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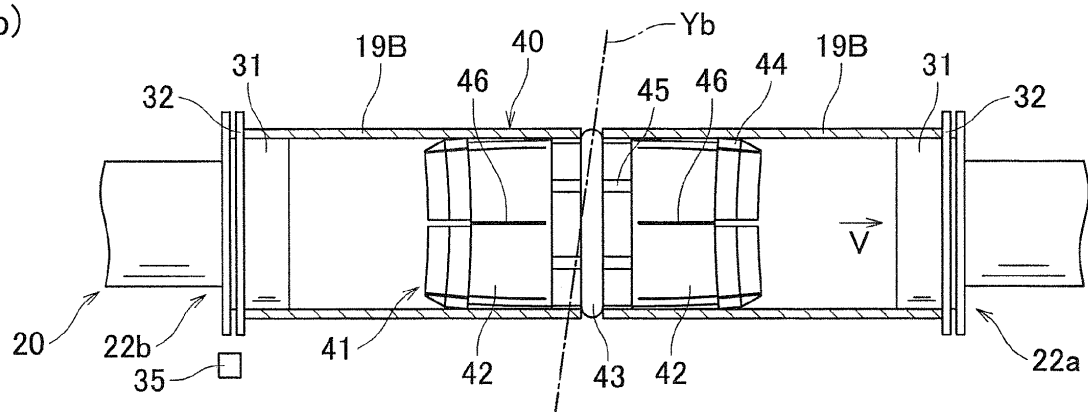
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(54) **Yarn winder, connection member, and yarn winding method**

(57) A connection member 41 is a substantially cylindrical component. Parts sandwiching the central portion in the axial directions are insertion portions 42, and these two insertion portions 42 are inserted into take up tubes 19B from the leading end sides so that the two take up tubes 19B are connected with each other. Each insertion portion 42 extends from the leading end of the

insertion portion 42 along the axial directions of the connection member 41, and has a plurality of slits 46 aligned in the circumferential directions of the connection member 41. With this, the insertion portion 42 is changeable in diameter. Around the part of the connection member 41 between the two insertion portions 42, an O-ring 43 (annular component) made of an elastic material such as rubber is provided.

FIG.4(b)



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a yarn winder for winding a yarn onto a take up tube, a connection member for connecting a plurality of take up tubes with one another, and a yarn winding method of winding a yarn onto a take up tube.

[0002] A yarn winder recited in Patent Literature 1 (Japanese Unexamined Patent Publication No. 2009-74219) is arranged so that a single take up tube is rotatably supported by a cradle and is arranged to be switchable between (i) the formation of a single package by doubling supplied two yarns and winding the doubled yarns onto the take up tube and (ii) the formation of two packages by winding supplied two yarns onto different parts of the take up tube, respectively. In case of the formation of two packages, the take up tube is cut after the winding of the yarns, with the result that the two packages are separated from each other.

[0003] In case of the formation of two packages on a single take up tube by the yarn winder recited in Patent Literature 1, as described above, it is necessary to cut the take up tube after the formation of the packages in order to separate the two packages from each other, and this step of cutting the take up tube complicates the formation of packages.

SUMMARY OF THE INVENTION

[0004] An object of the present invention is to provide a yarn winder which is able to easily produce packages when packages are formed by winding a plurality of yarns onto take up tubes rotatably supported by a single cradle, a connection member for connecting a plurality of take up tubes with one another, and a yarn winding method.

[0005] According to the first aspect of the invention, a yarn winder includes: a cradle which rotatably supports a winding body including a plurality of take up tubes that are detachably connected with one another and aligned in axial directions, and a plurality of packages being formed by winding a plurality of supplied yarns onto the take up tubes, respectively.

[0006] According to the tenth aspect of the invention, a yarn winding method includes the steps of: rotatably supporting, by a cradle, a winding body including a plurality of take up tubes detachably connected with one another and aligned in axial directions, and forming a plurality of packages by winding a plurality of supplied yarns onto the take up tubes, respectively.

[0007] According to these aspects of the invention, because a plurality of packages are formed by winding yarns onto respective take up tubes constituting a winding body rotatably supported by a cradle, the packages are easily separated from one another by separating the connected take up tubes from one another after the formation of the packages.

[0008] According to the second aspect of the invention, the yarn winder of the first aspect further includes a doubling apparatus that doubles the supplied yarns, wherein, the cradle is able to rotatably support the winding body and a single take up tube which is substantially identical with the winding body in length in the axial directions, and it is switchable between (i) formation of a plurality of packages which is carried out such that the winding body is rotatably supported by the cradle and the supplied yarns are wound onto the respective take up tubes and (ii) formation of a single package which is carried out such that the single take up tube is rotatably supported by the cradle, the supplied yarns are doubled by the doubling apparatus, and a yarn formed by doubling the yarns is wound onto the single take up tube.

[0009] The present invention makes it possible to perform both the formation of a single package by winding a yarn formed by doubling supplied yarns onto a single yarn winder and the formation of a plurality of packages by winding the supplied yarns without doubling the same.

[0010] According to the third aspect of the invention, a connection member of the yarn winder of the first or second aspect, which detachably connects the take up tubes with one another, is arranged such that, the connection member is structured to be a pipe extending in the axial directions of the take up tubes and has, at around respective end portions in the axial directions, insertion portions inserted into the take up tubes, and two neighboring take up tubes among the take up tubes are detachably connected with each other as the two insertion portions are inserted into the respective take up tubes.

[0011] According to the present invention, the take up tubes are connected with one another by neighboring two take up tubes are connected with each other. Furthermore, because neighboring two take up tubes are connected with each other, the take up tubes are easily separated from one another even if the number of the connected take up tubes is large.

[0012] According to the fourth aspect of the invention, the connection member of the third aspect is arranged so that, at a part between the two insertion portions, a yarn end holding portion is provided to support a yarn end of a yarn which is to be wound onto at least one of the two connected take up tubes.

[0013] According to the present invention, because the yarn is supported at the yarn end holding portion, yarn threading or the like onto the take up tube is easily carried out.

[0014] According to the fifth aspect of the invention, the connection member of the fourth aspect is arranged so that the yarn end holding portion is formed by winding an annular component made of an elastic member around a part between the two insertion portions, and supports the yarn end by sandwiching the yarn between the annular component and an end of the take up tube.

[0015] According to the present invention, the yarn end holding portion is easily formed by providing an annular component made of an elastic material around the part

between two insertion portions.

[0016] According to the sixth aspect of the invention, the connection member of the fourth aspect is arranged so that, the yarn end holding portion is formed by forming a groove at a part between the two insertion portions to extend in circumferential directions not to completely surround the connection member, the groove guiding the yarn to the inner circumference of the take up tube, and the yarn end holding portion supports the yarn end by sandwiching the yarn end between a wall of the groove and the inner circumference of the take up tube.

[0017] According to the present invention, the yarn end holding portion is easily formed by forming, between two insertion portions, a groove guiding the yarn to the inner circumference of the take up tube.

[0018] According to the seventh aspect of the invention, the connection member of any one of the third to sixth aspects is arranged so that the diameter of the insertion portion is changeable at a part contacting the take up tube.

[0019] According to the present invention, the take up tube after the winding of a yarn thereon may be smaller in diameter than the take up tube before the winding, on account of the tension of the yarn. In this regard, because the diameter of the insertion portion is changeable at the part contacting the take up tube, the take up tube on which the yarn winding is completed is easily pulled off from the connection member even in the case above.

[0020] Furthermore, while the internal diameters of the take up tubes are typically not uniform, because in the present invention the diameter of the insertion portion is changeable at the part contacting the take up tube, the insertion portion is tightly fit into each take up tube even if the internal diameters of the take up tubes are not uniform.

[0021] According to the eighth aspect of the invention, the connection member of the seventh aspect is arranged so that the diameter of the part of the insertion portion contacting the take up tube is arranged to be changeable in such a way that a plurality of slits are formed through the insertion portion to be aligned in circumferential directions, and each of the slits extends in the axial directions and is open at an end of the insertion portion.

[0022] According to the present invention, the insertion portion is arranged to be changeable in diameter at the part contacting the take up tube because a plurality of slits are formed through the insertion portion.

[0023] According to the ninth aspect of the invention, a connection member of the yarn winder of the first or second aspect, which detachably connects the take up tubes with one another, is arranged so that, the connection member is structured to be a pipe extending in the axial directions of the take up tubes and is inserted into all of the take up tubes so as to detachably connect all of the take up tubes with one another.

[0024] According to the present invention, even if the number of take up tubes is three or more, all take up tubes are connected with one another by a single con-

nection member.

[0025] According to the present invention, because a plurality of packages are formed by winding yarns onto respective take up tubes constituting a winding body rotatably supported by a cradle, the packages are easily separated from one another by separating the connected take up tubes from one another after the formation of the packages.

10 BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a schematic diagram of a doubling draw texturing machine according to an embodiment of the present invention.

FIG. 2 is a schematic view in which components of the doubling draw texturing machine are exploded along the path of the yarn.

FIG. 3 is a schematic diagram of the winding section. FIG. 4 shows arrangements in the vicinity of the cradle of FIG. 3. FIG. 4 (a) shows a state in which a single take up tube is supported, and FIG. 4(b) shows a state in which a winding body including two take up tubes is supported.

FIG. 5 shows a bobbin holder viewed in the direction indicated by an arrow V in FIG. 4.

FIG. 6 shows the arrangement of the connection member. FIG. 6(a) shows the connection member in a direction orthogonal to the axial directions, whereas FIG. 6(b) is an axial direction cross section of the connection member.

FIG. 7(a) is a cross section taken at the A-A in FIG. 6 whereas FIG. 7(b) is a cross section taken at the B-B line in FIG. 6.

FIG. 8 relates to a modification 1 and is equivalent to FIG. 4(b).

FIG. 9 relates to a modification 2 and is equivalent to FIG. 6(b).

FIG. 10 shows the operation to insert the insertion portion of the connection member into the take up tube in the modification 2.

FIG. 11 relates to a modification 3 and is equivalent to FIG. 4(b).

FIG. 12 shows an example where three take up tubes are connected.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0027] The following will describe a preferred embodiment of the present invention.

[0028] A doubling draw texturing machine 1000 of the present embodiment includes false-twisting units 100 aligned in the crosswise directions of FIG. 2. FIG. 2 shows two units among the false-twisting units 100.

[0029] As shown in FIG. 1 and FIG. 2, each false-twisting unit 100 includes a yarn supplying portion 1, a false twisting section 2, a doubling section 3, a post processing

section 4, and a winding section 5. The yarn supplying portion 1 is a part which is upstream of a later-described first feed roller 6, whereas the false twisting section 2 is a part between the first feed roller 6 and a later-described upstream-side second feed roller 7. Similarly, the doubling section 3 indicates a part between the upstream-side second feed roller 7 and a later-described downstream-side second feed roller 8, whereas the post processing section 4 indicates a part between the downstream-side second feed roller 8 and a later-described third feed roller 9. The winding section 5 indicates a part on the downstream of the third feed roller 9. Note that, each of the first feed roller 6, the upstream-side second feed roller 7, the downstream-side second feed roller 8, and the third feed roller 9 may be a pair of rollers corresponding to later-described two yarns Ya and Yb, respectively.

[0030] The yarn supplying portion 1 includes two yarn supply packages 11a and 11b that are supported by a creel stand 10 and send out two yarns Ya and Yb. The yarns Ya and Yb sent out from the yarn supply packages 11a and 11b are supplied to the false twisting section 2 via pipes 12a and 12b and the first feed roller 6.

[0031] The false twisting section 2 false-twists a pair of yarns Ya and Yb sent out from the yarn supplying portion 1. The false twisting section 2 includes, from the upstream to the downstream in the running direction of the yarns Ya and Yb, a primary heater 13 for heating the yarns Ya and Yb, coolers 14a and 14b for cooling the yarns Ya and Yb, and false twisting devices 15a and 15b for false-twisting the yarns Ya and Yb. The primary heater may be a pair of primary heaters for yarns Ya and Yb, respectively.

[0032] The doubling section 3 forms interlaced portions in the yarns false-twisted by the false twisting section 2 and includes interlace nozzles 16a and 16b (doubling apparatus). As the two yarns Ya and Yb pass together through an interlace nozzle 16b (or through the interlace nozzle 16a; the same hereinafter) among the interlace nozzles 16a and 16b, the interlace nozzle 16b forms interlaced portions in the yarns Ya and Yb, and hence the yarns Ya and Yb are doubled. On the other hand, when the yarns Ya and Yb pass through the respective interlace nozzles 16a and 16b, the interlace nozzle 16a forms interlaced portions in the yarn Ya whereas the interlace nozzle 16b forms interlaced portions in the yarn Yb.

[0033] The post processing section 4 is provided for subjecting the yarns Ya and Yb to thermal treatment and includes a secondary heaters 17. The secondary heater 17 may be a pair of heaters provided for the two yarns Ya and Yb, respectively.

[0034] The winding section 5 is provided for winding the two yarns Ya and Yb false-twisted by the false twisting section 2 onto a take up tube, and includes a winding device 18 (yarn winder). The winding device 18 includes components such as a cradle 20, a traverse unit 21, and a winding drum 23. In consideration of the size of the

doubling draw texturing machine 1000, the winding devices 18 of the respective units 100 are arranged to substantially vertically overlap one another. Alternatively, the winding devices 18 of the respective units 100 may be provided in a staggered manner in vertical directions.

[0035] The cradle 20 includes a pair of opposing bobbin holders 22a and 22b, and rotatably supports a single long substantially-cylindrical take up tube 19A via the bobbin holders 22a and 22b, as shown in FIGs. 3 (a) and 4(a). Alternatively, as shown in FIGs. 3(b) and 4(b), the cradle 20 rotatably supports a winding body 40 having two take up tubes 19B.

[0036] More specifically, as shown in FIG. 3 (a) and FIG. 4(b), the bobbin holders 22a and 22b are rotatably supported, and each includes an insertion portion 31 and a biasing portion 32. The insertion portion 31 is substantially cylindrical and has a diameter substantially identical with the inner diameter of each of the take up tubes 19A and 19B, and is inserted into the take up tubes 19A and 19B. As the insertion portion 31 is inserted into the take up tubes 19A and 19B, the take up tube 19A and the winding body 40 are rotatably supported. The biasing portion 32 is a disc-shaped part placed axially outside of the insertion portion 31 and having a longer diameter than the insertion portion 31. This biasing portion 32 contacts the axial ends of the take up tube 19A and the winding body 40. The biasing portion 32 is biased axially inward by an unillustrated spring or the like, and hence the take up tube 19A and the winding body 40 supported by the cradle 20 are biased axially inward by the biasing portion 32.

[0037] In addition to the above, the biasing portion 32 is provided with, as shown in FIG. 5, a notch 33 that extends axially inward from the outer periphery of the biasing portion 32 and penetrates the biasing portion 32 of the bobbin holder 22a (22b) in the axial direction. For easier understanding, in FIG. 5 the surface of the biasing portion 32 on the insertion portion 31 side is hatched and the position of the take up tube 19B is indicated by a two-dot chain line.

[0038] In addition to the above, the cradle 20 is provided with a revolution counter 35 for measuring the revolution of the bobbin holder 22b(or 22a). The revolution of the take up tubes 19A and 19B is measured by measuring the revolution of the bobbin holder 22b by this revolution counter 35.

[0039] Now, the winding body 40 will be described. The winding body 40 includes two take up tubes 19B which are axially about half as long as the take up tube 19A and a connection member 41 which detachably connects the take up tube 19B.

[0040] As shown in FIGs. 6 and 7, the connection member 41 is made of an elastic material such as synthetic resins, is substantially cylindrical, and has the outer diameter substantially identical with the inner diameter of the take up tube 19B. The axial end portions of the connection member 41 sandwiching its central part are insertion portions 42. As these two insertion portions 42

are inserted into the take up tubes from the leading end sides, the take up tubes 19B are attached to the connection member 41 and hence the two take up tubes 19B are connected with each other.

[0041] The insertion portion 42 is shorter than the take up tube 19B in the axial directions, and in the winding body 40 the take up tube 19B protrudes in the axial direction as compared to the connection member 41. With this, it is possible to cause the insertion portion 31 of each of the bobbin holders 22a and 22b to be inserted into the part of the take up tube 19B protruding axially outward as compared to the connection member 41, as described above.

[0042] At the leading end of each insertion portion 42 is provided a protruding portion 44 which extends along the entirety of the outer circumference of the portion 42 and protrudes radially outward as compared to the remaining portions. In the meanwhile, at the end of the insertion portion 42 opposite to the leading end, a plurality of protrusions 45 are provided along the outer circumference at substantially regular intervals.

[0043] With this, after the insertion portion 42 is inserted into the take up tube 19B, the protruding portion 44 and the protrusions 45 closely contact the inner circumference of the take up tube 19B on account of the elasticity of the insertion portion 42, with the result that the take up tube 19B is fixed to the insertion portion 42.

[0044] Each insertion portion 42 has a plurality of slits 46. The slits 46 are aligned in the circumferential directions of the connection member 41. Each slit 46 extends along the axis of the connection member 41 and opens at the leading end of the insertion portion 42. With this arrangement, the insertion portion 42 is inserted into the take up tube 19B, and the diameter of the insertion portion 42 reduces when a radially inward force is applied from the take up tube 19B, and the diameter is restored by elasticity after the take up tube 19B is removed from the insertion portion 42. In other words, the diameter of each insertion portion 42 is changeable.

[0045] On the axially substantially central part of the connection member 41 between the two insertion portions 42 is mounted an O-ring 43 (annular component) made of an elastic material such as rubber. When the take up tubes 19B are attached to the insertion portions 42, the axial inner edges of the take up tubes 19B closely contact the O-ring 43.

[0046] The traverse unit 21 includes a belt component 26 that is reciprocally moved by an unillustrated motor and two traverse guides 27a and 27b that are attached to the belt component 26 to guide the yarns Ya and Yb. The belt component 26 is, for example, a toothed belt having many teeth on the inner circumference, and is mounted on a driving pulley 28 rotated forward or backward by an unillustrated drive motor and a pair of driven pulleys 29. The running path of the belt component 26 between the pair of driven pulleys 29 is substantially in parallel to the axis of the take up tube 19B. Between the driven pulleys 29, the above-described traverse guides

27a and 27b are provided on the belt component 26 with a predetermined distance therebetween. The predetermined distance in the present embodiment is more or less the same as the distance between the centers of the respective take up tubes 19B in the axial directions. The two traverse guides 27a and 27b are detachable to the belt component 26.

[0047] In addition to the above, on the upstream of the traverse unit 21 are provided a yarn guide 30a for changing the yarn path of the yarn Ya sent out from the third feed roller 9 to the front of the traversal center of the traverse guide 27a and a yarn guide 30b for changing the yarn path of the yarn Yb sent out from the third feed roller 9 to the front of the traversal center of the traverse guide 27b. Furthermore, a yarn guide 30c is provided between the yarn guides 30a and 30b. As shown in FIG. 2 and FIG. 3, the yarn guide 30c is provided to be further from the traverse guides 27a and 27b as compared to the yarn guides 30a and 30b, in a direction orthogonal to the central axes of the take up tubes 19A and 19B attached to the cradle 20 (i.e., the vertical direction in FIG. 2 and FIG. 3). The yarn guides 30a to 30c may be arranged to be detachable and positionally changeable according to the usage.

[0048] The winding drum 23 is provided to closely contact the outer circumferences of the take up tubes 19A and 19B supported by the cradle 20. As the winding drum 23 is rotated by an unillustrated motor, the take up tubes 19A and 19B closely contacting the winding drum 23 are rotated.

[0049] Now, a process of forming a package P in the false-twisting unit 100 will be described. The false-twisting unit 100 is switchable between the formation of two packages P by winding two yarns Ya and Yb onto two take up tubes 19B and the formation of a single package P by doubling two yarns Ya and Yb and winding a yarn Yg formed by the doubling onto a single take up tube 19A.

[0050] First, the operation to form two packages P will be described. In such a case, two yarns Ya and Yb sent out from the yarn supply packages 11a and 11b are supplied to the winding device 18 via the pipes 12a and 12b, the first feed roller 6, the primary heater 13, the coolers 14a and 14b, the false twisting devices 15a and 15b, the upstream-side second feed roller 7, the interlace nozzles 16a and 16b, the downstream-side second feed roller 8, the secondary heater 17, and the third feed roller 9, respectively.

[0051] More specifically, the yarn supplying rate of the upstream-side second feed roller 7 is arranged to be higher than the yarn supplying rate of the first feed roller 6. With this, the yarns Ya and Yb are drawn between the first feed roller 6 and the upstream-side second feed roller 7, and the drawn yarns are twisted in the interval between the first feed roller 6 and the upstream-side second feed roller 7, by the false twisting devices 15a and 15b. The yarns Ya and Yb having been drawn and twisted are subjected to thermal treatment by the primary heater 13, and then cooled by the coolers 14a and 14b. The yarns Ya

and Yb having been twisted, heated, and cooled pass through the false twisting devices 15a and 15b, and are then untwisted before reaching the upstream-side second feed roller 7.

[0052] After passing through the upstream-side second feed roller 7, the yarns Ya and Yb are led to the interlace nozzles 16a and 16b. Interlaced portions are formed by the interlace nozzles 16a and 16b, and then the yarns Ya and Yb are supplied to the downstream-side second feed roller 8.

[0053] The yarn supplying rate of the downstream-side second feed roller 8 is typically arranged to be different from the yarn supplying rate of the third feed roller 9. With this, the yarns Ya and Yb are slacken in the intervals between the downstream-side second feed roller 8 and the third feed roller 9. The slackened yarns Ya and Yb are subjected to slacken thermal treatment by the secondary heater 17, and are then supplied to the third feed roller 9. The ratio between the yarn supplying rate of the downstream-side second feed roller 8 and the yarn supplying rate of the third feed roller 9 is determined in accordance with the state of the yarns.

[0054] The two yarns Ya and Yb sent out from the third feed roller 9 pass through the yarn guide 30c and then the yarn guides 30a and 30b, respectively, and are wound onto the two take up tubes 19B contacting and rotated by the rotating winding drum 23 while being traversed by the traverse guides 27a and 27b that are reciprocally moved in directions in parallel to the axes of the two take up tubes 19B by the reciprocal movement of the belt component 26. As a result, two packages P are formed. At this stage, the moving speeds of the traverse guides 27a and 27b are controlled based on the revolution of the take up tube 19B measured by the revolution counter 35.

[0055] After the formation of the two packages P is completed, the yarns Ya and Yb are cut in the space between the third feed roller 9 and the packages P, and then an unillustrated doffing mechanism rotates the cradle 20 to perform the doffing by removing the packages P from the winding drum 23. As the winding body 40 having two empty take up tubes 19B is supplied to the cradle 20 and retained by the bobbin holders 22a and 22b, the cradle 20 is rotated to cause the two take up tubes 19B to contact the winding drum 23. In response to this, the two take up tubes 19B contacting the winding drum 23 start to rotate. Thereafter, the operator threads the yarn ends of the yarns Ya and Yb onto the take up tubes 19B, and the winding of the yarns Ya and Yb is resumed.

[0056] The yarn threading onto the take up tube 19B on the bobbin holder 22b side (i.e., left side in FIG. 3(b)) is carried out in such a way that, as indicated by a dashed line in FIG. 4(b), the yarn Yb is arranged to run across the border between the take up tube 19B and the O-ring 43 in a direction non-parallel to the vertical line in FIG. 4(b), so as to closely contact the outer circumference of the winding body 40. As a result, the yarn Yb is guided to the gap between the end of the take up tube 19B and

the O-ring 43, and the yarn is sandwiched therebetween and supported on account of the elasticity of the O-ring 43. In other words, according to the present embodiment, the yarn holding member of the present invention is formed by providing the O-ring 43 around the part of the connection member 41 between the two insertion portions 42. As the take up tube 19B in this state is rotated, a bunch winding B is formed at the right end portion of the take up tube 19B as shown in FIG. 4(b), and the yarn threading is completed. In this connection, instead of causing the yarn Yb to closely contact the outer circumference of the take up tube 40 in a non-parallel manner as described above, the yarn Yb may be directly inserted into the border between the take up tube 19B and the O-ring 43.

[0057] In the meanwhile, the yarn threading onto the take up tube 19B on the bobbin holder 22a side (i.e., the right side in FIG. 3(b)) is, as indicated by a dashed line in FIG. 5, carried out by inserting the yarn Ya into the notch 33 formed through the biasing portion 32 of the bobbin holder 22a. With this, the yarn Ya is guided to the gap between the end of the take up tube 19B and the biasing portion 32, and is sandwiched therebetween and retained. As the take up tube 19B in this state is rotated, a bunch winding B is formed at the right end portion of the take up tube 19B as shown in FIG. 3(b), and the yarn threading is completed.

[0058] On the contrary, the yarn winder may be differently constructed such that the yarn Yb is guided to the gap between the end of the take up tube 19B and the biasing portion 32 so that the yarn Yb is supported by being sandwiched between the end of the take up tube 19B and the biasing portion 32 and the yarn Ya is guided to the gap between the end of the take up tube 19B and the O-ring 43 so that the yarn Ya is supported by being sandwiched between the end of the take up tube 19B and the O-ring 43. In this case, bunch windings B are formed at the left end portions of the respective take up tubes 19B in FIG. 3(b).

[0059] When a plurality of packages P are formed in this manner, because two packages P are formed by winding yarns Ya and Yb onto two take up tubes 19B, respectively, the two packages P are separated from each other by pulling off the take up tubes 19B from the connection member 41 in the winding body 40 having been detached from the cradle 20 after the formation of the packages P. As such, being different from Patent Literature 1 above, a complicated process such as cutting of the take up tube is unnecessary to separate the two packages P, and hence the two packages P are easily separated from each other.

[0060] In addition to the above, after the yarns Ya and Yb are wound onto the take up tubes 19B, the diameters of the take up tubes 19B may be reduced because the tubes are pressed radially inward by the tension of each of the yarns Ya and Yb. In this regard, because as described above the present embodiment is arranged so that a plurality of slits 46 are formed through the insertion

portion 42, the diameter of the insertion portion 42 is changeable. For this reason, when the diameter of the take up tube 19B is reduced, the diameter of the insertion portion 42 is reduced on account of the force applied from the take up tube 19B to the insertion portion 42.

[0061] This prevents the occurrence of a problem that the take up tube 19B cannot be pulled off from the insertion portion 42 after the formation of the package P. Furthermore, by forming the slits 46 through the insertion portion 42, it is possible to easily arrange the diameter of the insertion portion 42 to be changeable.

[0062] In the case above, furthermore, the yarn threading onto the take up tube 19B on the bobbin holder 22a side is performed such that the yarn Ya introduced from the notch 33 is supported by being sandwiched between the biasing portion 32 and the take up tube 19B, whereas the yarn threading onto the take up tube 19B on the bobbin holder 22b side is performed such that the yarn Yb is supported by being sandwiched between the O-ring and the take up tube 19B. For this reason, the bunch windings B are formed on the same sides of the take up tubes 19B in the axial direction (i.e., right sides in FIG. 3). On this account, the yarns Ya and Yb are wound in the same direction onto the two take up tubes 19B.

[0063] In addition to the above, because the O-ring 43 is provided around the part of the connection member 41 between the two insertion portions 42, a yarn holding member for supporting the yarn Yb is easily formed between the O-ring 43 and the take up tube 19B.

[0064] Now, an operation to form a single package P will be described. In this case, in the same manner as above, two yarns Ya and Yb drawn and twisted between the first feed roller 6 and the upstream-side second feed roller 7 pass through the upstream-side second feed roller 7 and are then introduced into a single interlace nozzle 16b, and after being doubled in the interlace nozzle 16b, the yarns Ya and Yb are conveyed to the downstream-side second feed roller 8.

[0065] The yarn Yg formed by the doubling is slacken in the part between the downstream-side second feed roller 8 and the third feed roller 9, and the yarn Yg in this state is subjected to slacken thermal treatment by the secondary heater 17 and then conveyed to the third feed roller 9.

[0066] As shown in FIG. 3(a), the yarn Yg sent out from the third feed roller 9 passes through the yarn guide 30c which is further from the traverse guide 27b as compared to the yarn guides 30a and 30b, and is directly sent from the yarn guide 30c to the traverse guide 27b. The yarn Yg is wound onto a single take up tube 19A contacting and rotated by the rotating winding drum 23, while being traversed on the yarn guide 30c by the traverse guide 27b which is reciprocally moved in directions in parallel to the axis of the take up tube 19A by the reciprocal movement of the belt component 26, with the result that a single package P is formed.

[0067] In the present embodiment, the moving distance of the traverse guide 27b when the yarn Yg is

wound onto a single take up tube 19A is longer than the moving distance of each of the traverse guides 27a and 27b when the yarns Ya and Yb are wound onto two take up tube 19B, respectively. In this regard, because the yarn Yg is traversed on the yarn guide 30c which is further from the traverse guide 27a than the yarn guides 30a and 30b, the bending angle of the yarn Yg at the yarn guide 30c is of the same degree as the bending angles of the yarns Ya and Yb at the yarn guides 30a and 30b.

[0068] Furthermore, in the case of the formation of a single package above, the traverse guide 27a is detached from the belt component 26 in advance in order to prevent the traverse guide 27a from obstructing the movement of the traverse guide 27b. Note that, the traverse guide 27b may be detached instead of the traverse guide 27a.

[0069] Also in the case of the formation of a single package, the package P is detached from the winding drum 23 and doffed after the formation of the package P is completed, in the same manner as above. As the empty take up tube 19A is supplied to the cradle 20 and retained by the bobbin holders 22a and 22b, the cradle 20 is rotated to cause the take up tube 19A to contact the winding drum 23. In response to this, the take up tube 19A contacting the winding drum 23 starts to rotate. Thereafter, the operator threads the yarn end of the yarn Yg onto the take up tube 19A, and the winding of the yarn Yg is resumed.

[0070] In this regard, the yarn threading onto the take up tube 19A is carried out in such a way that, in the same manner as the above-described yarn threading onto the take up tube 19B on the bobbin holder 22a side (right side in FIG. 3(a)), the yarn Yg is caused to pass through the notch 33 formed through the biasing portion 32 of the bobbin holder 22a.

[0071] A preferred embodiment of the present invention has been described. This embodiment may be modified as below.

[0072] In the embodiment above, because the O-ring 43 is provided around the part of the connection member 41 between the two insertion portions 42, the yarn Yb is sandwiched between the O-ring 43 and the take up tube 19B at the time of yarn threading. This arrangement, however, is not essential. For example, instead of the O-ring 43, an annular component which is made of an elastic material such as rubber and is substantially rectangular in cross section may be provided.

[0073] In addition to the above, providing the O-ring 43 around the part of the connection member 41 between the two insertion portions 42 is not essential. According to a modification (modification 1), as shown in FIG. 8, in the connection member 50, a groove 51 is formed along the circumference of the connection member 50 not to completely surround the same, in an area across the inner end portion of each insertion portion 42 in the axial directions and the part between the two insertion portions 42. The number of grooves 51 may be one or more than one, corresponding to each insertion portion 42. When

the number of grooves is more than one, the grooves are aligned in the circumferential directions of the connection member 41.

[0074] In this case, as described above, at the time of yarn threading, as indicated by a dashed line in FIG. 8, the yarn Yb is arranged to run across the border between the inner edge of the take up tube 19B in the axial directions and the groove 51 in a direction non-parallel to the vertical line in FIG. 8, so as to closely contact the outer circumference of the winding body 40. As a result, the yarn Yb is introduced into the groove 51 and is supported by being sandwiched between the inner circumference of the take up tube 19B and the wall of the groove 51 of the connection member 50. That is to say, according to the modification 1, the groove 51 is formed on the connection member 50 so that the yarn holding member of the present invention is formed at the part of the connection member 50 between the two insertion portions 42.

[0075] In addition to the above, while in the embodiment above and the modification 1 the O-ring 43 or the groove 51 is provided to support the yarn Yb by sandwiching the yarn between the O-ring or the groove and the take up tube 19B. These arrangements, however, are not essential. For example, a yarn guide that is able to independently support the yarn Yb may be provided at a part of an insertion portion 42 between two connection members.

[0076] In the embodiment above, at the time of yarn threading onto the take up tubes 19B, bunch windings B are formed on the same sides of the two take up tubes 19B (i.e., right side in FIG. 3) by supporting the yarn Ya by sandwiching the same between the biasing portion 32 and an end of one of the two take up tube 19B and supporting the yarn Yb by sandwiching the same between the O-ring 43 and an end of the other one of the take up tubes 19B. This arrangement, however, is not essential.

[0077] For example, at the time of yarn threading onto the take up tubes 19B, the yarns Ya and Yb may be supported by being sandwiched between the O-ring 43 and the inner ends of the take up tubes 19B. Alternatively, notches 33 may be formed on biasing portions 32 of both of two bobbin holders 22a and 22b, and the yarns Ya and Yb may be guided to the notches 33 of the biasing portions 32 of the bobbin holders 22a and 22b, respectively, and supported by being sandwiched between the biasing portion 32 and the ends of the take up tubes 19B. In this regard, because in these cases the bunch windings B are formed at the opposite end portions of the two take up tubes 19B, the direction of winding of the yarn Ya (Yb) is opposite between the two take up tubes 19B.

[0078] In the examples above, an arrangement (such as the O-ring 43, the groove 51, and the slit 33) for supporting the yarns Ya and Yb is formed at the part of the connection member between the two insertion portions 42 or at the bobbin holders 22a and 22b. Such an arrangement, however, is not essential.

[0079] For example, the inner ends of the two take up tubes 19B in the axial directions closely contact each

other, and the yarns Ya and Yb are supported by being sandwiched between the two take up tubes 19B such that the yarns Ya and Yb are inclined to run across the border between the two take up tubes 19B to closely contact the outer circumferences of the take up tubes 19B.

[0080] Alternatively, for example, a groove is formed along the circumference of one end portion of the take up tube 19B in the axial directions, and the yarns Ya and Yb are supported in the groove such that the yarns Ya and Yb are inclined to run across the groove to closely contact the outer circumferences of the take up tubes 19B. Alternatively, a groove is formed at an end portion of the take up tube 19A, and the yarn Yg is supported in this groove at the time of yarn threading.

[0081] In the embodiment above, a plurality of slits 46 are formed through the insertion portion 42 to arrange substantially entirety of the insertion portion 42 to be changeable in diameter, including the part contacting the take up tube 19B. This arrangement, however, is not essential.

[0082] According to another modification (modification 2), as shown in FIG. 9, a groove 61 is formed to completely surround the insertion portion 42 of the connection member 60 in the circumferential directions, instead of the slit 46 (see FIG. 4). Around the part of the insertion portion 42 where the groove 61 is formed, an O-ring 65 made of an elastic material such as rubber is provided.

[0083] The groove 61 has two engaging portions 62 and 63 and a connecting portion 64. The two engaging portions 62 and 63 are separated from each other in the axial directions, and each portion has a curved bottom surface corresponding to the shape of the O-ring 65. Furthermore, among the two engaging portions 62 and 63, the bottom surface of the engaging portion 63 which is on the inner side in the axial directions is radially outside as compared to the bottom surface of the engaging portion 62 on the outer side. Furthermore, when the insertion portion 42 is not inserted into the take up tube 19B, the O-ring 65 is engaged with the engaging portion 62 which is on the outer side in the axial directions. The connecting portion 64 extends between the engaging portion 62 and the engaging portion 63 to connect the engaging portion 62 with the engaging portion 63.

[0084] In the case above, as the insertion portion 42 is inserted into the take up tube 19B, as shown in FIG. 10(a), the inner circumference of the take up tube 19B contacts the O-ring 65 engaged with the engaging portion 62. As the take up tube 19B is further inserted in this state, as shown in FIG. 10(b), the O-ring 65 moves at the connecting portion 64 from the engaging portion 62 toward the engaging portion 63 on account of a friction force between the O-ring and the take up tube 19B.

[0085] Subsequently, as shown in FIG. 10(c), the O-ring 65 reaches the engaging portion 63 before the insertion portion 42 is completely inserted into the take up tube 19B, and the engagement between the O-ring 65 and the engaging portion 63 is maintained until the in-

sertion portion 42 is completely inserted into the take up tube 19B.

[0086] In this regard, because as described above the bottom surface of the engaging portion 63 is on the outside of the bottom surface of the engaging portion 62 in the radial direction of the connection member 60, the O-ring 65 is expanded in diameter as it moves from the engaging portion 62 to the engaging portion 63. As a result, the O-ring 65 further closely contacts the take up tube 19B and hence the take up tube 19B is fixed to the insertion portion 42.

[0087] On the other hand, when the take up tube 19B is removed from the insertion portion 42, on the contrary to the above, the O-ring 65 moves from the engaging portion 63 to the engaging portion 62 and reduces in diameter. For this reason, even if the take up tube 19B is reduced in diameter on account of the winding of the yarn Ya or Yb, it is possible to easily pull off the take up tube 19B from the insertion portion 42.

[0088] As described above, according to the modification 2, the part of the insertion portion 42 contacting the take up tube 19B (i.e., the O-ring 65) is arranged to be changeable in diameter. Alternatively, the part of the insertion portion 42 contacting the take up tube 19B may be arranged to be changeable in diameter by an arrangement different from the slits 46 of the embodiment above and the groove 61 and the O-ring 65 of the modification 2.

[0089] Furthermore, the insertion portion 42 may not be changeable in diameter. The insertion portion 42 may be a cylinder always having the same diameter.

[0090] In the embodiment above, the insertion portion 42 is shorter than the take up tube 19B in the axial directions, and the winding body 40 is supported by the bobbin holders 22a and 22b as the insertion portions 31 of the bobbin holders 22a and 22b are inserted into the take up tubes 19B. This arrangement, however, is not essential.

[0091] According to a further modification (modification 3), as shown in FIG. 11, a connection member 71 is longer than the total length of the two take up tubes 19B in the axial directions, and the end portions of the connection member 71 protrude from the take up tubes 19B when the connection member 71 are inserted into the two take up tubes 19B. As the insertion portions 31 of the bobbin holders 22a and 22b are inserted into the end portions of the connection member 71, a winding body 70 constituted by the take up tubes 19B and the connection member 71 is supported by the bobbin holders 22a and 22b.

[0092] In addition to the above, the connection member 71 is provided with an O-ring 43 at a substantially central part in the axial directions in the same manner as the embodiment above, and is further provided with the groove 61 and the O-ring 65 identical with those in the modification 2.

[0093] Also in this case, after two packages P are formed by winding the yarns Ya and Yb onto two take up tubes 19B, respectively, the connection member 71 is pulled off from the two take up tubes 19B. In this way, the two packages P are easily separated from each other.

[0094] In addition to the above, in the examples above the winding body has two take up tubes 19B connected with each other, and two packages P are formed by winding yarns Ya and Yb onto the two take up tubes 19B, respectively. Alternatively, the winding body is provided with three or more take up tubes 19B connected with one another, and three or more packages P are formed by winding yarns onto the three or more take up tubes 19B, respectively.

[0095] In case where, for example, three take up tubes 19B are provided, as shown in FIG. 12, the three or more take up tubes 19B are connected with one another in such a way that each pair of adjacent take up tubes 19B among the take up tubes 19B are connected with each other by the above-described connection member 41 or the like.

[0096] Subsequently, as shown in FIG. 12, the adjacent two take up tubes 19B connected with each other by the connection member 41 or the like are easily separated from each other by pulling off the take up tubes 19B from the insertion portion 42.

[0097] In addition to the above, to connect three or more take up tubes 19B with one another, three or more take up tubes 19B may be connected with one another by a single long connection member, instead of being connected such that each pair of adjacent take up tubes 19B among the take up tubes 19B are connected with each other by the connection member 41.

[0098] In addition to the above, while in the embodiment above the false-twisting unit 100 is switchable between the formation of two packages P by winding yarns Ya and Yb onto respective take up tubes 19B and the formation of a single package by winding a yarn Yg formed by doubling yarns Ya and yarn Yb onto a single take up tube 19A, the false-twisting unit 100 may be able to form only a plurality of packages. The features of all claims and all embodiments can be combined with each other, as long as they do not contradict each other.

Claims

1. A yarn winder comprising:

a cradle which rotatably supports a winding body including a plurality of take up tubes that are detachably connected with one another and aligned in axial directions, and
a plurality of packages being formed by winding a plurality of supplied yarns onto the take up tubes, respectively.

2. The yarn winder according to claim 1, further comprising:

a doubling apparatus that doubles the supplied yarns, wherein,
the cradle is able to rotatably support the winding

- body and a single take up tube which is substantially identical with the winding body in length in the axial directions, and
 it is switchable between (i) formation of a plurality of packages which is carried out such that the winding body is rotatably supported by the cradle and the supplied yarns are wound onto the respective take up tubes and
 (ii) formation of a single package which is carried out such that the single take up tube is rotatably supported by the cradle, the supplied yarns are doubled by the doubling apparatus, and a yarn formed by doubling the yarns is wound onto the single take up tube.
3. A connection member of the yarn winder according to claim 1 or 2, which detachably connects the take up tubes with one another, wherein,
 the connection member is structured to be a pipe extending in the axial directions of the take up tubes and has, at around respective end portions in the axial directions, insertion portions inserted into the take up tubes, and
 two neighboring take up tubes among the take up tubes are detachably connected with each other as the two insertion portions are inserted into the respective take up tubes.
 4. The connection member according to claim 3, wherein,
 at a part between the two insertion portions, a yarn end holding portion is provided to support a yarn end of a yarn which is to be wound onto at least one of the two connected take up tubes.
 5. The connection member according to claim 4, wherein,
 the yarn end holding portion is formed by winding an annular component made of an elastic member around a part between the two insertion portions, and supports the yarn end by sandwiching the yarn between the annular component and an end of the take up tube.
 6. The connection member according to claim 4, wherein,
 the yarn end holding portion is formed by forming a groove at a part between the two insertion portions to extend in circumferential directions not to completely surround the connection member, the groove guiding the yarn to the inner circumference of the take up tube, and the yarn end holding portion supports the yarn end by sandwiching the yarn end between a wall of the groove and the inner circumference of the take up tube.
 7. The connection member according to any one of claims 3 to 6, wherein,

the diameter of the insertion portion is changeable at a part contacting the take up tube.

8. The connection member according to claim 7, wherein,
 the diameter of the part of the insertion portion contacting the take up tube is arranged to be changeable in such a way that a plurality of slits are formed through the insertion portion to be aligned in circumferential directions, and each of the slits extends in the axial directions and is open at an end of the insertion portion.
9. A connection member of the yarn winder according to claim 1 or 2, which detachably connects the take up tubes with one another, wherein,
 the connection member is structured to be a pipe extending in the axial directions of the take up tubes and is inserted into all of the take up tubes so as to detachably connect all of the take up tubes with one another.
10. A yarn winding method comprising the steps of:
 rotatably supporting, by a cradle, a winding body including a plurality of take up tubes detachably connected with one another and aligned in axial directions, and
 forming a plurality of packages by winding a plurality of supplied yarns onto the take up tubes, respectively.

FIG.1

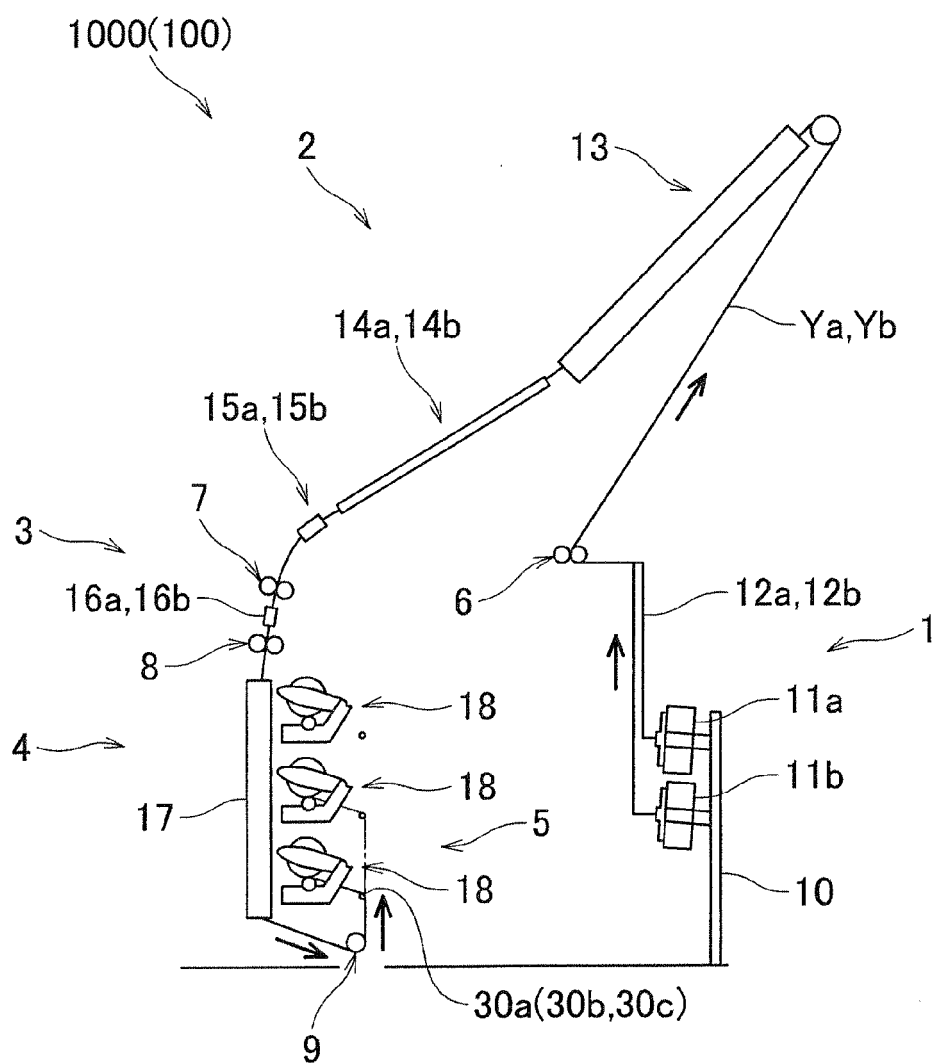


FIG.2

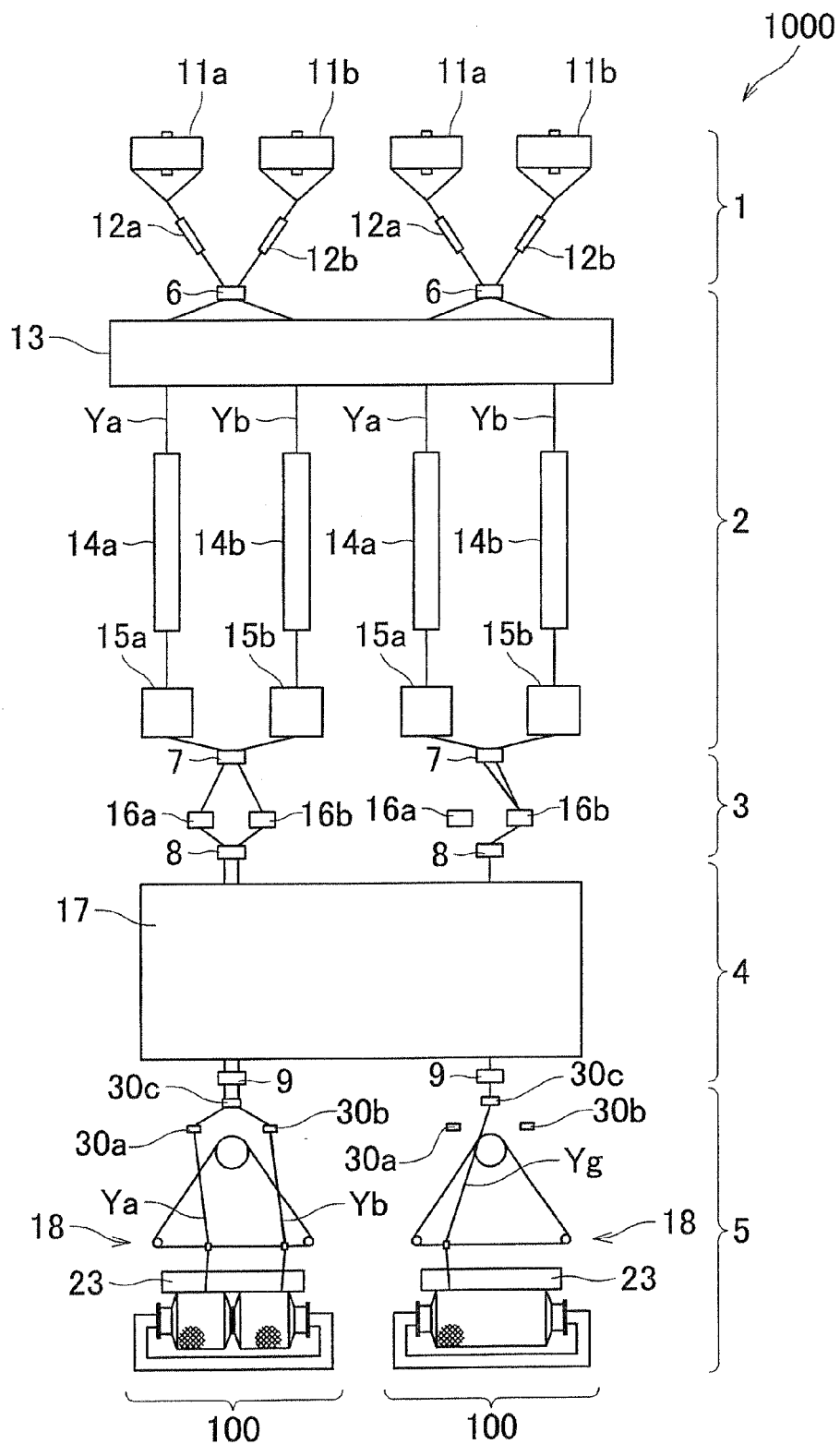


FIG.3(a)

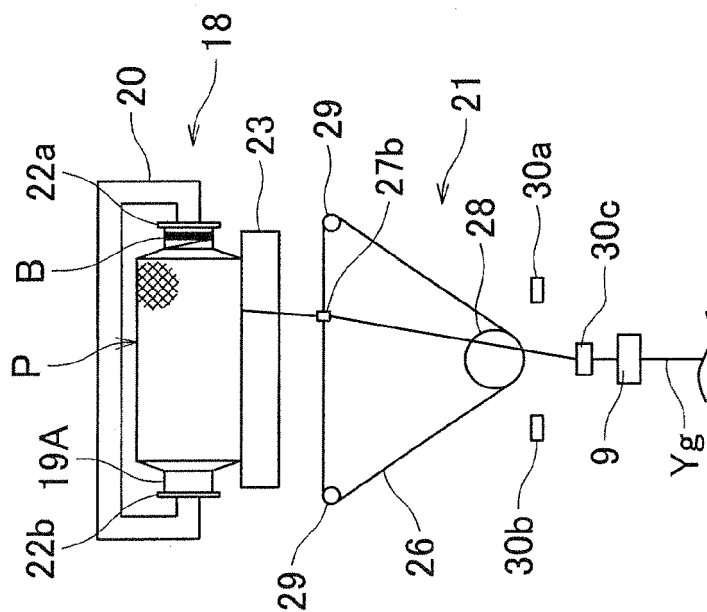
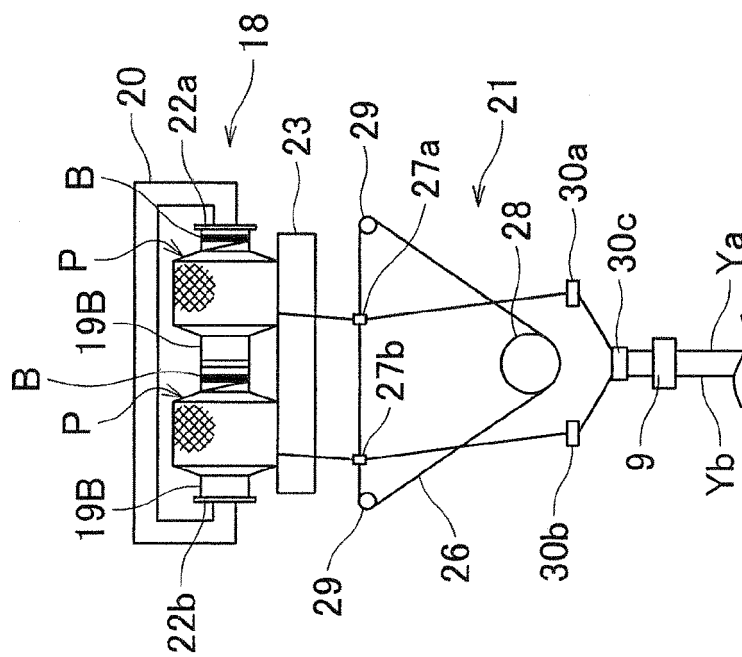


FIG.3(b)



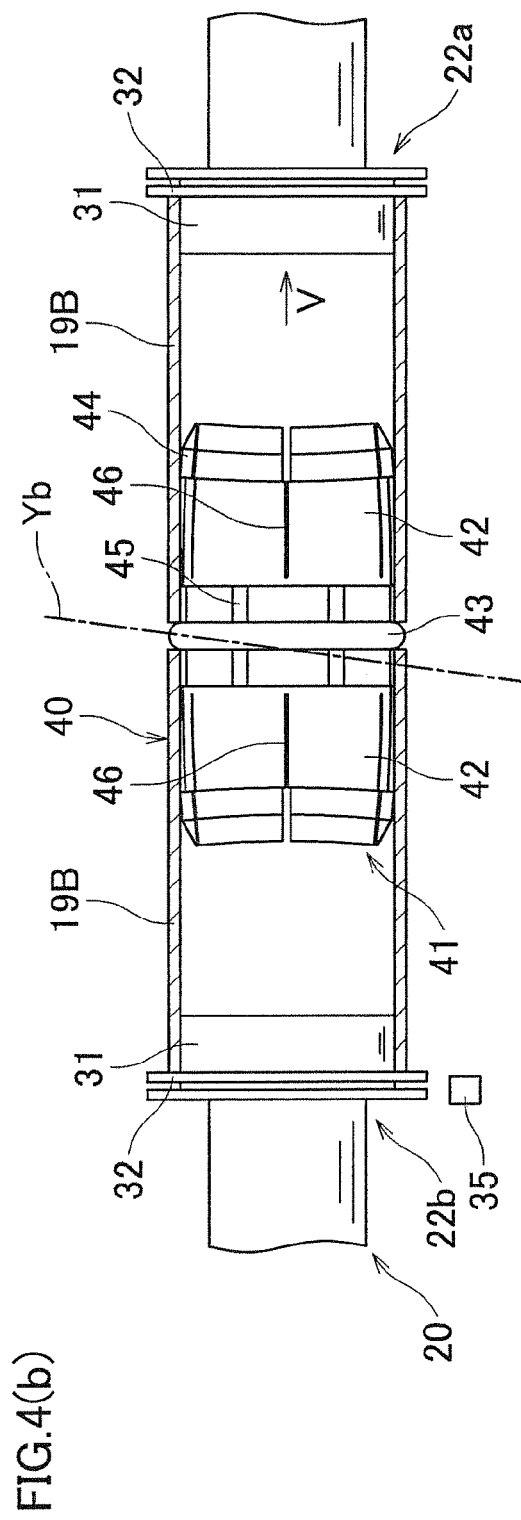
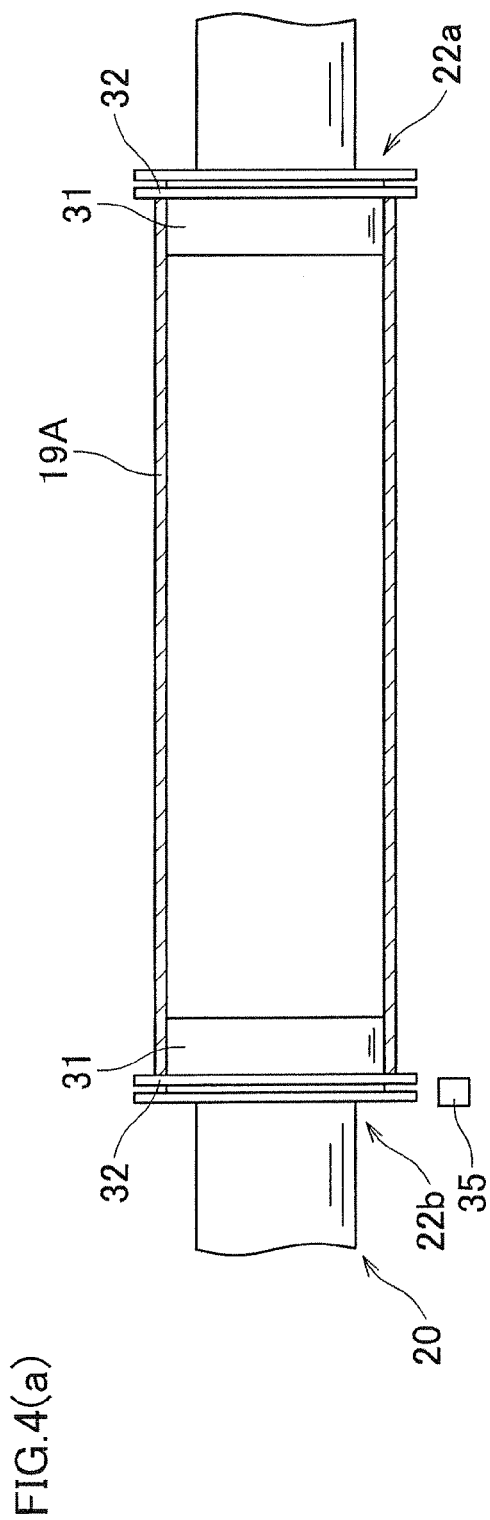


FIG.5

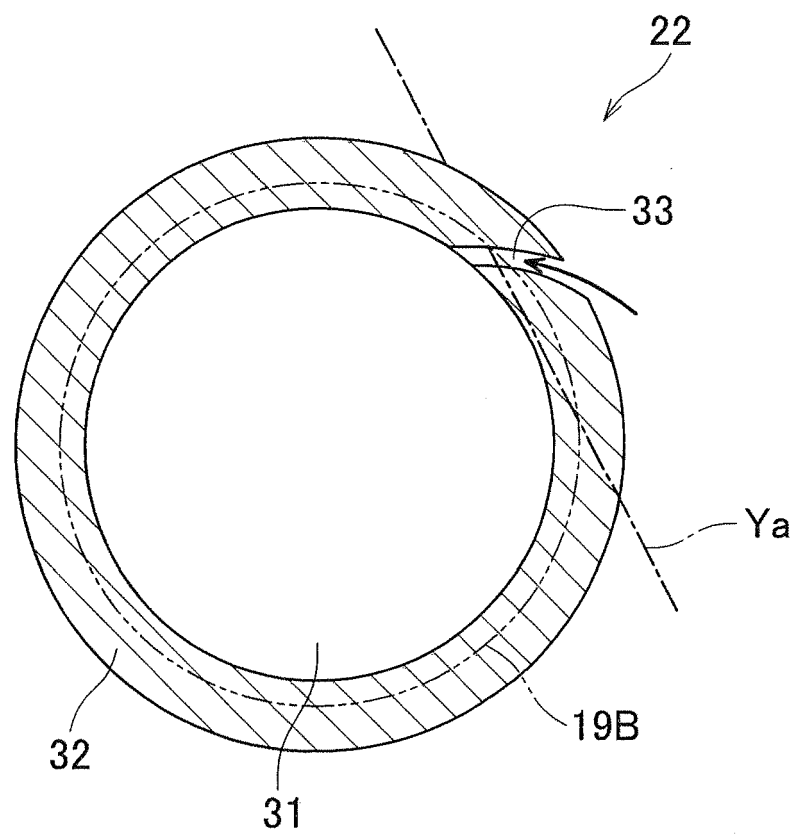


FIG.6(a)

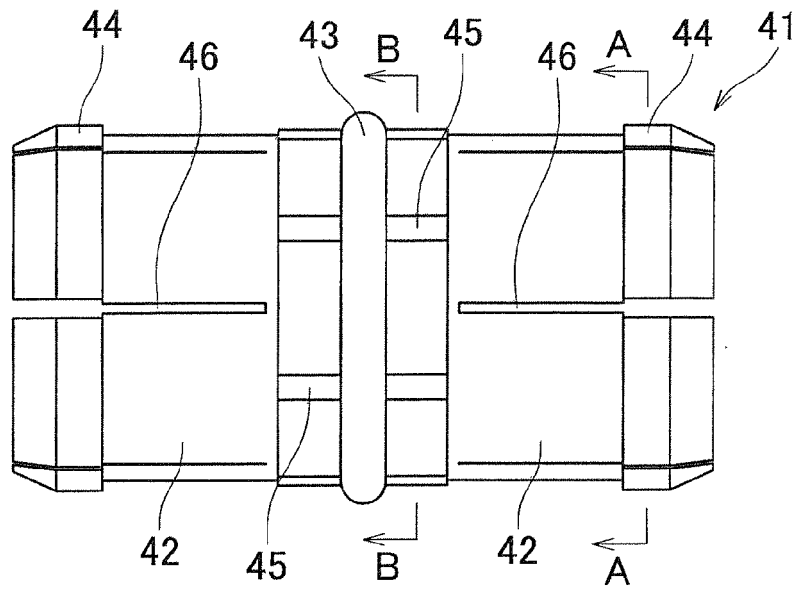


FIG.6(b)

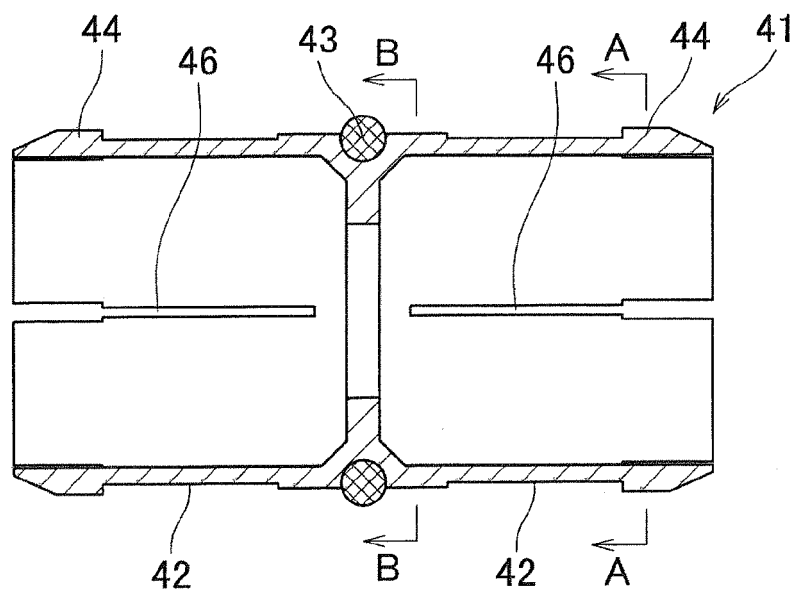


FIG.7(a)

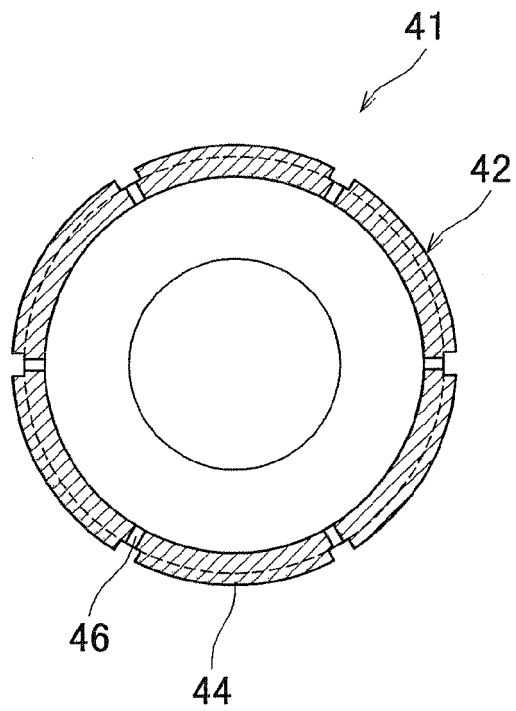


FIG.7(b)

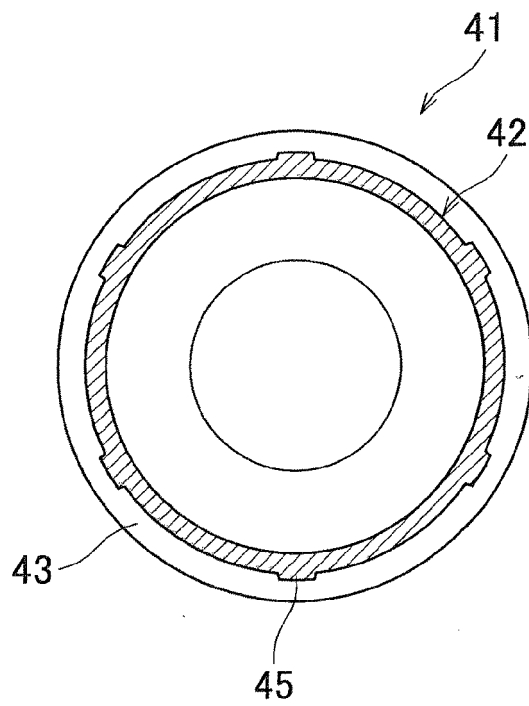


FIG.8

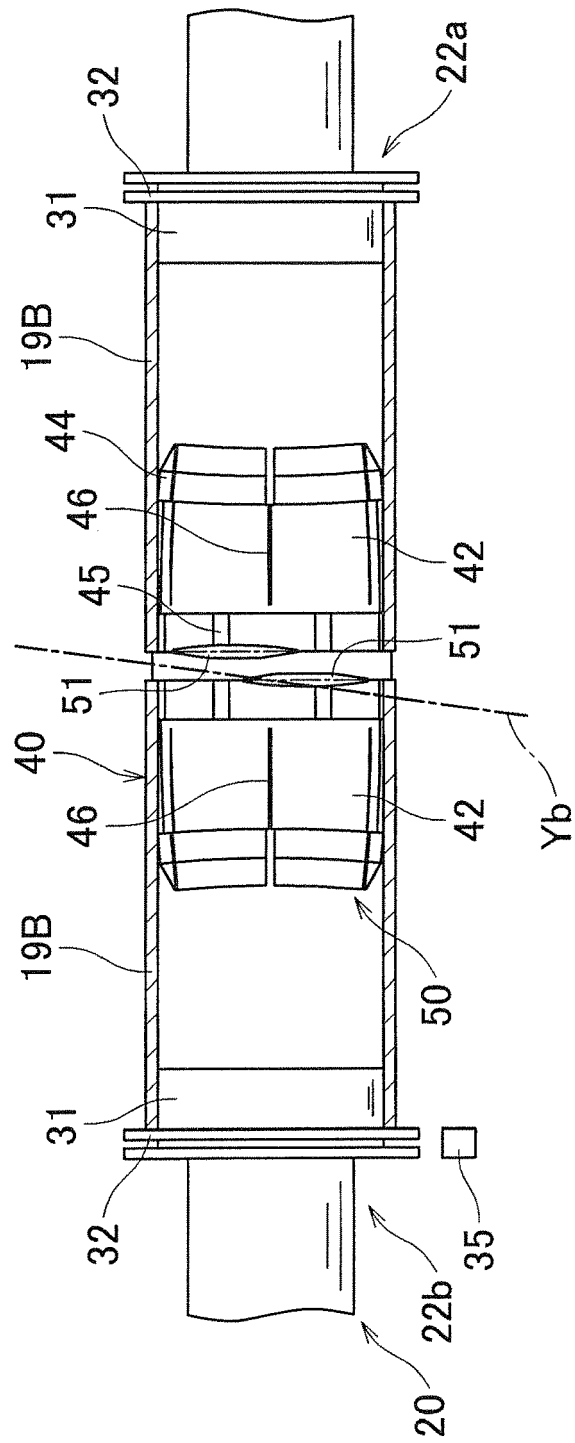


FIG.9

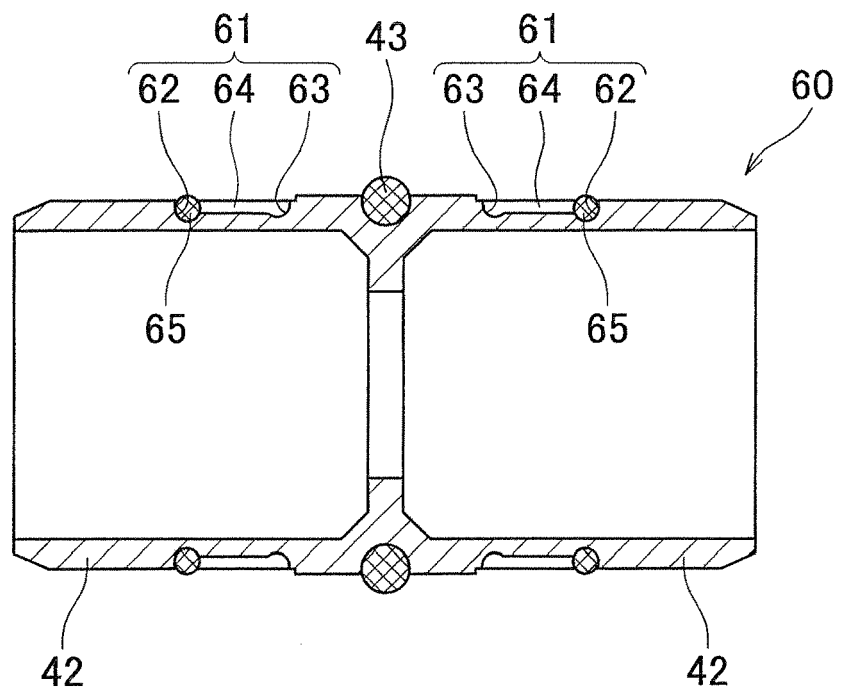


FIG.10(a)

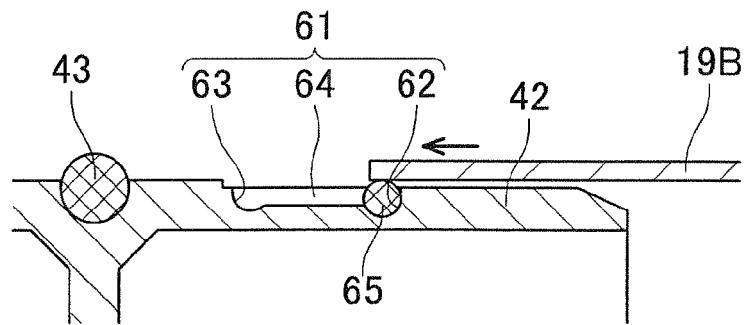


FIG.10(b)

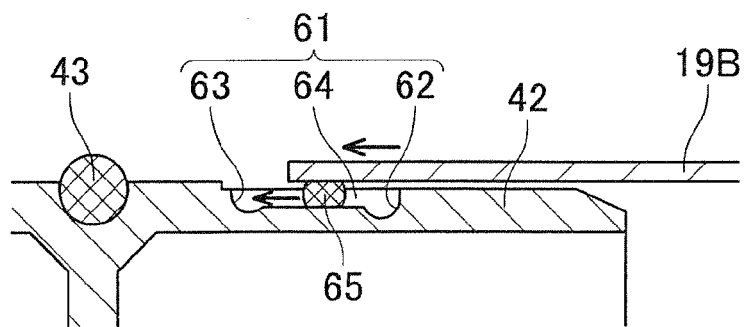


FIG.10(c)

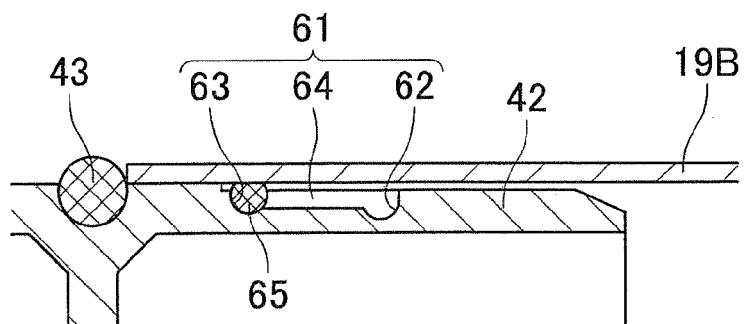


FIG.11

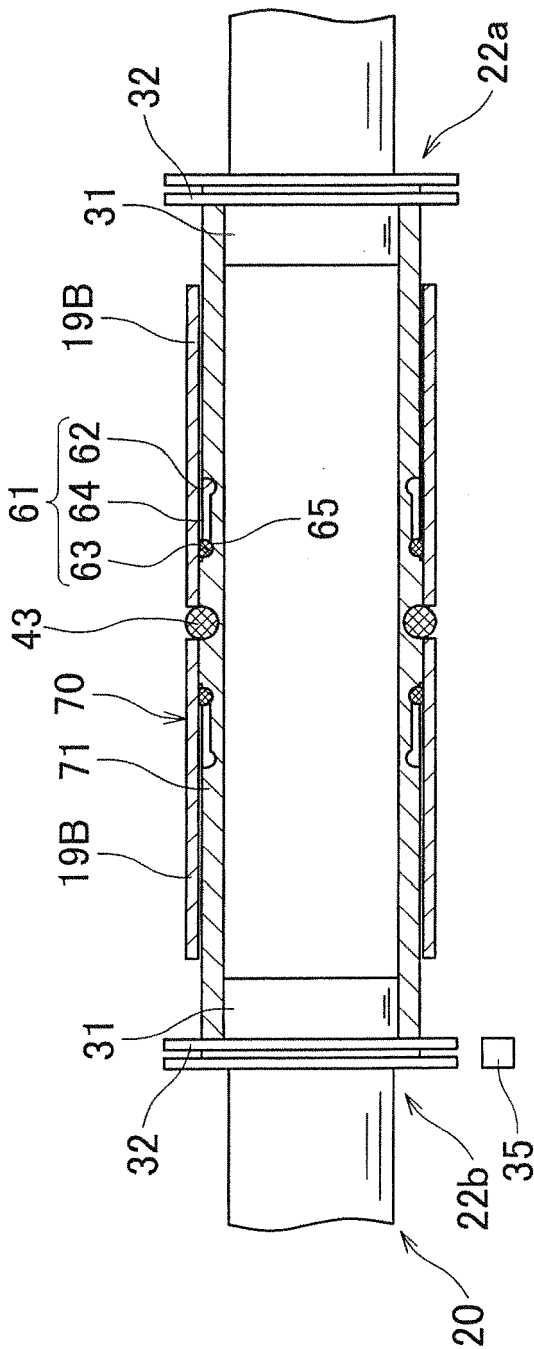
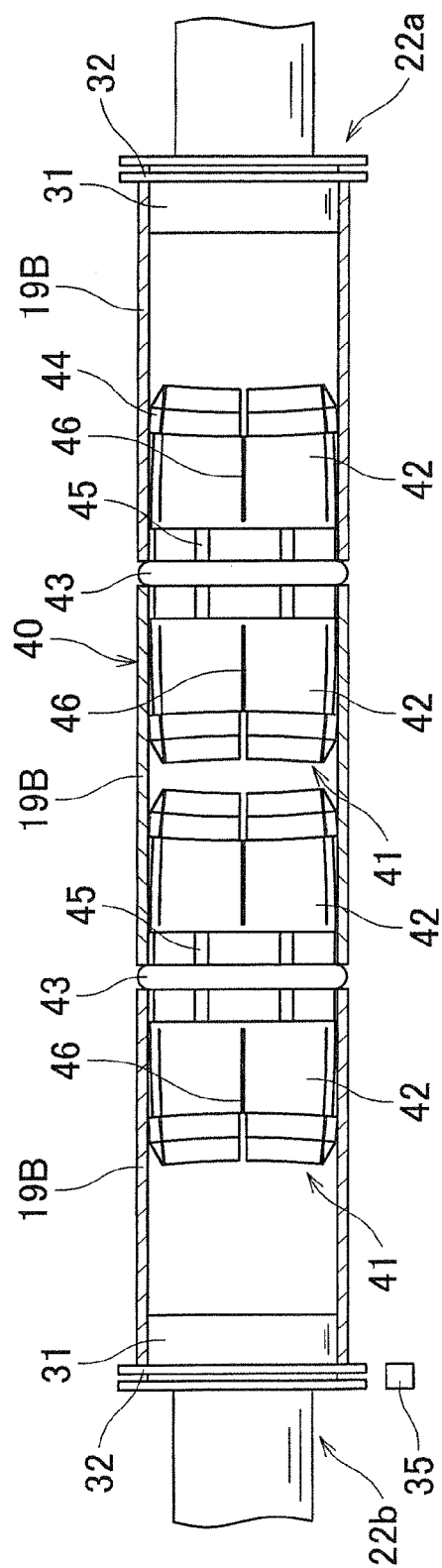


FIG. 12



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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