62.

[0077] This allows the holder body 61 to support a portion of the core member 62 prone to be deformed and a portion of the core member 62 prone to include an antinode of vibration. Therefore, the excessive vibration of the bobbin holder 41 is suppressed even more robustly.

[0078] In the bobbin holder 41 of the present embodiment, the intermediate supporter 80 includes the base member 81 and the O-rings (the first inner O-ring 82a, the second inner O-ring 82b, the first outer O-ring 82c, and the second outer O-ring 82d). The base member 81 is ring-shaped and includes the recesses (the first inner recess 81a, the second inner recess 81b, the first outer recess 81c, and the second outer recess 81d) formed along the circumferential direction. The O-rings are attached to the recesses of the base member 81.

[0079] Installing the O-rings allows the intermediate supporter 80 to cling to the holder body 61 or to the core member 62, so that vibration caused due to looseness is less likely to occur. In addition, if the O-rings are ar-

ranged between the holder body 61 and the core member 62 without any other components or attachments, vibration due to deformation of the O-rings may occur. However, by installing the base member 81, the deformation of the O-rings is moderated, so that the vibration due to the deformation of the O-rings is less likely to occur.

[0080] In the bobbin holder 41 of the present embodiment, a plurality of the O-ring is arranged along the axial direction at the intermediate supporter 80.

[0081] This allows the posture of the core member 62 to be stabilized more firmly compared to when a single O-ring is arranged in the axial direction, so that the excessive vibration of the bobbin holder 41 is suppressed even more robustly.

[0082] In the bobbin holder 41 of the present embodiment, the intermediate supporter 80 includes the inner O-rings (the first inner O-ring 82a and the second inner O-ring 82b) and the outer O-rings (the first outer O-ring 82c and the second outer O-ring 82d) as the O-rings. The inner O-rings are arranged in contact with the core member 62 and the base member 81. The outer O-rings are arranged in contact with the cylindrical portion 61c of the holder body 61 and the base member 81.

[0083] In this manner, the O-rings are arranged at both the side of the core member 62 and the side of the holder body 61, so that vibration caused due to looseness is less likely to occur.

[0084] The bobbin holder 41 of the present embodiment includes the retaining structure 70 that retains the bobbins 91 on the holder body 61. The retaining structure 70 includes the protruding piece 72 and the sliding pieces 74. The protruding piece 72 is arranged at the holder body 61 and can protrude radially outward from the holder body 61. The sliding pieces 74 are arranged at the core member 62 and press the protruding piece 72 radially outward by sliding along the axial direction. The intermediate supporter 80 is arranged between the sliding pieces 74 in the axial direction.

[0085] Placing the intermediate supporter 80 between the sliding pieces 74 allows the bobbin holder 41 to include the retaining structure 70 to retain the bobbins 91 and the intermediate supporter 80 at the same time.

[0086] The yarn winder 1 of the present embodiment includes the bobbin holder 41 and the bobbin holder motor 54. The bobbin holder motor 54 rotationally drives the bobbin holder 41 to wind elastic yarn on each of the bobbins 91 held by the bobbin holder 41.

[0087] This allows the yarn winder 1 wherein excessive vibration of the bobbin holder 41 is suppressed.

[0088] Although a preferred embodiment and a modification of the present invention has been described above, the above-described configurations can be modified, for example, as follows.

[0089] The number of the intermediate supporter 80 that the bobbin holder 41 includes is not limited to one or two, but it may be three or more. The locations of the intermediate supporter 80 described above are disclosed just as examples and they may be changed as desired.

For example, in a case where one intermediate supporter 80 is included, the intermediate supporter 80 may be arranged at a position that does not belong to the central portion. In a case where two or more intermediate supporters 80 are included, the intermediate supporters 80 may be arranged asymmetrically in the axial direction.

[0090] Although the traverse apparatus 21 of the above embodiment is of cam drum type, the traverse apparatus 21 may have a different configuration as long as it is possible to make the traverse guide 23 reciprocate in the winding width direction. For example, instead of the traverse apparatus 21, a belt-type traverse apparatus may be used.

[0091] In the description of the above embodiment, the example where the present invention is applied to a yarn winder that winds yarn produced by a spinning machine has been described. However, the present invention may also be applied to a draw texturing machine or a rewinder.

Claims

1. A bobbin holder (41), comprising:

a holder body (61) including a cylindrical portion (61c) and holding a plurality of bobbins (91) used for winding yarn (93) aligned in an axial direction; a core member (62) arranged inside the cylindrical portion (61c) of the holder body (61), a first end portion (62a) and a second end portion (62b) of the core member (62) in an axial direction supported by the holder body (61); and an intermediate supporter (80) arranged at a position which is radially inside the cylindrical portion (61c), radially outside the core member (62), and between the first end portion (62a) and the second end portion (62b) so that the holder body (61) supports the core member (62).

2. The bobbin holder (41) according to claim 1, wherein a plurality of the intermediate supporters (80) are arranged along the axial direction.

3. The bobbin holder (41) according to claim 1 or 2, wherein the intermediate supporter (80) is arranged at a center of the core member (62) in the axial direction or at a position where distance from the center is within 30 percent of length of the core member (62).

4. The bobbin holder (41) according to any one of claim 1 to 3, wherein the intermediate supporter (80) comprises:

a base member (81) that is ring-shaped and includes a recess (81a, 81b, 81c, 81d) formed along a circumferential direction; and an O-ring (82a, 82b, 82c, 82d) that is attached

to the recess (81a, 81b, 81c, 81d) of the base member (81).

5. The bobbin holder (41) according to claim 4, wherein a plurality of the O-rings (82a, 82b, 82c, 82d) are arranged along the axial direction at the intermediate supporter (80). 5

6. The bobbin holder (41) according to claim 4, wherein, the intermediate supporter (80) comprises: 10

an inner O-ring (82a, 82b) as the O-ring that is arranged in contact with the core member (62) and the base member (81); and
an outer O-ring (82c, 82d) as the O-ring that is arranged in contact with the cylindrical portion (61c) of the holder body (61) and the base member (81). 15

7. The bobbin holder (41) according to any one of claim 1 to 6, comprising a retaining structure (70) that retains the bobbins (91) on the holder body (61), 20

wherein the retaining structure (70) comprises: 25

a protruding piece (72) that is arranged at the holder body (61) and can protrude radially outward from the holder body (61); and sliding pieces (74) that are arranged at the core member (62) and press the protruding piece (72) radially outward by sliding along the axial direction, and 30

wherein the intermediate supporter (80) is arranged between the sliding pieces (74) in the axial direction. 35

8. A yarn winder (1), comprising:

the bobbin holder (41) according to any one of claim 1 to 7; and 40
a drive unit (54) that rotationally drives the bobbin holder (41) to wind elastic yarn on each of the bobbins (91) held by the bobbin holder (41). 45

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FIG. 1

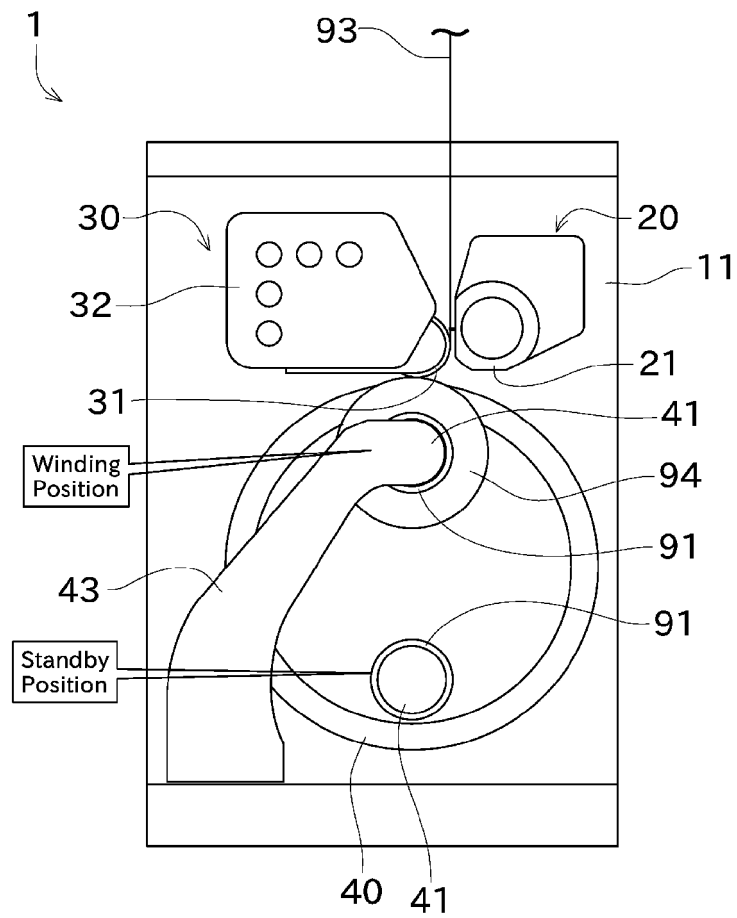


FIG. 2

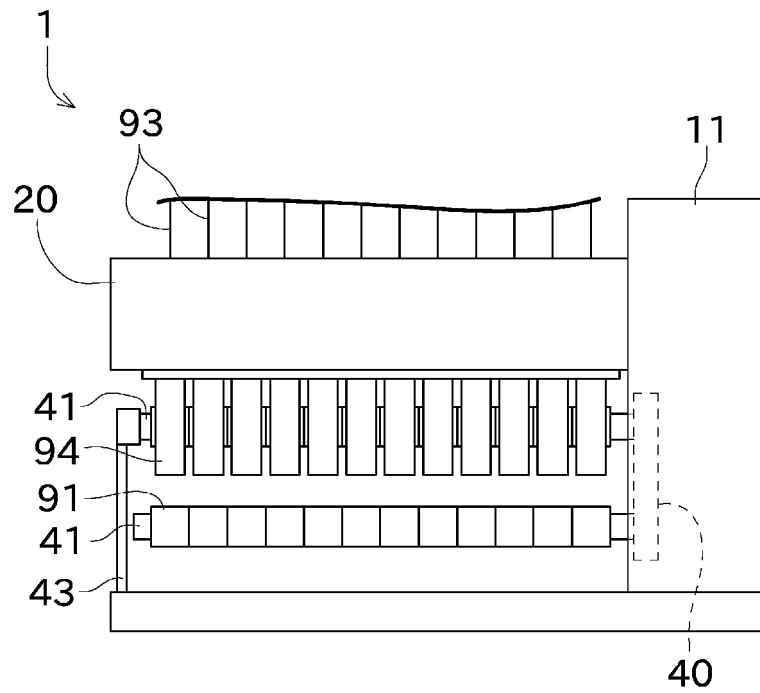


FIG. 3

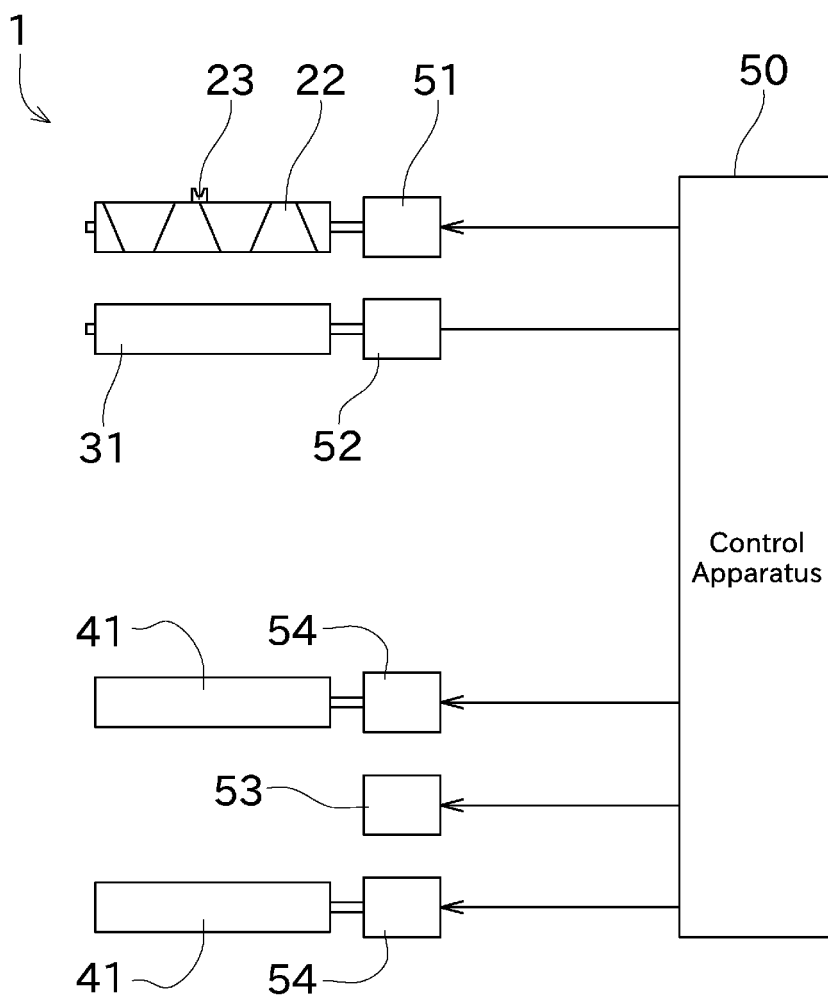


FIG. 4

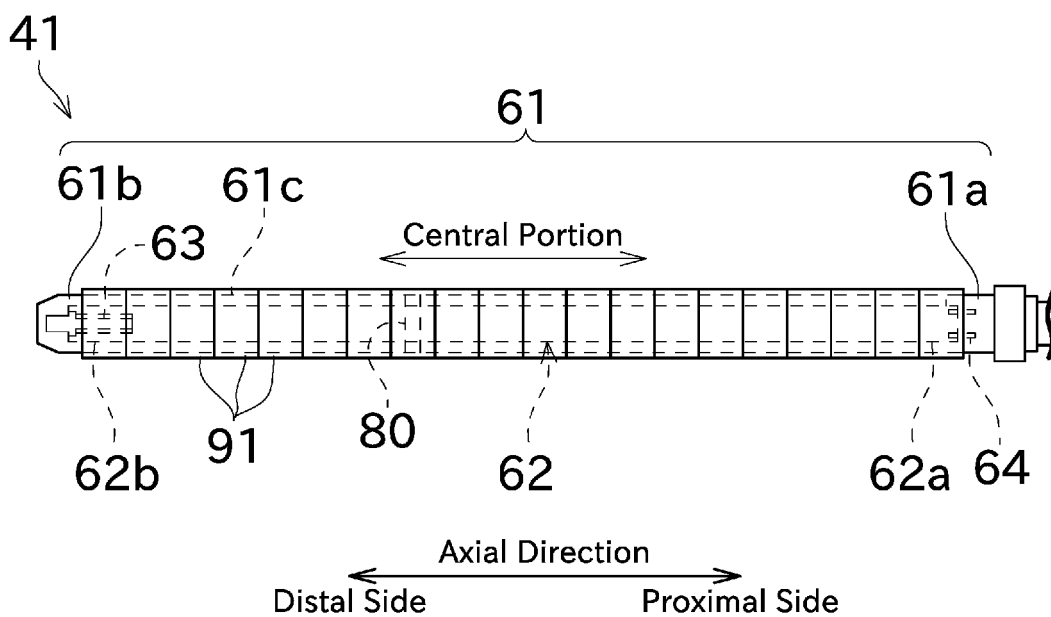


FIG. 5

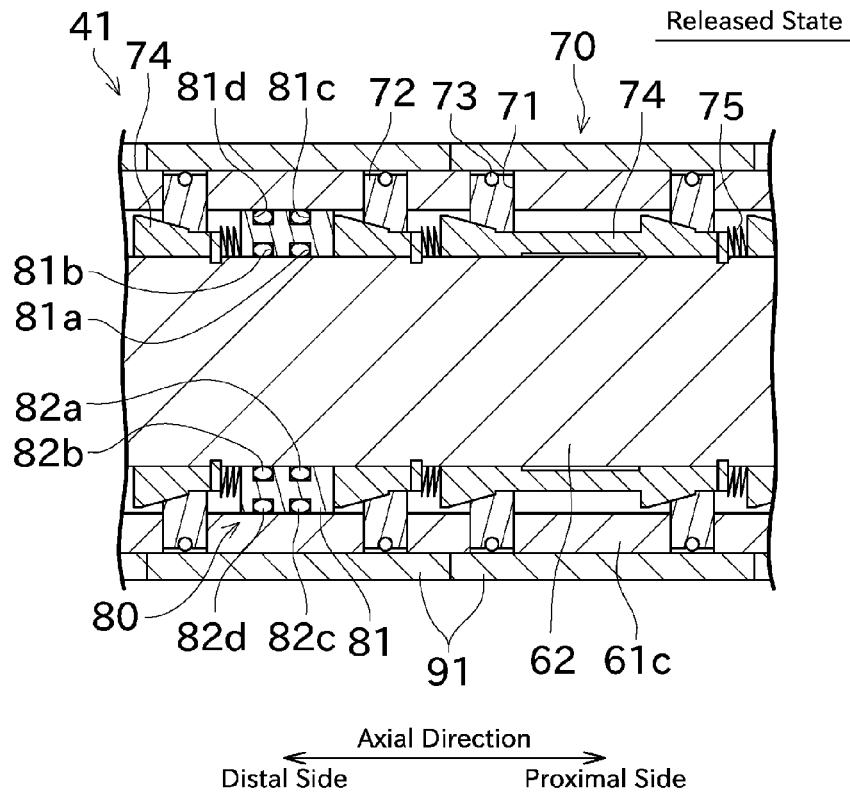


FIG. 6

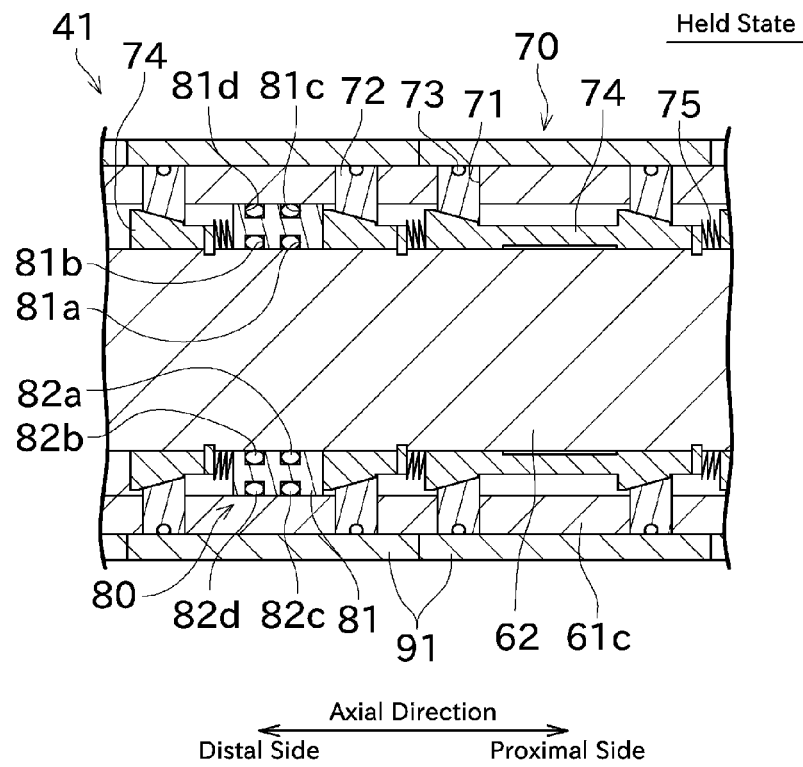


FIG. 7

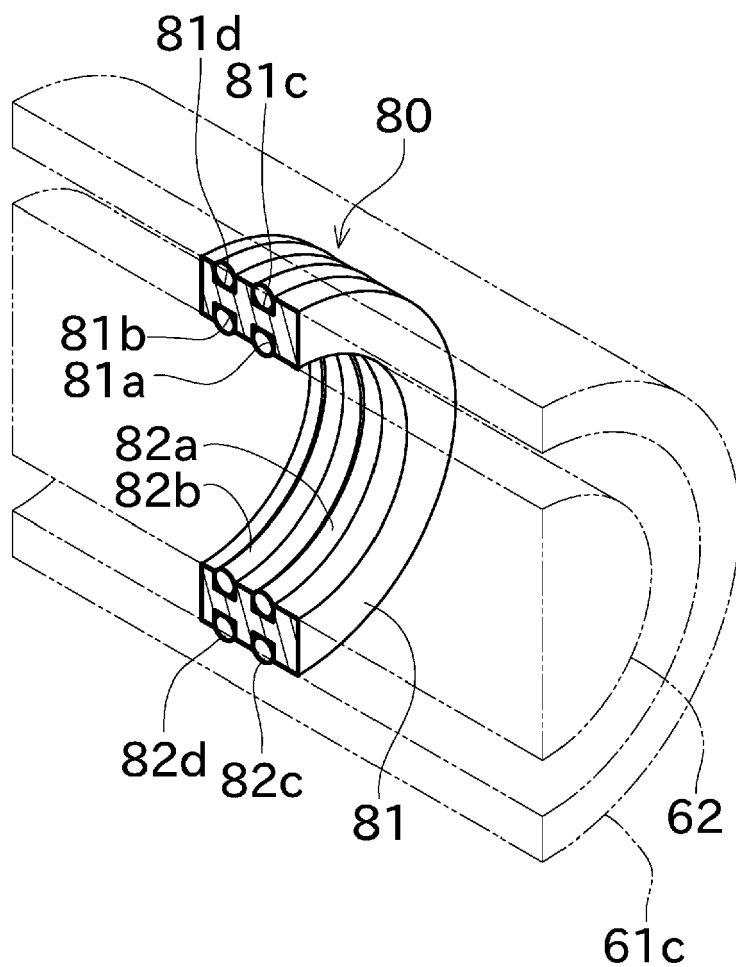


FIG. 8

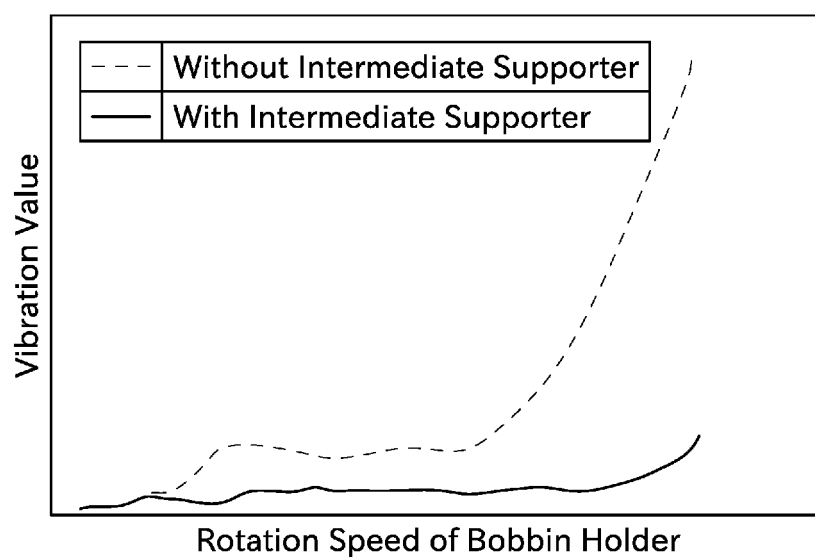


FIG. 9

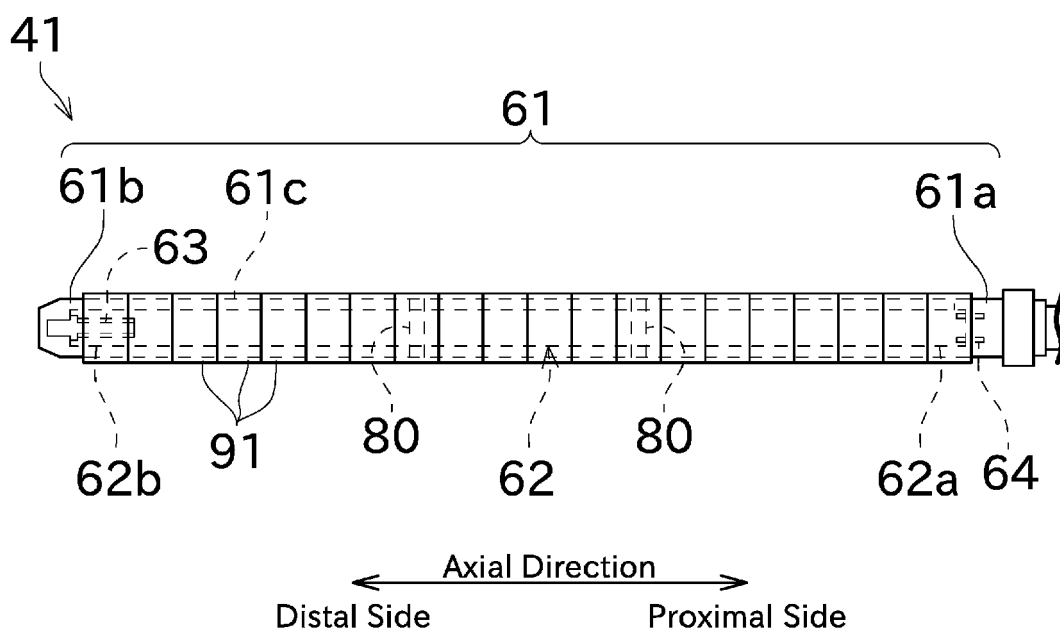
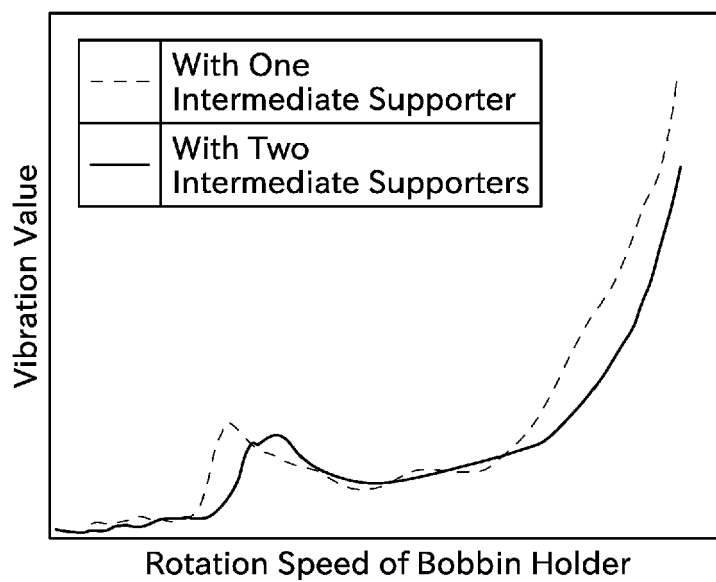


FIG. 10





EUROPEAN SEARCH REPORT

Application Number

EP 23 18 4752

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EPO FORM 1503 03.82 (P04C01)

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			B65H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 14 November 2023	Examiner Lemmen, René
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14-11-2023

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