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(71) Applicant: **Murata Machinery, Ltd.**
Minami-ku
Kyoto-shi
Kyoto 601-8326 (JP)

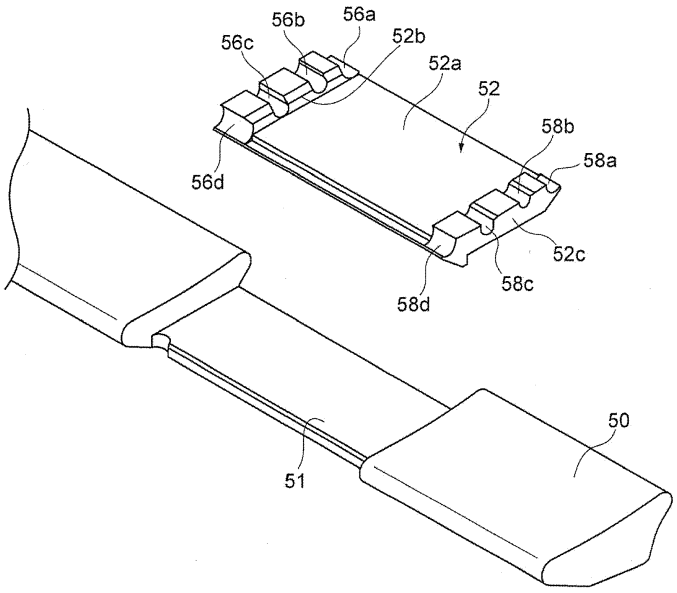
(72) Inventors:
- **SHODA, Yuichi**
  Kyoto, 612-8686 (JP)
- **OKA, Masaki**
  Kyoto, 612-8686 (JP)
- **MATSUI, Toshihiro**
  Kyoto, 612-8686 (JP)

(74) Representative: **Weickmann & Weickmann PartmbB**
Postfach 860 820
81635 München (DE)

(54) TENSOR, DRAFT DEVICE, AND SPINNING MACHINE

(57) A tensor (40) includes rollers (54a to 54d) adapted to support an apron belt (18a), a supporting body (52) in which bearings (56a to 56d, 58a to 58d) adapted to detachably position the rollers (54a to 54d) are arranged in one direction, and a main body section (50) extending in a rotation axis direction of the bottom roller (16a) and on which the supporting body (52) is detachably fixed so that the bearings (56a to 56d, 58a to 58d) are arranged along a draft direction of a fiber bundle (S).

FIG. 9



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a tensor, a draft device, and a spinning machine.

2. Description of the Related Art

[0002] There is known a spinning machine including a draft device adapted to draft a fiber bundle, and a spinning device adapted to twist the drafted fiber bundle to produce a spun yarn. The draft device includes a plurality of pairs of rollers in a draft direction of the fiber bundle. An apron belt adapted to grip (nip) and draft the fiber bundle is stretched across a bottom roller of a pair of rollers and a tensor (tensor bar).

[0003] DE102005000990A describes a draft device including a tensor (belt bridge) in which five rotatable rollers are arranged.

[0004] According to the tensor of DE102005000990A, friction between the tensor and the apron belt when the apron belt is rotated can be reduced.

[0005] In such a draft device, a gripping position (nip position) and a gripping force of the fiber bundle by the apron belt affect quality of the yarn. In particular, in the draft device adapted to draft a plurality of types of fiber bundles, it is desired that the supporting state of the fiber bundle by the apron belt can be changed at a high degree of freedom according to the fiber bundle. However, in the conventional tensor, the gripping position (nip position) and the gripping force of the fiber bundle by the apron belt cannot be easily adjusted.

BRIEF SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to provide a tensor, a draft device, and a spinning machine in which a supporting state of a fiber bundle by an apron belt can be easily changed.

[0007] A tensor according to the present invention is provided in a draft device adapted to draft a fiber bundle by a pair of rollers including a bottom roller and a top roller, the tensor adapted to adjust a tension of an apron belt stretched across the bottom roller and the tensor, the tensor including: a supporting member (at least one supporting member) adapted to support the apron belt; a replacement member in which positioning portions adapted to detachably position the supporting member are arranged in one direction; and a main body section extending in a rotation axis direction of the bottom roller and on which the replacement member is detachably fixed so that the positioning portions are arranged along a draft direction of the fiber bundle.

[0008] In the tensor having such a configuration, the supporting member is detachably held on the replacement member, so that the nip force of the fiber bundle by the apron belt can be easily adjusted by, for example, replacing with a supporting member which is different from the supporting member in the amount of projection from the replacement member, or replacing with a supporting member which is different from the supporting member in contacting area with the apron belt. Furthermore, for example, the position of the supporting member in the arrangement direction can be easily changed by replacing with the replacement member in which the positions of the positioning portions in the arrangement direction differ from each other. In other words, the nip position of the fiber bundle by the apron belt can be easily adjusted. Consequently, the supporting state of the fiber bundle by the apron belt can be easily changed.

[0009] According to one embodiment, the positioning portions may have shapes from which a plurality of supporting members having shapes different from each other are detachable. According to the tensor having such a configuration, replacement can be made with supporting members whose projection amounts from the replacement member differ from each other, or with supporting members whose contacting areas with the apron belt differ from each other, so that the nip force of the fiber bundle by the apron belt can be easily adjusted. Furthermore, for example, the nip position of the fiber bundle by the apron belt can be easily adjusted by attaching or removing of the supporting member.

[0010] In one embodiment, the main body section may have a shape from which a replacement member in which the positions of the positioning portions in the arrangement direction differ from each other and/or the shapes of the positioning portions differ from each other is detachable. According to the tensor having such a configuration, the position of the supporting member in the arrangement direction can be changed by replacing with a replacement member in which the positions of the positioning portions in the arrangement direction differ from each other. In other words, the nip position of the fiber bundle by the apron belt can be easily adjusted. Moreover, according to the tensor having such a configuration, since the shapes of the positioning portions differ from each other, the supporting members whose projection amounts from the replacement member differ from each other can be held, or the supporting members whose contacting areas with the apron belt differ from each other can be held, so that the nip force of the fiber bundle by the apron belt can be easily adjusted.

[0011] In one embodiment, the supporting member may be a roller rotatable with a rotation axis as a center, the rotation axis extending in the same direction as an extending direction of the main body section. According to the tensor having such a configuration, the friction between the tensor and the apron belt when the apron belt is rotated can be reduced.

[0012] In one embodiment, the positioning portion may be a bearing adapted to rotatably support the rotation axis of the roller. According to the tensor having such a

configuration, the supporting member of a roller configuration can be easily held.

[0013] A draft device according to the present invention includes : a pair of rollers including a bottom roller and a top roller; the tensor described above; and an apron belt stretched across the bottom roller and the tensor.

[0014] According to the draft device having such a configuration, the supporting state of the fiber bundle by the apron belt can be easily changed.

[0015] A spinning machine according to the present invention includes: the draft device described above; a pneumatic spinning device adapted to twist the fiber bundle drafted by the draft device to produce a yarn; and a winding device adapted to wind the yarn produced by the pneumatic spinning device into a package.

[0016] According to the spinning machine having such a configuration, in the draft device, the supporting state of the fiber bundle by the apron belt can be changed at a high degree of freedom according to the type of the fiber bundle. Thus, the gripping position (nip position) and the gripping force of the fiber bundle by the apron belt can be appropriately adjusted according to the type of the fiber bundle. As a result, the yarn of high quality can be produced.

[0017] According to the present invention, the supporting state of the fiber bundle by the apron belt can be easily changed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is a front view of a spinning machine including a draft device according to one embodiment;
FIG. 2 is a side view of a spinning unit of the spinning machine illustrated in FIG. 1;
FIG. 3 is a plan view of the draft device of the spinning unit illustrated in FIG. 2;
FIG. 4 is a side view of the draft device of the spinning unit illustrated in FIG. 2;
FIG. 5 is a perspective view illustrating a pair of middle rollers;
FIG. 6 is a cross-sectional view of the pair of middle rollers;
FIG. 7 is a perspective view illustrating a tensor;
FIG. 8 is a perspective view illustrating the tensor where illustration of the roller is omitted;
FIG. 9 is an exploded perspective view of a main body and a supporting body illustrated in FIG. 8;
FIG. 10 is an exploded perspective view illustrating a supporting body in which positions of bearings are different;
FIG. 11 is a perspective view illustrating a tensor in which the rollers are arranged on the supporting body of FIG. 10;
FIG. 12 is a perspective view illustrating a tensor according to another embodiment;
FIG. 13 is a cross-sectional view taken along line a-a in FIG. 12; and
FIG. 14 is a perspective view illustrating a tensor according to another embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0019] Preferred embodiments of the present invention will be hereinafter described in detail with reference to the accompanied drawings. The same or corresponding components are denoted with the same reference numerals in the description of the drawings, and the redundant description will be omitted.

[0020] As illustrated in FIG. 1, a spinning machine 1 includes a plurality of spinning units 2, a yarn joining cart 3, a doffing cart (not illustrated), a first end frame 4, and a second end frame 5. The plurality of the spinning units 2 are arranged in a row. Each of the spinning units 2 is adapted to produce a yarn Y and to wind the yarn Y into a package P. The yarn joining cart 3 is adapted to perform a yarn joining operation in a spinning unit 2 after the yarn Y is cut, or is broken for some reason in such a spinning unit 2. The doffing cart is adapted to doff the package P and to supply a new bobbin B to the spinning unit 2 when the package P is fully-wound in a spinning unit 2.

[0021] The first end frame 4 accommodates, for example, a collecting device adapted to collect a fiber waste, a yarn waste, and the like generated in the spinning units 2. The second end frame 5 accommodates an air supplying section adapted to adjust air pressure of compressed air (air) to be supplied to the spinning machine 1 and to supply the air to each section of the spinning machine 1, a drive motor adapted to supply power to each section of the spinning unit 2, and the like. The second end frame 5 is provided with a machine control device 100, a display screen 102, and input keys 104. The machine control device 100 is adapted to intensively manage and control each section of the spinning machine 1. The display screen 102 is capable of displaying information relating to set contents and/or status of the spinning unit 2, or the like. An operator can perform an appropriate operation using the input keys 104 to carry out a setting operation of the spinning unit 2. The display screen 102 may be a touch panel display, and the touch panel display may be operated instead of the input keys 104.

[0022] As illustrated in FIGS. 1 and 2, each spinning unit 2 includes a draft device 6, a pneumatic spinning device 7, a yarn monitoring device 8, a tension sensor 9, a yarn storage device 11, a waxing device 12, and a winding device 13 in this order from upstream in a travelling direction of the yarn Y. A unit controller 10 is provided for every predetermined number of spinning units 2 and is adapted to control operations of the spinning units 2.

[0023] The draft device 6 is adapted to draft a sliver (fiber bundle) S. The draft device 6 includes a pair of back rollers 14, a pair of third rollers 15, a pair of middle rollers

16, and a pair of front rollers 17 in this order from upstream in a travelling direction of the sliver S. Each pair of rollers 14, 15, 16, and 17 includes a bottom roller and a top roller. The bottom roller is rotationally driven by a drive motor provided in the second end frame 5 or by a drive motor provided in each spinning unit 2. An apron belt (bottom belt) 18a is provided with respect to the bottom roller of the pair of middle rollers 16. An apron belt (top belt) 18b is provided with respect to the top roller of the pair of middle rollers 16.

[0024] The pneumatic spinning device 7 is adapted to produce the yarn Y by twisting a fiber bundle F, which has been drafted by the draft device 6, with a whirling airflow. More specifically (however, not illustrated), the pneumatic spinning device 7 includes a spinning chamber, a fiber guiding section, a whirling airflow generating nozzle, and a hollow guide shaft body. The fiber guiding section is adapted to guide, into the spinning chamber, the fiber bundle F supplied from the upstream draft device 6. The whirling airflow generating nozzle is arranged at a periphery of a path where the fiber bundle F travels. A whirling airflow is generated in the spinning chamber by injecting air from the whirling airflow generating nozzle. With the whirling airflow, each fiber end of a plurality of fibers that form the fiber bundle F is reversed and whirled. The hollow guide shaft body is adapted to guide the yarn Y from the spinning chamber to an outside of the pneumatic spinning device 7.

[0025] The yarn monitoring device 8 is adapted to monitor information on the travelling yarn Y between the pneumatic spinning device 7 and the yarn storage device 11, and to detect presence or absence of a yarn defect based on the information acquired by the monitoring. When detecting the yarn defect, the yarn monitoring device 8 transmits a yarn defect detection signal to a unit controller 10. The yarn monitoring device 8 detects a thickness abnormality of the yarn Y and/or a foreign substance included in the yarn Y, for example, as the yarn defect. The yarn monitoring device 8 also detects a yarn breakage or the like. The tension sensor 9 is adapted to measure tension of the travelling yarn Y between the pneumatic spinning device 7 and the yarn storage device 11, and to transmit a tension measurement signal to the unit controller 10. When the unit controller 10 determines presence of an abnormality based on a detection result of the yarn monitoring device 8 and/or the tension sensor 9, the yarn Y is cut in the spinning unit 2. Specifically, by stopping air supply to the pneumatic spinning device 7 to interrupt the production of the yarn Y, the yarn Y is cut. Alternatively, the yarn Y may be cut with a separately provided cutter.

[0026] The waxing device 12 is adapted to apply wax to the yarn Y between the yarn storage device 11 and the winding device 13.

[0027] The yarn storage device 11 is adapted to eliminate a slack of the yarn Y between the pneumatic spinning device 7 and the winding device 13. The yarn storage device 11 has a function of stably pulling out the yarn Y from the pneumatic spinning device 7, a function of preventing the yarn Y from slackening by accumulating the yarn Y fed from the pneumatic spinning device 7 at the time of the yarn joining operation or the like by the yarn joining cart 3, and a function of preventing variation in the tension of the yarn Y at downstream of the yarn storage device 11 from being propagated to the pneumatic spinning device 7.

[0028] The winding device 13 is adapted to wind the yarn Y around a bobbin B to form a package P. The winding device 13 includes a cradle arm 21, a winding drum 22, and a traverse guide 23. The cradle arm 21 is adapted to rotatably support the bobbin B. The cradle arm 21 is swingably supported by a support shaft 24 and is adapted to bring a surface of the bobbin B or a surface of the package P into contact with a surface of the winding drum 22 under appropriate pressure. A drive motor (not illustrated) provided in the second end frame 5 is adapted to simultaneously drive the winding drums 22 each provided in the plurality of the spinning units 2. Accordingly, in each spinning unit 2, the bobbin B or the package P is rotated in a winding direction. The traverse guide 23 of each spinning unit 2 is provided on a shaft 25 shared by the plurality of the spinning units 2. By the drive motor in the second end frame 5 driving the shaft 25 to reciprocate in a direction of a rotational axis of the winding drum 22, the traverse guide 23 traverses the yarn Y in a predetermined width with respect to the rotating bobbin B or package P.

[0029] After the yarn Y is cut, or is broken for some reason in a spinning unit 2, the yarn joining cart 3 travels to such a spinning unit 2 to perform the yarn joining operation. The yarn joining cart 3 includes a yarn joining device 26, a suction pipe 27, and a suction mouth 28. The suction pipe 27 is swingably supported by a support shaft 31, and is adapted to catch the yarn Y from the pneumatic spinning device 7 and to guide the caught yarn Y to the yarn joining device 26. The suction mouth 28 is swingably supported by a support shaft 32, and is adapted to catch the yarn Y from the winding device 13 and to guide the caught yarn Y to the yarn joining device 26. The yarn joining device 26 is adapted to join the guided yarns Y together. The yarn joining device 26 is a splicer using the compressed air, a knotter adapted to join the yarns Y together in a mechanical manner, or the like.

[0030] When the yarn joining cart 3 performs the yarn joining operation, the package P is rotated in an unwinding direction (reversely rotated). At this time, the cradle arm 21 is moved by an air cylinder (not illustrated) such that the package P is located away from the winding drum 22, and the package P is reversely rotated by a reversely-rotating roller (not illustrated) provided in the yarn joining cart 3.

[0031] The draft device 6 described above will be more specifically described.

[0032] As illustrated in FIGS. 3 and 4, the pair of back rollers 14 includes a back bottom roller 14a and a back top roller 14b facing each other with a travelling path R,

where the sliver S travels, therebetween. The pair of third rollers 15 includes a third bottom roller 15a and a third top roller 15b facing each other with the travelling path R therebetween. The pair of middle rollers 16 includes a middle bottom roller 16a and a middle top roller 16b facing each other with the travelling path R therebetween. The pair of front rollers 17 includes a front bottom roller 17a and a front top roller 17b facing each other with the travelling path R therebetween. Each of the plurality of pairs of rollers 14, 15, 16, 17 feeds the sliver S supplied from a can (not illustrated) and guided by a fiber bundle guide 77 from the upstream toward the downstream while drafting.

[0033] The back bottom roller 14a is rotatably supported by a back roller housing 66. The third bottom roller 15a is rotatably supported by a third roller housing 67. The middle bottom roller 16a is rotatably supported by a middle roller housing 68. The front bottom roller 17a is rotatably supported by a front roller housing 69. Each of the bottom rollers 14a, 15a, 16a, 17a is rotated at a rotation speed different from each other so as to be faster toward the downstream by the power from the second end frame 5. At least part of or all of the bottom rollers 14a, 15a, 16a, 17a may be rotated by the drive motor provided in each spinning unit 2.

[0034] The back top roller 14b, the third top roller 15b, the middle top roller 16b, and the front top roller 17b are rotatably supported by a draft cradle 71. Each top roller 14b, 15b, 16b, 17b is brought into contact with each bottom roller 14a, 15a, 16a, 17a at a predetermined pressure to be driven and rotated.

[0035] The draft cradle 71 can be swung with a support shaft 72 as a center to a position where each top roller 14b, 15b, 16b, 17b is brought into contact with each bottom roller 14a, 15a, 16a, 17a at a predetermined pressure, and a position where each top roller 14b, 15b, 16b, 17b is separated from each bottom roller 14a, 15a, 16a, 17a. The draft cradle 71 is swung using a handle (not illustrated) provided in the draft cradle 71. The draft cradle 71 rotatably supports each top roller 14b, 15b, 16b, 17b of the draft device 6 arranged in each of the pair of adjacent spinning units 2. That is, the draft cradle 71 is shared by the two draft devices 6 arranged in each of the pair of adjacent spinning units 2.

[0036] A regulating section 74 referred to as a sliver guide or a capacitor, for example, is arranged between the pair of third rollers 15 and the pair of middle rollers 16. A through-hole 74a, through which the sliver S is passed, is formed in the regulating section 74. The width of the sliver S in a direction (hereinafter referred to as "rotation axis direction") in which the rotation axis of each roller 14a, 14b, 15a, 15b, 16a, 16b, 17a, 17b extends is regulated to the width of the through-hole 74a in the rotation axis direction. Thus, the regulating section 74 regulates the path, where the sliver S travels, on the travelling path R, and regulates the width of the sliver S in the rotation axis direction to the width of the through-hole 74a in the rotation axis direction. The regulating section 74 is supported by a supporting section 75. The supporting section 75 is located on a lower side of the travelling path R in a machine height direction, and is attached to a middle roller housing 68 adapted to rotatably support the middle bottom roller 16a. The position of the regulating section 74 with respect to the pair of middle rollers 16 is thereby fixed. In FIGS. 1 and 2, the regulating section 74 and the supporting section 75 are omitted.

[0037] As illustrated in FIGS. 5 and 6, the apron belt 18a is stretched across the middle bottom roller 16a and a tensor 40. The apron belt 18a is driven by the rotation of the middle bottom roller 16a. In FIG. 3, the tensor 40 is omitted. The apron belt 18b is stretched across the middle top roller 16b and an apron tensioner 42. The apron tensioner 42 is supported by the draft cradle 71. The apron belt 18b is driven by the rotation of the top roller 16b that rotates accompanying the rotation of the middle bottom roller 16a.

[0038] In the pair of middle rollers 16, the apron belt 18a is pressed by the tensor 40 and the apron belt 18b is pressed by the apron tensioner 42, so that the sliver S is nipped (sandwiched) by the apron belt 18a and the apron belt 18b while pressure is applied.

[0039] Next, a description will be made in detail on the tensor 40. As illustrated in any of FIGS. 5 to 9, the tensor 40 includes a main body section 50, a supporting body (replacement member) 52, and rollers (supporting members) 54a, 54b, 54c, 54d.

[0040] The main body section 50 is a member that extends in one direction and that has a predetermined thickness. The main body section 50 is, for example, made of a material such as metal. As illustrated in FIG. 4, the main body section 50 is arranged downstream (on the front bottom roller 17a side) of the middle bottom roller 16a in the travelling path R of the sliver S. As illustrated in FIG. 3, the main body section 50 is arranged to extend in the same direction as the extending direction (direction in which the spinning units 2 are arranged) of the bottom roller 16a. In other words, the main body section 50 is arranged to extend in the same direction as the direction in which the rotation axis of the bottom roller 16a extends. The main body section 50 is, for example, provided commonly for the draft devices 6 of the two adjacent spinning units 2. One main body section 50 may be provided for one spinning unit 2. The main body section 50 is supported by a supporting mechanism (not illustrated). As illustrated in FIG. 9, the main body section 50 includes a recess 51. The recess 51 is formed, for example, by partially cutting out the main body section 50 in the thickness direction.

[0041] The supporting body 52 rotatably supports the rollers 54a to 54d (see FIG. 6). The supporting body 52 is made of, for example, a material such as resin. As illustrated in FIG. 9, the supporting body 52 is detachably provided on the main body section 50. The supporting body 52 is arranged and held in the recess 51 of the main body section 50. The supporting body 52 is fixed to the main body section 50 with, for example, a fixture (not

illustrated) such as a screw.

[0042] The supporting body 52 includes a main body portion 52a, a first end 52b, and a second end 52c. The main body portion 52a, the first end 52b, and the second end 52c are, for example, integrally molded. The main body portion 52a is a plate-shaped member presenting a substantially rectangular shape.

[0043] The first end 52b and the second end 52c are each arranged at an end in a longitudinal direction of the main body portion 52a, and are provided along a width direction of the main body portion 52a. The first end 52b and the second end 52c each project out from the surface of the main body portion 52a. In other words, the thicknesses of the first end 52b and the second end 52c are larger than the thickness of the main body portion 52a. Thus, the supporting body 52 presents a substantially recessed shape when seen from a direction along the surface of the main body portion 52a.

[0044] The first end 52b is provided with bearings (positioning portions) 56a, 56b, 56c, 56d. At the first end 52b, the bearings 56a to 56d are arranged in this order from one end toward the other end in the longitudinal direction of the first end 52b (width direction of the main body portion 52a). The second end 52c is provided with bearings (positioning portions) 58a, 58b, 58c, 58d. At the second end 52c, the bearings 58a to 58d are arranged in this order from one end toward the other end in the longitudinal direction of the second end 52c. The bearing 56a and the bearing 58a are arranged at positions facing each other with the main body portion 52a therebetween. Similarly, the bearing 56b and the bearing 58b, the bearing 56c and the bearing 58c, and the bearing 56d and the bearing 58d are respectively arranged at positions facing each other with the main body portion 52a therebetween.

[0045] The bearings 56b, 56c and the bearings 58b, 58c are grooves formed in each of the first end 52b and the second end 52c. The bearings 56a, 56d and the bearings 58a, 58d are cutouts formed in each of the first end 52b and the second end 52c. The bearings 56a to 56d and the bearings 58a to 58d each present a shape corresponding to the outer shape of the rollers 54a to 54d (curved shape in the present embodiment). The shape of each of the bearings 58a to 58d may be formed in a U-shape or a V-shape when seen in the axial direction.

[0046] The bearings 56a to 56d and the bearings 58a to 58d detachably support the rollers 54a to 54d. Specifically, the bearing 56a and the bearing 58a are provided with the roller 54a to rotatably support the roller 54a. The bearing 56b and the bearing 58b are provided with the roller 54b to rotatably support the roller 54b. The bearing 56c and the bearing 58c are provided with the roller 54c to rotatably support the roller 54c. The bearing 56d and the bearing 58d are provided with the roller 54d to rotatably support the roller 54d.

[0047] The rollers 54a to 54d are rotatably supported by the supporting body 52. The rollers 54a to 54d present a circular column shape. In the present embodiment, the cross-section of the rollers 54a to 54d presents a true circular shape, as illustrated in FIG. 6. The rollers 54a to 54d are, for example, made of a material having abrasion resistance. The rollers 54a to 54d may be in a mode in which a material having abrasion resistance is applied on the surface. The surface of the rollers 54a to 54d may be in a state (smooth state) without almost any bumps, or may be subjected to mirror-like finish, pearskin finish, grain finish, groove finish, or the like.

[0048] The diameters of the rollers 54a to 54d may be appropriately set according to design between, for example, 3 mm and 7 mm. In the present embodiment, the diameters of the roller 54b and the roller 54c are set to 3 mm. The diameters of the roller 54a and the roller 54d are set to 4 mm. The axial lengths (hereinafter simply referred to as "lengths") of the rollers 54a to 54d are appropriately set according to the width of the apron belt 18a within a range where the rigidity can be ensured. Specifically, the lengths of the rollers 54a to 54d merely need to be equal to or larger than the width of the apron belt 18a. That is, the lengths of the rollers 54a to 54d may be the same as the width of the apron belt 18a, or may be larger than the width of the apron belt 18a. In FIG. 5, a mode in which the lengths of the rollers 54a to 54d are larger than the width of the apron belt 18a is illustrated by way of example. An identifiable mark may be given to each of the rollers 54a to 54d and/or the supporting body 52. Examples of the mark include an engraved mark, a color coding, and a sticker.

[0049] As illustrated in FIGS. 7 and 8, the roller 54a has its ends supported by the bearing 56a and the bearing 58a. The roller 54b has its ends supported by the bearing 56b and the bearing 58b. The roller 54c has its ends supported by the bearing 56c and the bearing 58c. The roller 54d has its ends supported by the bearing 56d and the bearing 58d. According to such a configuration, the rollers 54a to 54d are arranged in this order from the upstream toward the downstream in the draft direction in the present embodiment. Both ends of the rollers 54a to 54d make contact with the side surfaces of the recess 51 of the main body section 50. The axial movement of the rollers 54a to 54d is thereby restricted.

[0050] The rollers 54a to 54d in the width direction of the main body portion 52a may be arranged at equal intervals or at unequal intervals. In the present embodiment, the rollers 54a to 54d are arranged at an interval (gap) with each other along the width direction of the main body portion 52a, but may be arranged with almost no interval (with no gap).

[0051] The apron belt 18a is stretched across the bottom roller 16a and the tensor 40. Specifically, the apron belt 18a is stretched across the bottom roller 16a and the roller 54d of the tensor 40. The apron belt 18a is rotated accompanying the rotation of the bottom roller 16a rotated by the drive section (not illustrated). The upper part of each of the rollers 54a to 54d is pressed toward the lower side by the apron belt 18a. The vertical position of each of the rollers 54a to 54d is thereby restricted. The

rollers 54a to 54d are rotated accompanying the rotation of the apron belt 18a.

[0052] As described above, the rollers 54a to 54d are detachably supported by the bearings 56a to 56d and the bearings 58a to 58d, and hence the supporting body 52 may be attached to the main body section 50 in a state where the roller 54c is removed from the bearing 56c and the bearing 58c, for example,. The rollers 54a to 54d can be removed from the bearings 56a to 56d and the bearings 58a to 58d like the roller 54c. Thus, a nip position P2 in the width direction (direction in which the rollers 54a to 54d are arranged) of the main body portion 52a can be adjusted. The interval between the rollers 54a to 54d is appropriately set according to the type of the sliver S.

[0053] The method for adjusting the nip position P2 in the width direction of the main body section 50 is not limited to the method described above. For example, the supporting body 52 fixed to the main body section 50 may be replaced with a supporting body 152 as illustrated in FIG. 10. In the supporting body 152, the positions of the bearings 56a to 56d and the bearings 58a to 58d in the width direction of the main body section 50 are different from those in the supporting body 52. As illustrated in FIG. 11, the nip position P2 in the width direction of the main body section 50 can be adjusted by fixing the rollers 54a to 54d held by such a supporting body 152 to the main body section 50. An identifiable mark may be given to each of the rollers 54a to 54d and/or the supporting body 152. Examples of the mark include an engraved mark, a color coding, and a sticker.

[0054] Furthermore, the supporting body may be replaced with the supporting body 152 in which not only the positions of the bearings 56a to 56d and the bearings 58a to 58d in the width direction of the main body section 50 are different from those of the supporting body 52, but also the shapes of the bearings 56a to 56d and the bearings 58a to 58d are different. In such a case, in addition to adjustment of the nip position P2 in the width direction of the main body section 50, replacement can also be made to rollers (supporting members) whose projection amounts from the supporting body 52, 152 differ from each other, or replacement can be made to rollers (supporting members) whose contacting areas with the apron belt 18a differ from each other. Thus, the nip force of the sliver S by the apron belt 18a can be easily adjusted.

[0055] As illustrated in FIG. 6, the roller 54b is arranged at a position where a distance D1 between a nip position P1 of the sliver S by the middle bottom roller 16a and the middle top roller 16b and the nip position P2 of the sliver S by the apron belt 18a and the apron belt 18b by the roller 54b is in a range of 11 mm or more and 22 mm or less. That is, the bearing 56b and the bearing 58b are arranged at positions to support the roller 54b where the distance D1 between the nip position P1 and the nip position P2 is in a range of 11 mm or more and 22 mm or less. In the present embodiment, the distance D1 is, for example, set between 16 mm and 17 mm.

[0056] The roller 54d is arranged at a position where a distance D2 between the nip position P1 and the end on the front bottom roller 17a side of the roller 54d is, for example, 35 mm. A linear distance between the nip position P1 and the nip position of the sliver S by the front bottom roller 17a and the front top roller 17b is, for example, 47 mm.

[0057] As illustrated in FIG. 6, a height position of the contacting point of the roller 54b and the apron belt 18a is higher than height positions of the contacting points of the other rollers 54a, 54c, 54d and the apron belt 18a. In other words, the roller 54b projects farther out toward the upper side than the rollers 54a, 54c, and 54d. The contacting point of the roller 54b and the apron belt 18a is located above a line connecting the contacting point of the roller 54a and the apron belt 18a and the contacting point of the roller 54d and the apron belt 18a. The contacting point of the roller 54a and the apron belt 18a and the contacting point of the roller 54d and the apron belt 18a may be at the same height position, or may be at different height positions. The contacting point of the roller 54c and the apron belt 18a is located above the line connecting the contacting point of the roller 54a and the apron belt 18a and the contacting point of the roller 54d and the apron belt 18a, and located below the contacting point of the roller 54b and the apron belt 18a.

[0058] As described above, in the tensor 40 according to the embodiment described above, since the rollers 54a to 54d are detachably held by the supporting body 52, the nip position P2 in the width direction of the main body section 50 can be easily adjusted by adjusting the attachment/non-attachment of the rollers 54a to 54d. Furthermore, by replacing the supporting bodies 52, 152 in which the shapes of the bearings 56a to 56d and the bearings 58a to 58d are different from each other, the rollers whose projection amounts from the supporting body 52, 152 differ from each other can be held, and the rollers whose contacting areas with the apron belt 18a differ from each other can be held. Thus, the nip force of the sliver S by the apron belt 18a can be easily adjusted. Consequently, the supporting state of the sliver S by the apron belt 18a can be easily changed.

[0059] Moreover, in the tensor 40 of the embodiment described above, the supporting body 52, 152 and/or the rollers 54a to 54d are appropriately replaced by the operator according to the yarn type. An identifiable mark is given to the supporting body 52, 152 and/or the rollers 54a to 54d. Thus, the operator can, for example, easily replace the supporting body and/or the rollers with the supporting body and/or the rollers adapted to the yarn type by looking at the instruction manual (table) and the like. Therefore, each of the rollers 54a to 54d can be easily and accurately arranged in the supporting body 52, 152 according to the type of sliver S.

[0060] In the tensor 40 of the embodiment described above, the rollers 54a to 54d are arranged rotatable around the rotation axis, which extends in the same direction as the extending direction of the main body sec-

tion 50, as the center. Accordingly, the friction between the tensor 40 and the apron belt 18a when the apron belt 18a is rotated can be reduced.

[0061] According to the spinning machine 1 including the draft device 6 of the embodiment described above, the supporting state of the sliver S by the apron belt 18a can be changed with a high degree of freedom according to the sliver S in the draft device 6. Thus, the gripping position (nip position) and the gripping force of the sliver S by the apron belt 18a can be appropriately adjusted according to the sliver S. As a result, the yarn Y of high quality can be produced.

[0062] One embodiment of the present invention has been described above, but the present invention is not limited to the above-described embodiment.

[0063] In the embodiment described above, an example in which the nip position in the width direction of the main body section 50 can be easily adjusted by adjusting the attachment/non-attachment of the rollers 54a to 54d with respect to the bearings 56a to 56d and the bearings 58a to 58d of the supporting body 52, 152 has been described, but the present invention is not limited thereto. For example, as illustrated in FIGS. 12 and 13, in the tensor, a stepped roller 59a to 59d in which diameters of shaft portions 59aa to 59da and diameters of roller portions supporting the apron belt 18a differ (may be large or small) from each other may be detachably and rotatably arranged with respect to the bearings 53a to 53d of the supporting body 153. Thus, even if the diameters of the shaft portions 59aa to 59da are the same with respect to each other, the rollers whose projection amounts from the supporting body 153 differ from each other may be held, or the rollers whose contacting areas with the apron belt 18a differ from each other may be held by replacing the rollers with the stepped rollers in which the diameters of the roller portions differ from each other. Thus, the nip force of the sliver S by the apron belt 18a can be easily adjusted.

[0064] In the embodiment described above or the alternative embodiment described above, an example in which the rollers 54a to 54d are rotatably held with respect to the bearings 56a to 56d and the bearings 58a to 58d of the supporting body 52, 152 has been described, but a configuration in which the rollers 54a to 54d are held so as not to rotate may be adopted.

[0065] In the embodiment described above or the alternative embodiment described above, the roller that can rotate with the rotation axis as the center has been described as an example of the supporting member for supporting the apron belt 18a, but the present invention is not limited thereto. For example, a supporting member 154 in which only the portion to be brought into contact with the apron belt 18a is formed in a circular arc shape may be adopted, as illustrated in FIG. 14. A groove 154a may be formed at the portion to be brought into contact with the apron belt 18a. In such a case, the friction between the tensor 40 and the apron belt 18a when the apron belt 18a is rotated can be reduced.

[0066] In the embodiment described above, a mode in which the cross-section of the rollers 54a to 54d presents a true circular shape has been described by way of example. However, the cross-section of the roller may present an elliptical shape.

[0067] In the embodiment described above, an example in which the rollers 54a to 54d are fixed to the supporting body 52, 152 by inserting the rollers 54a to 54d from the upper side with respect to the bearings 56a to 56d and the bearings 58a to 58d has been described, but the present invention is not limited thereto. For example, the bearings may be formed as circular hole portions, and the rollers 54a to 54d may be inserted while being sled in the axial direction with respect to the bearings to fix the rollers to the supporting body.

[0068] In the embodiment described above, a mode in which the contacting point of the roller 54b and the apron belt 18a is at a position higher than the contacting points of the other rollers 54a, 54c, 54d and the apron belt 18a has been described by way of example. However, the height positions of the contacting points of the rollers 54a to 54d and the apron belt 18a may be the same in the draft direction.

[0069] In the embodiment described above, a mode in which the roller 54b is arranged at a position where the distance D1 between the nip position P1 and the nip position P2 is in a range of 11 mm or more and 22 mm or less has been described by way of example. However, it is preferable if at least one bearing (positioning portion) is formed at the position where the distance D1 from the nip position P1 by the pair of rollers 16 on which the apron belts 18a, 18b are stretched across is in the range of 11 mm or more and 22 mm or less, or at the position where the distance D1 is in the range equal to or greater than half the average fiber length of the sliver S to draft and less than the average fiber length.

[0070] In the embodiment described above, four bearings 56a to 56d and four bearings 58a to 58d (four sets) are provided, but the number of bearings is not limited thereto. The number of bearings, that is, the positioning portions, is preferably greater than 1 (plural sets). The number of supporting members (rollers, etc.) to be installed on the positioning portion merely needs to be at least one.

[0071] The spinning machine may be other than the spinning machine 1 including the pneumatic spinning device 7, and for example, may be a ring spinning machine. The tensor and the draft device of the present invention can also be applied to a textile machine other than the spinning machine.

Claims

1. A tensor (40) provided in a draft device (6) adapted to draft a fiber bundle (S) by a pair of rollers (16) including a bottom roller (16a) and a top roller (16b), the tensor (40) adapted to adjust a tension of an

apron belt (18a) stretched across the bottom roller (16a) and the tensor (40),
the tensor (40) being **characterized by** comprising:

a supporting member (54a to 54d) adapted to support the apron belt;
a replacement member (52; 152; 153) in which positioning portions (56a to 56d, 58a to 58d) adapted to detachably position the supporting member (54a to 54d) are arranged in one direction; and
a main body section (50) extending in a rotation axis direction of the bottom roller (16a) and on which the replacement member (52; 152; 153) is detachably fixed so that the positioning portions (56a to 56d, 58a to 58d) are arranged along a draft direction of the fiber bundle(S).

2. The tensor (40) according to claim 1, **characterized in that** a plurality of positioning portions (56a to 56d, 58a to 58d) have shapes from which a plurality of supporting members (54a to 54d) having shapes different from each other are detachable.

3. The tensor (40) according to claim 1 or 2, **characterized in that** the main body section (50) has a shape from which a plurality of replacement members (52; 152; 153), in which positions of the positioning portions (56a to 56d, 58a to 58d) in the arrangement direction differ from each other, are detachable.

4. The tensor (40) according to any one of claims 1 to 3, **characterized in that** the main body section (50) has a shape from which the plurality of replacement members (52; 152; 153), in which shapes of the positioning portions (56a to 56d, 58a to 58d) differ from each other, are detachable.

5. The tensor (40) according to any one of claims 1 to 4, **characterized in that** the supporting member (54a to 54d) is a roller rotatable with a rotation axis as a center, the rotation axis extending in the same direction as an extending direction of the main body section (50).

6. The tensor (40) according to claim 5, **characterized in that** the positioning portion (56a to 56d, 58a to 58d) is a bearing adapted to rotatably support the rotation axis of the roller.

7. A draft device (6) comprising:

a pair of rollers (16) including a bottom roller (16a) and a top roller (16b);
the tensor (40) according to any one of claims 1 to 6; and
an apron belt (18a) stretched across the bottom roller (16a) and the tensor (40).

8. A spinning machine (1) comprising:

the draft device (6) according to claim 7;
a pneumatic spinning device (7) adapted to twist the fiber bundle(S) drafted by the draft device (6) to produce a yarn (Y) ; and
a winding device (13) adapted to wind the yarn (Y) produced by the pneumatic spinning device (7) into a package (P).

FIG. 1

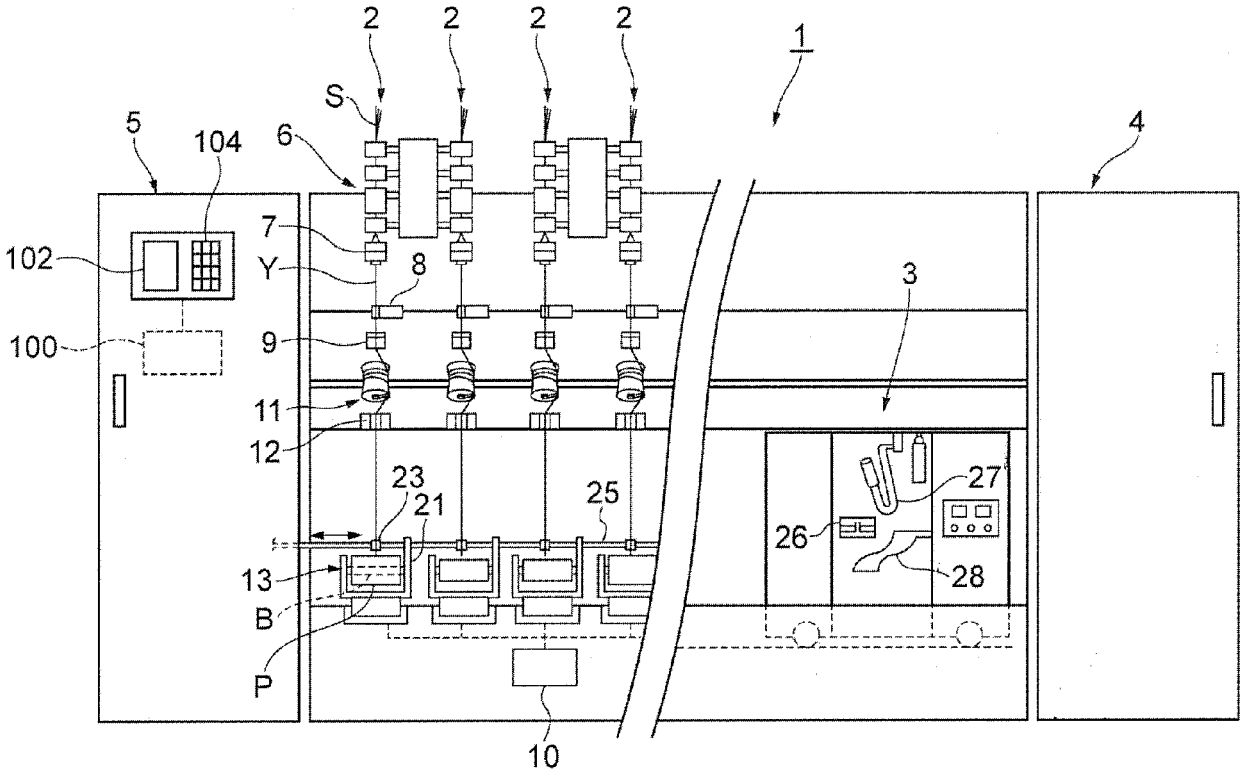


FIG. 2

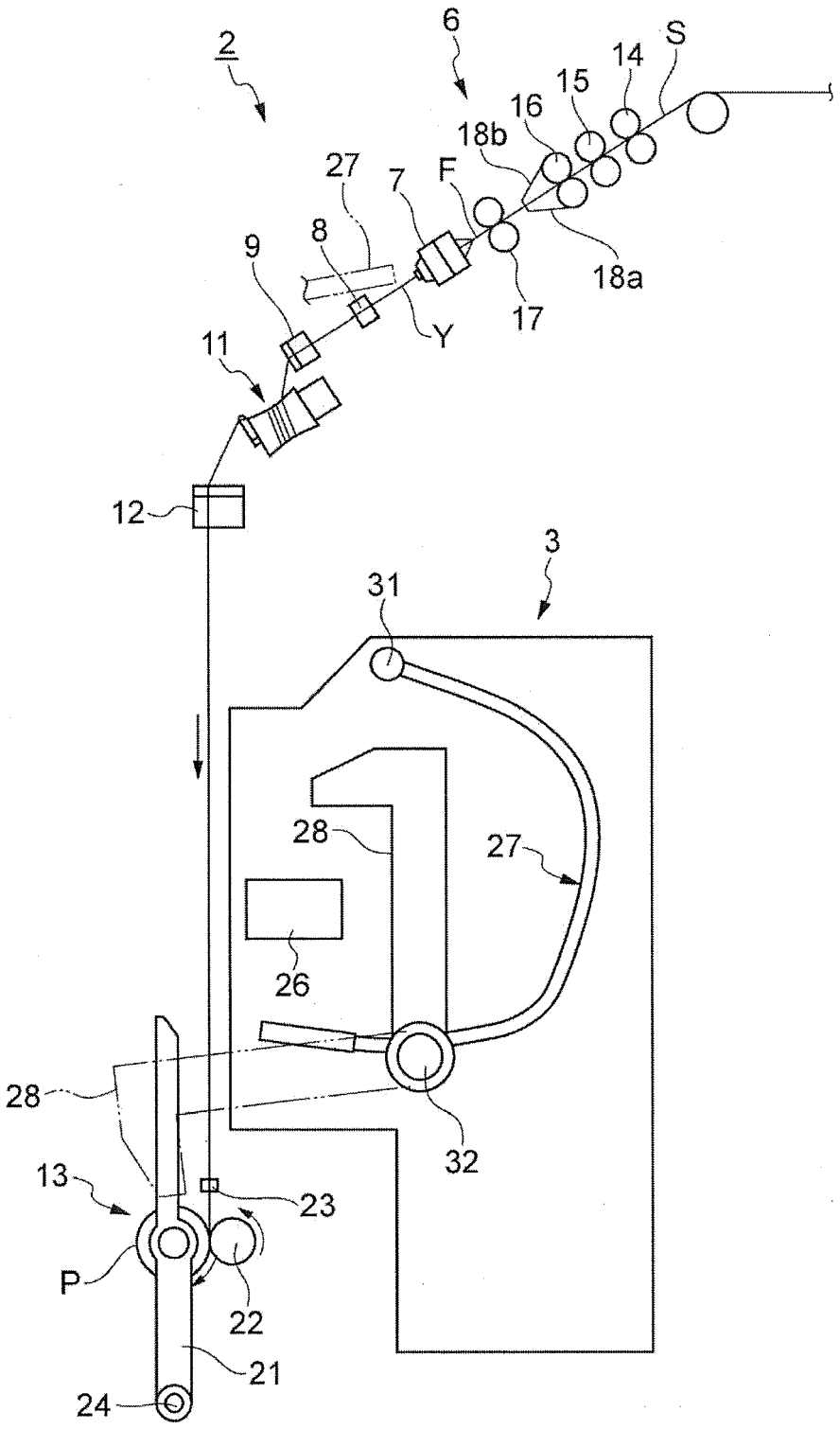

2
6
S
14
15
16
18b
27
7
F
8
9
18a
17
Y
11
12
3
31
28
27
26
28
32
13
23
P
22
21
24

FIG. 3

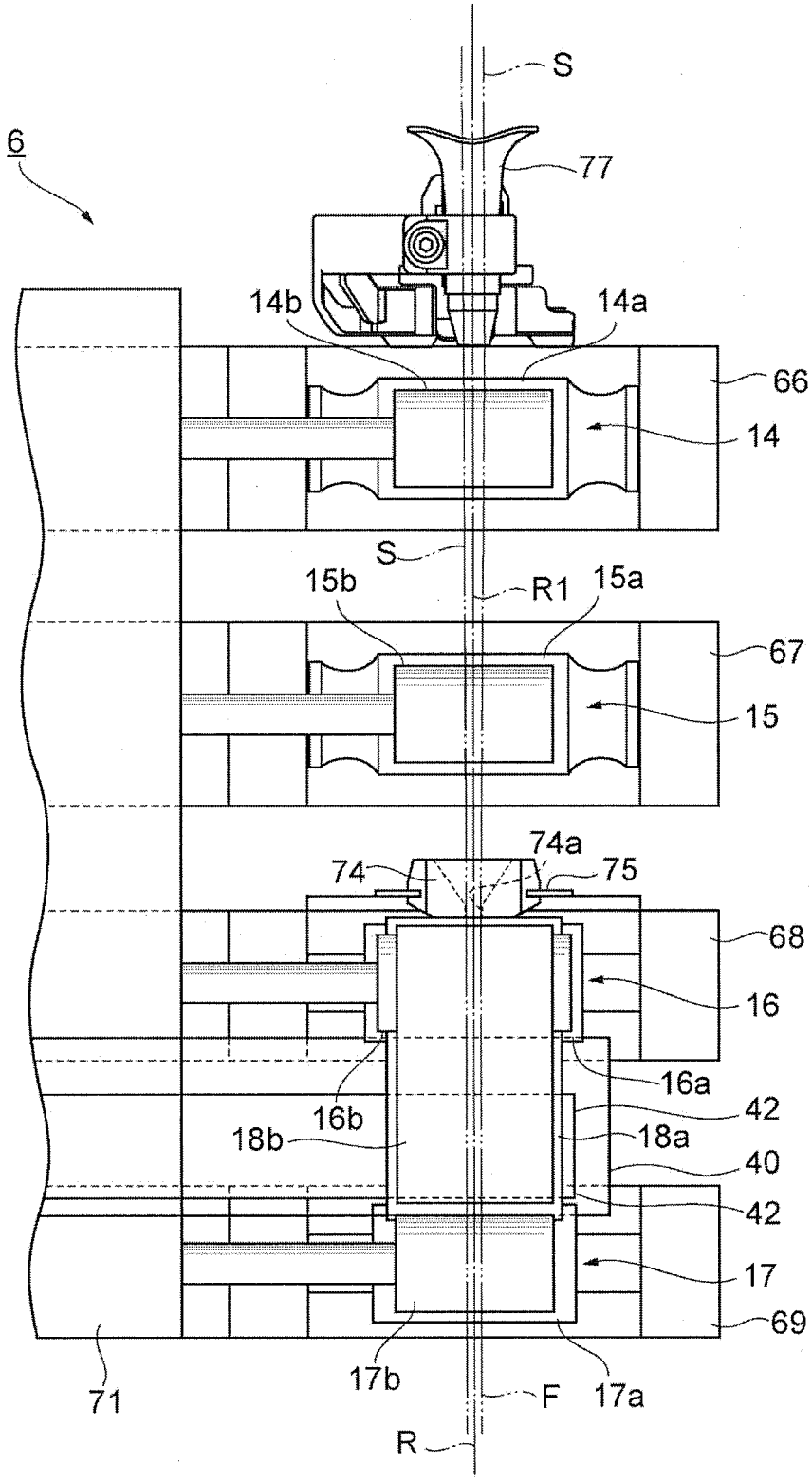

6
S
77
14b
14a
66
14
S
R1
15b
15a
67
15
74a
74
75
68
16
16a
16b
42
18b
18a
40
42
17
69
71
17b
F
17a
R

FIG. 4

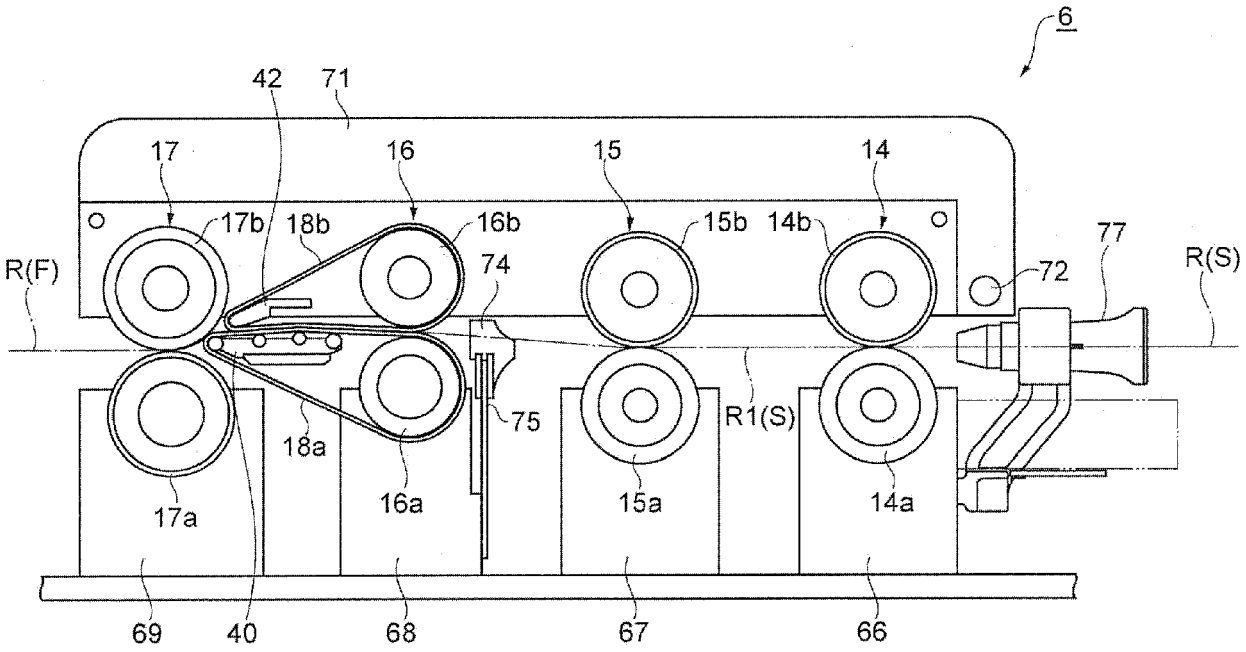

6
42
71
17
16
15
14
17b
18b
16b
15b
14b
77
R(S)
R(F)
74
72
75
R1(S)
18a
17a
16a
15a
14a
69
40
68
67
66

FIG. 5

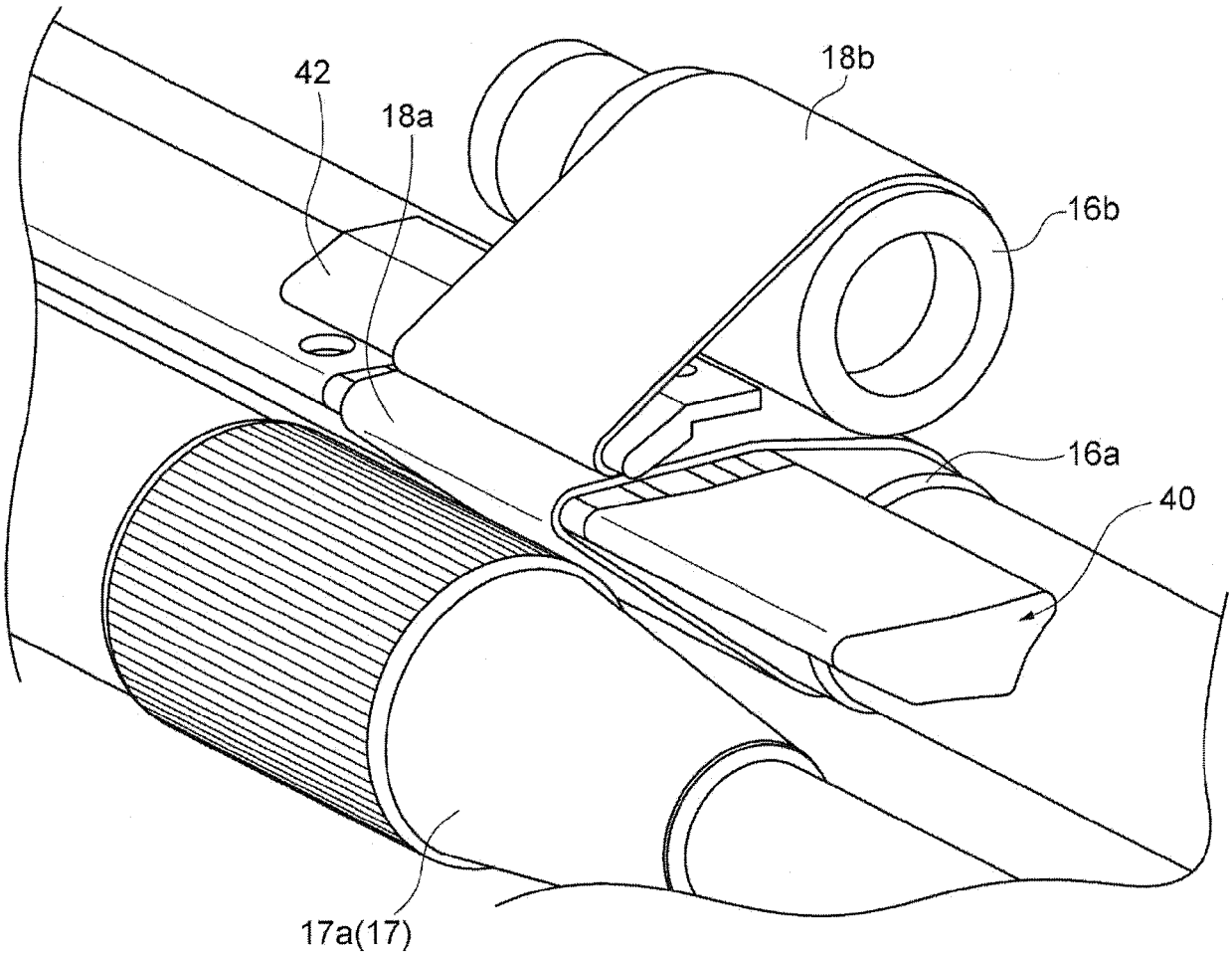


FIG. 6

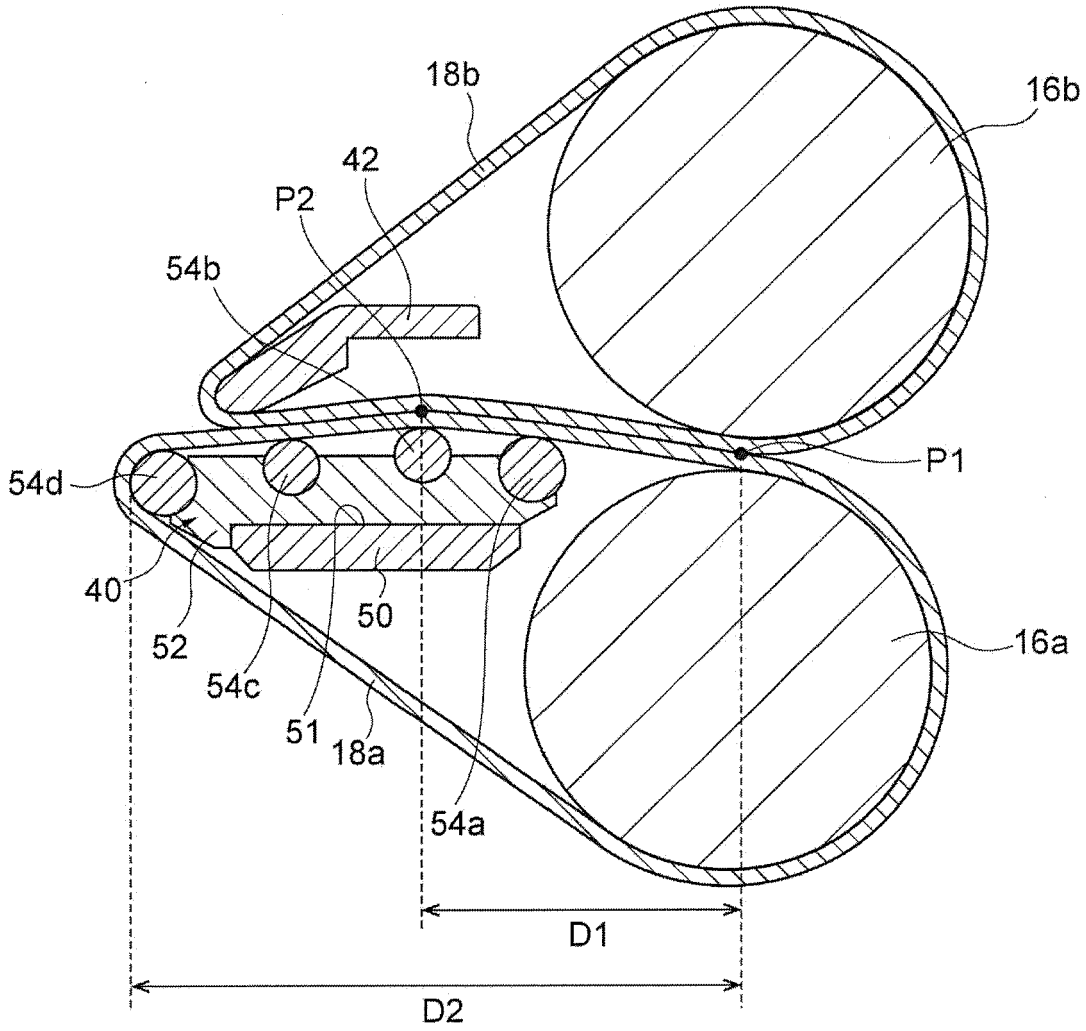


FIG. 7

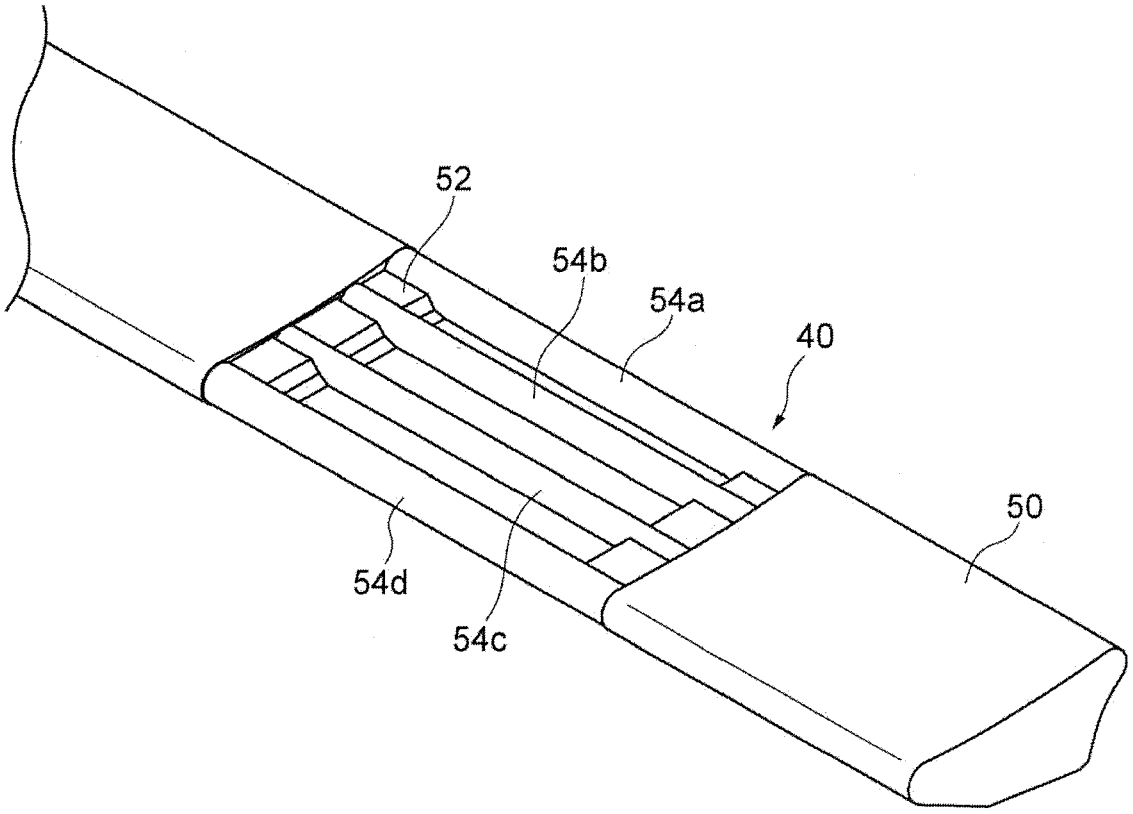


FIG. 8

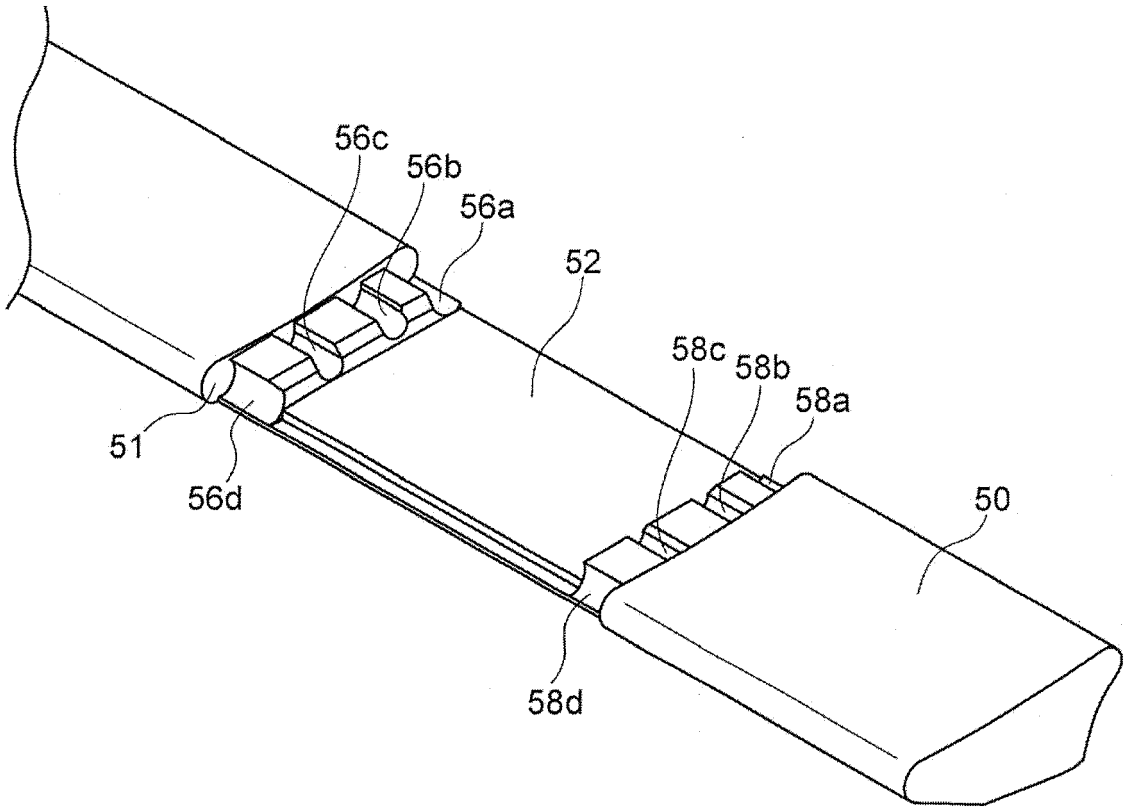


FIG. 9

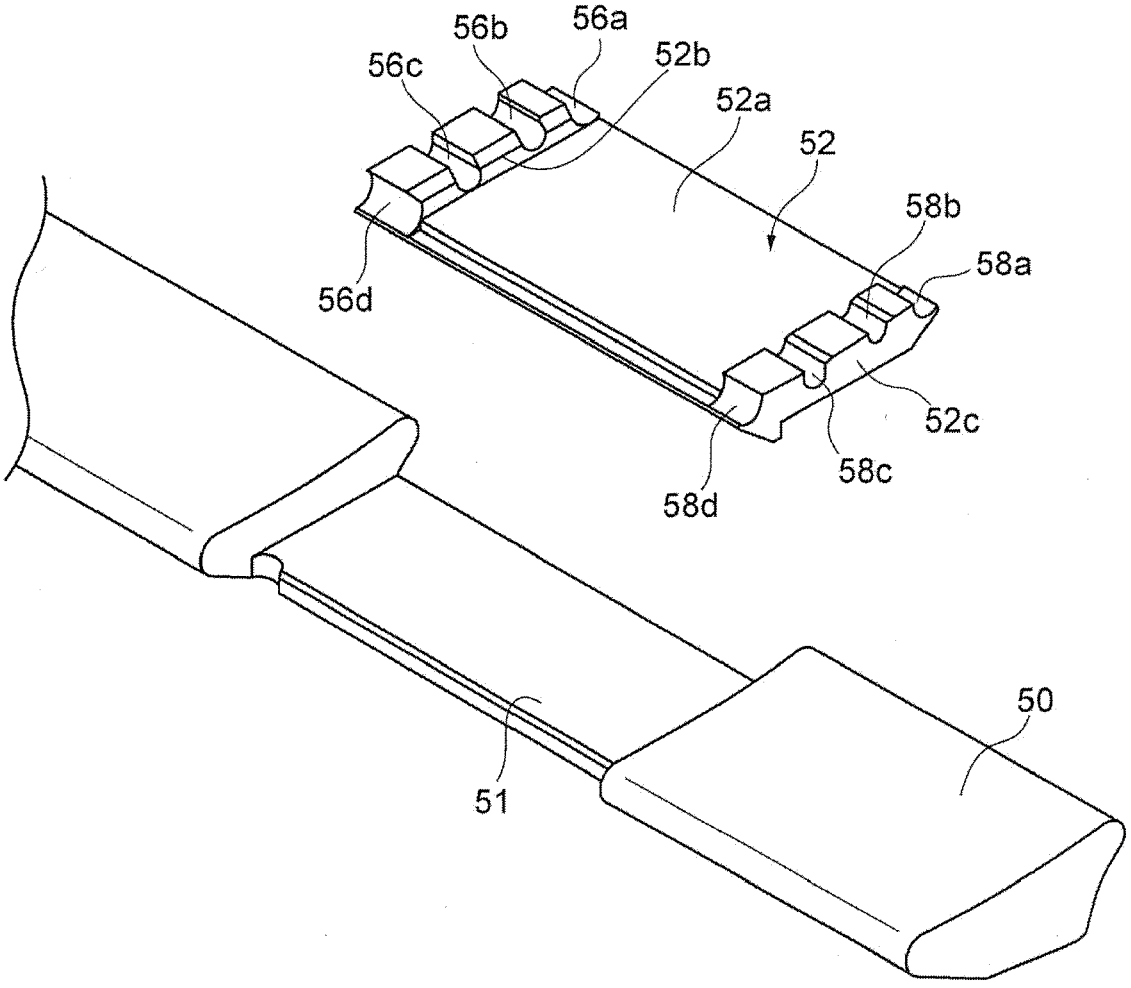


FIG. 10

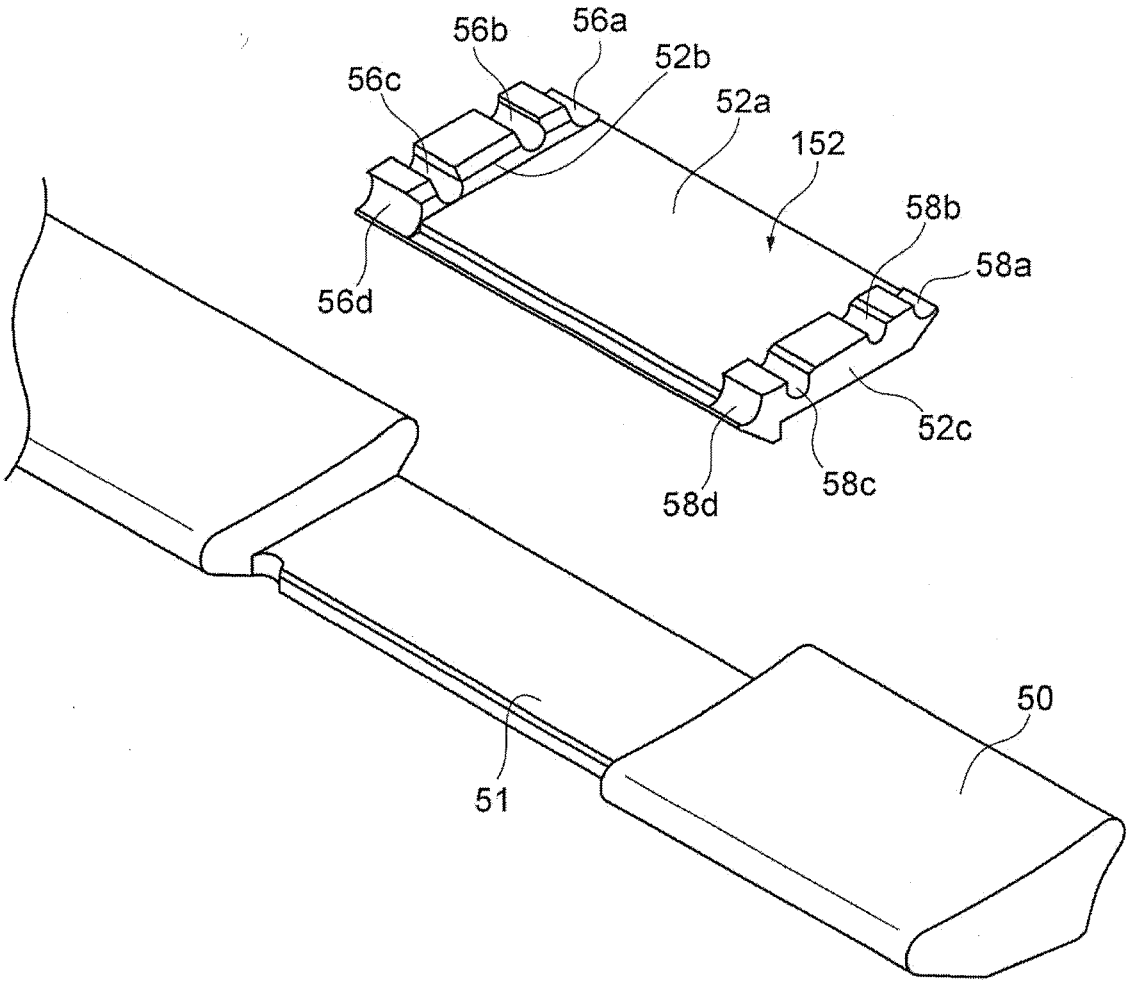


FIG. 11

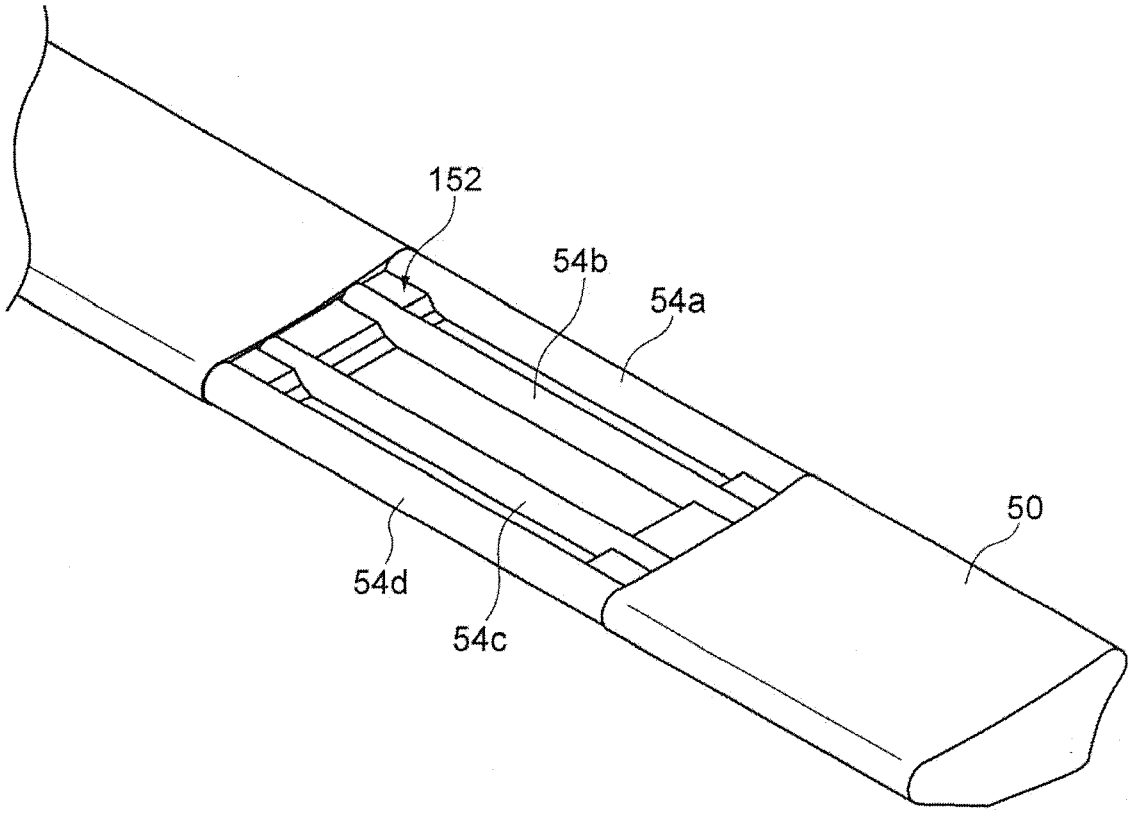


FIG. 12

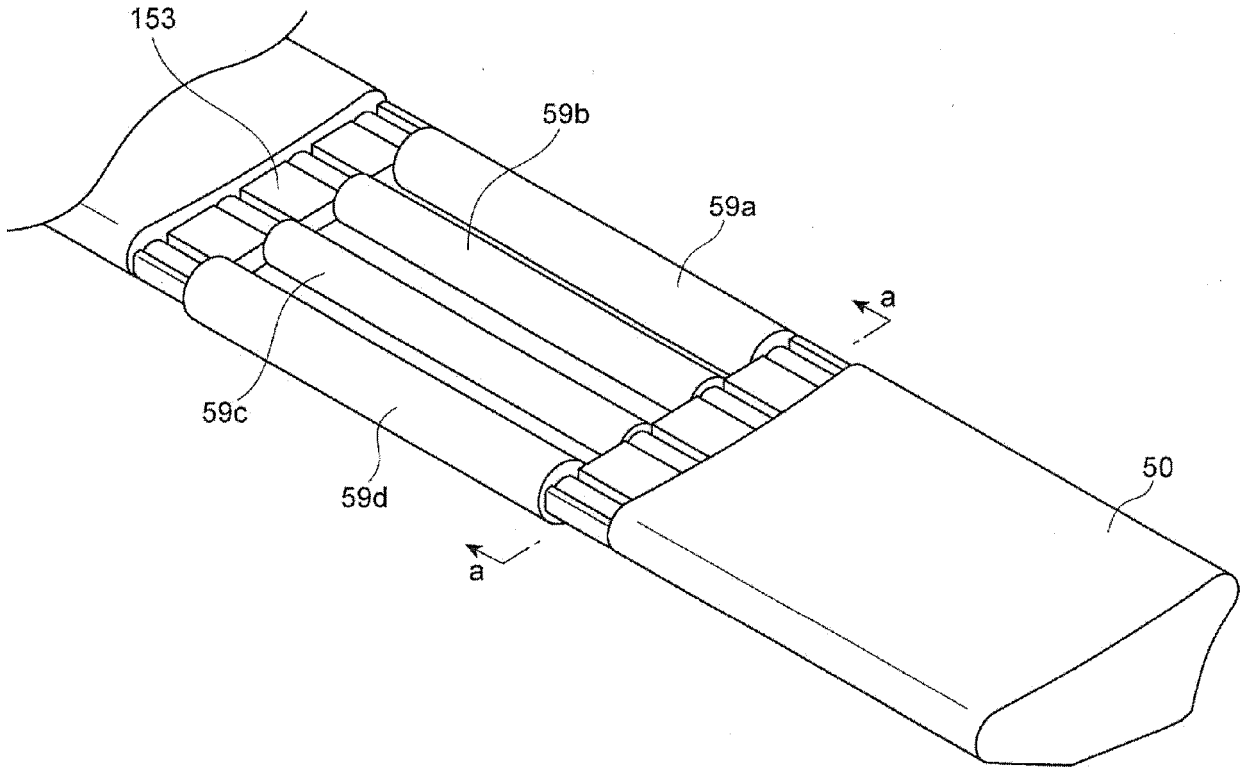


FIG. 13

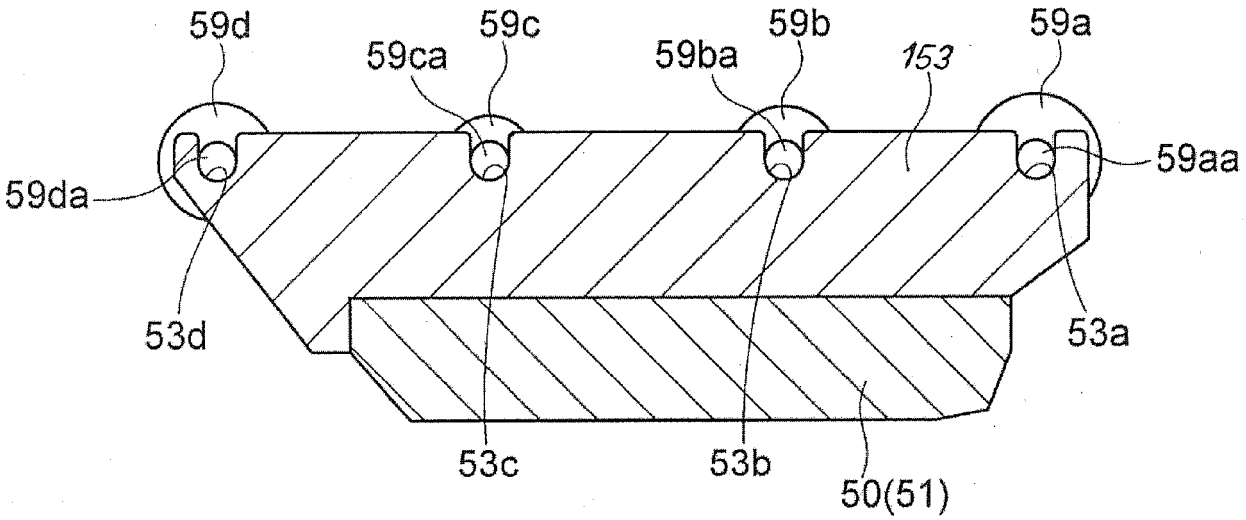
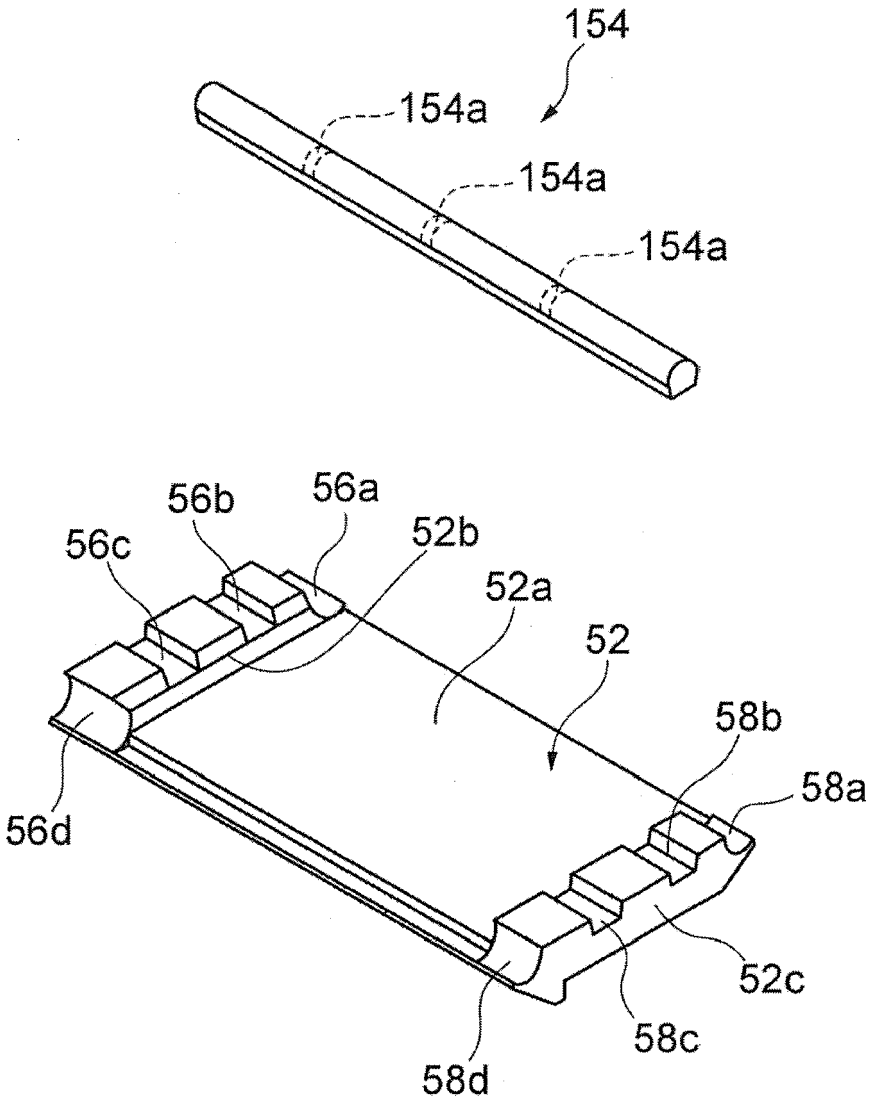


FIG. 14


154
154a
154a
154a
56b
56a
56c
52b
52a
52
58b
58a
56d
52c
58c
58d

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 4718

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 April 2017	Humbert, Thomas

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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