



(11)

EP 3 150 531 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.04.2017 Bulletin 2017/14

(51) Int Cl.: **B65H 51/22** ^(2006.01) **D01H 13/10** ^(2006.01)

(21) Application number: **16190800.9**

(22) Date of filing: **27.09.2016**

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

(30) Priority: 30.09.2015 JP 2015194857

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

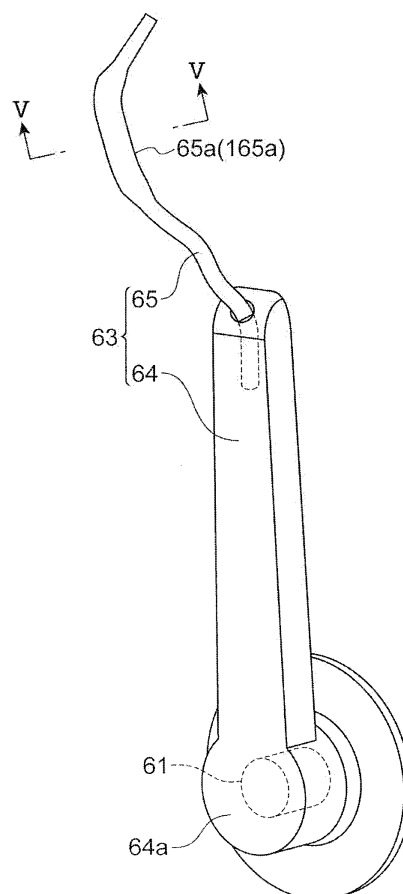
(72) Inventor: **OKA, Masaki**
Kyoto-shi, Kyoto 612-8686 (JP)

(74) Representative: **Stöckeler, Ferdinand et al**
Schoppe, Zimmermann, Stöckeler
Zinkler, Schenk & Partner mbB
Patentanwälte
Radlkoferstrasse 2
81373 München (DE)

(54) **YARN THREADING MEMBER, YARN STORAGE DEVICE, AND YARN WINDER**

(57) A yarn threading member (160) is installed in a yarn storage roller (51). The yarn threading member (160) includes a supporting unit (64, 464) installed so as to be capable of rotating relative to the yarn storage roller (51) and an elongated member (65, 365) provided on the supporting unit (64, 464) and extending in a direction away from the supporting unit (64, 464). The elongated member (65, 365) has a cross-sectional surface (166, 366), perpendicular to the extending direction, on which are provided a first portion (S1) with a radius of curvature of a first size, and a second portion (S2) with a radius of curvature smaller than the first size.

Fig.4



Description

TECHNICAL FIELD

[0001] The present disclosure relates to a yarn threading member, a yarn storage device, and a yarn winder.

BACKGROUND

[0002] Textile machines (such as an air spinning machine winding up spun yarn and forming a package) are known that has a yarn storage device capable of transiently storing yarn. For example, Patent Literature 1 (Japanese Unexamined Patent Publication No. 2 004-277 94 6) and Patent Literature 2 (Japanese Unexamined Patent Publication No. 2010-180023) describe a yarn storage device including a yarn storage roller (a slack eliminating roller) and a yarn threading member (a flyer) relatively rotatable with respect to the yarn storage roller and configured such that rotational resistance to the yarn storage roller is added to the yarn threading member.

SUMMARY

[0003] The yarn threading member of the yarn storage device guides yarn to the yarn storage roller by hooking the yarn. The portion of the yarn threading member where the yarn is hooked may wear due to contact with the yarn.

[0004] An embodiment of the present disclosure aims to provide a yarn threading member, a yarn storage device, and a yarn winder that can extend the product life of the yarn threading member by reducing the progression of wear on a portion in contact with yarn.

[0005] A yarn threading member according to an embodiment of the present disclosure is installed in a yarn storage roller. The yarn threading member includes a supporting unit installed so as to be capable of rotating relative to the yarn storage roller, and an elongated member provided on the supporting unit and extending in a direction away from the supporting unit. The elongated member has a cross-sectional surface, perpendicular to the extending direction, on which are provided a first portion with a radius of curvature of a first size, and a second portion with a radius of curvature smaller than the first size.

[0006] The yarn threading member configured as described above has a relatively larger area of contact between the yarn and the first portion compared to the diameter of the yarn. Disposing the yarn, which is unwound from the yarn storage roller, so as to be in contact with the first portion can decrease the pressure (the surface pressure) per unit area applied to the first portion by the yarn. This configuration can thus reduce progression of wear on the portion in contact with yarn, thereby extending the product life of the yarn threading member. Furthermore, an increase in size of the elongated member can be suppressed by setting the radius of curvature of

the second portion, which is not in contact with yarn, so as to be smaller than the first size. Consequently, the yarn threading member has good responsiveness to and ability to follow fluctuations in load (yarn tension).

[0007] In an embodiment, at least a part of the cross-sectional surface may be formed in an elliptic curve.

[0008] When yarn contacts with an elongated member having the above-described cross-sectional surface, the area of contact between the yarn and the elongated member increases compared with the case that yarn contacts with an elongated member having a circular cross-sectional surface. This configuration can further reduce the pressure (the surface pressure) per unit applied to the first portion by the yarn. Consequently, this configuration can reduce progression of wear caused on the portion contacting with yarn, thereby extending the product life of the yarn threading member.

[0009] In an embodiment, a cross-sectional surface having the first portion and the second portion may be formed only on a part of the elongated member in the extending direction.

[0010] In the yarn threading member configured as above, the first portion and the second portion can be easily formed compared with the case of forming the first portion and the second portion over the entire part of the elongated member.

[0011] In an embodiment, the elongated member may have a hollow portion being hollow along the extending direction.

[0012] The above-described configuration of the yarn threading member can decrease the weight of the elongated member. The decrease in weight can reduce effects of the inertial force resulting from the weight of the elongated member when moving the elongated member. Consequently, the yarn threading member has good responsiveness and flexibility to fluctuations in the load (yarn tension).

[0013] In an embodiment, the supporting unit may include a front-end portion having the elongated member, a boss fixed to the yarn storage roller, the main body extending in a direction between the front-end portion and the boss, and a reinforcement unit for reinforcing the main body.

[0014] In the yarn threading member configured as above, the supporting unit can stably support the elongated member.

[0015] In an embodiment, the reinforcement unit may have a projecting portion formed so as to project from a surface of the main body and extend in a direction in which the main body extends.

[0016] In the yarn threading member configured as above, the reinforcement unit can be easily formed.

[0017] In an embodiment, the boss may project from the main body. The projecting portion may be provided in a center area of the surface of the main body from which the boss projects, the center area being in a direction intersecting with a direction in which the boss projects and a direction in which the main body extends, and

formed across a predetermined length from an end on which the boss is provided in the extending direction of the main body.

[0018] In the yarn threading member configured as above, such a simply configured supporting unit can stably support the main body.

[0019] In an embodiment, the reinforcement unit may have an increased thickness portion formed at least one of both ends of the main body in a direction intersecting with both a direction in which the boss projects and a direction in which the main body extends.

[0020] In the yarn threading member configured as above, the supporting unit can stably support the main body.

[0021] A yarn storage device according to an embodiment of the present disclosure includes the above-described yarn threading member and a yarn storage roller in which the yarn threading member is rotatably installed.

[0022] A yarn winder according to an embodiment of the present disclosure includes a drafting device configured to draft a fiber bundle, a spinning device configured to generate yarn by twisting the fiber bundle drafted by the drafting device, the above-described yarn storage device configured to store the yarn generated by the spinning device, and a yarn winding device configured to wind yarn stored in the yarn storage roller into a package. The elongated member is disposed such that yarn unwound from the yarn storage roller is in contact with the first portion.

[0023] The yarn storage device and the yarn winder configured as above employ a yarn threading member that can reduce progression of wear caused on a portion contacting with yarn and extend the product life, which results in extension of the replacement cycle of the yarn threading member in the yarn storage device. Consequently, this configuration can improve operation efficiency of the yarn storage device and the yarn winder.

[0024] According to an embodiment of the present disclosure, progression of wear caused on a portion contacting with yarn can be reduced, which can extend the product life of the yarn threading member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a front view of a spinning machine of a first embodiment.

FIG. 2 is a side view of a spinning unit of the spinning machine of FIG. 1.

FIG. 3 is an enlarged side view of the yarn storage device of FIG. 1 and its periphery.

FIG. 4 is a perspective view of a yarn threading member of FIG. 3.

FIG. 5A is a cross-sectional view of a guiding unit of the yarn threading member of FIG. 4 taken along the V-V line.

FIG. 5B is a cross-sectional view of a guiding unit of

a yarn threading member according to a modification of the first embodiment taken along the V-V line.

FIG. 6A is a cross-sectional view of a guiding unit of a yarn threading member according to a second embodiment taken along the V-V line.

FIG. 6B is a cross-sectional view of a guiding unit of a yarn threading member according to a modification of the second embodiment taken along the V-V line.

FIG. 7A is a cross-sectional view of a guiding unit of a yarn threading member according to another modification of the second embodiment taken along the V-V line.

FIG. 7B is a cross-sectional view of a guiding unit of a yarn threading member according to a still another modification of the second embodiment taken along the V-V line.

FIG. 8 is a perspective view of a yarn threading member according to another different modification.

FIG. 9 is a perspective view of an arm unit according to a modification.

DETAILED DESCRIPTION

[0026] An embodiment will now be described with reference to the drawings. In the drawings, like numerals indicate like or corresponding parts, and overlapping description will be omitted.

First embodiment

[0027] As illustrated in FIG. 1, a spinning machine 1 includes a plurality of spinning units (yarn winders) 2, a splicing carrier 3, a first end frame 5A, and a second end frame 5B. The spinning units 2 are aligned in a row. In the following description, on a path (a yarn path) along which yarn Y travels, an end where the yarn Y is generated is referred to as an upstream side, whereas the other end where the yarn Y is wound is referred to as a downstream side.

[0028] Each of the spinning units 2 generates the yarn Y and winds the yarn Y into a package P. When the yarn Y is cut or breaks in a spinning unit 2 for any reason, the splicing carrier 3 splices the yarn Y in the spinning unit 2.

[0029] The first end frame 5A accommodates therein, for example, at least one of a pressure regulator for causing swirling airflow and a suction source for causing suction airflow in the parts of the spinning unit 2.

[0030] The second end frame 5B accommodates therein, for example, a driving motor for supplying power to the parts of the spinning unit 2. The second end frame 5B includes a machine controlling device 11, a display unit D, and an input key K.

[0031] The machine controlling device 11 intensively manages and controls the units in the spinning machine 1. The display unit D can display at least one of pieces of information on the settings of the spinning unit 2 or information on the status of the spinning unit 2.

An operator performs necessary operations through the

input key K and sets up the spinning unit 2.

[0032] As FIGs. 1 and 2 illustrate, each spinning unit 2 includes, in the order from the upstream side in the travel direction of the yarn Y, a drafting device 6, an air spinning device 7, a yarn monitoring device 8, a tension sensor 9, a yarn storage device 50, a waxing device 12, and a winding device 13. A unit controller 10 is provided in every certain number of spinning units 2 for controlling operations of the spinning units 2.

[0033] The drafting device 6 drafts a sliver (fiber bundle) S. The drafting device 6 includes, in the order from the upstream side in the travel direction of the sliver S, 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. Each pair of rollers 14, 15, 16, and 17 has a bottom roller and a top roller. The bottom roller is driven and rotated by the driving motor provided in the second end frame 5B or a driving motor provided in the spinning unit 2. The top roller of the pair of middle rollers 16 has an apron belt 16A. The bottom roller of the pair of middle rollers 16 has an apron belt 16B.

[0034] The air spinning device 7 generates the yarn Y by twisting the fiber bundle F drafted by the drafting device 6 using swirling airflow. More specifically (although not illustrated in the drawings), the air spinning device 7 has a spinning room, a fiber guiding unit, a swirling airflow generating nozzle, and a hollow guide shaft. The fiber guiding unit guides the fiber bundle F supplied from the drafting device 6 in the upstream side to the spinning room. The swirling airflow generating nozzle is disposed around a path on which the fiber bundle F travels. Swirling airflow is generated in the spinning room with the swirling airflow generating nozzle spraying air. The swirling airflow reverses and swirls the fiber tips of a plurality of fibers included in the fiber bundle F. The hollow guide shaft guides the yarn Y from the spinning room to the outside of the air spinning device 7.

[0035] The yarn monitoring device 8 is disposed between the air spinning device 7 and the yarn storage device 50. The yarn monitoring device 8 is an optical yarn monitoring device irradiating the traveling yarn Y with light and detecting the status of the yarn Y. Specifically, the yarn monitoring device 8 monitors the status of the traveling yarn Y and detects whether the yarn Y has any defects. Upon detection of a defect on the yarn, the yarn monitoring device 8 transmits a yarn defect detection signal to the unit controller 10. The yarn monitoring device 8 detects, for example, at least abnormality in the size of the yarn Y or a foreign matter included in the yarn Y as a defect of the yarn Y. The yarn monitoring device 8 further detects a defect such as yarn breakage.

[0036] The tension sensor 9 disposed between the air spinning device 7 and the yarn storage device 50 measures tension of the traveling yarn Y and transmits a tension measurement signal to the unit controller 10. When the unit controller 10 determines that abnormality has been caused based on at least one of a detection result of the yarn monitoring device 8 and a detection result of

the tension sensor 9, the yarn Y is cut in the spinning unit 2. Specifically, air supply to the air spinning device 7 stops and generation of the yarn Y is terminated, and the yarn Y is accordingly cut. In another way, the yarn Y may be cut with a cutter separately provided.

[0037] The waxing device 12 disposed between the yarn storage device 50 and the winding device 13 applies wax to the yarn Y.

[0038] The yarn storage device 50 disposed between the air spinning device 7 and the winding device 13 eliminates slack from the yarn Y. The yarn storage device 50 has functions of stably drawing the yarn Y from the air spinning device 7, preventing the yarn Y from slacking by retaining the yarn Y sent from the air spinning device 7, for example, in the yarn splicing operation of the splicing carrier 3, and preventing fluctuations in tension of the yarn Y located downstream of the yarn storage device 50 from spreading to the air spinning device 7. A detailed configuration of the yarn storage device 50 will be later described.

[0039] The winding device 13 winds the yarn Y onto a bobbin B and forms a package P. The winding device 13 has a cradle arm 21, a winding drum 22, and a traverse guide 23.

[0040] The cradle arm 21 rotatably supports the bobbin B. The cradle arm 21 is swingably supported by a supporting shaft 24 and has the surface of the bobbin B or the surface of the package P contact with the surface of the winding drum 22 at appropriate pressure. The driving motor (not illustrated) installed in the second end frame 5B simultaneously drives the winding drums 22 of the respective spinning units 2, and the bobbin B or the package P of each spinning unit 2 is accordingly rotated in a winding direction. The traverse guide 23 of each spinning unit 2 is mounted on a shaft 25 shared by the spinning units 2. With the driving motor in the second end frame 5B driving the shaft 25 in a direction of the rotational axis of the winding drum 22 in a reciprocating manner, the traverse guide 23 has the yarn Y traverse a rotating bobbin B or package P at a certain width.

[0041] When the yarn Y is cut or breaks in a spinning unit 2 for any reason, the splicing carrier 3 runs to the spinning unit 2 and performs a splicing operation. The splicing carrier 3 has a suction pipe 31, a splicing device 37, and a suction mouth 38.

[0042] The suction pipe 31 is rotatably supported by a supporting shaft 31A, catches the yarn Y sent from the air spinning device 7, and guides the yarn Y to the splicing device 37. The suction mouth 38 is rotatably supported by a supporting shaft 38A, catches the yarn Y sent from the winding device 13, and guides the yarn Y to the splicing device 37. The splicing device 37 splices the guided pieces of the yarn Y with each other. Examples of the splicing device 37 include a splicer using compressed air, a piecer using seed yarn, and a knotter mechanically splicing the yarn Y.

[0043] In the splicing operation, the splicing carrier 3 rotates (reversely rotates) the package P in a reverse

direction of winding. Specifically, the cradle arm 21 is moved by an air cylinder (not illustrated) so that the package P is separated from the winding drum 22, and a reverse rotating roller installed in the splicing carrier 3 reversely rotates the package P.

[0044] The yarn storage device 50 will now be described in more detail. As illustrated in FIG. 3, the yarn storage device 50 includes a yarn storage roller 51 and a yarn threading member 60. The yarn storage device 50 may further include a storage amount sensor 56, an upstream guide 57, a downstream guide 59, and a yarn taking-off member 71.

[0045] The yarn storage roller 51 is fixed to a driving shaft 55A of an electric motor 55 and is rotated by the electric motor 55. The yarn storage roller 51 has a yarn storage portion 52, a base-end taper portion 53, and a front-end taper portion 54. The yarn storage portion 52 is a cylindrical portion onto which the yarn Y is wound and is formed in a manner slightly tapering toward the front end. The yarn storage portion 52 has a base-end portion 52a from which winding of the yarn Y starts and a front-end portion 52b from which the yarn Y is unwound. The base-end taper portion 53 is formed in a manner gradually widened from the base-end portion 52a toward the upstream side. The front-end taper portion 54 is formed in a manner gradually widened from the front-end portion 52b toward the downstream side.

[0046] The base-end taper portion 53 receives the yarn Y led onto the yarn storage roller 51 from the upstream side and smoothly guides the yarn Y to the base-end portion 52a. With this process, the yarn Y is orderly wound onto the yarn storage portion 52 from the base-end side toward the front-end side. The yarn Y wound onto the yarn storage portion 52 forms a yarn layer on the yarn storage portion 52. The yarn layer is a portion of the yarn storage portion 52 where pieces of the yarn Y are wound in a manner substantially parallel with one another. The front-end taper portion 54 smoothly leads out the yarn Y from the yarn storage roller 51 toward the downstream side while preventing a ring slipping-off phenomenon that pieces of the yarn Y wound onto the yarn storage portion 52 are simultaneously slipped off when the yarn Y is unwound from the yarn storage roller 51.

[0047] The storage amount sensor 56 detects the amount of yarn Y stored in the yarn storage roller 51 in a non-contact manner. The storage amount sensor 56 transmits the detected amount of storage to the unit controller 10 (see FIG. 1).

[0048] The upstream guide 57 is disposed upstream of the yarn storage roller 51 and appropriately guides the yarn Y onto the outer peripheral surface of the yarn storage roller 51. The upstream guide 57 prevents twist of the yarn Y transmitted from the air spinning device 7 from spreading downstream of the upstream guide 57.

[0049] The downstream guide 59 is disposed downstream of the yarn storage roller 51. The downstream guide 59 stabilizes the traveling path of the yarn Y in the downstream side of the downstream guide 59 by control-

ling the orbit of the yarn Y and guides the yarn Y.

[0050] The yarn threading member 60 is a member disposed in the front end of the yarn storage roller 51. The yarn threading member 60 hooks the yarn Y and has the yarn Y wound onto the yarn storage roller 51. As illustrated in FIG. 4, the yarn threading member 60 has a flyer shaft 61 and a flyer 63. The flyer shaft 61 is rotatably provided around the same axis as the yarn storage roller 51. As illustrated in FIGs. 3 and 4, the flyer 63 is fixed to the tip of the flyer shaft 61 and is formed in a curved shape so that its front end is positioned above the front-end taper portion 54 of the yarn storage roller 51. Means for generating magnetic force that causes torque of a certain value or larger is provided between the yarn storage roller 51 and the flyer shaft 61 so as to relatively rotate the yarn threading member 60 with respect to the yarn storage roller 51.

[0051] As illustrated in FIGs. 2 and 3, the yarn taking-off member 71 is a member for taking off the yarn Y from the yarn threading member 60 and is disposed near the front-end taper portion 54 of the yarn storage roller 51. The yarn taking-off member 71 is supported by a supporting shaft 71A such that its front end is swingable between the descent position and the ascent position. The descent position is a position retracted from the yarn path, whereas the ascent position is a position for pressing up the yarn Y on the yarn path and taking off the yarn Y from the yarn threading member 60. The yarn taking-off member 71 is pressed against the descent position side by a spring (not illustrated). More specifically, the yarn taking-off member 71 is usually disposed in the descent position. In the splicing operation or the like, the yarn taking-off member 71 is moved to the ascent position by a pneumatic cylinder (not illustrated) installed in the splicing carrier 3.

[0052] As illustrated in FIG. 4, the flyer 63 has an arm unit (a supporting unit) 64 and a guiding unit (an elongated member) 65. The arm unit 64 is mounted on the tip of the flyer shaft 61 in a manner rotatable together with the flyer shaft 61. Furthermore, the arm unit 64 has a boss 64a with which the flyer shaft 61 is engaged. The arm unit 64 is formed in an elongate shape extending from the boss 64a toward a direction of the diameter of the yarn storage roller 51.

[0053] The guiding unit 65 is fixed to the arm unit 64 and extends from the front end of the arm unit 64 in a direction away from the arm unit 64. The guiding unit 65 is an elongated member made from ceramic, iron, or piano wire and has a circular cross-sectional surface perpendicular to the extending direction of the guiding unit 65. The guiding unit 65 is formed in such a shape that curves as appropriate toward the outer peripheral surface (the yarn storage portion 52) of the yarn storage roller 51 by bending the elongated member.

[0054] A large diameter portion 65a is formed on a part of the guiding unit 65 in the extending direction. As illustrated in FIG. 5A, the large diameter portion 65a has a circular cross-sectional surface perpendicular to the ex-

tending direction of the guiding unit 65. The diameter D1 is equal to or greater than 0.9 mm and equal to or less than 1.2 mm. The guiding unit 65 further has a yarn guiding surface 66 configured with an outer peripheral surface 66a of the large diameter portion 65a. In other words, the yarn guiding surface 66 is formed by using the outer peripheral surface 66a of the large diameter portion 65a formed on a part of the guiding unit 65 in the extending direction. The yarn guiding surface 66 is configured with an arc having a radius of curvature of equal to or greater than 0.45 mm and equal to or less than 0.60 mm. The yarn guiding surface 66 is a portion contacting with the yarn Y (hooking the yarn Y) and guiding the yarn Y to the yarn storage portion 52. With this configuration, the guiding unit 65 can guide the yarn Y to the outer peripheral surface (the yarn storage portion 52) of the yarn storage roller 51 by engaging with the yarn Y (by hooking the yarn Y).

[0055] The large diameter portion 65a may be integrally formed with other portions of the guiding unit 65 or may be provided to the body of the guiding unit 65 as a separate unit detachable and attachable from and to the body. In the case that the large diameter portion 65a is provided as a separate unit, the material used for the large diameter portion 65a may be different from the material for the other portions of the guiding unit 65 or may be the same as that.

[0056] As illustrated in FIG. 5B, the guiding unit 65 may have a hollow portion 67 extending in the extending direction. The hollow portion 67 may extend over the entire length of the guiding unit 65 from the base end fixed to the arm unit 64 to the front end opposite thereto or may be partly formed in the extending direction. For example, when the guiding unit 65 has an outer diameter D1 of 1.1 mm, the inner diameter D2 of the guiding unit 65 is equal to or greater than 0.45 mm and equal to or less than 0.63 mm. When the outer diameter D1 is 1.2 mm, the inner diameter D2 is equal to or greater than 0.63 mm and equal to or less than 0.79 mm. When the outer diameter D1 is 1.3 mm, the inner diameter D2 is equal to or greater than 0.83 mm and equal to or less than 0.94 mm. This configuration of the yarn threading member 60 can reduce the weight of the guiding unit 65. The decrease in weight can reduce effects of the inertial force resulting from the weight of the guiding unit 65 when moving the guiding unit 65. Consequently, the yarn threading member 60 has good responsiveness and flexibility to fluctuations in the load (yarn tension).

[0057] The yarn threading member 60 in the first embodiment has a large area of contact between the yarn Y and the yarn guiding surface 66 with respect to the diameter of the yarn Y. This configuration can reduce the pressure (the surface pressure) per unit applied to the yarn guiding surface 66 by the yarn Y. This configuration can thus reduce progression of wear caused on the portion contacting with the yarn Y, thereby extending the product life of the yarn threading member 60.

[0058] The yarn Y stored in the yarn storage roller 51

generally has a diameter of equal to or greater than 0.1 mm and equal to or less than 0.4 mm. The surface pressure on the yarn guiding surface 66 can be decreased by setting the diameter of the guiding unit 65, with which the yarn Y having a diameter in the above-described range contacts, at equal to or greater than 0.9 mm and equal to or less than 1.2 mm.

[0059] In the first embodiment, the yarn guiding surface 66 configured with an arc having a radius of curvature of equal to or greater than 0.45 mm and equal to or less than 0.60 mm has been described as an example; however, the embodiment is not limited thereto. For example, the yarn guiding surface 66 may have a radius of curvature of equal to or less than 5.00 mm (a diameter of equal to or less than 10.0 mm). The radius of curvature may be therefore equal to or less than 1.50 mm or equal to or less than 0.60 mm as described in the first embodiment.

Second embodiment

[0060] A spinning machine 101 including a yarn threading member 160 according to a second embodiment will now be described. The yarn threading member 160 of the second embodiment is different from the yarn threading member 60 of the first embodiment only in that the shape of a yarn guiding surface 166 formed on the guiding unit 65 differs from the shape of the yarn guiding surface 66 of the first embodiment. Except that, the yarn threading member 160 has the same configuration as that of the yarn threading member 60 of the first embodiment. The yarn guiding surface 166 formed on the guiding unit 65 will now be described in detail, and description of other components will be omitted.

[0061] As illustrated in FIG. 6A, on a part of the guiding unit 65 in the extending direction, the yarn guiding surface 166 is formed by using an elliptic curve as a part of a cross-sectional surface perpendicular to the extending direction. As an example, on a part of the guiding unit 65 in the extending direction, the yarn guiding surface 166 is formed by using a part of an outer peripheral surface (an outer shape) 166a of a half-elliptic cross-sectional surface perpendicular to the extending direction. In other words, on the yarn threading member 160, the yarn Y is guided by contacting with the yarn guiding surface 166 formed by using the outer peripheral surface 166a of the half-elliptic cross-sectional surface. The half ellipse in this embodiment has a ratio of the major axis to the minor axis of 2:1. Another outer peripheral surface 167a opposite to the side with the yarn guiding surface 166 has a circular cross-sectional surface perpendicular to the extending direction. In other words, the yarn guiding surface 166 is formed by using an outer peripheral surface 166a of a processed portion 165a formed on a part of the guiding unit 65 in the extending direction. The yarn guiding surface 166 is a portion contacting with the yarn Y unwound from the yarn storage roller 51. This yarn guiding surface 166 can be formed, for example, by pressing (press working) a part of the outer peripheral surface of

the guiding unit 65, which has a circular cross-sectional surface perpendicular to the extending direction and has a diameter D1 of equal to or greater than 0.9 mm and equal to or less than 1.2 mm.

[0062] The yarn threading member 160 of the second embodiment has a larger area of contact between the yarn Y and the yarn guiding surface 166 compared with the case that a guiding unit having a circular cross-sectional surface contacts with the yarn Y. This configuration can reduce the pressure (the surface pressure) per unit applied to the yarn guiding surface 166 by the yarn Y. This configuration can thus reduce progression of wear caused on the portion contacting with the yarn Y, thereby extending the product life of the yarn threading member 160.

[0063] As another example, as illustrated in FIG. 6B, a part of the guiding unit 65 in the extending direction may have an elliptic cross-sectional surface perpendicular to the extending direction. The outer peripheral surface 167a opposite to the side with the yarn guiding surface 166 may be flat as illustrated in FIG. 7A or may be concave as illustrated in FIG. 7B. In any of these cases, the yarn Y is guided by contacting with the yarn guiding surface 166 formed by using the outer peripheral surface 166a of a half-elliptic cross-sectional surface.

[0064] Furthermore, in any of these cases, the radius of curvature of a second portion S2 having no contact with the yarn Y is set smaller than the radius of curvature of a first portion S1 so that the guiding unit 65 is not increased in size. Consequently, the yarn threading member 160 has good responsiveness and flexibility to fluctuations in the load (yarn tension).

[0065] In any of these cases, as illustrated in FIG. 5B, the guiding unit 65 may have the hollow portion 67 extending in the extending direction. The hollow portion 67 may extend from the base end fixed to the arm unit 64 to the front end opposite thereto or may be partly formed.

[0066] The guiding unit 65 has a portion S1 (a first portion) forming the yarn guiding surface 166 and having a large radius of curvature (small curvature) and a portion S2 (a second portion) having a radius of curvature smaller (larger in curvature) than that of the yarn guiding surface 166. The area of contact between the yarn Y and the yarn guiding surface 166 increases when the yarn Y contacts with the outer peripheral surface of the first portion S1 compared with the case that the yarn Y contacts with the outer peripheral surface of the second portion S2. This configuration can reduce the pressure (the surface pressure) per unit applied to the yarn guiding surface 166 by the yarn Y.

[0067] An embodiment of the present disclosure has been described as above; however, the embodiment is not limited thereto.

First modification

[0068] In the above-described embodiments (the first and the second embodiments), such configurations have

been described as examples that the yarn guiding surfaces 66 and 166 are formed by using, respectively, the outer peripheral surface 66a of the large diameter portion 65a and the outer peripheral surface 166a of the processed portion 165a, each of which is formed on a part of the guiding unit 65 in the extending direction.

[0069] For example, as illustrated in FIG. 8, a guiding unit 265 may be an elongated member having such a cross-sectional surface perpendicular to the extending direction that is, as illustrated in FIG. 5A, circular with a diameter of equal to or greater than 0.9 mm and equal to or less than 10.0 mm (or may be equal to or less than 3.00 mm or equal to or less than 1.20 mm) over the entire length from the base end to the front end opposite thereto in the extending direction. On a part of the guiding unit 265 in the extending direction, a yarn guiding surface 266 is formed by using an arc of an outer peripheral surface 265a (having a radius of curvature of equal to or greater than 0.45 mm and equal to or less than 5.00 mm (or may be equal to or less than 1.50 mm or equal to or less than 0.60 mm)) of the guiding unit 265. The guiding unit 265 may similarly have the hollow portion 67 as illustrated in FIG. 5B. In addition to the guiding unit 265 that has a cross-sectional surface as illustrated in FIG. 5A or FIG. 5B described in the first embodiment, such a guiding unit 365 may also be applicable that has a cross-sectional surface as illustrated in any of FIG. 6A, FIG. 6B, FIG. 7A, and FIG. 7B described in the second embodiment. A yarn guiding surface 366 is formed on a part of the guiding unit 365 in the extending direction in a manner of using an outer peripheral surface 365a of the guiding unit 365.

[0070] Similarly, in these cases, progression of wear caused on a portion contacting with the yarn Y can be reduced, which can accordingly extend the product life of the yarn threading members 60 and 160.

Second modification

[0071] In the second embodiment, such an exemplary guiding unit has been described that has the first portion S1 with a radius of curvature of a first size and the second portion S2 with a radius of curvature smaller than the first size on a cross-sectional surface perpendicular to the extending direction (in this case, the yarn guiding surface 166 configured with an elliptic curve formed on at least a part of the cross-sectional surface perpendicular to the extending direction is formed on a part of the guiding unit 65 in the extending direction). The embodiment, however, is not limited thereto. The guiding unit may have such a cross-sectional surface perpendicular to the extending direction that is configured with an arc (the first portion), the radius of curvature of which is equal to or greater than 0.45 mm and equal to or less than 5.0 mm (or may be equal to or less than 1.50 mm or equal to or less than 0.60 mm) (the first size), and another arc (the second portion), the radius of curvature of which is equal to or greater than 0.20 mm and less than 0.45 mm.

Other modifications

[0072] One or more covering layers may be formed on each of the surfaces of the guiding units 65, 265, and 365 according to the above-described embodiments and modifications. In the case of forming a single covering layer, the covering layer may be formed by diamond-like carbon (DLC) coating. In the case of forming two layers of covering layer, the main body (steel such as piano wire and spring steel) of each of the guiding units 65, 265, and 365 may be covered with a layer made from hard chrome, and the layer made from hard chrome may be further covered with another layer formed by DLC coating. This configuration can reduce progression of wear caused on a portion contacting with the yarn Y on each of the guiding units 65, 265, and 365, thereby extending the product life of the yarn threading members 60 and 160. In addition, this configuration can smoothen the surfaces of the yarn guiding surfaces 66, 166, 266, and 366, which improves the quality of the yarn Y.

[0073] Such examples has been described in the embodiments and modifications that means for generating magnetic force that causes torque of a certain value or larger is provided between the yarn storage roller 51 and the flyer shaft 61 so as to relatively rotate the yarn threading members 60 and 160 with respect to the yarn storage roller 51. In another way, the yarn threading members 60 and 160 and the yarn storage roller 51 may be separately rotated by respective motors.

[0074] Furthermore, the yarn threading members 60 and 160 in the embodiments and modifications have the arm unit 64 and the guiding units 65, 265, and 365 separately formed; however, the arm unit 64 and the guiding units 65, 265, and 365 may be integrally formed.

[0075] The shape of the yarn storage roller 51 is not limited to the shapes of the above-described embodiments or the shape illustrated in FIG. 3. For example, the front-end taper portion 54 may be omitted.

[0076] The arm unit 64 according to the above-described embodiments and modifications may be in a shape different from the shapes illustrated in FIG. 4 and FIG. 8. As illustrated in FIG. 9, an arm unit (a supporting unit) 464 may include a front-end portion 401 with guiding units 65, 265, and 365, a boss 403 fixed to the yarn storage roller 51, a main body 402 extending in a direction between the front-end portion 401 and the boss 403, and a projecting portion 404 serving as a reinforcement unit for reinforcing the main body 402. With the projecting portion 404 provided to the main body 402, the guiding units 65, 265, and 365 can stably guide the yarn Y in the guiding operation. FIG. 9 illustrates the front-end portion 401 with the guiding units 65, 265, and 365, which are omitted for illustrative purposes, provided thereto.

[0077] The projecting portion 404 is configured in a manner projecting from a surface 402a of the main body 402 and extending in a direction (the direction L in FIG. 9) in which the main body 402 extends. The boss 403 projects from the main body 402. The projecting portion

404 is formed in the center area of the surface 402a, from which the boss 403 projects, of the main body 402 in a direction (the direction W in FIG. 9) perpendicular to (intersecting with) a direction in which the boss 403 projects and a direction in which the main body 402 extends. The projecting portion 404 is formed over a certain length (in FIG. 9, a half of the length of the main body 402 in the extending direction) from a side with the boss 403 in the extending direction of the main body 402. The length of the projecting portion 404 is not limited to the length illustrated in FIG. 9. For example, the projecting portion 404 may be formed in a manner reaching the periphery of the front end, in other words, in almost the same length as the main body 402 in the extending direction. In the example of FIG. 9, the amount of projection from the surface 402a of the main body 402 gradually decreases from the boss 403 toward the front-end portion 401; however, without being limited to this example, the amount of projection may decrease stepwise or may be constant.

[0078] In addition to the projecting portion 404 serving as a reinforcement unit, or on behalf of the projecting portion 404, increased thickness portions 405A and 405B may be formed in respective ends of the main body 402 in a direction (the transverse direction) perpendicular to (intersecting with) both a direction in which the boss 403 projects and a direction in which the main body 402 extends. Instead of forming the increased thickness portions 405A and 405B in respective ends of the main body 402 in the transverse direction, only one of the increased thickness portions 405A and 405B may be formed in an end of the main body 402 in the transverse direction. Furthermore, the length L of each of the increased thickness portions 405A and 405B in the extending direction is not limited to the length illustrated in FIG. 9. For example, the increased thickness portions 405A and 405B may be formed in a manner reaching the periphery of the front end (in other words, in almost the same length as the main body 402 in the extending direction). In the example of FIG. 9, the amount of thickness (the amount of increased thickness with the center area of the main body 402, which has no increased thickness portion 405A or 405B, serving as a reference point) increased from the surface 402a of the main body 402 is gradually decreased from the boss 403 toward the front-end portion 401. The amount of increased thickness is not limited to this example. The amount may be decreased stepwise from the boss 403 toward the front-end portion 401 or may be constant.

[0079] In the above-described embodiments and modifications, the air spinning device may further include a needle retained in a fiber guiding unit and projecting into the spinning room so as to prevent twist of the fiber bundle from spreading to the upstream side of the air spinning device. In another case, instead of using the needle, the air spinning device may prevent twist of the fiber bundle from spreading to the upstream side of the air spinning device using an end in the downstream side of the fiber guiding unit. Instead of the above configurations, the air

spinning device may include a pair of air jet nozzles for twisting the fiber bundle in respective directions opposite to each other.

[0080] In the above-described embodiments and modifications, the spinning unit 2 has the yarn storage device 50 draw the yarn Y from the air spinning device 7. Instead of this configuration, the spinning unit 2 may include a delivery roller and a nip roller for drawing the yarn Y from the air spinning device 7.

[0081] In the above-described embodiments and modifications, the devices in the spinning machine 1 are disposed such that the yarn Y supplied in the upper side is wound in the lower side in the height direction of the machine. Instead of this configuration, the devices may be disposed such that the yarn Y supplied in the lower side is wound in the upper side.

[0082] Furthermore, in the above-described embodiments and modifications, the spinning machine 1 has at least one of bottom rollers of the drafting device 6 and the traverse guide 23 driven by power from the second end frame 5B (in other words, driven by power shared by a plurality of spinning units 2). Instead of this configuration, the devices (such as the drafting device, the spinning device, and the winding device) of each spinning unit 2 may be driven on a per-spinning unit 2 basis.

[0083] In the above-described embodiments and modifications, the tension sensor 9 may be disposed in the upstream side of the yarn monitoring device 8 in a direction in which the yarn Y travels. The unit controller 10 may be provided in each spinning unit 2. The waxing device 12, the tension sensor 9, and the yarn monitoring device 8 may be omitted from each spinning unit 2.

[0084] FIG. 1 illustrates the spinning machine 1 winding the yarn into the package P in a cheese-like shape; however, the spinning machine 1 can wind yarn into a package in a corn-like shape. In the case with a package in a corn-like shape, the yarn traverse causes slack on the yarn; however, the slack can be absorbed by the yarn storage device 50. Materials and shapes of the components are not limited to those described as above, and various materials and shapes may be employed.

[0085] At least a part of the above-described embodiments may be combined as appropriate.

[0086] A yarn threading member according to an embodiment of the present disclosure is installed in a yarn storage roller. The yarn threading member includes a supporting unit rotatably installed in the yarn storage roller and a guiding unit configured to contact with yarn unwound from the yarn storage roller, the guiding unit being an elongated member provided on the supporting unit and extending in a direction away from the supporting unit. A yarn guiding surface configured with an arc, which is formed on at least a part of a cross-sectional surface perpendicular to an extending direction of the guiding unit and has a radius of curvature of equal to or greater than 0.45 mm and equal to or less than 5.00 mm, is formed on at least a part of the guiding unit in the extending direction.

[0087] The yarn threading member in the above-described configuration has a large area of contact between the yarn and the yarn guiding surface with respect to the diameter of the yarn. This configuration can reduce the pressure (the surface pressure) per unit applied to the yarn guiding surface by the yarn. This configuration can thus reduce progression of wear caused on the portion contacting with yarn, thereby extending the product life of the yarn threading member.

[0088] A yarn threading member according to an embodiment of the present disclosure is installed in a yarn storage roller. The yarn threading member includes a supporting unit rotatably installed in the yarn storage roller and a guiding unit configured to contact with yarn unwound from the yarn storage roller, the guiding unit being an elongated member provided on the supporting unit and extending in a direction away from the supporting unit. The guiding unit has a first portion with a radius of curvature of a first size and a second portion with a radius of curvature smaller than that of the first size on a cross-sectional surface perpendicular to the extending direction. A yarn guiding surface contacting with yarn is formed on the first portion.

[0089] The yarn threading member in the above-described configuration has a relatively large area of contact between the yarn and the yarn guiding surface with respect to the diameter of the yarn. This configuration can reduce the pressure (the surface pressure) per unit applied to the yarn guiding surface by the yarn. This configuration can thus reduce progression of wear caused on the portion contacting with yarn, thereby extending the product life of the yarn threading member. Furthermore, an increase in size of the guiding unit can be controlled by setting the radius of curvature of the second portion, contacting with no yarn, smaller than that of the first portion. Consequently, the yarn threading member has good responsiveness and flexibility to fluctuations in the load (yarn tension).

[0090] A yarn threading member according to an embodiment of the present disclosure is installed in a yarn storage roller. The yarn threading member includes a supporting unit rotatably installed in the yarn storage roller and a guiding unit configured to contact with yarn unwound from the yarn storage roller, the guiding unit being an elongated member provided on the supporting unit and extending in a direction away from the supporting unit. A yarn guiding surface configured with an elliptic curve formed on at least a part of a cross-sectional surface perpendicular to an extending direction of the guiding unit is formed on at least a part of the guiding unit in the extending direction.

[0091] An area of contact between yarn and the above-described yarn guiding surface is larger compared with such a case that a guiding unit having a circular cross-sectional surface contacts with yarn. This configuration can reduce the pressure (the surface pressure) per unit applied to the yarn guiding surface by the yarn. Consequently, this configuration can reduce progression of

wear caused on the portion contacting with yarn, thereby extending the product life of the yarn threading member.

[0092] A yarn threading member according to an embodiment of the present disclosure is installed in a yarn storage roller. The yarn threading member includes a supporting unit relatively rotatably installed in the yarn storage roller and an elongated member provided on the supporting unit and extending in a direction away from the supporting unit. The elongated member has a circular cross-sectional surface perpendicular to the extending direction and has a hollow portion being hollow along the extending direction.

[0093] The yarn threading member configured as above can decrease the weight of the elongated member, and the decrease in weight can reduce effects of the inertial force resulting from the weight of the elongated member when moving the elongated member. Consequently, the yarn threading member has good responsiveness and flexibility to fluctuations in the load (yarn tension).

[0094] A yarn winder according to an embodiment of the present disclosure includes a drafting device configured to draft a fiber bundle, a spinning device configured to generate yarn by twisting the fiber bundle drafted by the drafting device, the above-described yarn storage device, and a yarn winding device configured to wind yarn stored in the yarn storage roller into a package.

[0095] The yarn winder configured as above employs a yarn threading member that can reduce progression of wear caused on a portion contacting with yarn and extend the product life, which results in extension of the replacement cycle of the yarn threading member in the yarn storage device. Consequently, this configuration can improve operation efficiency of the yarn storage device and the yarn winder.

[0096] A yarn threading member according to an embodiment of the present disclosure is installed in a yarn storage roller. The yarn threading member includes a supporting unit rotatably installed in the yarn storage roller and an elongated member provided on the supporting unit and extending in a direction away from the supporting unit. The supporting unit includes a front-end portion with the elongated member provided thereto, a boss fixed to the yarn storage roller, a main body extending in a direction between the front-end portion and the boss, and a reinforcement unit reinforcing the main body.

[0097] The supporting unit configured as above can stably support the elongated member.

[0098] A yarn threading member according to an embodiment of the present disclosure is installed in a yarn storage roller. The yarn threading member includes a supporting unit relatively rotatably installed in the yarn storage roller and an elongated member provided on the supporting unit and extending in a direction away from the supporting unit. The supporting unit includes a front-end portion with the elongated member provided thereto, a boss fixed to the yarn storage roller, a main body extending in a direction between the front-end portion and

the boss, and a reinforcement unit reinforcing the main body. The reinforcement unit has a projecting portion projecting from a surface of the main body and extending in a direction in which the main body extends.

[0099] With the supporting unit configured as above, the reinforcement unit can be easily formed.

[0100] A yarn threading member according to an embodiment of the present disclosure is installed in a yarn storage roller. The yarn threading member includes a supporting unit relatively rotatably installed in the yarn storage roller and an elongated member provided on the supporting unit and extending in a direction away from the supporting unit. The supporting unit includes a front-end portion with the elongated member provided thereto, a boss fixed to the yarn storage roller, a main body extending in a direction between the front-end portion and the boss, and a reinforcement unit reinforcing the main body. The reinforcement unit has a projecting portion projecting from a surface of the main body and extending in a direction in which the main body extends. The boss projects from the main body. On a surface with the boss of the main body projecting therefrom, the projecting portion is formed in the center area in a direction intersecting with a direction in which the boss projects and a direction in which the main body extends and formed over a certain length from an end with the boss provided thereto in the extending direction of the main body.

[0101] The supporting unit simply configured as above can more stably support the main body.

[0102] A yarn threading member according to an embodiment of the present disclosure is installed in a yarn storage roller. The yarn threading member includes a supporting unit relatively rotatably installed in the yarn storage roller and an elongated member provided on the supporting unit and extending in a direction away from the supporting unit. The supporting unit includes a front-end portion with the elongated member provided thereto, a boss fixed to the yarn storage roller, a main body extending in a direction between the front-end portion and the boss, and a reinforcement unit reinforcing the main body. The reinforcement unit has an increased thickness portion formed at least at one of both ends of the main body in a direction intersecting with a direction in which the boss projects and a direction in which the main body extends.

[0103] The supporting unit configured as above can more stably support the main body.

Claims

1. A yarn threading member (60, 160) installed in a yarn storage roller (51), comprising:

a supporting unit (64, 464) installed so as to be capable of rotating relative to the yarn storage roller (51);

an elongated member (65, 265, 365) provided

- on the supporting unit (64, 464) and extending in a direction away from the supporting unit (64, 464), wherein the elongated member has a cross-sectional surface, perpendicular to the extending direction, including a first portion (S1) with a radius of curvature of a first size, and a second portion (S2) with a radius of curvature smaller than the first size.
2. The yarn threading member (60, 160) according to claim 1, wherein at least a part of the cross-sectional surface is formed in an elliptic curve.
 3. The yarn threading member (60, 160) according to claim 1 or 2, wherein the cross-sectional surface including the first portion and the second portion is formed on only a part of the elongated member (65, 265, 365) in the extending direction.
 4. The yarn threading member (60, 160) according to any one of claims 1 to 3, wherein the elongated member (65, 265, 365) has a hollow portion (67) being hollow along the extending direction.
 5. The yarn threading member (60, 160) according to any one of claims 1 to 4, wherein the supporting unit (464) includes a front-end portion (401) on which the elongated member (65, 265, 365) is provided, a boss (403) fixed to the yarn storage roller (51), a main body (402) extending in a direction between the front-end portion (401) and the boss (403), and a reinforcement unit reinforcing the main body (402).
 6. The yarn threading member (60, 160) according to claim 5, wherein the reinforcement unit has a projecting portion (404) formed so as to project from a surface of the main body (402) and extend in a direction in which the main body (402) extends.
 7. The yarn threading member (60, 160) according to claim 6, wherein the boss (403) projects from the main body (402), and the projecting portion (404) is provided in a center area of the surface of the main body (402) from which the boss (403) projects, the center area being in a direction intersecting with a direction in which the boss (403) projects and a direction in which the main body (402) extends, and formed across a predetermined length from an end on which the boss (403) is provided in the extending direction of the main body (402).
 8. The yarn threading member (60, 160) according to any one of claims 5 to 7, wherein the reinforcement unit has an increased thickness portion (405A, 405B) formed at least at one of both ends of the main body (402) in a direction intersecting with a direction in which the boss (403) projects and a direction in which the main body (402) extends.
 9. A yarn storage device (50) comprising:
 - the yarn threading member (60, 160) according to any one of claims 1 to 8; and
 - a yarn storage roller (51) in which the yarn threading member (60, 160) is rotatably installed.
 10. A yarn winder (2) comprising:
 - a drafting device (6) configured to draft a fiber bundle;
 - a spinning device (7) configured to generate yarn (Y) by twisting the fiber bundle drafted by the drafting device;
 - the yarn storage device according to claim 9 configured to store the yarn generated by the spinning device (7); and
 - a winding device (13) configured to wind the yarn stored in the yarn storage roller (51) and form a package, wherein the elongated member is disposed such that yarn unwound from the yarn storage roller (51) is in contact with the first portion.

Fig.1

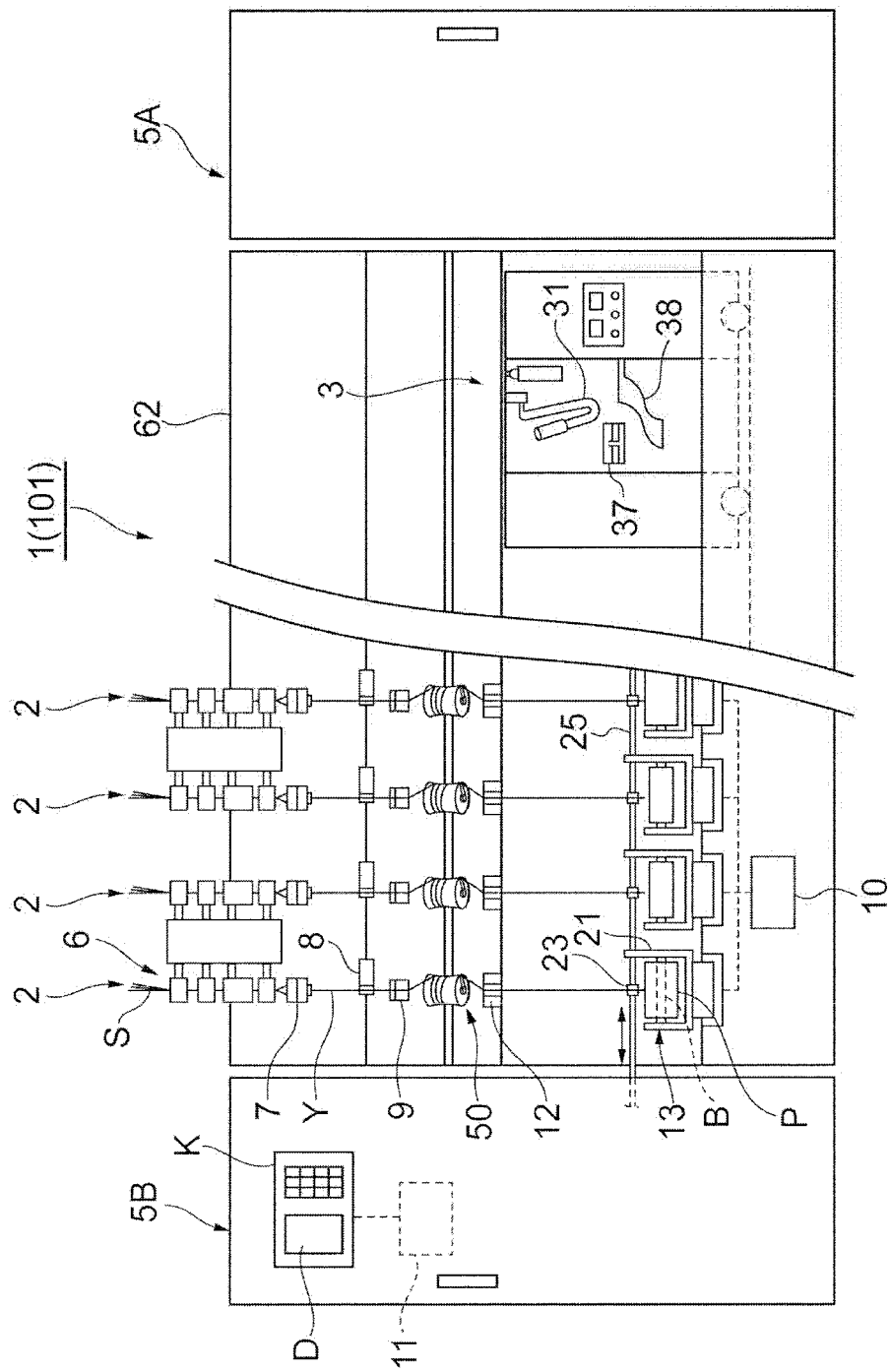


Fig.2

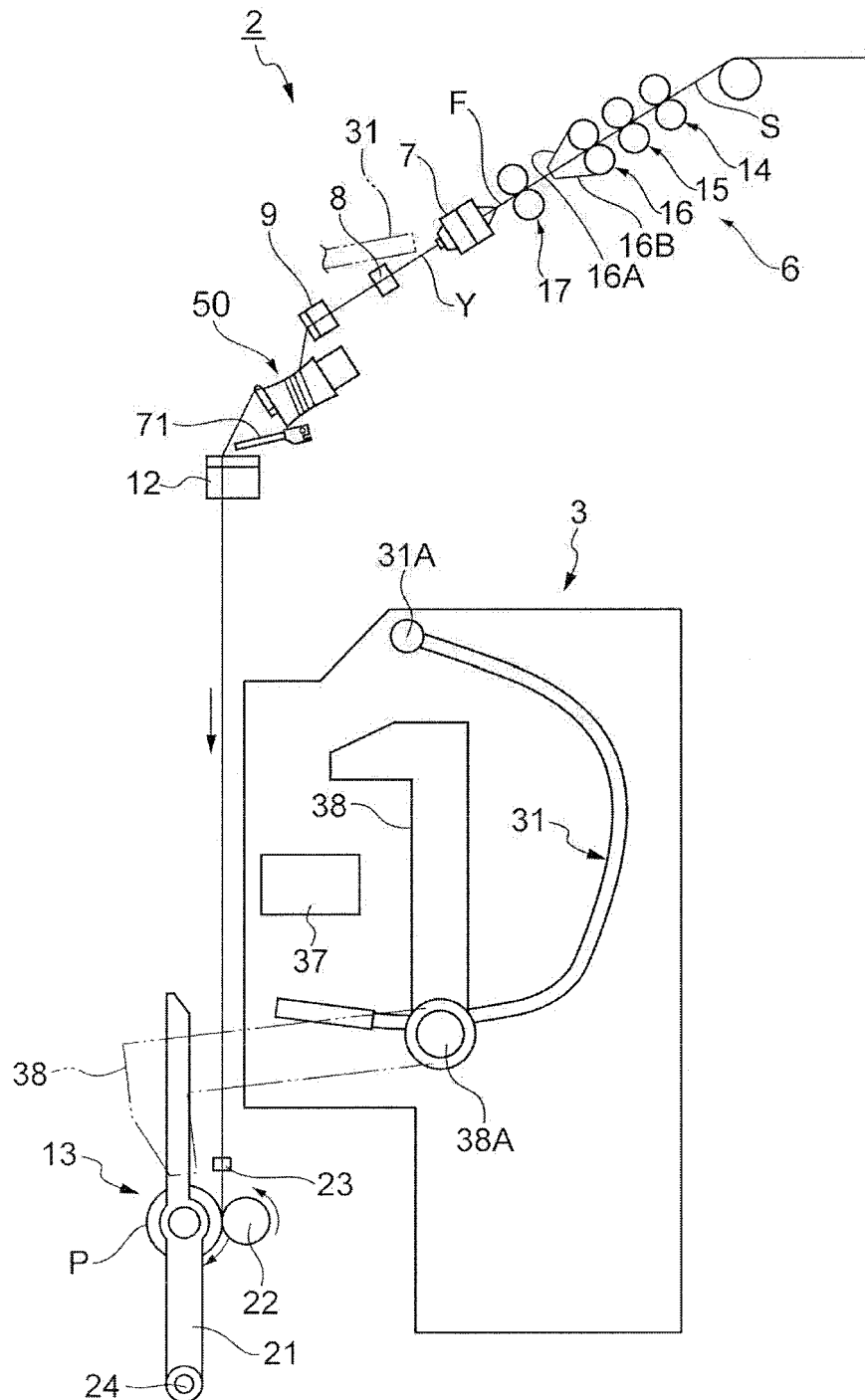


Fig.3

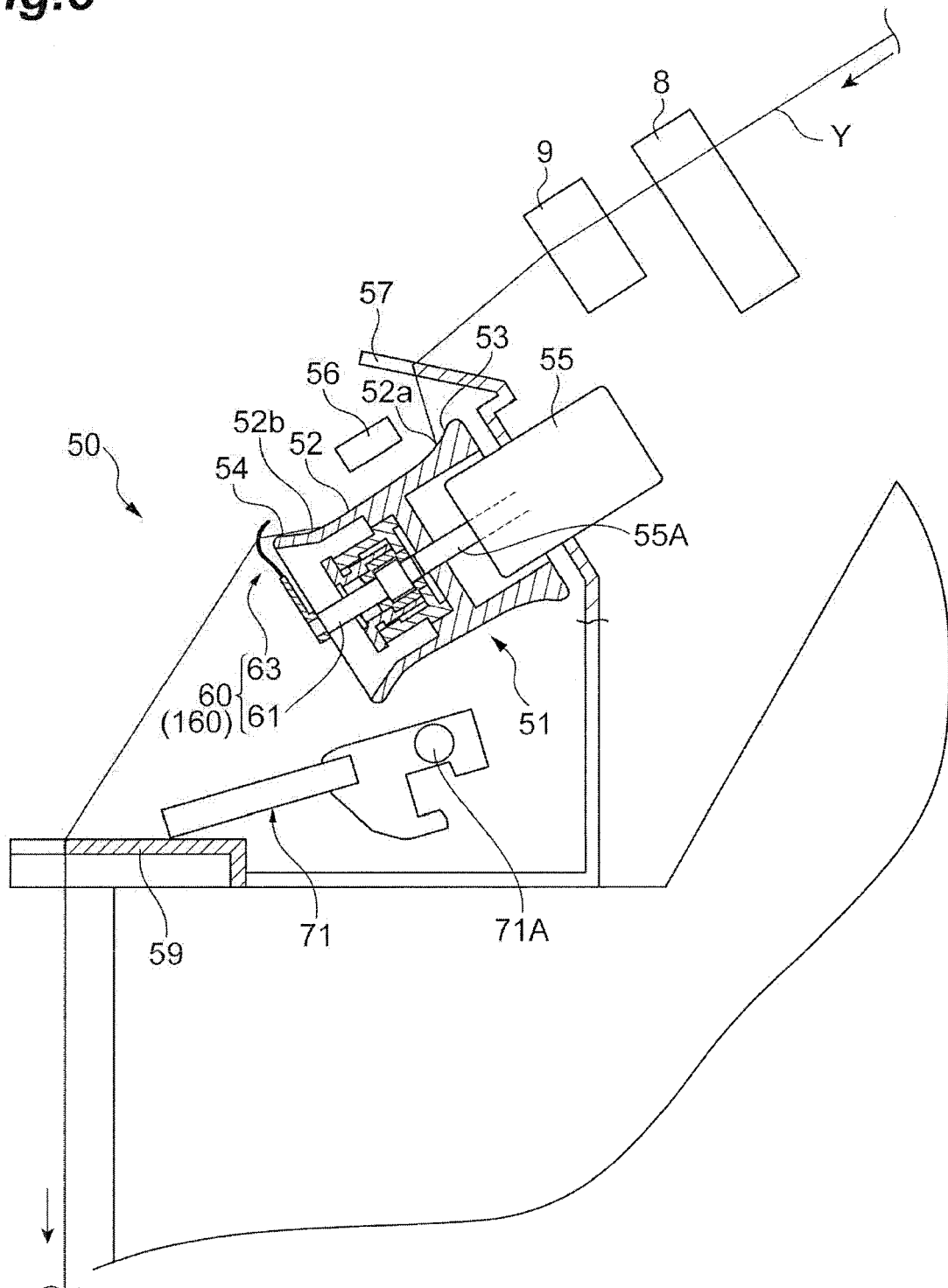


Fig.4

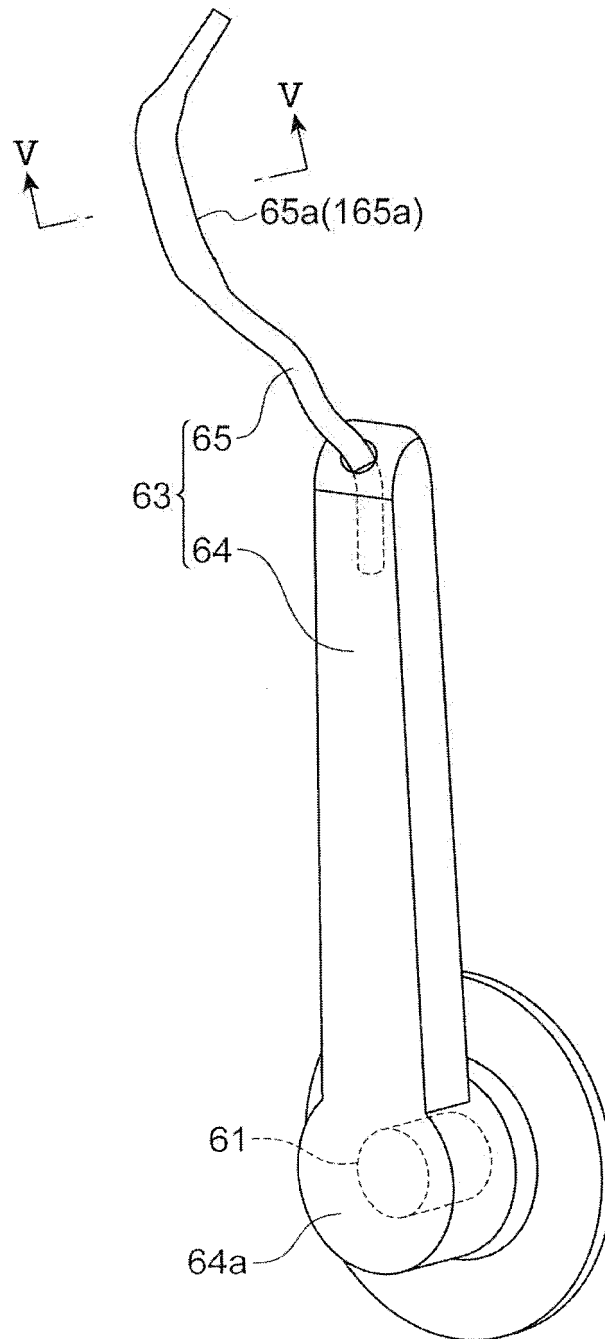


Fig.5A

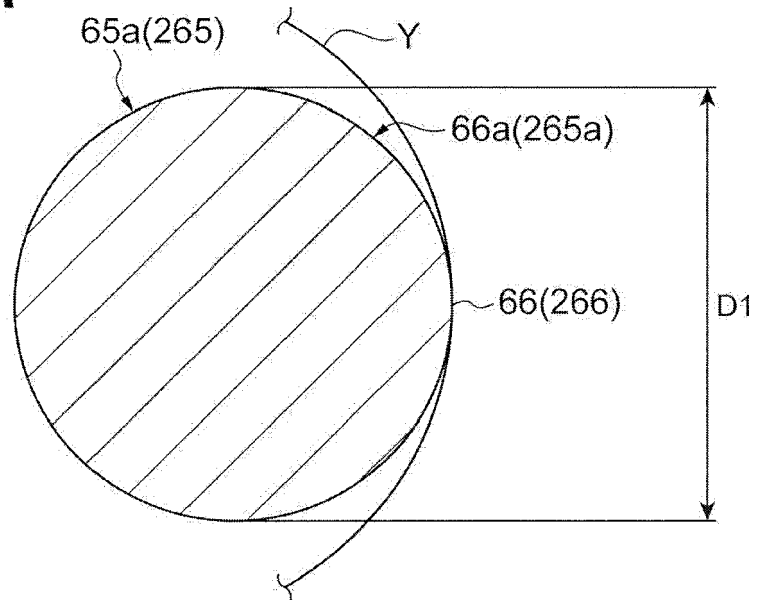


Fig.5B

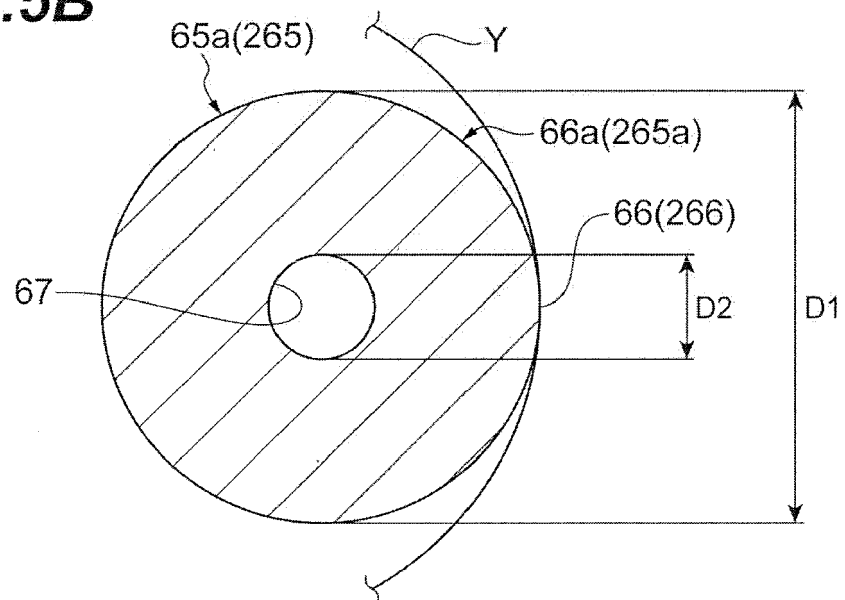


Fig.6A

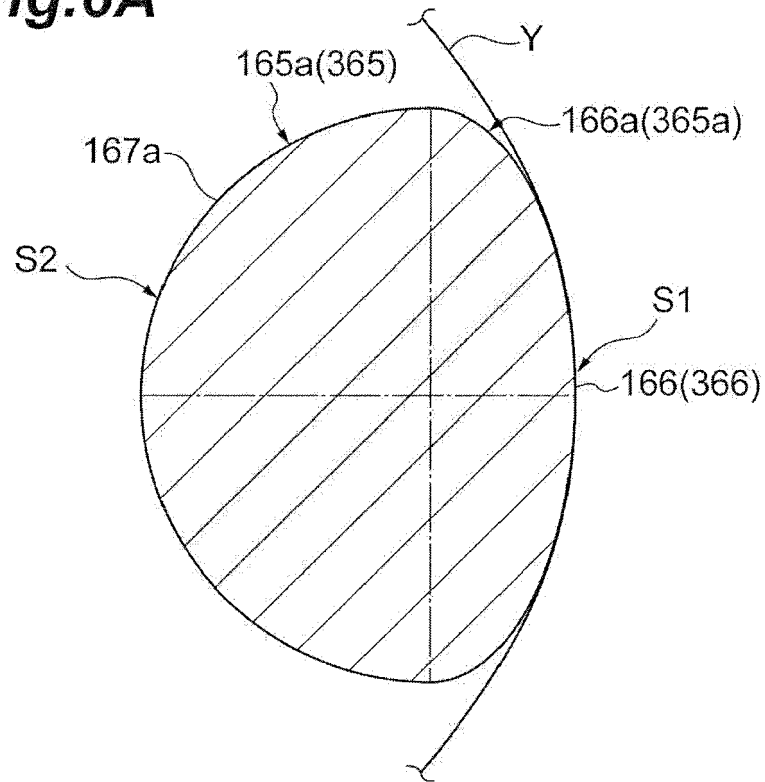


Fig.6B

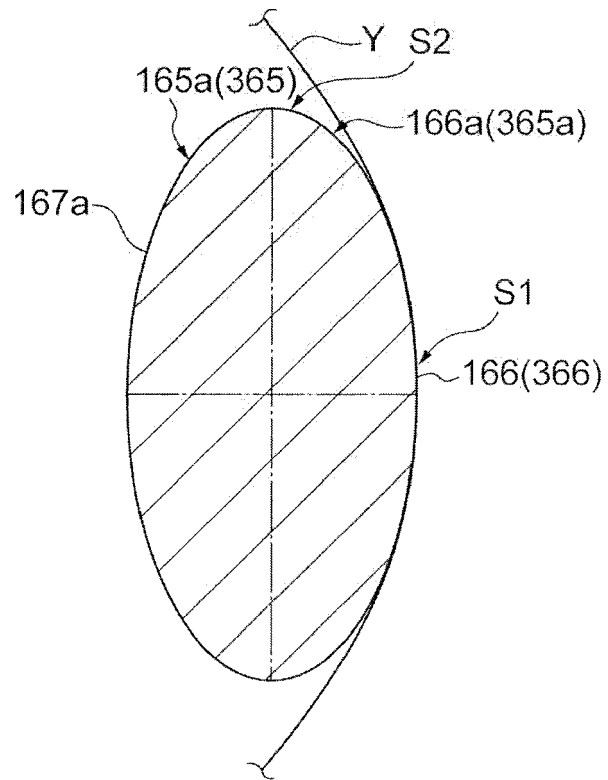


Fig.7A

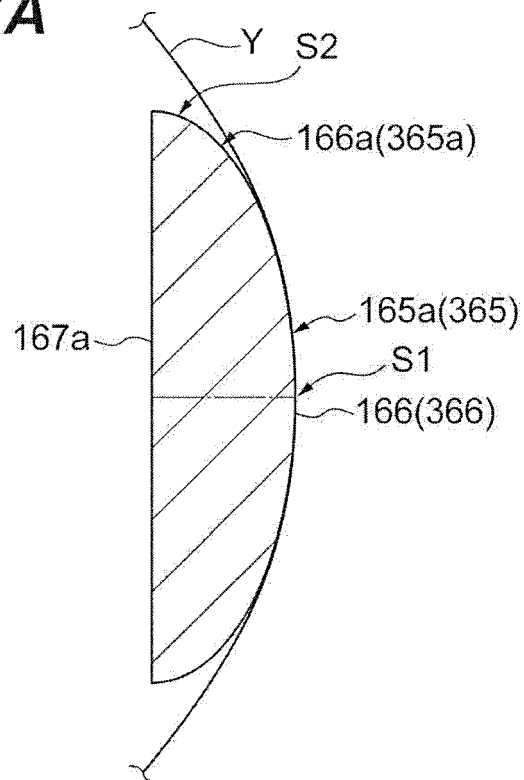


Fig.7B

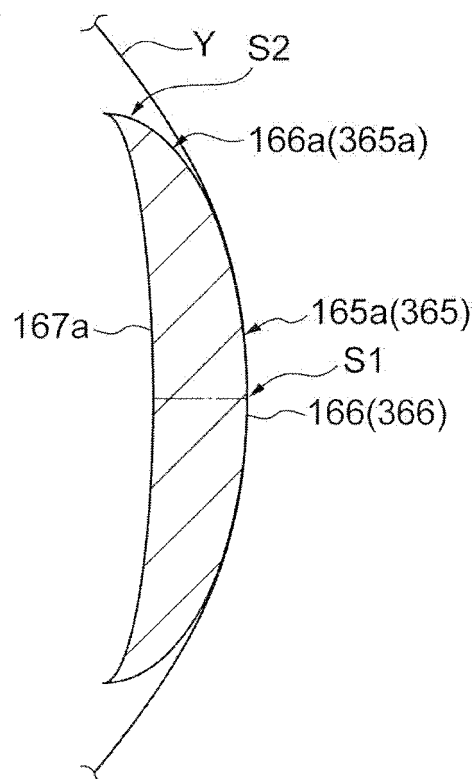


Fig.8

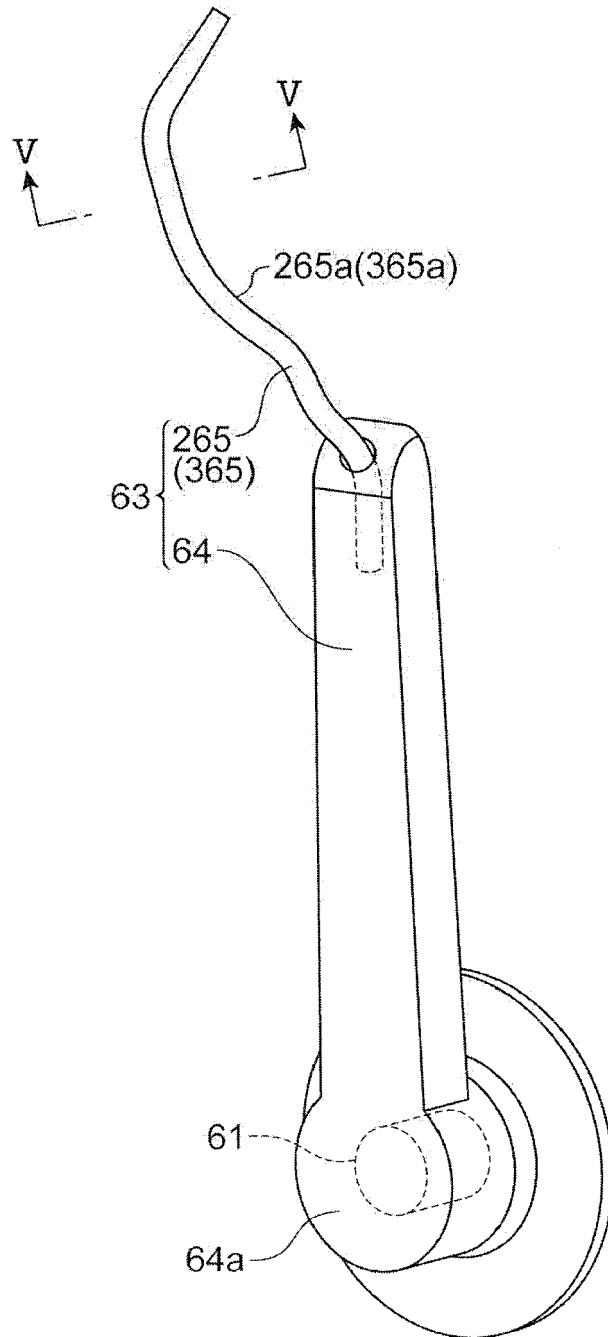
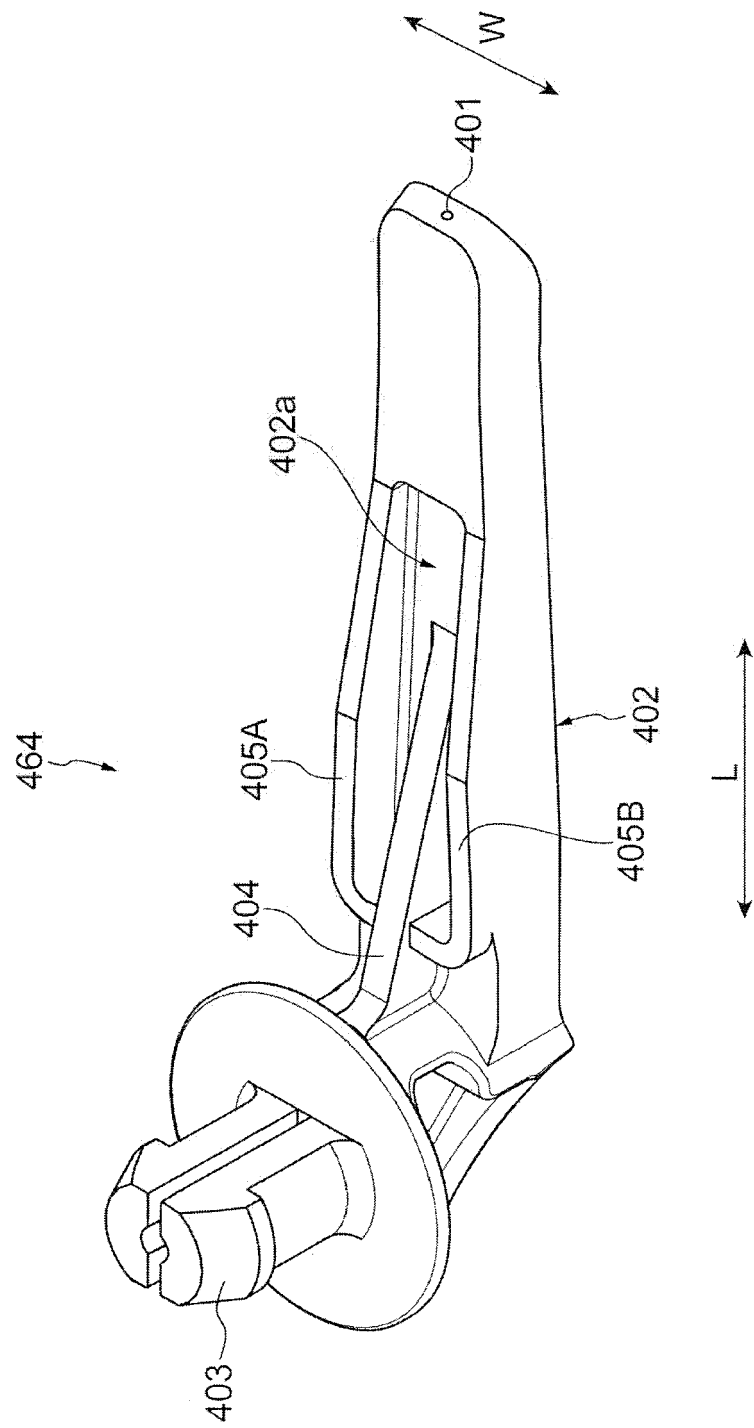


Fig. 9





EUROPEAN SEARCH REPORT

 Application Number
 EP 16 19 0800

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 889 250 A1 (RIETER CZ S R O [CZ]) 1 July 2015 (2015-07-01) * paragraph [0020]; figures 1-4 *	1-10	INV. B65H51/22 D01H13/10
A,D	JP 2010 180023 A (MURATA MACHINERY LTD) 19 August 2010 (2010-08-19) * the whole document *	1-10	
A	EP 2 889 249 A1 (RIETER CZ S R O [CZ]) 1 July 2015 (2015-07-01) * paragraph [0024]; figures 6, 6a *	1-10	
A	EP 2 537 787 A1 (OERLIKON TEXTILE GMBH & CO KG [DE]) 26 December 2012 (2012-12-26) * paragraphs [0029] - [0031] *	1,2	
A	US 2 431 150 A (TAYLOR GEORGE F) 18 November 1947 (1947-11-18) * column 2, lines 24-29; figure 3 *	1-3	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65H D01H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 February 2017	Examiner Pussemier, Bart
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1
 EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 19 0800

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-02-2017

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2889250 A1	01-07-2015	CN 104787616 A	22-07-2015
		CZ 304712 B6	03-09-2014
		EP 2889250 A1	01-07-2015
		JP 2015120598 A	02-07-2015
		US 2015175381 A1	25-06-2015

JP 2010180023 A	19-08-2010	NONE	

EP 2889249 A1	01-07-2015	CN 104787623 A	22-07-2015
		CZ 304713 B6	03-09-2014
		EP 2889249 A1	01-07-2015
		JP 2015120599 A	02-07-2015
		US 2015175380 A1	25-06-2015

EP 2537787 A1	26-12-2012	CN 102837991 A	26-12-2012
		DE 102011105553 A1	27-12-2012
		EP 2537787 A1	26-12-2012
		JP 5930301 B2	08-06-2016
		JP 2013006702 A	10-01-2013

US 2431150 A	18-11-1947	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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 2004277946 B [0002]
- JP 2010180023 A [0002]