



(11) **EP 2 031 104 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.03.2009 Bulletin 2009/10

(51) Int Cl.:
D01H 1/38 (2006.01)

(21) Application number: **08012482.9**

(22) Date of filing: **10.07.2008**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT
RO SE SI SK TR**
Designated Extension States:
AL BA MK RS

(72) Inventors:
• **Takashima, Shingo**
Kyoto-shi
Kyoto (JP)
• **Yoshida, Yasunori**
Kyoto-shi
Kyoto (JP)

(30) Priority: **28.08.2007 JP 2007220616**

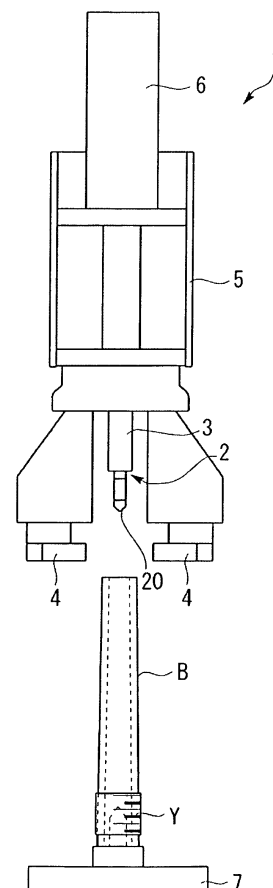
(71) Applicant: **Murata Machinery, Ltd.**
Kyoto 601 (JP)

(74) Representative: **Liedl, Christine et al**
c/o Hansmann & Vogeser,
Albert-Rosshaupter-Strasse 65
81369 München (DE)

(54) **Residual-yarn removing device and picker member**

(57) A picker member 20 that is inserted into a bobbin B has a plurality of tight contact portions 23 which are arranged in an inner circumferential direction of the bobbin B with a gap between the adjacent tight contact portions 23 and which are displaceable in a radial direction of the bobbin B between a reduced diameter state and an increased diameter state in which the tight contact portions 23 widen out in the radial direction compared to the reduced diameter state, and a coupling portion 24 that couples the plurality of tight contact portions 23 together (Fig.1).

FIGURE 1



EP 2 031 104 A2

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a residual-yarn removing device that removes a residual yarn on a bobbin, and a picker member of the residual-yarn removing device.

Description of the Related Art

[0002] Residual-yarn removing devices (bobbin strippers) are conventionally known which are each provided in a bobbin conveying device in a yarn winding apparatus to remove a yarn (residual yarn) on a bobbin discharged by the yarn winding apparatus. Such a residual-yarn removing device generally has a picker member for picking up those of conveyed bobbins from which the residual yarn is to be removed. For example, a residual-yarn removing device in the Unexamined Japanese Patent Application Publication (Tokkai-Hei) No. 11-100171 has a picker member which is composed of a rubber tube having an inner circumferential groove formed in an axially central portion thereof and which is inserted into a cylindrical bobbin. This residual-yarn removing device is configured such that an air cylinder is used to compress the picker member in an axial direction thereof to elastically deform the axially central portion thereof with the groove formed therein to tightly contact the picker member with an inner surface of the bobbin to hold the bobbin.

BRIEF SUMMARY OF THE INVENTION

[0003] However, the picker member as described in the Unexamined Japanese Patent Application Publication (Tokkai-Hei) No. 11-100171 is configured such that upon returning from a state in which the diameter of the picker member is increased to allow the picker member to hold the bobbin to a state in which the diameter of the picker member is reduced, the picker member is contracted from the increased diameter state only by the elastic restoring force of the picker member itself. Consequently, the picker member may return inappropriately and fail to slip out of the bobbin.

[0004] An object of the present invention is to provide a residual-yarn removing device that prevents the picker member from returning inappropriately from the increased diameter state to the reduced diameter state, enabling the held bobbin to be reliably released.

[0005] According to a first invention, there is provided a residual-yarn removing device removing a residual yarn on a cylindrical bobbin, the device being characterized by comprising a picker member that is displaceable between an increased diameter state in which the picker member tightly contacts with an inner surface of the bobbin to hold the bobbin and a reduced diameter state in

which an outer diameter of the picker member is made smaller than an inner diameter of the bobbin, a picker driving means for switching the picker member between the increased diameter state and the reduced diameter state, a support base that supports the picker driving means, and a support base driving means for driving the support base in an axial direction of the bobbin.

[0006] With the residual-yarn removing device, first, the picker member in the reduced diameter state is inserted into the bobbin. Then, the picker driving means forcibly widens the picker member out into the increased diameter state. The picker member thus tightly contacts with the inner surface of the bobbin to hold the bobbin. The residual yarn is then removed from the bobbin held by the picker member. The picker driving means then forcibly narrows the picker member inward in a radial direction thereof to return the picker member to the reduced diameter state. The held bobbin is thus released.

[0007] According to the present invention, the picker driving means forcibly switches the picker member between the increased diameter state and the reduced diameter state. Thus, the picker member is prevented from returning inappropriately from the increased diameter state to the reduced diameter state. Consequently, the held bobbin can be reliably released.

[0008] A residual-yarn removing device according to a second invention in the first invention is characterized in that the picker driving means has a picker shaft inserted through the picker member, and one end of the picker member is fixed to the picker shaft, while the other end of the picker member is fixed to the support base, and in that the picker shaft of the picker driving means moves in the axial direction of the bobbin with respect to the support base to switch the picker member between the increased diameter state and the reduced diameter state.

[0009] In this configuration, the one end of the picker member is fixed to the picker shaft, while the other end of the picker member is fixed to the support base. Thus, the picker shaft moves in the axial direction of the bobbin with respect to the support base to compress and expand the picker member in the axial direction thereof, forcibly switching the picker member between the increased diameter state and the reduced diameter state.

[0010] A residual-yarn removing device according to a third invention in the first invention or the second invention is **characterized in that** the picker member has a plurality of tight contact portions which are arranged in an inner circumferential direction of the bobbin and which are displaceable in the radial direction of the bobbin, and a coupling portion that couples the plurality of tight contact portions together.

[0011] With the above-described conventional picker member composed of the rubber tube (the Unexamined Japanese Patent Application Publication (Tokkai-Hei) No. 11-100171), the amount by which the picker member is elastically deformed in the radial direction thereof (the amount by which the diameter is increased) when compressed in the axial direction thereof is obtained utilizing

the elastic deformation characteristic of the rubber tube itself. Accordingly, it is difficult to significantly deform the picker member beyond the elastic deformation capability of the rubber itself. It is thus difficult for a single type of picker member to deal with plural types of bobbins with different inner diameters. That is, every time the type of bobbins handled by a bobbin conveying device is changed, the picker member needs to be replaced with one suitable for the bobbins used. Moreover, in the conventional picker member, both local contraction and bending deformation occur repeatedly in an axially central portion of the picker member. Consequently, the axially central portion is likely to suffer fatigue fracture and is thus not durable.

[0012] On the other hand, according to the present invention, the picker member is divided into the plurality of tight contact portions. Accordingly, when a load acts on the picker member in the axial direction of the bobbin, the tight contact portions are easily bendably deformed with respect to the coupling portion and can thus be significantly deformed in the radial direction of the bobbin. In this manner, the plurality of tight contact portions, into which the picker member is divided, are each deformed in the radial direction thereof on the basis of the bending deformation. This enables an increase in the amount by which the picker member is displaced in the radial direction (that is, the amount by which the diameter is increased). Therefore, the single type of picker member can be commonly used for the plural types of bobbins with the different inner diameters. This enables a reduction in the time and effort required to replace the picker member depending on the type of the bobbins.

[0013] Furthermore, the diameter of the plurality of tight contact portions of the picker member is repeatedly increased and reduced almost only on the basis of the bending deformation. Thus, when the picker member is displaced from the increased diameter state to the reduced diameter state or from the reduced diameter state to the increased diameter state, the picker member, particularly each of the tight contact portions is subjected to very insignificant expansion and contraction. Consequently, compared to the conventional picker member, which is repeatedly subjected to both expansion and contraction and bending deformation, the picker member according to the present invention is unlikely to suffer fatigue fracture and offers improved durability.

[0014] A residual-yarn removing device according to a fourth invention in the third invention is **characterized in that** the picker member comprises a cylinder having a plurality of slits formed in an axially central portion thereof, the slits extending along the axial direction of the cylinder and arranged in a circumferential direction of the cylinder, and the axially central portion of the cylinder is divided in the circumferential direction of the cylinder by the plurality of slits to form the plurality of tight contact portions, the cylinder having axially opposite ends each comprising the coupling portion coupling the plurality of tight contact portions together.

[0015] When the picker member, composed of the cylinder, is compressed in the axial direction thereof, the plurality of tight contact portions, into which the picker member is divided in the circumferential direction thereof by the plurality of slits, are bendably deformed so as to bulge outward in the radial direction thereof. The diameter of the picker member as a whole is thus increased to tightly contact the picker member with the inner circumferential surface of the bobbin.

[0016] The shape of the plurality of slits is not particularly limited provided that the slits generally extend along the axial direction of the cylinder so as to allow the axially central portion of the cylindrical picker member to be divided in the circumferential direction of the cylinder to form the plurality of tight contact portions. Accordingly, the slits according to the present invention need not necessarily be parallel to the axial direction of the picker member. For example, the slits according to the present invention may extend in a direction inclined to the axial direction or may extend curvedly or zigzag.

[0017] A residual-yarn removing device according to a fifth invention in the fourth invention is **characterized in that** the picker member is formed of an elastic member, and a circular stress relaxing portion is formed at each of opposite ends of the slit.

[0018] With this arrangement, the stress relaxing portions relax stress concentration that may occur at the positions of the opposite ends of each of the slits when the plurality of tight contact portions are bendably deformed so as to increase or reduce the diameter of the picker member. This prevents cracks from developing from the opposite ends of each of the slits.

[0019] According to a sixth invention, there is provided a picker member characterized by comprising a cylinder which is inserted into a cylindrical bobbin and which has a plurality of slits formed in an axially central portion thereof, the slits extending along an axial direction of the cylinder and arranged in a circumferential direction of the cylinder, the cylinder being an elastic member, the picker member comprising a plurality of tight contact portions which is formed by dividing the cylinder in the circumferential direction thereof by the plurality of slits and which are displaceable in a radial direction of the bobbin between a reduced diameter state and an increased diameter state in which the tight contact portions widen out compared to the reduced diameter state, coupling portions provided at respective axially opposite ends of the cylinder to couple the plurality of tight contact portions together, and circular stress relaxing portions formed at respective opposite ends of each of the slits.

[0020] The picker member is divided into the plurality of tight contact portions with respect to the inner circumferential direction of the bobbin. Thus, the tight contact portions are easily bendably deformed with respect to the coupling portion and can thus be significantly deformed in the radial direction of the bobbin. This enables an increase in the amount by which the picker member is displaced in the radial direction (that is, the amount by

which the diameter is increased). Therefore, the single type of picker member can be commonly used for the plural types of bobbins with the different inner diameters. This enables a reduction in the time and effort required to replace the picker member depending on the type of the bobbins. Furthermore, compared to the conventional picker member, which is repeatedly subjected to both expansion and contraction and bending deformation, the picker member according to the present invention is unlikely to suffer fatigue fracture and offers improved durability.

[0021] Moreover, the stress relaxing portions relax stress concentration that may occur at the positions of the opposite ends of each of the slits when the plurality of tight contact portions are bendably deformed so as to increase or reduce the diameter of the picker member. This prevents cracks from developing from the opposite ends of each of the slits.

[0022] Other features, elements, processes, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments of the present invention with reference to the attached drawings.

Brief Description of the Drawings

[0023]

Figure 1 is a front view of a residual-yarn removing device (standby state) according to an embodiment of the present invention.

Figure 2 is a front view of the residual-yarn removing device (bobbin holding state).

Figure 3 is a front view of the residual-yarn removing device (bobbin lifting state).

Figure 4 is a front view of the residual-yarn removing device (the bobbin is being pulled out).

Figure 5 is a front view of the residual-yarn removing device (bobbin pullout completion state).

Figure 6 is an enlarged view of a bobbin picker.

Figure 7 is a vertical sectional view of the bobbin picker (reduced diameter state) in Figure 6.

Figure 8 is a horizontal sectional view of the bobbin picker taken along line VIII-VIII in Figure 6.

Figure 9 is a vertical sectional view of the bobbin picker (increased diameter state).

Figure 10 is a diagram showing a picker member according to a variation.

Figure 11 is a horizontal sectional view of a picker member and a picker shaft according to another variation.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0024] Now, embodiments of the present invention will be described. Figure 1 is a front view of a residual-yarn removing device (bobbin stripper) according to the

present embodiment. A residual-yarn removing device 1 according to the present embodiment is provided in a bobbin conveying device in an automatic winder that rewinds a yarn unwound from a supplying bobbin to form a winding package.

[0025] In the automatic winder, when a yarn wound around a bobbin is determined to be defective, unwinding of the yarn from the bobbin is suspended, and the bobbin with the residual yarn is discharged from the automatic winder. Where the bobbin with the residual yarn is returned to a spinning machine as it is, a new yarn is wound on the defective yarn in the spinning machine. Thus, the bobbin conveying device generally has the residual-yarn removing device removing the residual yarn from the bobbin before returning the bobbin to the spinning machine.

[0026] As shown in Figure 1, the residual-yarn removing device 1 comprises a bobbin picker 2 that is inserted into a cylindrical bobbin B in a vertical posture from an upper end of the bobbin, a bar-like pusher 3 (support base) coupled to the bobbin picker 2, a clasper 4 that grips a residual yarn Y on the bobbin B held by the bobbin picker 2, and the like. The components of the residual-yarn removing device 1, including the bobbin picker 2, the pusher 3, and the clasper 4, are supported by a fixedly provided frame 5.

[0027] Furthermore, the residual-yarn removing device 1 comprises a residual-yarn detecting sensor (not shown in the drawings) that determines whether or not any yarn is left on the bobbin B. A residual-yarn removing operation is performed only when the sensor detects that the conveyed bobbin B has the residual yarn Y thereon.

[0028] The bobbin picker 2 has a cylindrical picker member 20. The bobbin picker 2 is disposed in the pusher 3 and configured such that a picker cylinder 22 (see Figures 7 and 9) supported in the pusher 3 increases the diameter of the picker member 20 to tightly contact the picker member 20 with an inner surface of the bobbin B to hold the bobbin. The specific configuration of the bobbin picker 2 will be described below in detail.

[0029] The pusher 3 is supported in the frame 5 so as to be movable in a vertical direction and driven in the vertical direction (the axial direction of the bobbin B) by a pusher cylinder 6 (support base driving means). A tip (lower end) of the pusher 3 is coupled to an upper end of the bobbin picker 2. Consequently, when the pusher 3 is driven by the pusher cylinder 6 to move in the vertical direction, the bobbin picker 2 (and the bobbin B held by the bobbin picker 2) moves up and down integrally with the pusher 3.

[0030] A lateral pair of claspers 4 is provided at the bottom of the frame 5. The paired claspers 4 are driven by a driving means such as an air cylinder (not shown in the drawings) so as to move closer to and away from each other. The paired claspers 4 can thus grip and release the residual yarn Y on the bobbin B.

[0031] In the residual-yarn removing device 1 according to the present embodiment, the picker cylinder 22,

the pusher cylinder 6, the clasper 4, and the like are controlled by a control device (not shown in the drawings) to remove the residual yarn Y from the bobbin B.

[0032] As shown in Figure 1, the bobbin conveying device conveys a tray 7 with the bobbin B held thereon in a vertical posture to the residual-yarn removing device 1. Then, only when the residual-yarn detecting sensor (not shown in the drawings) detects that the residual yarn Y is present on the bobbin B, the residual-yarn removing device 1 performs a series of residual-yarn removing operations as described below.

[0033] First, as shown in Figure 2, the diameter of the picker member 2 is increased by the picker cylinder 22, and the bobbin B is held by the bobbin picker 2. Then, as shown in Figure 3, the bobbin picker 2 is driven upward together with the pusher 3 by means of the pusher cylinder 6. The bobbin B is thus lifted.

[0034] Then, as shown in Figure 4, the residual yarn Y on the bobbin B is gripped by the lateral pair of clasper 4, and the pusher 3 is driven downward by the pusher cylinder 6 to push out the bobbin B downward. The bobbin B is pulled out from the residual yarn Y.

[0035] Finally, as shown in Figure 5, the gripped residual yarn Y is released from the pair of claspers 4. Air is blown, by a blast (not shown in the drawings), against the residual yarn Y positioned at an upper end of the bobbin B. An on-off valve 10 is further opened by the air cylinder 9 to allow a suction pipe 8 to suck and remove the residual yarn Y from the bobbin B.

[0036] Now, the bobbin picker 2 will be described in detail. Figure 6 is an enlarged view of the bobbin picker in the reduced diameter state. Figure 7 is a vertical sectional view of the bobbin picker. Figure 8 is a sectional view of the bobbin picker taken along line VIII-VIII in Figure 6. Figure 9 is a vertical sectional view of the bobbin picker in the increased diameter state. As shown in Figures 6 to 9, the bobbin picker 2 has the cylindrical picker member 20 and a picker shaft 21 inserted through the picker member 20.

[0037] The cylinder constituting the picker member 20 is formed of a relatively soft elastic member, for example, a rubber material or a resin material. As shown in Figures 6 and 8, a plurality of (in the present embodiment, eight) slits 25 are formed in an axially (vertical direction) central portion of the picker member 20 at equal intervals in a circumferential direction of the picker member 20; the slits 25 extend parallel to one another in the axial direction of the picker member 20 and are arranged in the circumferential direction. Furthermore, as shown in Figure 8, each of the slits 25 penetrates the picker member 20 in a radial direction thereof from an outer surface to an inner surface thereof. Thus, the axially central portion of the picker member 20 is divided in the circumferential direction by the plurality of slits 25. In other words, a plurality of tight contact portions 23 are formed in the axially central portion of the picker member 20; the picker member 20 is divided into the tight contact portions 23 by the plurality of slits 25, and the tight contact portions 23 are

arranged in the circumferential direction of the picker member 20. The tight contact portions 23 are arranged in contact with the picker shaft 21, but are not fixed to the picker shaft 21. Furthermore, the slit 25 has a very small width. Where the picker member 20 is in the reduced diameter state (the state shown in Figure 6), the circumferentially adjacent tight contact portions 23 are almost in contact with each other.

[0038] In this manner, the axially central portion of the picker member 20 is divided into the plurality of tight contact portions 23 with respect to the circumferential direction of the picker member 20 (the inner circumferential direction of the bobbin B). Thus, when an axial load acts on the picker member 20, each of the plurality of tight contact portions 23 is easily bendably deformed and can thus be significantly deformed in the radial direction of the picker member 20.

[0039] As shown in Figure 6, circular notch portions 26 (stress relaxing portions) each having a diameter larger than the width of the slit 25 are formed at the respective opposite ends of each slit 25. The notch portions 26 relax stress concentration that may occur at the opposite ends of the slit 25 where the tight contact portions 23 are bendably deformed and displaced in the radial direction of the picker member 20.

[0040] Furthermore, the plurality of tight contact portions 23, into which the picker member 20 is divided in the circumferential direction thereof by the plurality of slits 25, are coupled together by axially opposite ends of the picker member 20. That is, the axially opposite ends of the picker member 20 constitute respective coupling portions 24 that couple the plurality of tight contact portions 23 together. As shown in Figures 7 and 9, annular engaging portions 20a, 20b are formed at the respective axially opposite ends of the picker member 20 to fix the picker member 20 to the picker shaft 21 and the pusher 3.

[0041] The picker shaft 21 is supported by the pusher 3 so as to be movable in the vertical direction (the axial direction of the bobbin B). The picker shaft 21 is driven in the vertical direction with respect to the pusher 3 by the picker cylinder 22, disposed in the pusher 3 (forward and backward driving). The picker shaft 21 and the picker cylinder 22 correspond to a picker driving means according to the present invention.

[0042] Furthermore, the picker shaft 21 is inserted through the cylindrical picker member 20, described above. A tapered fixing bracket 27 is externally threadably fitted around a threaded portion formed at the tip of the picker shaft 21. That is, the fixing bracket 27 is fixed to the picker shaft 21. Furthermore, an annular engaging portion 27a is formed at an upper end of the fixing bracket 27. The engaging portion 27a engages the annular engaging portion 20a, located at the lower end of the picker member 20, to fix the picker member 20 and the picker shaft 21 to each other via the fixing bracket 27.

[0043] Moreover, a cylindrical fixing bracket 28 is slidably externally fitted around a part of the picker shaft 21 located above the picker member 20. A threaded por-

tion is formed on the outer circumference of an upper half of the fixing bracket 28. A lower end of the pusher 3 is externally threadably fitted around the threaded portion. That is, the fixing bracket 28 is fixed to the pusher 3. Furthermore, an annular engaging portion 28a is formed at a lower end of the fixing bracket 28. The engaging portion 28a engages the annular engaging portion 20b, located at an upper end of the picker member 20, to fix the picker member 20 and the pusher 3 to each other via the fixing bracket 28.

[0044] In this manner, the two coupling portions 24 are positioned at the respective axially opposite ends of the picker member 20 to couple the plurality of tight contact portions 23, arranged between the axially opposite ends of the picker member 20; one of the coupling portions 24 is fixed to the picker shaft 21 via the fixing bracket 27, while the other is fixed to the pusher 3 via the fixing bracket 28. Thus, in the reduced diameter state, in which the picker member 20 does not bulge outward in the radial direction thereof, when the picker member shaft 21 is driven upward by the picker cylinder 22 so as to retract into the pusher 3 as shown in Figure 7, an axial compression force is exerted on the picker member 20 fixed to both the pusher shaft 21 and the pusher 3.

[0045] Here, as previously described, the axially central portion of the picker member 20 is divided into the plurality of tight contact portions 23 with respect to the circumferential direction of the picker member 20. Accordingly, when the axially central portion of the picker member 20 is subjected to an axial compression force, the tight contact portions 23 can be easily bendably deformed with respect to the coupling portions 24. Thus, when the picker member 20 is compressed in the axial direction thereof, the compression is converted into the bending deformation of the tight contact portions 23 without locally expanding or contracting the tight contact portions 23.

[0046] Consequently, as shown in Figure 9, the plurality of tight contact portions 23 of the picker member 20 are significantly bendably deformed so as to project outward in the radial direction of the picker member 20 with respect to the coupling portions 24. This results in the increased diameter state in which the tight contact portions 23 bulge outward in the radial direction of the picker member 20. Thus, the plurality of tight contact portions 23 tightly contact with the inner circumference of the bobbin B, which is thus held by the picker member 20.

[0047] Furthermore, with the bobbin B held by the picker member 20 in the increased diameter state, when the picker shaft 21 is driven downward by the picker cylinder 22 so as to advance from the pusher 3, the picker member 20 is quickly expanded because the two coupling portions 24 of the picker member 20 are fixed to the picker shaft 21 and the pusher 3, respectively. In conjunction with the expansion, the tight contact portions 23 bendably deformed so as to project outward in the radial direction return to the reduced diameter state, shown in Figure 7. Then, each of the plurality of tight contact portions 23

leaves the inner surface of the bobbin B to allow the picker member 20 to quickly release the held bobbin B.

[0048] As described above, the residual-yarn removing device 1 according to the present embodiment is configured such that the picker driving means (picker shaft 21 and picker cylinder 22) can switch the picker member 20 between the increased diameter state and the reduced diameter state. That is, the picker shaft 21 and the picker cylinder 22 can forcibly displace the picker member 20 not only from the reduced diameter state to the increased diameter state but also from the increased diameter state to the reduced diameter state. Therefore, the picker member 20 is prevented from returning inappropriately from the increased diameter state, in which the picker member 20 holds the bobbin B, to the reduced diameter state. The held bobbin B can thus be reliably released.

[0049] More specifically, the one end of the picker member 20 is fixed to the picker shaft 21, while the other end is fixed to the pusher 3. Thus, the picker shaft 21 moves in the axial direction of the bobbin B with respect to the pusher 3 to compress and expand the picker member 20 in the axial direction. As a result, the increased diameter state and the reduced diameter state are forcibly switched.

[0050] Furthermore, the axially central portion of the picker member 20 is divided in the circumferential direction thereof by the slits 25 to form the plurality of tight contact portions 23. Thus, each of the plurality of tight contact portions 23 can be easily bendably deformed with respect to the coupling portions 24. This enables an increase in the amount by which the picker member 20 is displaced in the radial direction (the amount by which the diameter is increased). Therefore, the single type of picker member 20 can be commonly used for the plural types of bobbins B with difference inner diameters. This enables a reduction in the time and effort required to replace the picker member 20 depending on the type of the bobbin B.

[0051] Additionally, the diameter of the plurality of tight contact portions 23 is repeatedly increased and reduced almost only on the basis of the bending deformation. Consequently, when the diameter is increased or reduced, the tight contact portions 23 are subjected to very insignificant local expansion or contraction. Thus, compared to the conventional picker member, which is repeatedly subjected to both expansion and contraction and bending deformation, the picker member 20 is unlikely to suffer fatigue fracture and offers improved durability.

[0052] Moreover, the circular notch portions 26 (stress relaxing portions) are formed at the respective positions of the opposite ends of each of the slits 25 in the picker member 20. Consequently, the stress relaxing portions relax stress concentration that may occur at the positions of the opposite ends of the slit when the tight contact portions 23 are bendably deformed with respect to the coupling portions 24. This prevents possible development of cracks from the opposite ends of the slit 25, which

may finally result in a fracture.

[0053] Now, variations obtained by making various changes to the above-described embodiment will be described. However, components of the variations having configurations similar to those of the above-described embodiment are denoted by the same reference numerals, and the description of these components is omitted as required.

[0054] The plurality of slits formed in the picker member to divisionally form the plurality of tight contact portions 23 are not limited to the shape according to the above-described embodiment. That is, the shape of the slits is not particularly limited provided that the slits generally extend along the axial direction of the picker member so as to divide the axially central portion of the picker member into a plurality of tight contact portions.

[0055] For example, as shown in Figure 10A, slits 25A may each have a width such that a gap is formed between adjacent tight contact portions 23A even where the picker member 20 is in the reduced diameter state.

[0056] Alternatively, as shown in Figure 10B, slits 25B may extend in a direction inclined to the axial direction. Alternatively, as shown in Figure 10C, slits 25C may extend curvedly (for example, circularly). Alternatively, as shown in Figure 10D, slits 25D may generally extend along the axial direction while locally bending zigzag.

[0057] Alternatively, a structure may be adopted in which the slits reach one end of the picker member 20, whereas the plurality of tight contact portions 23 into which the picker member 20 is divided by the slits are coupled together by only one of the coupling portions located at the other end of the picker member 20. In this case, the diameter of the plurality of tight contact portions 23 into which the picker member 20 is divided by the slits can be increased such that the tight contact portions are shaped like an umbrella.

[0058] Furthermore, the number of the slits formed in the cylindrical picker member can be appropriately determined on the basis of conditions such as the required displacement amount in the radial direction (the required amount by which the diameter is increased).

[0059] The picker member is not limited to the cylinder. For example, as shown in Figure 11, a picker member 30 may be composed of two divided members 31, 32 that are completely separated from each other in the circumferential direction of the picker member 30. The two divided members 31, 32 are not coupled together but are independently attached to the picker shaft 21. Moreover, at least one slit 35 extending in the axial direction (the direction perpendicular to the sheet of Figure 11) is formed in each of the divided members 31, 32. The slit 35 divisionally forms a plurality of tight contact portions 33 in the circumferential direction.

[0060] In the picker member 30, when an axial compression force acts on each of the two divided members 31, 32, that is, the right and left divided members 31, 32, the plurality of tight contact portions 33, formed in each of the divided members 31, 32, are displaced in the radial

direction of the picker member 30. The diameter of the picker member 30 as a whole is thus increased to allow the picker member 30 to hold the bobbin B.

[0061] The material constituting the picker member is not limited to the soft elastic material such as the rubber material or resin material. However, the material constituting the picker member is not particularly limited provided that the material is flexible enough to allow the plurality of tight contact portions to be easily bendably deformed with respect to the coupling portions and displaced in the radial direction of the picker member. Therefore, the picker member may be formed of a hard material such as a flexible, thin metal plate.

[0062] While the present invention has been described with respect to preferred embodiments thereof, it will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other than those specifically set out and described above. Accordingly, it is intended by the appended claims to cover all modifications of the present invention that fall within the true spirit and scope of the invention.

Claims

1. A residual-yarn removing device (1) removing a residual yarn on a bobbin (B), the device being **characterized by** comprising a picker member (20) that is displaceable between an increased diameter state in which the picker member (20) tightly contacts an inner surface of the bobbin (B) to hold the bobbin (B) and a reduced diameter state in which an outer diameter of the picker member (20) is made smaller than an inner diameter of the bobbin (B), a picker driving means (21, 22) for switching the picker member (20) between the increased diameter state and the reduced diameter state, a support base (3) that supports the picker driving means (21, 22), and a support base driving means (6) for driving the support base (3) in an axial direction of the bobbin (B).
2. A residual-yarn removing device (1) according to Claim 1, **characterized in that** the picker driving means (21, 22) has a picker shaft (21) inserted through the picker member (20), and one end of the picker member (20) is fixed to the picker shaft (21), while the other end of the picker member (20) is fixed to the support base (3), and **in that** the picker shaft (21) of the picker driving means (21, 22) moves in the axial direction of the bobbin (B) with respect to the support base (3) to switch the picker member (20) between the increased diameter state and the reduced diameter state.
3. A residual-yarn removing device (1) according to Claim 1 or Claim 2, **characterized in that** the picker member (20) has a plurality of tight contact portions

(23) which are arranged in an inner circumferential direction of the bobbin (B) and which are displaceable in the radial direction of the bobbin (B), and a coupling portion (24) that couples the plurality of tight contact portions (23) together.

5

4. A residual-yarn removing device (1) according to Claim 3, **characterized in that** the picker member (20) comprises a cylinder having a plurality of slits (25) formed in an axially central portion thereof, the slits (25) extending along the axial direction of the cylinder and arranged in a circumferential direction of the cylinder, and the axially central portion of the cylinder is divided in the circumferential direction of the cylinder by the plurality of slits (25) to form the plurality of tight contact portions (23), the cylinder having axially opposite ends each comprising the coupling portion (24) coupling the plurality of tight contact portions (23) together.
5. A residual-yarn removing device (1) according to Claim 4, **characterized in that** the picker member (20) is formed of an elastic member, and a circular stress relaxing portion (26) is formed at each of opposite ends of the slit (25).
6. A picker member **characterized by** comprising a cylinder which is inserted into a cylindrical bobbin (B) and which has a plurality of slits (25) formed in an axially central portion thereof, the slits extending along an axial direction of the cylinder and arranged in a circumferential direction of the cylinder, the cylinder being an elastic member, the picker member comprising a plurality of tight contact portions (23) which are formed by dividing the cylinder in the circumferential direction thereof by the plurality of slits (25) and which are displaceable in a radial direction of the bobbin (B) between a reduced diameter state and an increased diameter state in which the tight contact portions (23) widen out compared to the reduced diameter state, coupling portions (24) provided at respective axially opposite ends of the cylinder to couple the plurality of tight contact portions (23) together, and circular stress relaxing portions (26) formed at respective opposite ends of each of the slits (25).

10

15

20

25

30

35

40

45

50

55

FIGURE 1

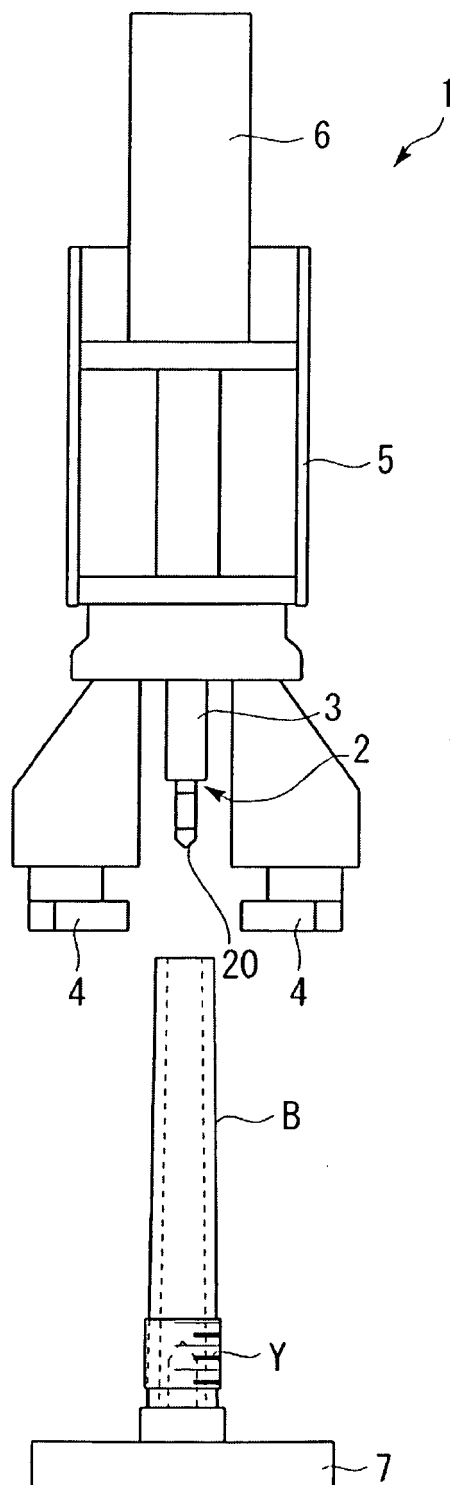


FIGURE 2

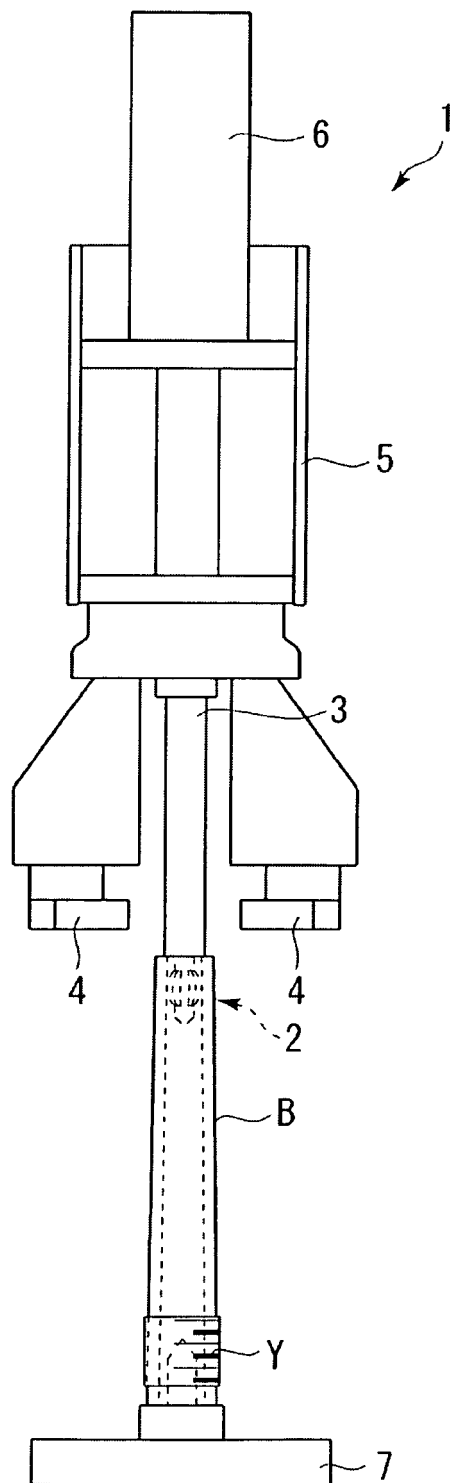


FIGURE 3

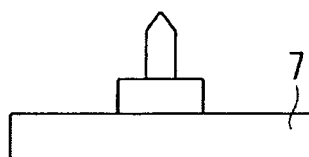
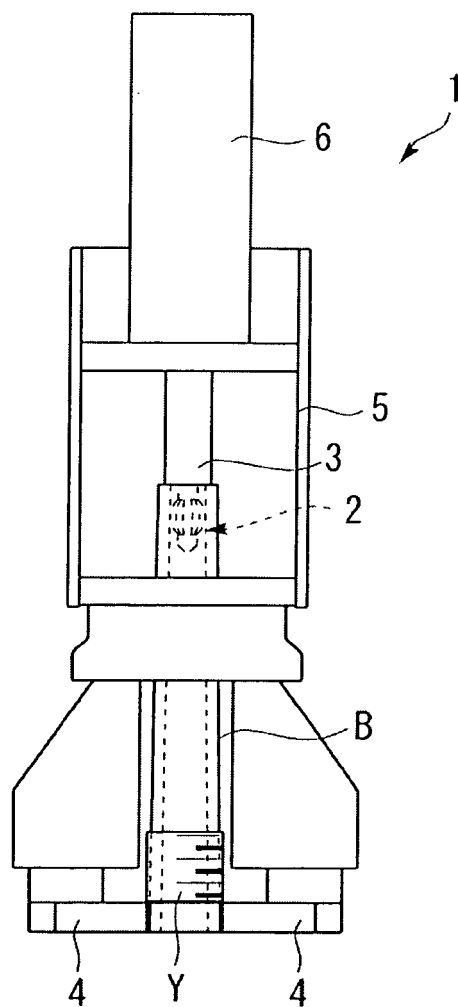


FIGURE 4

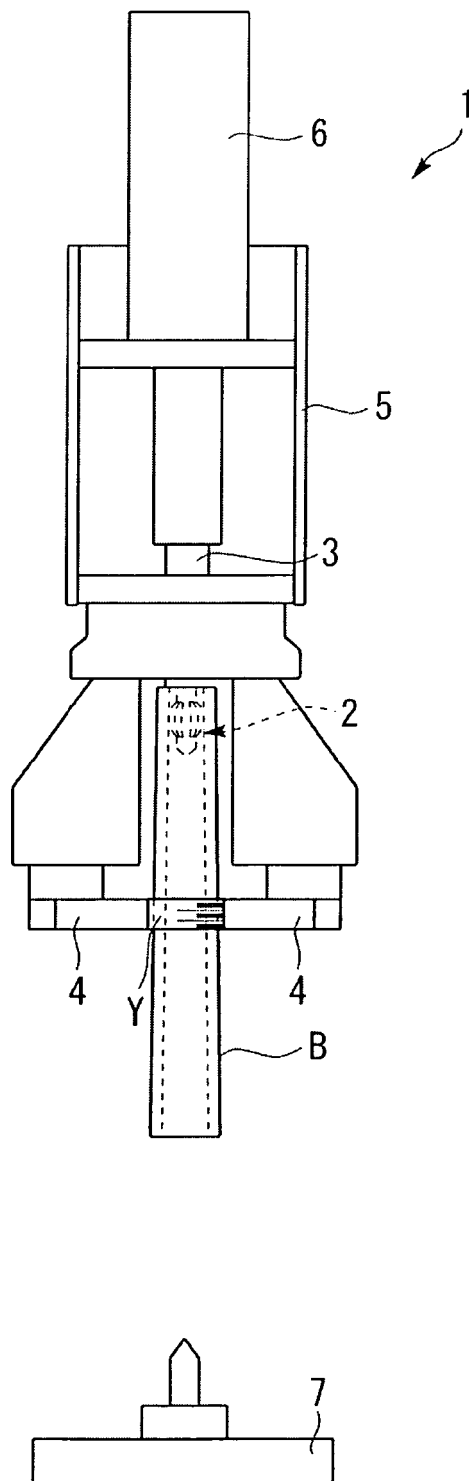


FIGURE 5

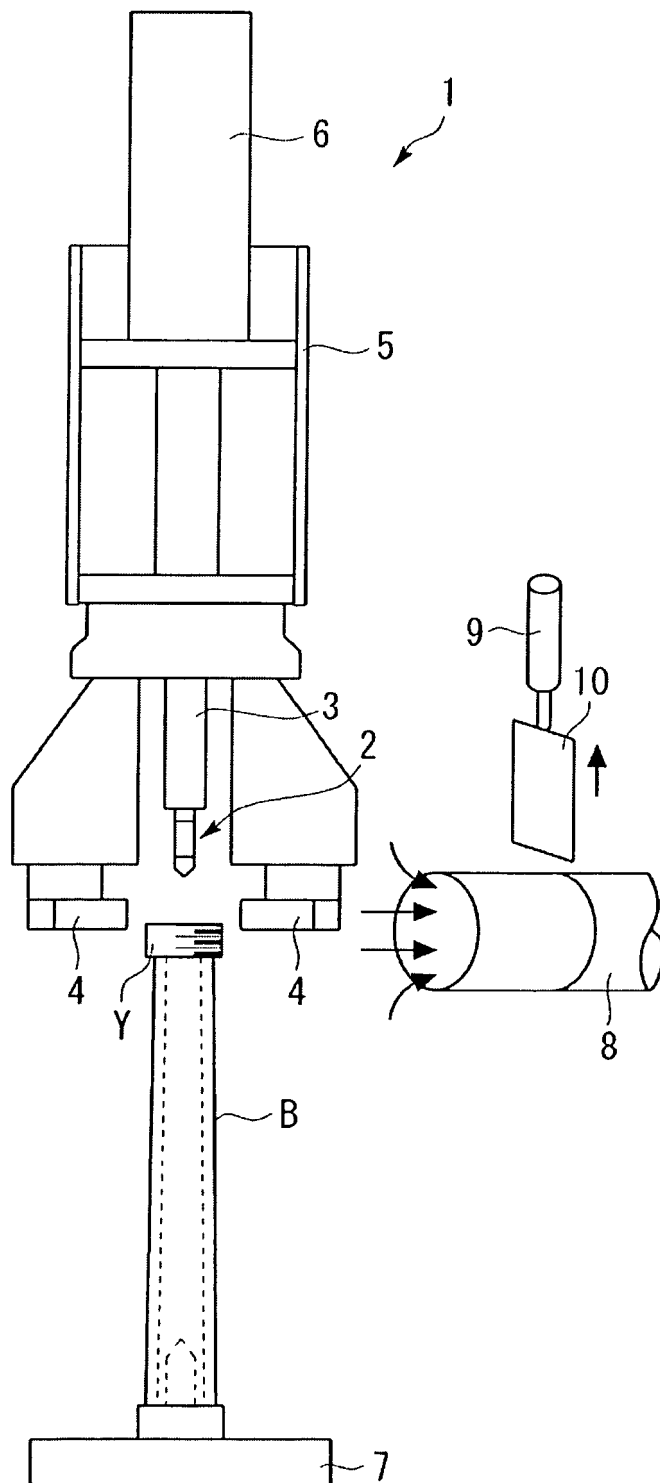


FIGURE 6

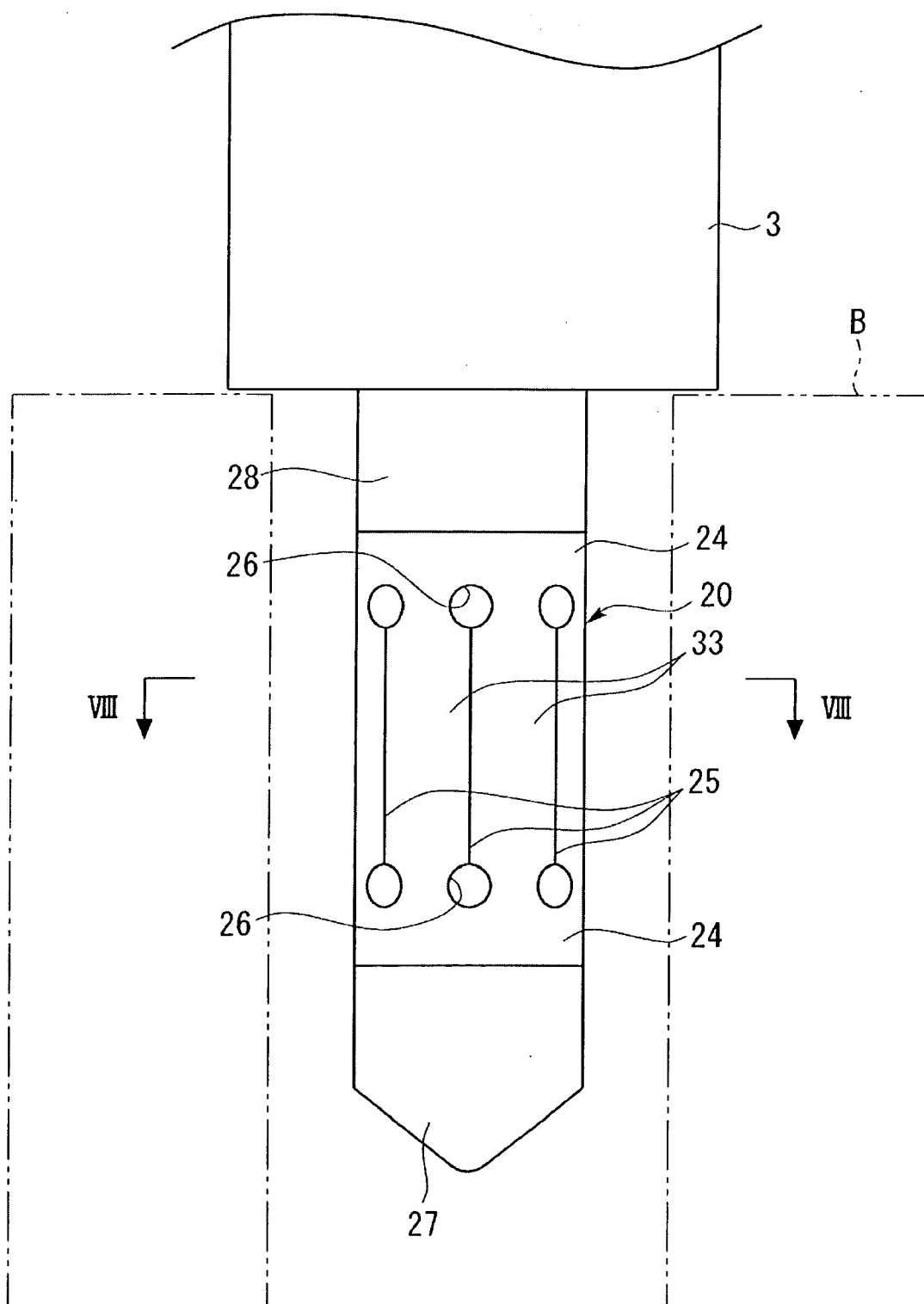


FIGURE 7

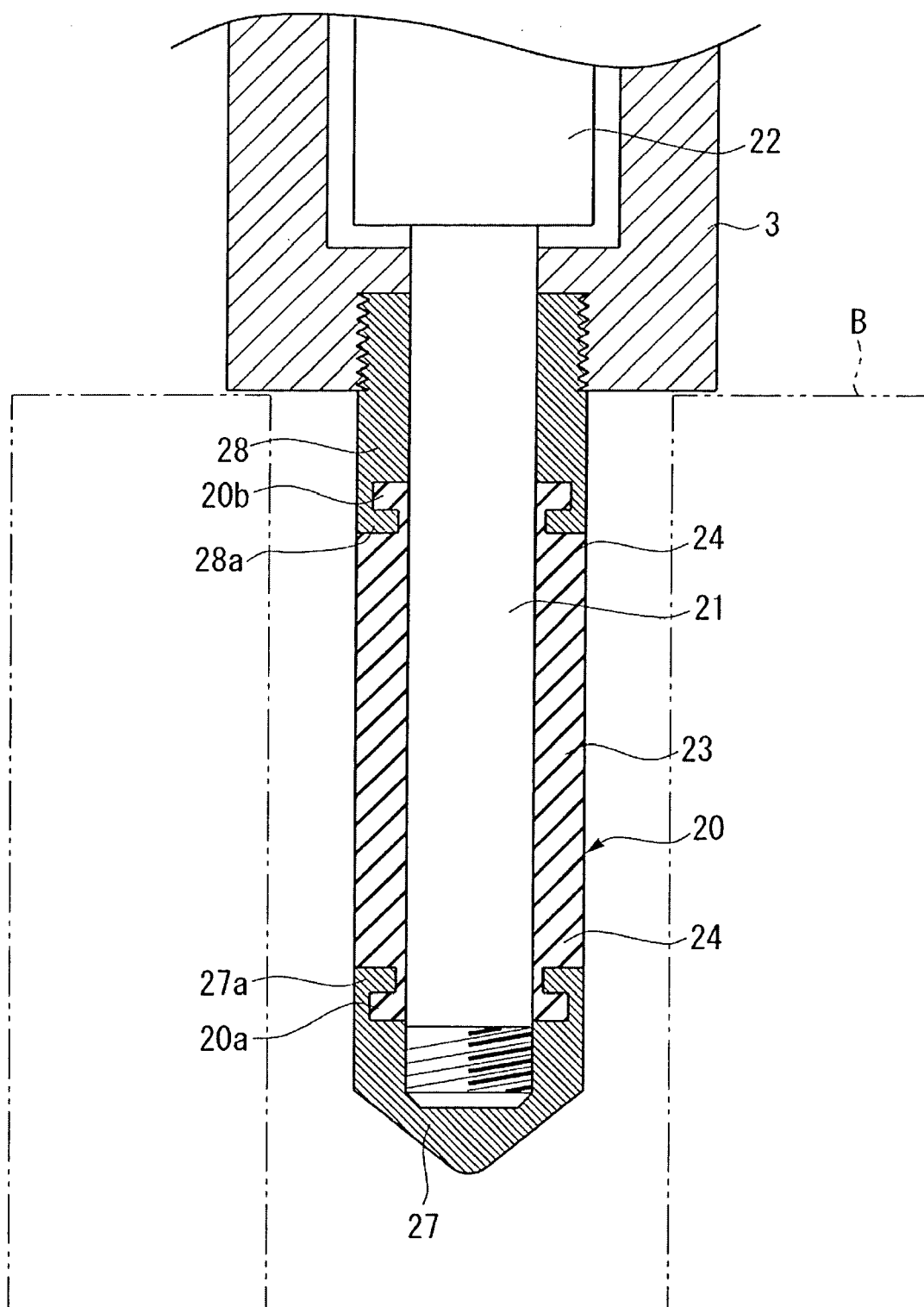


FIGURE 8

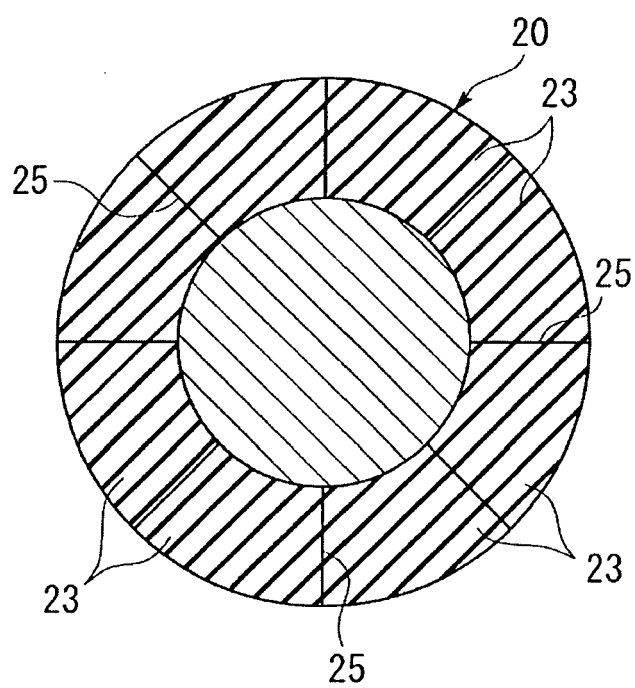


FIGURE 9

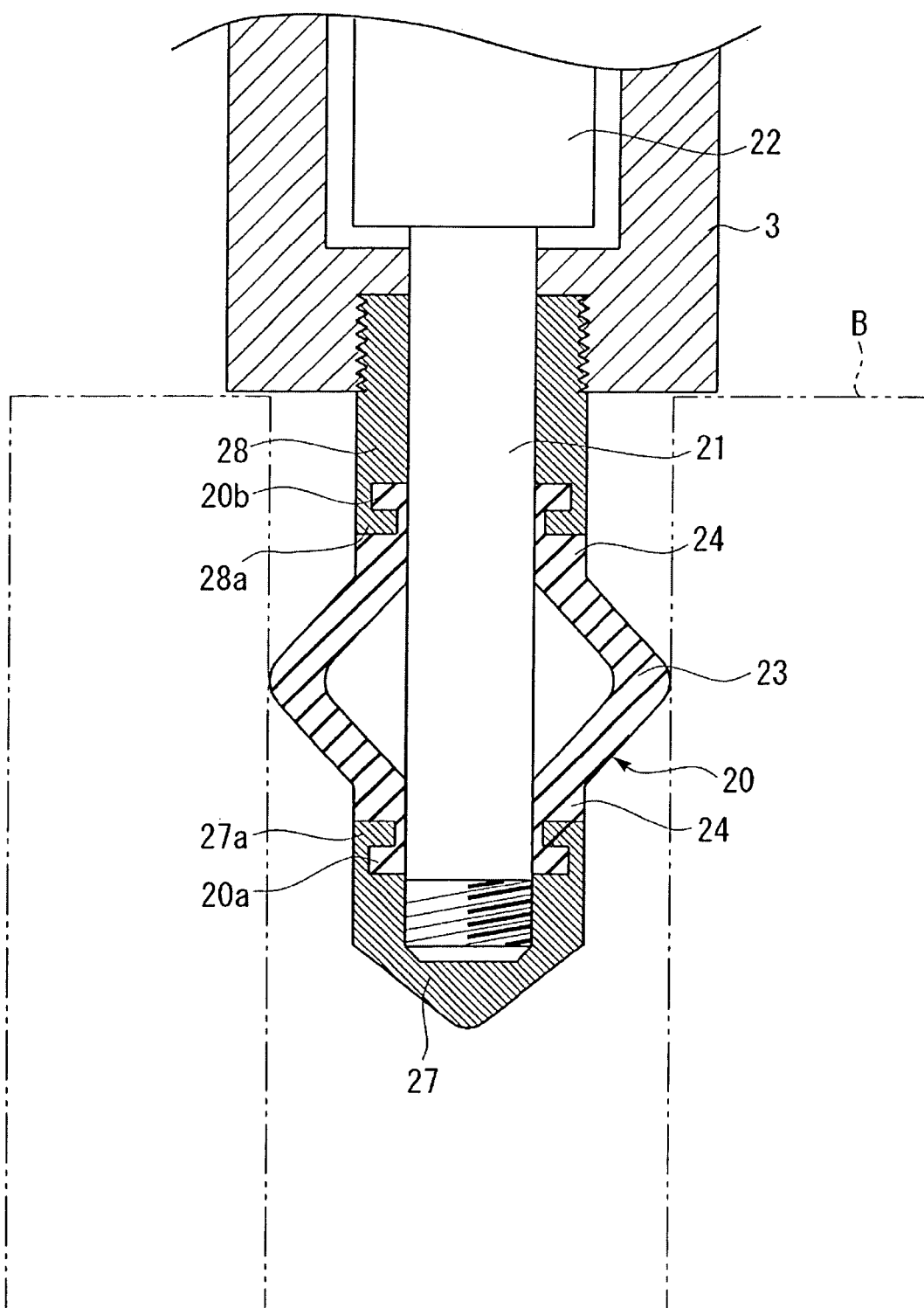


FIGURE 10A

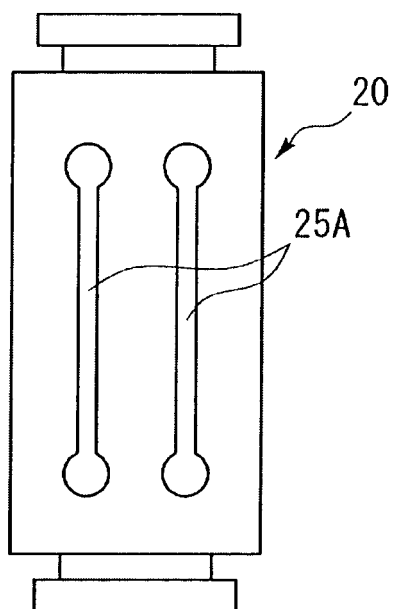


FIGURE 10B

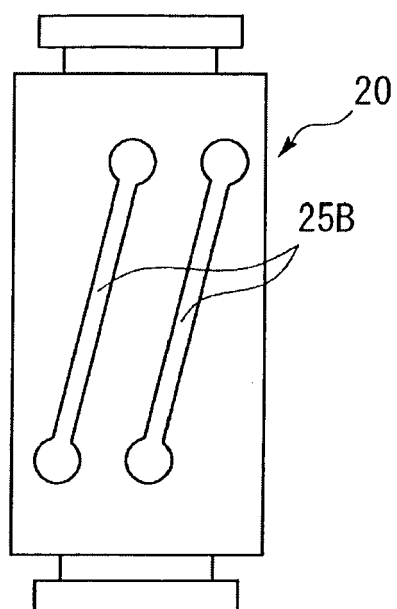


FIGURE 10C

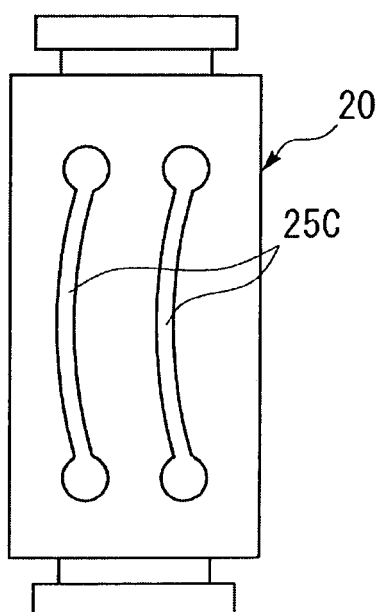


FIGURE 10D

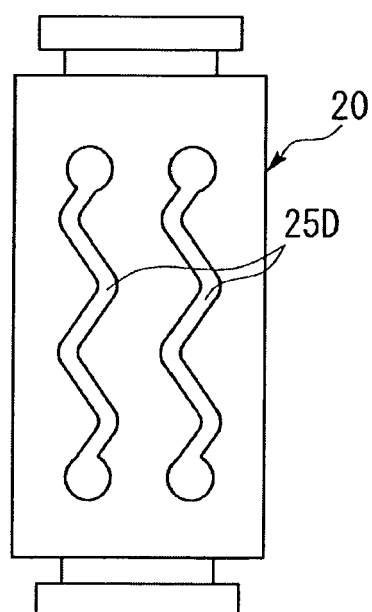
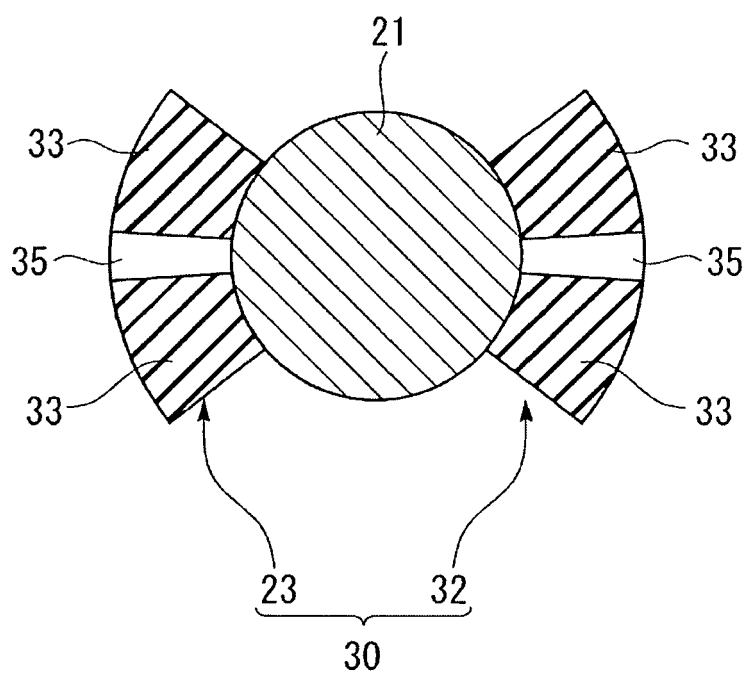


FIGURE 11



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 11100171 A [0002] [0003] [0011]