

(19)



(11)

EP 3 505 472 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.07.2019 Bulletin 2019/27

(51) Int Cl.:
B65H 69/06 (2006.01)

(21) Application number: **18214587.0**

(22) Date of filing: **20.12.2018**

(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:
KH MA MD TN

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

(72) Inventor: **Sawada, Akira**
Kyoto, 612-8686 (JP)

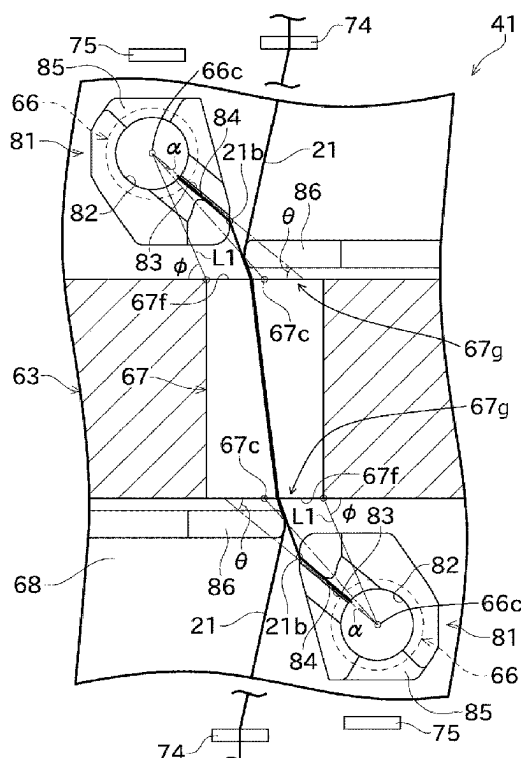
(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(30) Priority: **26.12.2017 JP 2017249253**

(54) YARN JOINING DEVICE

(57) A yarn joining device (41) includes two untwisting pipes (66), a twisting member (63), and two flexure guide members (81). Each of the untwisting pipes (66) untwists a yarn end that entered therein by applying air current to the yarn end. A swirling chamber (67) that performs yarn joining by applying air current to the untwisted

yarn ends is formed in the twisting member (63). A guide surface (83) that guides the yarn end before the yarn end pulled out from the corresponding untwisting pipe (66) arrives at the swirling chamber (67) is formed in each of the flexure guide members (81).

FIG.8**EP 3 505 472 A1**

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn joining device that untwists a yarn and then twists and joins the yarn.

2. Description of the Related Art

[0002] Conventionally, a yarn joining device provided in a yarn winding machine such as a spinning machine and that joins yarn ends of a yarn that has been discontinued for some reason during winding of the yarn is known in the art. For example, Japanese Utility Model Laid-Open No. H2-2365 discloses such a yarn joining device.

[0003] Japanese Utility Model Laid-Open No. H2-2365 discloses a yarn joining device including a pair of untwisting pipes and a yarn joining member. A pair of slits is formed in an edge of an opening of each of the untwisting pipes. The slits are separated by 180 degrees from each other whereby the slits oppose each other. Air jetting holes for jetting air in the depth direction of the untwisting pipe are formed inside each of the untwisting pipes.

[0004] In this yarn joining device, the yarn is held by positioning the yarn ends in the slits of the untwisting pipe.

[0005] With this configuration, in the yarn joining device disclosed in Japanese Utility Model Laid-Open No. H2-2365, because coming off of the yarn can be prevented and the yarn can be untwisted surely, the yarn joining can be performed surely.

[0006] However, when the yarn joining device disclosed in Japanese Utility Model Laid-Open No. H2-2365 is used to perform the yarn joining of, for example, a yarn (elastic yarn) having an elastic core yarn and a non-elastic coating yarn coated on the core yarn, because the core yarn may expand and shrink, there are instances where guiding of the yarn ends in the yarn joining hole fails. Moreover, if the core yarn shrinks, there are instances where only the coating yarns are guided to the yarn joining hole whereby the yarn joining of only the coating yarns happens with the core yarns absent. Thus, there is room for improvement in the yarn joining device disclosed in Japanese Utility Model Laid-Open No. H2-2365 whereby the yarn joining of the elastic yarn can be performed correctly.

SUMMARY OF THE INVENTION

[0007] The present invention was made in view of the above discussion. One object of the present invention is to provide a yarn joining device that prevents failure in the yarn joining of an elastic yarn.

[0008] The problem to be solved by the invention is explained above and the means for solving the problem

and the advantages thereof are as explained below.

[0009] According to one aspect of the present invention, a yarn joining device having the following configuration is provided. That is, the yarn joining device includes two untwisting pipes, a yarn joining section, and a yarn guide section corresponding to each of the untwisting pipes. The untwisting pipe is configured as a hollow member and the untwisting pipe untwists a yarn end that entered therein by applying air current to the yarn end. The yarn joining section has an air chamber in which yarn joining of untwisted yarn ends is performed by applying air current to the yarn ends. A guide surface that guides the yarn end pulled out from the corresponding untwisting pipe before the yarn end arrives in the air chamber is formed in the yarn guide section. An opening from which the yarn end pulled out from the untwisting pipe is pushed into the air chamber is formed in the yarn joining section. When seen from a length direction of the untwisting pipe, the guide surface extends from the untwisting pipe and makes a first angle that is larger than zero degrees with respect to an opening surface of the opening. The first angle is smaller than a second angle that an imaginary line connecting a center of the untwisting pipe and an edge of the opening of the yarn joining section that is nearest to the untwisting pipe makes with the opening surface.

[0010] The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a side view indicating an overall configuration of a winder unit according to an embodiment of the present invention.

FIG. 2 is a perspective view of a part of a yarn joining device.

FIG. 3 is a schematic cross-section taken parallel to a side face of the yarn joining device and indicates a state in which, after a yarn is discontinued, an upper yarn and a lower yarn are guided to the yarn joining device.

FIG. 4 is a schematic cross-section taken parallel to a side face of the yarn joining device and indicates a state in which the upper yarn and the lower yarn are shifted by a yarn shifting lever from the state thereof shown in FIG. 3.

FIG. 5 is a schematic cross-section taken parallel to a side face of the yarn joining device and indicates a state in which the upper yarn and the lower yarn are cut from the state thereof shown in FIG. 4, and untwisting of yarn ends is performed by an untwisting pipe.

FIG. 6 is a schematic cross-section taken parallel to a side face of the yarn joining device and indicates a state in which the yarn ends are pulled by the yarn shifting lever from the untwisting pipe from the state thereof shown in FIG. 5 and twisting of the yarn ends is performed by a first twisting member.

FIG. 7 is a perspective view of a part of the yarn joining device indicating a flexure guide member.

FIG. 8 is a view for explaining an angle of a guide groove of the flexure guide member and a contact of the yarns with each other.

DETAILED DESCRIPTION

[0012] Exemplary embodiments of the present invention are explained below with reference to the accompanying drawings. FIG. 1 is a side view indicating an overall configuration of a winder unit 1 including a yarn joining device 41 according to an embodiment of the present invention. FIG. 2 is a perspective view of a part of the yarn joining device 41.

[0013] An automatic winder (textile machine) of the present embodiment includes a plurality of winder units 1 shown in FIG. 1. Each winder unit 1 unwinds a yarn 21 from a yarn supplying bobbin 20 and winds the yarn 21 on a winding bobbin 22. The winding bobbin 22 with the yarn 21 wound thereon will be called a package 23. In the following explanation, "upstream" and "downstream" respectively refer to the upstream and the downstream in a traveling direction of the yarn 21.

[0014] The winder unit 1 mainly includes a frame 24, a yarn supplying section 25, and a winding section 26.

[0015] The frame 24 is a chassis of the winder unit 1. Majority of the parts of the winder unit 1 are directly or indirectly supported by the frame 24.

[0016] The yarn supplying section 25 holds the yarn supplying bobbin 20 that supplies the yarn 21. The yarn supplying section 25 can be, for example, a holding section that holds the yarn supplying bobbin 20 in a substantially upright posture. The yarn supplying bobbin 20 can be, for example, the one on which a spandex yarn, in which a yarn having high elasticity made of polyurethane and the like is coated with short fiber of cotton and the like, has been wound.

[0017] The winding section 26 includes a cradle 28 and a winding drum 29. The cradle 28 rotatably holds the winding bobbin 22 in a state in which a peripheral surface of the winding bobbin 22 contacts a peripheral surface of the winding drum 29. The winding drum 29 is arranged opposed to the winding bobbin 22, and the winding drum 29 is rotationally driven by a not-shown winding-drum driving motor. Although not-shown, a reciprocating spiral traversing groove is formed on the peripheral surface of the winding drum 29. Because of this traversing groove, the yarn 21 that is wound on the winding bobbin 22 can be traversed.

[0018] In this configuration, in a state in which the peripheral surface of the winding bobbin 22 is in contact

with the winding drum 29, when the winding drum 29 is rotationally driven, the winding bobbin 22 rotatably supported by the cradle 28 is rotationally driven following the rotation of the winding drum 29. As a result, the yarn 21 unwound from the yarn supplying bobbin 20 can be wound on the winding bobbin 22 while being traversed by the traversing groove.

[0019] Note that, the configuration for traversing the yarn 21 is not limited to the winding drum 29 explained above. Alternatively, for example, the traversing can be performed by using an arm-type traversing device that includes a traversing guide that reciprocates within a pre-determined traversing width and guides the yarn 21. Moreover, instead of driving the winding bobbin 22 by using the winding drum 29, a driving force can be applied directly to the winding bobbin 22.

[0020] As shown in FIG. 1, the winder unit 1 includes, in a yarn traveling path between the yarn supplying section 25 and the winding section 26, an unwinding assisting device 31, a tension applying device 32, and a yarn monitoring device 33 from upstream to downstream of the yarn traveling path in this order.

[0021] The unwinding assisting device 31 includes a regulating member 35 that touches a bulged part (balloon) of the yarn 21 produced because of outward swinging around of the yarn 21 due to a centrifugal force when the yarn 21 is unwound from the yarn supplying bobbin 20. Excessive swinging around of the yarn 21 can be suppressed by touching the regulating member 35 to the balloon. Therefore, by maintaining the size of the balloon to a certain size, the unwinding of the yarn 21 from the yarn supplying bobbin 20 can be performed with a constant tension.

[0022] The tension applying device 32 applies a pre-determined tension to the traveling yarn 21. In the present embodiment, the tension applying device 32 is a gate-type member having fixed comb teeth and movable comb teeth. By passing the yarn 21 in a meandering state between the comb teeth that are in an engaged state, an appropriate tension can be applied to the yarn 21 in the tension applying device 32. Note that, for example, a disk-type tension applying device 32 can be used instead of the gate-type.

[0023] The yarn monitoring device 33 monitors quality of the traveling yarn 21 to detect a yarn defect (portion where there is abnormality) in the yarn 21. A not-shown cutter is arranged near the yarn monitoring device 33. The cutter immediately cuts the yarn 21 when the yarn monitoring device 33 detects a yarn defect.

[0024] The winder unit 1 includes the yarn joining device 41, an upper yarn suction pipe 36, and a lower yarn suction pipe 37.

[0025] When the yarn 21 between the yarn supplying bobbin 20 and the winding bobbin 22 is discontinued for some reason, the yarn joining device 41 joins the yarn 21 from the yarn supplying bobbin 20 and the yarn 21 from the winding bobbin 22. For example, the cause of discontinuing the yarn 21 can be cutting of the yarn 21

when a yarn defect is detected by the yarn monitoring device 33, and the like. As shown in FIG. 1, the yarn joining device 41 is positioned between the tension applying device 32 and the yarn monitoring device 33.

[0026] The upper yarn suction pipe 36 is supported by the frame 24 so as to be pivotable up and down. When the yarn 21 is cut, the upper yarn suction pipe 36 guides to the yarn joining device 41 the yarn end of the yarn 21 from the winding bobbin 22 that is on the downstream side. A suction port is arranged at a tip end part of the upper yarn suction pipe 36. The upper yarn suction pipe 36 catches the yarn 21 from the winding bobbin 22 by a suction current generated by a not-shown negative pressure source and guides the caught yarn end of the yarn 21 to the yarn joining device 41.

[0027] The lower yarn suction pipe 37 is supported by the frame 24 so as to be pivotable up and down. When the yarn 21 is cut, the lower yarn suction pipe 37 guides to the yarn joining device 41 the yarn end of the yarn 21 from the yarn supplying bobbin 20 that is on the upstream side. A suction port is arranged at a tip end part of the lower yarn suction pipe 37. The lower yarn suction pipe 37 catches the yarn 21 on the yarn supplying bobbin 20 side by a suction current generated by a not-shown negative pressure source and guides the caught yarn end of the yarn 21 to the yarn joining device 41.

[0028] The yarn joining device 41 is explained in detail below. The yarn joining device 41 is configured as a splicer device. The yarn joining device 41 generates a swirling current by jetting compressed air and applies the swirling current to the untwisted yarn ends to twist and join the yarn ends. Basically, the yarn joining device 41 twists the yarn ends by using the force of the air; however, it is allowable to mix an appropriate liquid (e.g., water) with the air in performing the yarn joining. Moreover, it is allowable to heat the air by using an appropriate heater and use the heated air in performing the yarn joining.

[0029] As shown in FIG. 2, the yarn joining device 41 mainly includes a frame 61, a support plate 68, untwisting pipes 66, a twisting member (yarn joining section) 63, guide plates 71, yarn shifting levers 72, and yarn pressing levers 76.

[0030] The frame 61 is a chassis to which various parts of the yarn joining device 41 are attached. The guide plates 71 and the like are fixed to the frame 61. Moreover, the yarn shifting levers 72, the yarn pressing levers 76, and the like are supported by the frame 61.

[0031] A flow path member 62 is fixed to the frame 61. A not-shown air flowing path is formed in the flow path member 62. The compressed air that is discharged by a not-shown compressed air source, such as a compressor, to perform untwisting and twisting of the yarn ends is circulated in this air flowing path. The air flowing path is connected to the two untwisting pipes 66 and the twisting member 63.

[0032] The support plate 68 is a plate-shaped member having a predetermined thickness. The support plate 68 is fixed to the flow path member 62. In the yarn joining

device 41, the support plate 68 is arranged so as to oppose the yarn traveling path formed in the winder unit 1.

[0033] When the yarn joining device 41 is seen from the yarn traveling path, a pair of the untwisting pipes 66 is arranged on either side of the twisting member 63 in a length direction of the yarn traveling path. Each of the untwisting pipes 66 is a narrow cylindrical member with both ends thereof open. The length direction of the untwisting pipes 66 is orthogonal to the yarn traveling path. Inside the untwisting pipe 66, a yarn suction port 68A is formed in the support plate 68 at an end near the yarn traveling path. A later-explained flexure guide member 81 is attached to this yarn suction port 68A.

[0034] A nozzle hole 66h (see FIG. 3) is formed in an inner wall of each of the untwisting pipes 66. The nozzle hole 66h is connected to a flow path of the compressed air formed in the flow path member 62. An air current that flows toward an opening on the other side of the yarn suction port 68A is generated inside the untwisting pipes 66 when the compressed air is jetted from the nozzle hole 66h.

[0035] In this configuration, the yarn end of the yarn 21, which is guided to the yarn joining device 41 by the upper yarn suction pipe 36 and cut by a later-explained cutter 75 arranged on a lower side, is sucked in the untwisting pipe 66 of the lower side and untwisted because of the action of the air current generated in the untwisting pipe 66. Similarly, the yarn end of the yarn 21, which is guided to the yarn joining device 41 by the lower yarn suction pipe 37 and cut by the later-explained cutter 75 arranged on an upper side, is sucked in the untwisting pipe 66 of the upper side and untwisted because of the action of the air current generated in the untwisting pipe 66.

[0036] The twisting member 63 is box shaped. The twisting member 63 is fixed to the support plate 68 such that the twisting member 63 protrudes from the support plate 68 toward the yarn traveling path. A swirling chamber 67 that is long and slender in an up-down direction (that is, a direction that is substantially parallel to the yarn traveling path) and that penetrates through the twisting member 63 is formed in the twisting member 63. An end of the swirling chamber 67 in the length direction thereof opens in each of an upper surface and a lower surface of the twisting member 63. Furthermore, a twisting guide groove 69 that is open on the yarn traveling path side is formed in the twisting member 63. The twisting guide groove 69 communicates to the swirling chamber 67. The twisting guide groove 69 is formed in a tapered shape that widens toward the open side thereof. Note that, instead of using the swirling chamber 67, a cylindrical swirling chamber for the lower yarn and a cylindrical swirling chamber for the upper yarn can be provided separately, and the axis of the cylindrical swirling chamber for the lower yarn and the axis of the cylindrical swirling chamber for the upper yarn can be shifted. When this configuration is adopted, interference between swirling air for the lower yarn and swirling air for the upper yarn can be prevented.

[0037] Although not shown, nozzle holes are formed in an inner wall of the swirling chamber 67 for jetting the compressed air inside the swirling chamber 67 to twist the yarn ends. The nozzle holes are connected to the flow path of the compressed air formed in the flow path member 62. In the state that the yarn ends of the yarn 21 are positioned in the swirling chamber 67, the compressed air is jetted from the nozzle holes to generate the swirling current inside the swirling chamber 67. Because of this swirling current, the yarn ends in the swirling chamber 67 are twisted. Thus, the swirling chamber 67 in which the air swirls functions as an air chamber 67. Alternatively, instead of forming the nozzle holes that generate the swirling air current, it is allowable to form nozzle holes in the inner wall of the swirling chamber 67 for jetting the air current in crossing directions inside the swirling chamber 67 to twist the yarns by applying impact to the yarns.

[0038] A pair of the guide plates 71 is fixed to the frame 61. Like the pair of the untwisting pipes 66, when the yarn joining device 41 is seen from the yarn traveling path, the pair of the guide plates 71 is arranged on either side of the twisting member 63 in the length direction of the yarn traveling path. A distance between the guide plates 71 and the twisting member 63 is longer than a distance between the untwisting pipes 66 and the twisting member 63.

[0039] Two guide grooves 73 in which the yarn 21 can be inserted is formed in each of the guide plates 71. Each of the guide grooves 73 is open on the side of the yarn traveling path. Each of the guide plates 71 includes a clamp 74 and the cutter 75. The clamp 74 can hold the yarn 21 that entered one of the two guide grooves 73. The cutter 75 can cut the yarn 21 that entered the other one of the guide grooves 73. In the following explanation, to distinguish the two guide grooves 73 to identify them, one may be referred to as "clamp side guide groove" and the other may be referred to as "cutter side guide groove". Note that, a clamp cutter having a clamping function can be used as the cutter 75. When the clamp cutter is used, because the yarn can be clamped when cutting the yarn, it can be prevented that the cut yarn shrinks and goes away from the untwisting pipe 66. By releasing the clamping in the state that the air current is being applied inside the untwisting pipe 66, the yarn can be surely sucked in the untwisting pipe 66 and the yarn can be untwisted.

[0040] The yarn shifting levers 72 include a pair of arm-shaped members each located on either side of the twisting member 63 in the length direction of the yarn traveling path. The two yarn shifting levers 72 rotate integrally with each other. Accordingly, the two yarn shifting levers 72 can move in a pulling direction, in which the yarn is pulled on the side of the yarn joining device 41, and in the opposite direction of the pulling direction. An appropriate gap is secured between the support plate 68 and the pair of the guide plates 71. Each of the yarn shifting levers 72 pass through this gap when rotating in the manner explained above.

[0041] Like the yarn shifting levers 72, the yarn pressing levers 76 include a pair of arm-shaped members each located on either side of the twisting member 63 in the length direction of the yarn traveling path. The two yarn pressing levers 76 rotate integrally with each other. Accordingly, the two yarn pressing levers 76 can move in a pressing direction, in which the yarn 21 is pressed toward the support plate 68 (yarn joining device 41), and in the opposite direction of the pressing direction.

[0042] A yarn joining operation performed by the yarn joining device 41 is explained below by referring to FIGS. 3 to 6. The yarn joining operation performed by the yarn joining device 41 when the yarn 21 is discontinued is shown step by step in FIGS. 3 to 6.

[0043] When the yarn 21 is discontinued for some reason, as shown in FIG. 3, the upper yarn suction pipe 36 guides the yarn 21 so that the yarn 21 enters the clamp side guide groove 73 of the upper guide plate 71 and enters the cutter side guide groove 73 of the lower guide plate 71. Moreover, the lower yarn suction pipe 37 guides the yarn 21 so that the yarn 21 enters the clamp side guide groove 73 of the lower guide plate 71 and enters the cutter side guide groove 73 of the upper guide plate 71. Simultaneously with this, the two yarns 21 present between the upper and lower guide plates 71 enter the swirling chamber 67 of the twisting member 63 after passing through the twisting guide groove 69.

[0044] In this state, the upper and lower yarn shifting levers 72 rotate from their state shown in FIG. 2. As a result, as shown in FIG. 4, the two yarns 21 are shifted by the yarn shifting levers 72 and pushed in the depth direction of each of the guide grooves 73.

[0045] In this state, the yarn 21 that is guided by the upper yarn suction pipe 36 is held by the clamp 74 of the upper guide plate 71 and cut by the cutter 75 of the lower guide plate 71. Moreover, the yarn 21 that is guided by the lower yarn suction pipe 37 is held by the clamp 74 of the lower guide plate 71 and cut by the cutter 75 of the upper guide plate 71. As a result, the unnecessary portions of the yarns 21 can be removed. The cut unnecessary portions of the yarns 21 are sucked by the upper yarn suction pipe 36 and the lower yarn suction pipe 37.

[0046] At this time, the air current is flowing in each of the two untwisting pipes 66. Therefore, as shown in FIG. 5, the yarn end obtained by cutting the yarn 21 by the upper cutter 75 is sucked by the upper untwisting pipe 66 and untwisted. Similarly, the yarn end obtained by cutting the yarn 21 by the lower cutter 75 is sucked by the lower untwisting pipe 66 and untwisted.

[0047] Thereafter, the two yarn shifting levers 72 rotate further as shown in FIG. 6 and enter, while shifting the yarn 21, the gap between the support plate 68 and the pair of the guide plates 71. As a result, the yarn ends that have entered the untwisting pipes 66 and untwisted are pulled out from the untwisting pipes 66 and inserted into the swirling chamber 67 of the twisting member 63. In this state, the compressed air is jetted from the nozzle holes of the swirling chamber 67 to twist the two yarn

ends and join the yarn ends.

[0048] The flexure guide member (yarn guide section) 81 is explained in detail below while referring to FIGS. 7 and 8. FIG. 7 is a perspective view of a part of the yarn joining device 41 indicating the flexure guide member 81. FIG. 8 is a front view for explaining an angle of a guide groove 84 of the flexure guide member 81 and a contact of the yarns 21 with each other.

[0049] One flexure guide member 81 is arranged at each yarn suction port 68A of each of the two untwisting pipes 66. Each of the flexure guide member 81 guides the yarn 21, whose yarn end has been untwisted by the untwisting pipe 66, in the swirling chamber 67 of the twisting member 63. The guide groove 84 in which the yarn 21 can enter is formed in the flexure guide member 81. The untwisted yarn 21 is pulled through this guide groove 84 and guided to the swirling chamber 67.

[0050] The flexure guide member 81 is box shaped. The flexure guide member 81 is fixed to the support plate 68 such that the flexure guide member 81 protrudes from the support plate 68 toward the yarn traveling path. A circular through-hole 82 is formed in the flexure guide member 81. This through-hole 82 constitutes an opening that opens on a surface of the flexure guide member 81 present on the yarn traveling path side.

[0051] The through-hole 82 is provided substantially coaxially with the yarn suction port 68A of the untwisting pipe 66. The through-hole 82 is connected to the untwisting pipe 66. Therefore, the untwisting pipe 66 can suck the yarn 21 via the opening of the through-hole 82 by the negative pressure generated because of the air current flowing in the untwisting pipe 66.

[0052] The guide groove 84 that opens on the yarn traveling path side is formed in the flexure guide member 81. When seen from the length direction of the untwisting pipe 66, the guide groove 84 is formed in a linear shape and connects the inside and the outside of the through-hole 82. One of the yarns between the two yarns 21 guided to the yarn joining device 41 is introduced into the guide groove 84 by the yarn end thereof being sucked by the untwisting pipe 66. When seen from the length direction of the untwisting pipe 66, as shown in FIG. 8, the direction of the guide groove 84 makes an angle α toward the clamp 74 that clamps the other yarn 21 that is to be joined to the yarn 21 that enters the guide groove 84, with respect to a line that connects a center 66c of the untwisting pipe 66 to a center 67c of an opening surface 67f at which the swirling chamber 67 opens in the surface of the twisting member 63 on the side near the flexure guide member 81.

[0053] Among the walls of the flexure guide member 81 divided by the guide groove 84, the inner wall surface of the wall on the side near the twisting member 63 constitutes a guide surface 83 for guiding the yarn 21. When seen from the length direction of the untwisting pipe 66, as shown in FIG. 8, the direction of the guide groove 84 and the direction of the guide surface 83 are the same.

[0054] Because the guide groove 84 is inclined in the

manner explained above, the yarn 21 that entered the guide groove 84 bends at a bending point 21b at an end that is near the swirling chamber 67 among the ends of the guide groove 84 in the length direction of the guide groove 84. Moreover, this end of the guide groove 84 is closer to a path of the other yarn 21 that is to be joined to the yarn 21 that has entered the guide groove 84. Therefore, when each of the yarns 21 have entered the guide groove 84 of the two flexure guide members 81, as shown in FIG. 8, the two yarns 21 come closer to each other inside as well as near the swirling chamber 67.

[0055] As shown in FIG. 7, a smoothly curved leading-in guide surface 87 that connects to the guide groove 84 is formed in the flexure guide member 81. As the leading-in guide surface 87 contacts the yarn 21 sucked in the untwisting pipe 66 (as shown in FIG. 5), the leading-in guide surface 87 guides the yarn 21 in the guide groove 84 while the yarn 21 touches the guide surface 83.

[0056] In the flexure guide member 81, a recess 85 is formed in an edge of the through-hole 82 that is farther from the twisting member 63. Because the yarn 21 is guided by the recess 85, the yarn end obtained by cutting the yarn 21 with the cutter 75 can be introduced smoothly into the through-hole 82 (that is, into the untwisting pipe 66).

[0057] The advantage obtained because of the flexure guide member 81 having the guide groove 84 is explained below.

[0058] A composite yarn in which a core yarn made of elastic polyurethane is coated with cotton, or chemical fiber such as polyester, or mixed fiber of cotton and chemical fiber is sometimes used as the yarn 21 wound in the winder unit 1. Because the composite yarn has elasticity, as shown in FIG. 5, the yarn is stretched by the action of the air current when the yarn end is inserted in the untwisting pipe 66 and untwisted by using the air current.

[0059] Thereafter, to perform the twisting operation, as shown in FIG. 6, the yarn end is pulled up to the swirling chamber 67 by the yarn shifting lever 72. At this time, at the instant the yarn end comes out of the untwisting pipe 66, because the pulling force on the yarn end by the air current is released, the yarn 21 suddenly shrinks because of a restoring force thereof whereby the yarn end does not enter the swirling chamber 67, whereby the twisting operation fails and the yarns cannot be joined. Alternatively, because only the core yarn present inside the coating yarn may shrink and come out of the swirling chamber 67, the coating yarns may be joined with the core yarn absent at the spliced point.

[0060] In this regard, in the present embodiment, because the yarn end that had entered the untwisting pipe 66 is pulled such that the yarn end follows the guide groove 84, a stable friction is generated between the yarn 21 and the flexure guide member 81 at the bending point 21b. Therefore, because the yarn end can be pulled into the swirling chamber 67 while preventing with the frictional force any shrinking of the yarn 21 because of the restoring force, the twisting operation can be performed

surely.

[0061] Because of the guide groove 84, the yarn 21 is pulled from the bending point 21b and immediately comes close to the other yarn 21. As a result, in addition to generation of the friction between the yarn 21 and the flexure guide member 81 at the bending point 21b, friction is generated between the yarn 21 and the other yarn 21 because of the contact therebetween. It is expected that this friction acts against any sudden shrinking of the yarn 21.

[0062] Particularly, in the state in which each of the two yarn ends of the yarn 21 have been sucked by each of the untwisting pipes 66, a tension acts on each of the yarns 21 because of the suction force. Accordingly, the yarns 21 are guided by the inner wall of the cylindrical swirling chamber 67, and as shown in FIG. 5, the two yarns 21 come close to each other in the innermost part of the swirling chamber 67.

[0063] In the yarn joining device 41 according to the present embodiment, for example, as shown in FIG. 8, to surely bring the two yarns 21 close, a pair of plate-shaped guide members 86 is fixed to the twisting member 63. As shown in FIG. 8, each of the guide members 86 is arranged so as to oppose, with a small gap, an end of the guide groove 84 of the flexure guide member 81. An edge of the guide member 86 projects toward the flexure guide member 81 than the center 67c of the opening surface 67f of the swirling chamber 67.

[0064] In this configuration, in the state that one of the yarns 21 has been shifted toward the flexure guide member 81 by the guide member 86, the other yarn 21 is pulled via the guide groove 84. As a result, the two yarns 21 are made to come close to each other and the occurrence of friction between the two yarns 21 can be promoted.

[0065] An angle of the guide groove 84 formed in the flexure guide member 81 is explained next.

[0066] As long as the yarn 21 is bent at the bending point 21b, the angle of the guide groove 84 is not particularly limited. In the present embodiment, when seen from the length direction of the untwisting pipe 66, as shown in FIG. 8, an angle θ that the guide groove 84 makes with the opening surface 67f is about 40 degrees.

[0067] The angle θ is smaller than an angle φ that an imaginary line L1 connecting the center 66c of the untwisting pipe 66 and an edge of the opening in the swirling chamber 67 that is the nearest to the untwisting pipe 66 makes with the opening surface 67f.

[0068] More the angle θ approaches zero degrees, stronger the bending of the yarn 21 at the bending point 21b is. It is preferable that the angle θ is larger than zero degrees but equal to or smaller than 45 degrees. When the angle θ is within this range, the yarn 21 can be bent relatively more, and the frictional force can be produced surely. It is more preferable that the angle θ is equal to or larger than 20 degrees but equal to or smaller than 45 degrees. When the angle θ is within this range, an appropriate balance can be achieved between the frictional

force that prevents shrinking of the yarn 21 and smooth pulling of the yarn 21.

[0069] As explained above, the yarn joining device 41 according to the present embodiment includes the untwisting pipe 66, the twisting member 63, and the flexure guide member 81. The untwisting pipe 66 is a long, slender, and hollow member. When the yarn end enters the untwisting pipe 66, the yarn end is untwisted by the air current flowing in the untwisting pipe 66. The swirling chamber 67 in which the yarn joining is performed by the action of the air current on the untwisted yarn ends is formed in the twisting member 63. The guide surface 83 that guides the yarn end before the yarn end pulled out from the untwisting pipe 66 arrives at the swirling chamber 67 is formed in the flexure guide member 81. An opening 67g from which the yarn end pulled out from the untwisting pipe 66 is pushed into the swirling chamber 67 is formed in the twisting member 63. When seen from the length direction of the untwisting pipe 66, the guide surface 83 extends from the untwisting pipe 66 and makes the angle θ that is larger than zero degrees with respect to the opening surface 67f of the opening 67g. When seen from the length direction of the untwisting pipe 66, the angle θ is smaller than the angle φ ($\theta < \varphi$) that the imaginary line L1 connecting the center 66c of the untwisting pipe 66 and the edge of the opening 67g that is the nearest to the untwisting pipe 66 makes with the opening surface 67f.

[0070] As a result, even when joining the yarn 21 having elasticity, the flexure guide member 81 can guide the yarn 21 in the swirling chamber 67 while bending the yarn 21 at the edge of the guide surface 83. Therefore, in the process of pulling the yarn 21 from the untwisting pipe 66, the yarn 21 can be prevented from suddenly shrinking because of the friction at the bending point 21b. As a result, because the yarn end can be surely guided to the swirling chamber 67, failure of the yarn joining can be prevented. Moreover, since the friction is generated because of the bending of the yarn 21, in comparison to a configuration that addresses the issue of shrinking of the yarn by putting the yarn in a slit, the frictional force does not change with the thickness of the yarn 21, and the shrinking of the yarn 21 can be suppressed stably.

[0071] Moreover, in the yarn joining device 41 according to the present embodiment, the angle between the guide surface 83 and the opening surface 67f is preferably larger than zero degrees but equal to or smaller than 45 degrees and more preferably equal to or larger than 20 degrees but equal to or smaller than 45 degrees.

[0072] When the angle is within this range, the frictional force that is sufficient to prevent the sudden shrinking of the yarn 21 can be obtained by bending the yarn 21 relatively more.

[0073] In the yarn joining device 41 according to the present embodiment, the guide surface 83 is constructed as one inner wall surface of the guide groove 84 formed in the flexure guide member 81.

[0074] Accordingly, because the yarn 21 is guided in

the state in which the yarn 21 is in the groove, the path at the time the yarn 21 is pulled out from the untwisting pipe 66 can be stabilized. As a result, the yarn 21 can be pulled while forming the stable bending point 21b.

[0075] In the yarn joining device 41 according to the present embodiment, in the flexure guide member 81 is formed the leading-in guide surface 87 that guides the yarn 21 to the guide surface 83 while contacting the yarn 21 whose yarn end has been sucked into the untwisting pipe 66 and connects to the guide surface 83.

[0076] Accordingly, because the yarn 21 can be smoothly guided to the guide surface 83 by using the sucking action of the untwisting pipe 66, the yarn 21 can be bent surely.

[0077] In the yarn joining device 41 according to the present embodiment, the flexure guide member 81 includes the through-hole 82 that communicates to the inside of the untwisting pipe 66. The guide surface 83 connects to the inner wall of the through-hole 82.

[0078] Accordingly, the yarn 21 with the yarn end thereof sucked in the untwisting pipe 66 via the through-hole 82 can be suitably guided by the guide surface 83.

[0079] An automatic winder according to the present embodiment includes the yarn joining device 41.

[0080] Accordingly, an automatic winder that can favorably perform the yarn joining of the yarn having elasticity can be realized.

[0081] Exemplary embodiments of the present invention are explained above. The configuration explained above can, however, be modified as explained below.

[0082] The yarn 21 having elasticity used in the winder unit 1 is not particularly limited. For example, the spandex yarn can be used as the yarn 21.

[0083] As long as the flexure guide member 81 can guide the yarn 21 in the bent state, the shape of the guide groove 84 formed in the flexure guide member 81 can be changed appropriately.

[0084] The flexure guide member 81 can be detachably attached to the yarn joining device 41. By adopting this configuration, it is possible to handle both the ordinary yarn and the special yarn having elasticity with a simple operation.

[0085] A wall of the flexure guide member 81 located opposite to the guide surface 83 across the guide groove 84 may be omitted. When this wall is omitted, the guide groove 84 is not provided and the yarn 21 is guided by the guide surface 83. Moreover, the movement of the yarn can be restricted by making the surface of the guide surface 83 rough. This leads to enhancing the frictional force for suppressing sudden shrinking of the yarn 21.

[0086] According to one aspect of the present invention, a yarn joining device having the following configuration is provided. That is, the yarn joining device includes two untwisting pipes, a yarn joining section, and a yarn guide section corresponding to each of the untwisting pipes. The untwisting pipe is configured as a hollow member and the untwisting pipe untwists a yarn end that entered therein by applying air current to the yarn end. The

yarn joining section has an air chamber in which yarn joining of untwisted yarn ends is performed by applying air current to the yarn ends. A guide surface that guides the yarn end pulled out from the corresponding untwisting pipe before the yarn end arrives in the air chamber is formed in the yarn guide section. An opening from which the yarn end pulled out from the untwisting pipe is pushed into the air chamber is formed in the yarn joining section. When seen from a length direction of the untwisting pipe, the guide surface extends from the untwisting pipe and makes a first angle that is larger than zero degrees with respect to an opening surface of the opening. The first angle is smaller than a second angle that an imaginary line connecting a center of the untwisting pipe and an edge of the opening of the yarn joining section that is nearest to the untwisting pipe makes with the opening surface.

[0087] As a result, even when joining the yarn having elasticity, the yarn guide section can guide the yarn in the air chamber while bending the yarn at the edge of the guide surface. Therefore, in the process of pulling the yarn from the untwisting pipe, the yarn can be prevented from suddenly shrinking because of the friction at the bending point. As a result, because the yarn end can be surely guided to the air chamber, failure of the yarn joining can be prevented. Moreover, since the friction is generated because of the bending of the yarn, in comparison to a configuration that addresses the issue of shrinking of the yarn by putting the yarn in a slit, the frictional force does not change with the thickness of the yarn, and the shrinking of the yarn can be suppressed stably.

[0088] In the yarn joining device, the first angle between the guide surface and the opening surface of the opening is preferably larger than zero degrees but equal to or smaller than 45 degrees.

[0089] When the first angle is within this range, the frictional force that is sufficient to prevent the sudden shrinking of the yarn can be obtained by bending the yarn relatively more.

[0090] In the yarn joining device, the first angle between the guide surface and the opening surface of the opening is preferably equal to or larger than 20 degrees but equal to or smaller than 45 degrees.

[0091] When the first angle is within this range, an appropriate balance can be achieved between the frictional force that prevents shrinking of the yarn and smooth pulling of the yarn.

[0092] In the yarn joining device, it is preferable that the guide surface is constructed as one inner wall surface of a guide groove formed in the yarn guide section.

[0093] Accordingly, because the yarn is guided in the state in which the yarn is in the groove, the path at the time the yarn is pulled out from the untwisting pipe can be stabilized. As a result, the yarn can be pulled while forming the stable bending point.

[0094] In the yarn joining device, it is preferable that in the yarn guide section is formed a leading-in guide sur-

face that guides the yarn to the guide surface while contacting the yarn whose yarn end has been sucked into the untwisting pipe and connects to the guide surface.

[0095] Accordingly, because the yarn can be smoothly guided to the guide surface by using the sucking action of the untwisting pipe, the yarn can be bent surely.

[0096] It is preferable that the yarn joining device has the following configuration. The yarn guide section includes a through-hole that communicates to the inside of the untwisting pipe. The guide surface connects to an inner wall of the through-hole.

[0097] As a result, the yarn with the yarn end thereof sucked in the untwisting pipe via the through-hole can be suitably guided by the guide surface.

[0098] According to another aspect of the present invention, a textile machine including the above yarn joining device is provided.

[0099] As a result, a textile machine that can favorably perform the yarn joining of the yarn having elasticity can be realized.

[0100] The yarn joining device can be used, for example, as a yarn joining device of an air spinning machine, instead of using the same in the automatic winder.

[0101] In the above explanation, the meaning of "a plurality of" also includes "a predetermined number of".

[0102] Although the invention has been explained with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the scope of the claims.

Claims

1. A yarn joining device (41) comprising:

two hollow untwisting pipes (66) that respectively untwists a yarn end by applying air current to the yarn end that entered therein;

a yarn joining section (63) having an air chamber (67) in which yarn joining of untwisted yarn ends is performed by applying air current to the yarn ends; and

a yarn guide section (81) corresponding to each of the untwisting pipes (66) having a guide surface (83) that guides the yarn end pulled out from the corresponding untwisting pipe (66) before the yarn end arrives in the air chamber (67), wherein

an opening (67g) from which the yarn end pulled by the untwisting pipe (66) is pushed into the air chamber (67) is formed in the yarn joining section (63),

when seen from a length direction of the untwisting pipe (66), the guide surface (83) extends from the untwisting pipe (66) and makes a first

angle (θ) that is larger than zero degrees with respect to an opening surface (67f) of the opening (67g), and

the first angle (θ) is smaller than a second angle (ϕ) that an imaginary line (L1) connecting a center (66c) of the untwisting pipe (66) and an edge of the opening (67g) of the yarn joining section (63) that is nearest to the untwisting pipe (66) makes with the opening surface (67f).

2. The yarn joining device (41) as claimed in Claim 1, wherein the guide surface (83) is arranged such that the first angle (θ) is larger than zero degrees but equal to or smaller than 45 degrees.

3. The yarn joining device (41) as claimed in Claim 1 or 2, wherein the guide surface (83) is arranged such that the first angle (θ) is equal to or larger than 20 degrees but equal to or smaller than 45 degrees.

4. The yarn joining device (41) as claimed in any one of Claims 1 to 3, wherein the guide surface (83) is constructed as one inner wall surface of a guide groove (84) formed in the yarn guide section (81).

5. The yarn joining device (41) as claimed in any one of Claims 1 to 4, wherein, in the yarn guide section (81) is formed a leading-in guide surface (87) that guides the yarn to the guide surface (83) while contacting the yarn whose yarn end has been sucked into the untwisting pipe (66) and connects to the guide surface (83).

6. The yarn joining device (41) as claimed in any one of Claims 1 to 5, wherein the yarn guide section (81) includes a through-hole (82) that communicates to the inside of the untwisting pipe (66), and the guide surface (83) connects to an inner wall of the through-hole (82).

7. A textile machine comprising the yarn joining device (41) as claimed in any one of Claims 1 to 6.

FIG.1

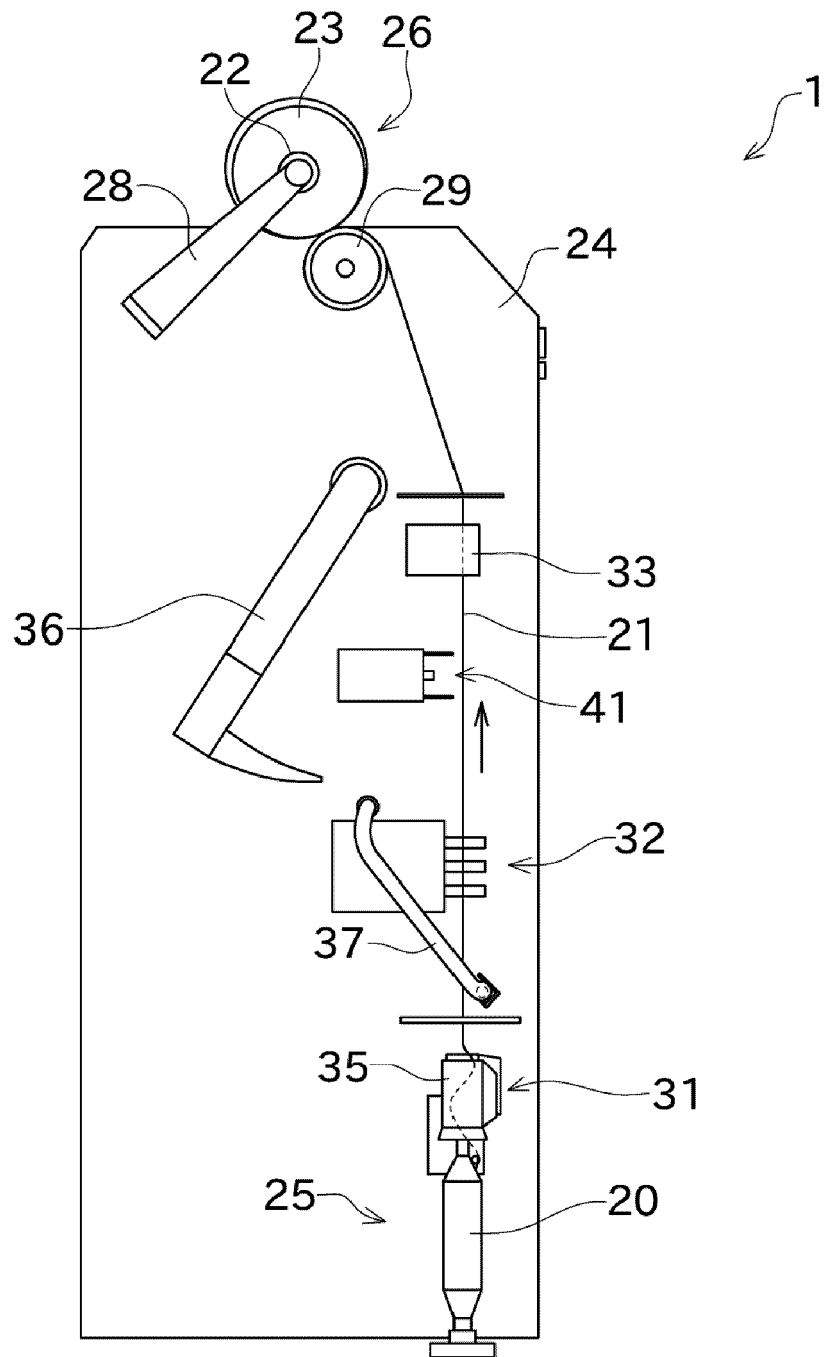


FIG.2

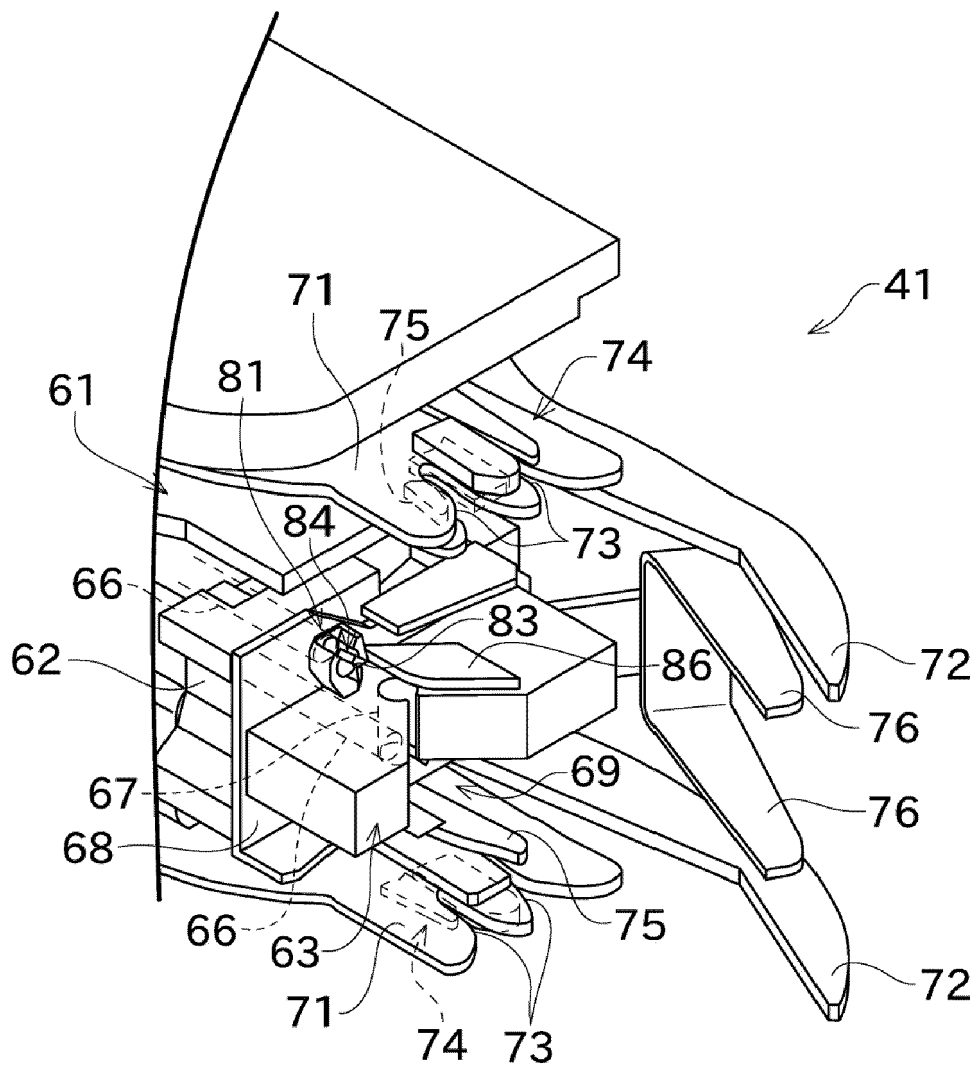


FIG.3

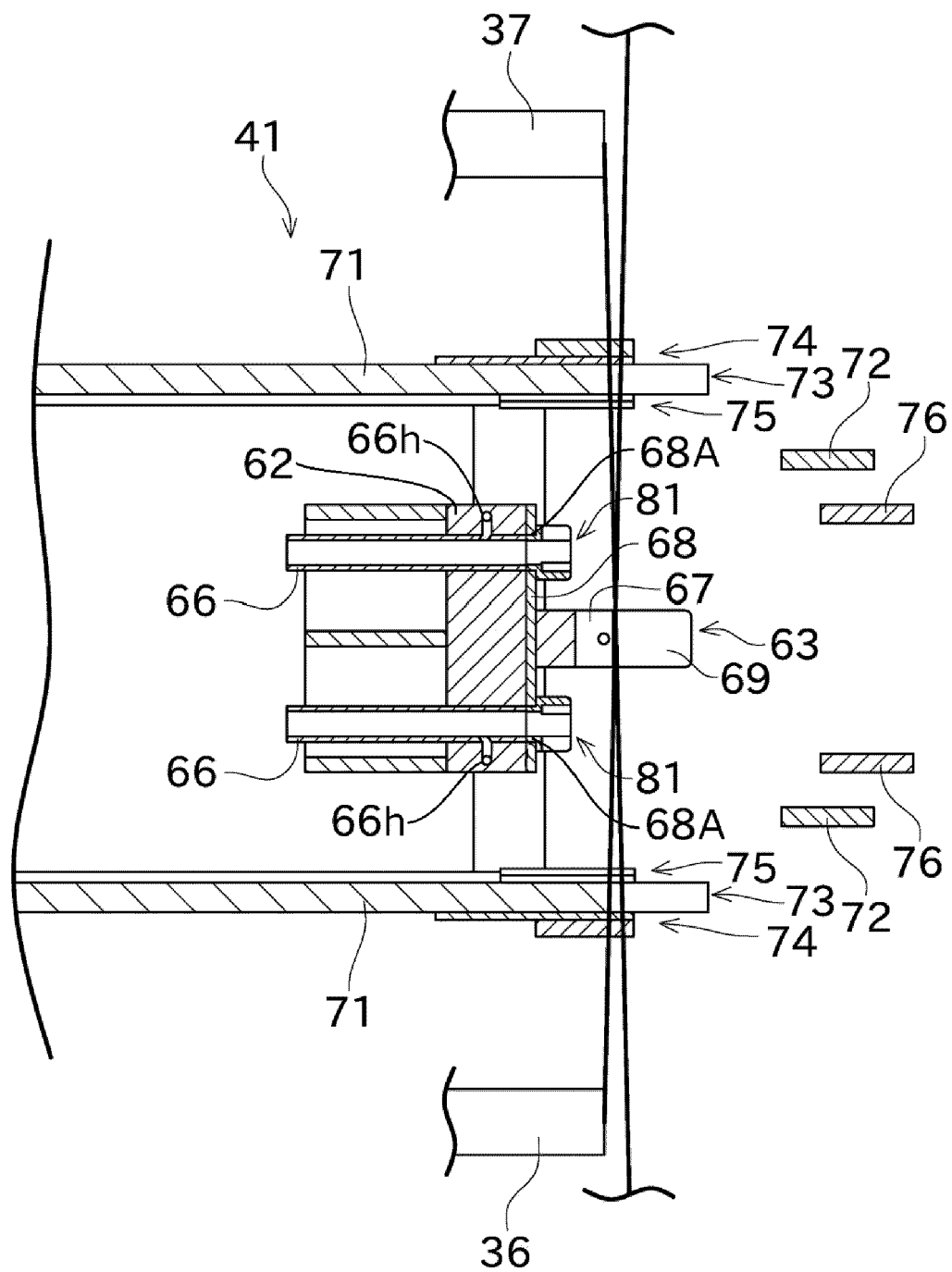


FIG.4

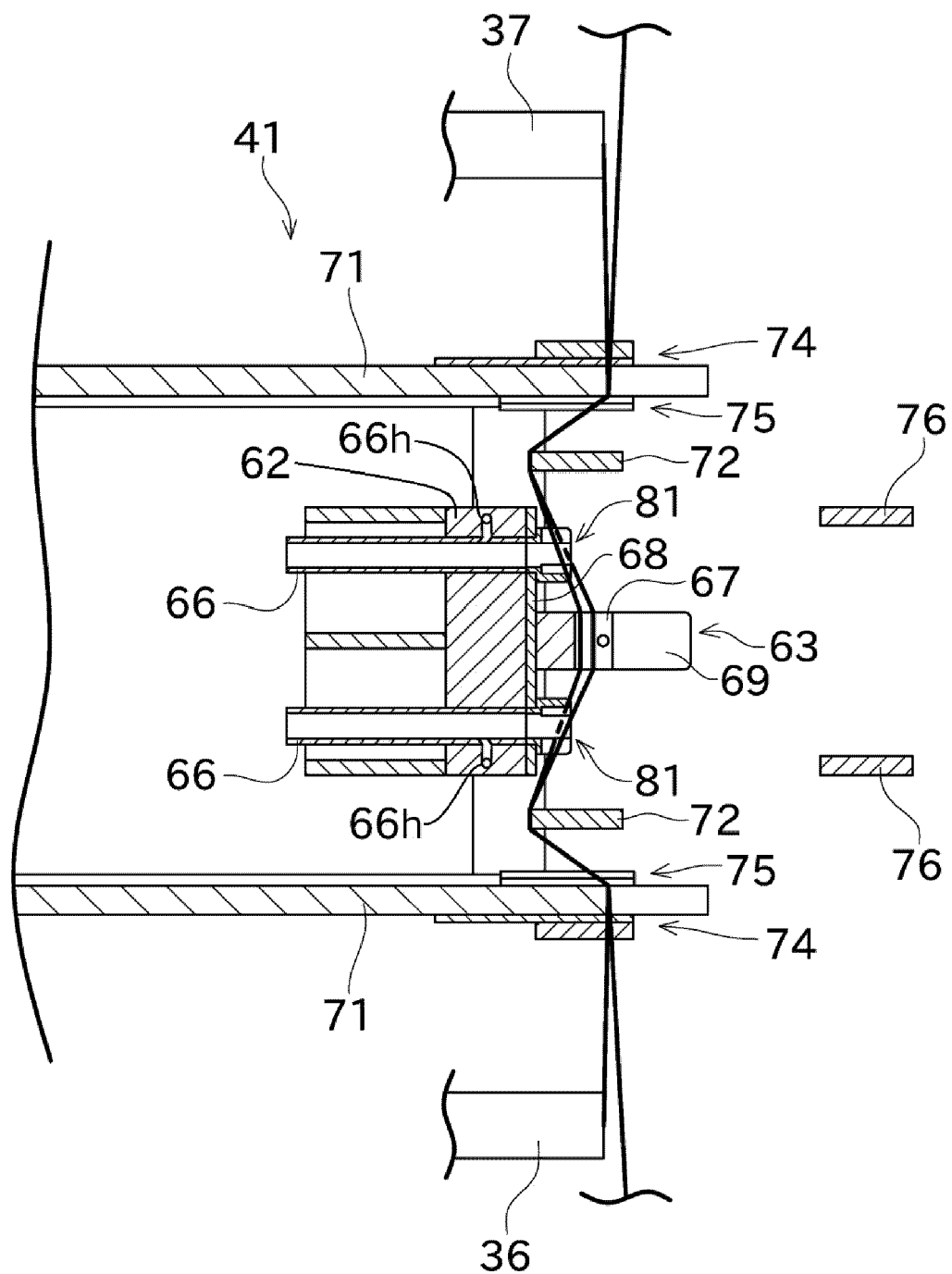


FIG.5

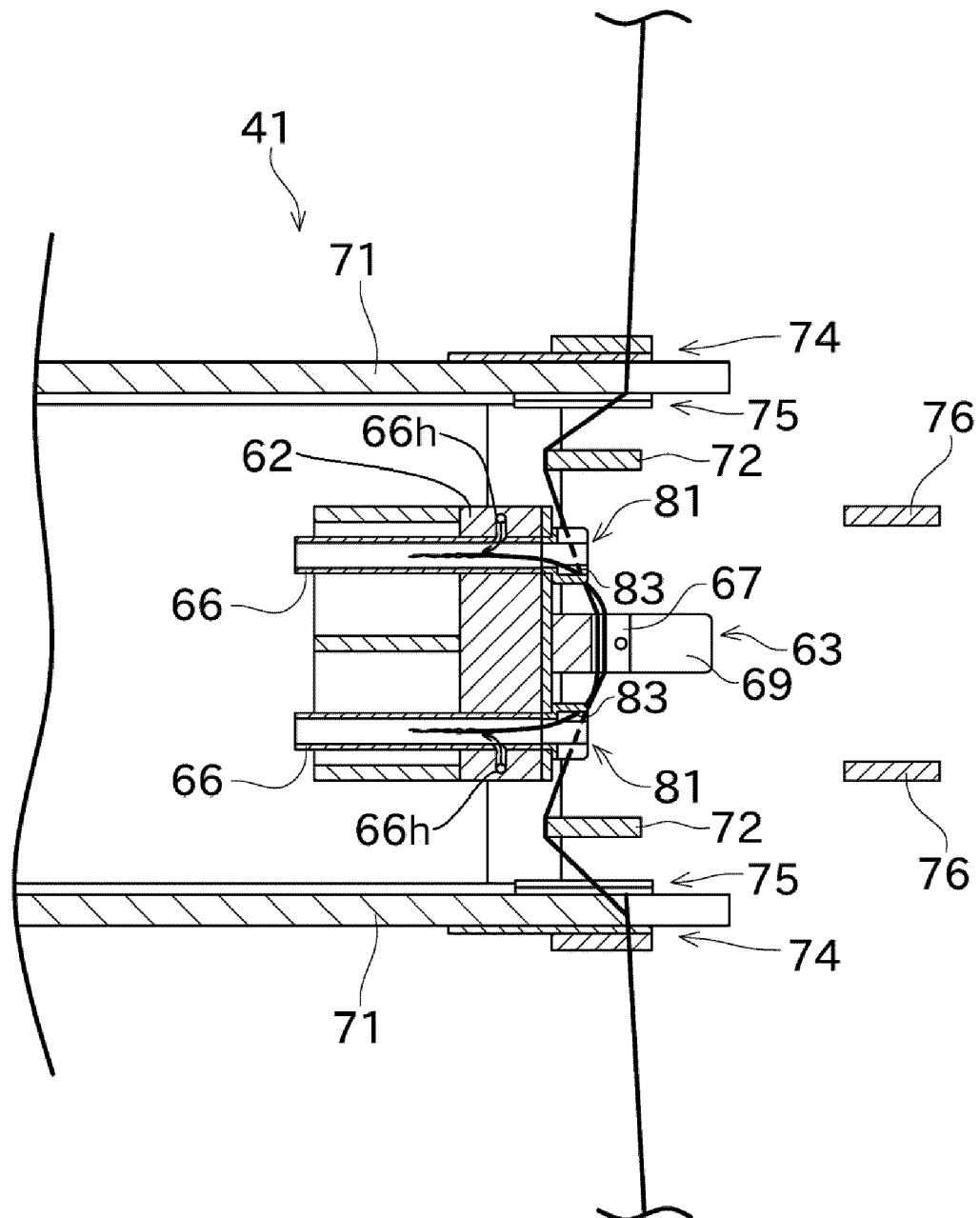


FIG.6

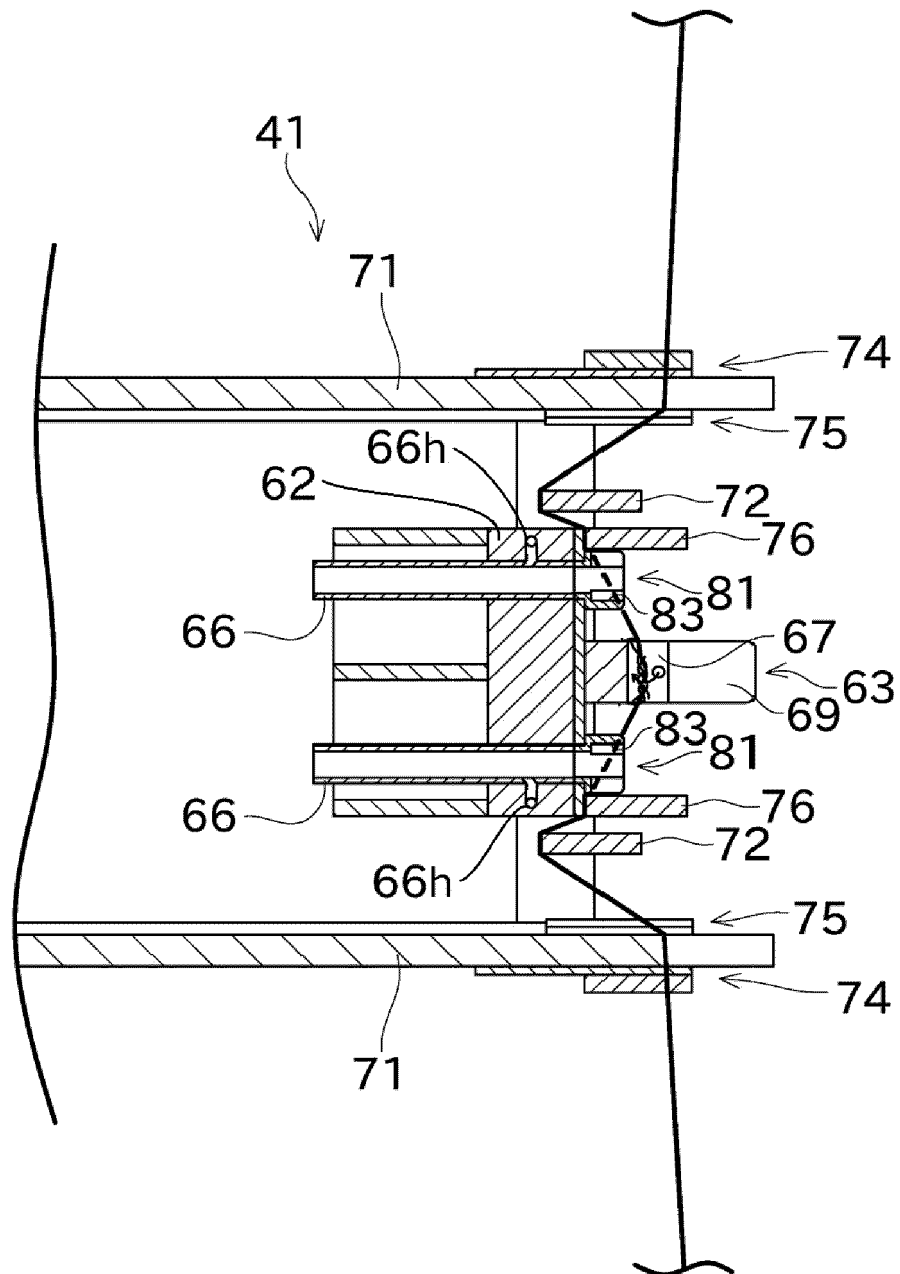


FIG.7

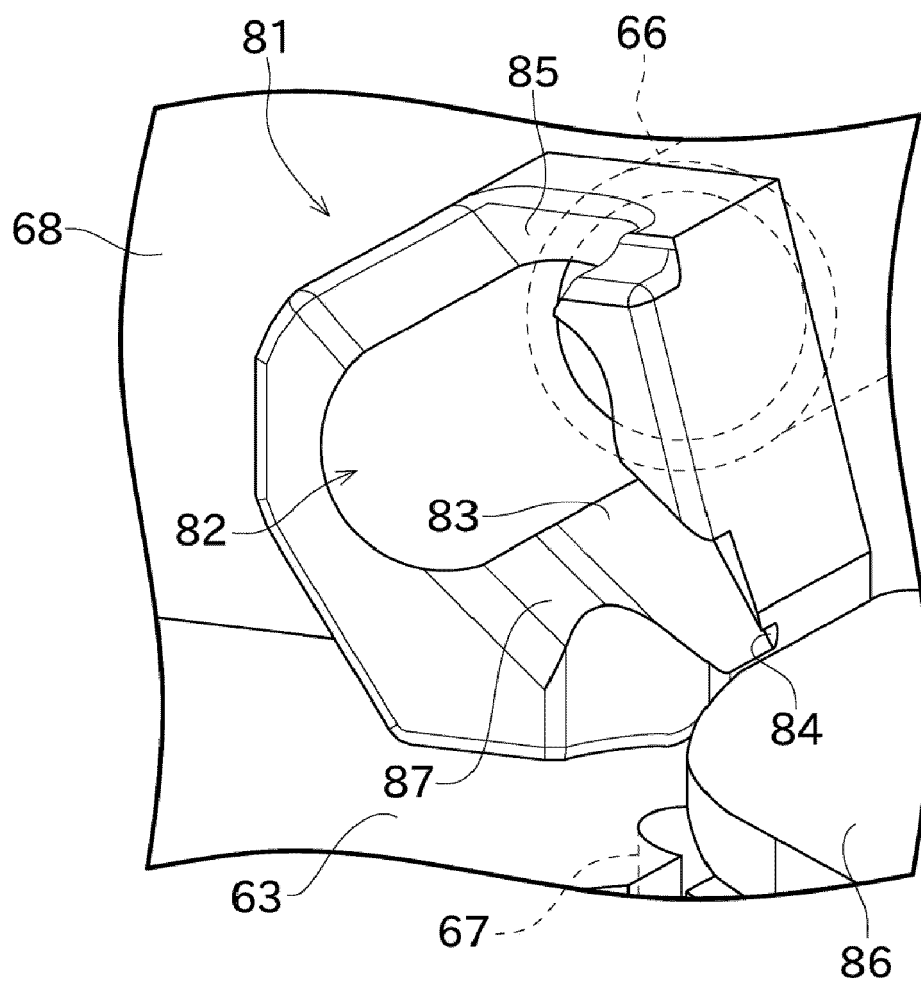
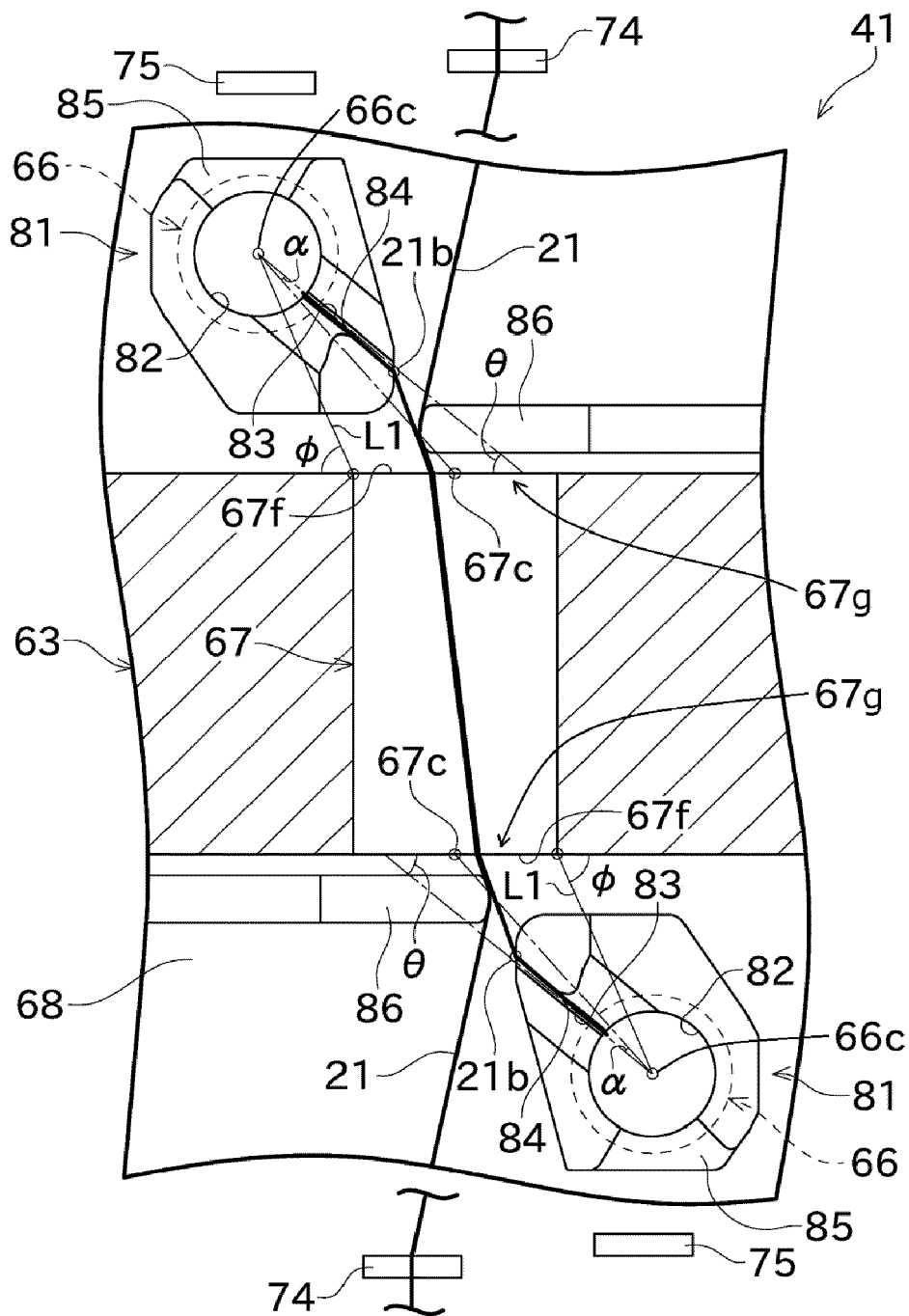


FIG.8





EUROPEAN SEARCH REPORT

Application Number
EP 18 21 4587

5

10

15

20

25

30

35

40

45

50

55

1

EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 549 392 A (KIMURA HIDETOSHI [JP]) 29 October 1985 (1985-10-29)	1-3,5,7	INV. B65H69/06
A	* column 9, lines 14-20; figures 24, 29 * -----	4,6	
X	US 4 676 055 A (NISHIMURA YOSHIHIRO [JP]) 30 June 1987 (1987-06-30)	1,2,5-7	
A	* column 3, line 67 - column 4, line 59; figure 1 * * column 6, lines 5-66; figure 8 * -----	3,4	
A,D	JP H02 2365 U (-) 9 January 1990 (1990-01-09) * figures 1-3 * -----	1,4	
A	JP H05 229738 A (MURATA MACHINERY LTD) 7 September 1993 (1993-09-07) * abstract; figures 1,5 * -----	1	
A	DE 35 18 316 A1 (SCHLAFHORST & CO W [DE]) 27 November 1986 (1986-11-27) * claim 1; figures 1-13 * -----	1	TECHNICAL FIELDS SEARCHED (IPC)
A	EP 1 671 910 A2 (MURATA MACHINERY LTD [JP]) 21 June 2006 (2006-06-21) * paragraphs [0002] - [0009], [0023], [0024]; figures 3-6 * -----	1	B65H
A	US 2002/174643 A1 (HUMML BALDUR [DE]) 28 November 2002 (2002-11-28) * paragraphs [0005] - [0011]; figures 3,5-7 * -----	1	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 18 April 2019	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			

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

EP 18 21 4587

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.

18-04-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4549392 A	29-10-1985	CH 666470 A5 DE 3417367 A1 FR 2545803 A1 IT 1177712 B JP H0140130 B2 JP S59211632 A US 4549392 A	29-07-1988 15-11-1984 16-11-1984 26-08-1987 25-08-1989 30-11-1984 29-10-1985
US 4676055 A	30-06-1987	CH 669180 A5 DE 3604643 A1 IT 1203742 B JP S61188374 A US 4676055 A	28-02-1989 28-08-1986 23-02-1989 22-08-1986 30-06-1987
JP H022365 U	09-01-1990	JP H022365 U JP H0522538 Y2	09-01-1990 10-06-1993
JP H05229738 A	07-09-1993	NONE	
DE 3518316 A1	27-11-1986	NONE	
EP 1671910 A2	21-06-2006	CN 1789099 A EP 1671910 A2 JP 2006168923 A	21-06-2006 21-06-2006 29-06-2006
US 2002174643 A1	28-11-2002	CN 1386689 A DE 10124832 A1 IT MI20020940 A1 JP 4082930 B2 JP 2002348745 A US 2002174643 A1	25-12-2002 28-11-2002 03-11-2003 30-04-2008 04-12-2002 28-11-2002

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 H22365 A [0002] [0003] [0005] [0006]