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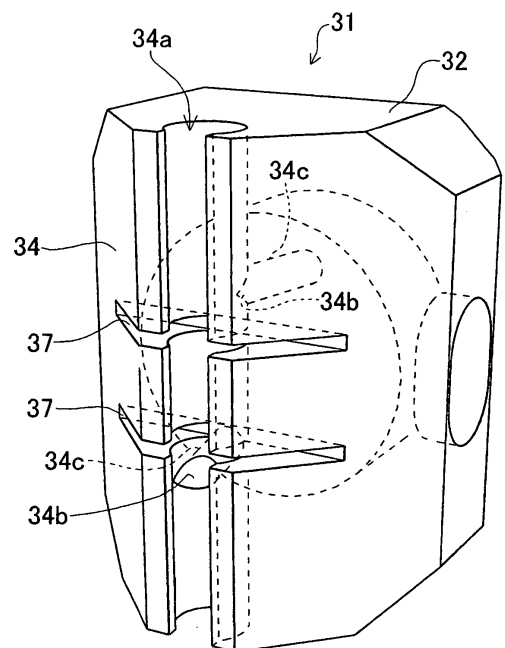
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(54) **Splicing device, yarn splicing method and joint**

(57) A twisting member (31) of a splicing device (7) includes a yarn splicing hole (34a) in which yarns to be twisted (Y, Y1, Y2) are set, groove portions (37, 37) as gas release portions (37, 37) formed in directions different from a longitudinal direction of the yarn splicing hole (34a), and air paths (34c, 34c) provided in a pair that form air injection ports (34b, 34b), respectively, in the yarn splicing hole (34a) and form whirling flows opposite to each other inside the yarn splicing hole (34a). A plurality of groove portions (37, 37) are formed, and the air injection ports (34b, 34b) formed by the air paths (34c, 34c) in the yarn splicing hole (34a) are positioned further outside than the plurality of groove portions (37, 37).

FIG. 9



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Description

[0001] The present invention mainly relates to a splicing device which applies a fluid such as compressed air to the ends of yarns in an untwisting direction, overlaps the yarn ends with each other and applies a fluid such as compressed air to the overlapping portion to splice the yarns.

[0002] As such a splicing device, for example, one is disclosed in Japanese Unexamined Patent Publication No. 2005-113314 (Document 1) which the applicant of this invention priorly submitted to the JPO. The splicing device of this Document 1 has a twisting member that injects compressed air to which a liquid is added to twist (splice) the ends of yarns. Thereby, depending on the kind of the yarns, the yarn splicing quality, external appearance, and yarn strength can be improved.

[0003] This twisting member comprises, as shown in Fig. 10 of the Document 1, a yarn splicing hole in which yarns to be twisted are set, an air injection port formed in the yarn splicing hole to inject air to which water is added, and one slit-like groove portion formed at the center of the twisting member to discharge the injected air.

[0004] Herein, according to the knowledge of the inventor of this application, in a splicing device which discharges compressed air via a groove portion formed perpendicularly to the yarn splicing hole as in the case of the Document 1, for maintaining the strength at the joint (tensile strength), it is important to properly determine the width of the groove portion (the slit width of the groove portion shown by the reference numeral 35 at the center of Fig. 10 of the Document 1), and by increasing this width of the groove portion, high strength is obtained.

[0005] However, when linen yarns are spliced with the splicing devices of the Document 1, the external appearance of the joint include one interlaced portion C between two twisted portions T and T as shown in Fig. 13. When the slit width of the groove portion is increased in the twisting member, the interlaced portion C to be formed tends to become larger. That is, when it is attempted to increase the strength at the joint, the interlaced portion C becomes conspicuous, resulting in deterioration of the external appearance.

[0006] The present invention was developed in view of these circumstances, and a main object thereof is to provide a splicing device which can form a joint that has excellent strength and excellent appearance.

[0007] The problem to be solved by the invention is as described above, and next, means for solving the problem and an effect thereof are described.

[0008] According to a first aspect of the invention, a splicing device having a twisting member that is configured as described below is provided. The twisting member comprises a yarn splicing hole in which yarns to be twisted are set, a pair of gas supply paths, respectively having an opening formed in the yarn splicing hole, wherein a pair of openings are spaced from each other in a longitudinal direction of the yarn splicing hole, and a

plurality of gas release portions connected to the yarn splicing hole so as to release a gas supplied from the gas supply paths into the yarn splicing hole in directions different from the longitudinal direction of the yarn splicing hole. A direction of one of the pair of openings is opposite to a direction of the other opening in a circumferential direction of the yarn splicing hole. Between the pair of openings, the plurality of gas release portions are disposed.

[0009] Thereby, yarn splicing can be performed while forming a joint that has an inconspicuous external appearance and excellent strength.

[0010] In this splicing device, the number of gas release portions is preferably two.

[0011] Thereby, the shape of the twisting member can be simplified and the manufacturing cost can be reduced. Even in comparison with the case where three or more gas release portions are provided, the yarn strength at the joint is almost the same. Therefore, simplification of the twisting member and yarn strength at a joint are simultaneously realized.

[0012] In the splicing device, preferably, a distance from one of the openings to one of the gas release portions is equal to a distance from the other opening to the other gas release portion.

[0013] Thereby, the whirling flows opposite to each other flow inside the yarn splicing hole in a balanced manner, so that a joint with an excellent external appearance can be formed.

[0014] In the splicing device, preferably, the gas release portions are formed into grooves crossing an entire flow path section of the yarn splicing hole.

[0015] Thereby, the gas is smoothly released in the whirling directions via the gas release portions, so that a joint with an excellent external appearance can be formed.

[0016] In the splicing device, preferably, a gas to which a liquid is added is injected from the gas supply paths.

[0017] Thereby, the ends of yarns are dampened and then the yarns are twisted, and depending on the kind of the yarns, yarn splicing quality, the external appearance, and strength at the joint can be improved.

[0018] In the splicing device, preferably, the yarns to be twisted are linen yarns, ply yarns, or core yarns.

[0019] That is, the splicing device of the invention is preferable especially for splicing special yarns listed above.

[0020] According to a second aspect of the invention, the following yarn splicing method is provided. That is, yarns to be twisted are set in a yarn splicing hole formed in a twisting member. In this state, by injecting a gas into the yarn splicing hole from respective gas supply paths provided in a pair in the twisting member, whirling flows opposite to each other are formed inside the yarn splicing hole. At least a part of the injected gas is released through a plurality of gas release portions provided between points of injection from the gas supply paths to the yarn splicing hole.

[0021] Thereby, yarn splicing can be performed while forming a joint that has an inconspicuous external appearance and excellent strength.

[0022] In the above-described yarn splicing method, preferably, the number of gas release portions is two.

[0023] Thereby, the shape of the twisting member can be simplified and the manufacturing cost of an apparatus for carrying out the yarn splicing method can be reduced.

[0024] In the yarn splicing method, preferably, a direction of releasing the gas through one of the two gas release portions and a direction of releasing the gas through the other gas release portion are almost opposite to each other.

[0025] Thereby, whirling flows opposite to each other flow in a balanced manner, so that a joint with an excellent external appearance can be formed.

[0026] In the yarn splicing method, preferably, a liquid is added to a gas to be injected into the yarn splicing hole.

[0027] Thereby, the ends of the yarns are dampened and then the yarns are twisted, and depending on the kind of the yarns, the yarn splicing quality, external appearance, and strength at the joint can be improved.

[0028] In the above-described yarn splicing method, preferably, the yarns to be twisted are linen yarns, ply yarns, or core yarns.

[0029] That is, the yarn splicing method of the invention is preferable especially for splicing special yarns listed above.

[0030] According to a third aspect of the invention, a joint is provided which is formed by splicing yarns and includes two twisted portions and a plurality of interlaced portions that are disposed between the two twisted portions and spaced from each other.

[0031] Thereby, a joint having an inconspicuous external appearance and excellent strength can be provided.

[0032] At the joint, preferably, no twisted portions are formed between the plurality of interlaced portions.

[0033] Thereby, a more inconspicuous joint can be provided.

[0034] Fig. 1 is a perspective view of a splicing device according to an embodiment of the invention;

[0035] Fig. 2 is a block diagram showing air paths of the splicing device;

[0036] Fig. 3 is an explanatory front view of attaching between the splicing device and a base member;

[0037] Fig. 4 is a front view of the splicing device;

[0038] Fig. 5 is a perspective view of a yarn splicing unit;

[0039] Fig. 6 is a sectional view of the yarn splicing unit;

[0040] Fig. 7 is a front view of the yarn splicing unit;

[0041] Fig. 8 is a side view of the yarn splicing unit;

[0042] Fig. 9 is a perspective view of a twisting member;

[0043] Fig. 10 is a perspective view of air flows inside a yarn splicing hole of the twisting member;

[0044] Fig. 11 is a schematic front view of a yarn winding unit of an automatic winder;

[0045] Fig. 12 is a schematic view of a joint formed by

the splicing device of the embodiment; and

[0046] Fig. 13 is a schematic view of a joint formed by the splicing device of the Document 1.

5 First Embodiment

[0047] Next, an embodiment of the invention is described with reference to the accompanying drawings. First, an automatic winder including a splicing device is described with reference to Fig. 11.

10 [0048] Fig. 11 shows a schematic front view of an automatic winder. A yarn winding unit 1 of this automatic winder forms a winding package P in a predetermined shape with a predetermined length by winding spun yarns (linen yarns in this embodiment) Y unwound and supplied from a yarn supplying bobbin B around a takeup bobbin Bf while traversing the yarns Y by a traversing drum 3. In Fig. 11, only one yarn winding unit 1 is illustrated, however, a plurality of such yarn winding units 1 are installed in line and an unillustrated frame control device is disposed at one end in the installing direction, whereby a yarn winder (automatic winder) is configured.

15 [0049] In the yarn winding unit 1, a unit frame 13 is provided on a horizontal one side in a front view of the yarn winding unit 1, and a yarn winding unit main body 14 that performs winding is provided on a side of the unit frame 13.

20 [0050] The yarn winding unit main body 14 comprises a cradle 2 that grips the takeup bobbin Bf, and a traversing drum (winding drum) 3 that traverses spun yarns Y. The cradle 2 is rotatively movable in directions to approach and separate from the traversing drum 3 so that a winding package P formed by winding the spun yarns Y around the takeup bobbin Bf is made to contact with and separate from the traversing drum 3. The cradle 2 includes a lift-up mechanism 2a that lifts up the cradle 2 to separate the winding package P from the traversing drum 3 when yarn breakage occurs, and a package brake mechanism 2b that stops rotation of the winding package P gripped by the cradle 2 at the same time when the cradle 2 is lifted up.

25 [0051] Spiral traversing grooves 3a are formed in the circumferential surface of the traversing drum 3 to traverse the spun yarn Y. The yarn winding unit 1 is provided with an unwinding assisting device 4, a tensioning device 5, a splicing device 7 as a yarn splicing device, and a clearer (yarn thickness detector) 8 arranged in this order from a yarn supplying bobbin B within the yarn running path between the yarn supplying bobbin B and the traversing drum 3.

30 [0052] The unwinding assisting device 4 has a cylinder covered on the core tube of the yarn supplying bobbin B, and assists unwinding of the yarns from the yarn supplying bobbin B by lowering the cylinder simultaneously with the yarn unwinding of the yarn supplying bobbin B. The tensioning device 5 applies a predetermined tension to the running spun yarns Y. As the tensioning device 5 of this embodiment, a gate type in which movable comb

teeth 5b are arranged with respect to fixed comb teeth 5a is used. The tensioning device 5 can be freely swung so that the movable comb teeth 5b mesh with or are released from the fixed comb teeth 5a. The tensioning device 5 is swung by a rotary solenoid.

[0053] The splicing device 7 splices a lower yarn Y1 from the yarn supplying bobbin B and an upper yarn Y2 from the winding package P together when the yarn has been cut by the clearer 8 as a result of a yarn defect being detected or when yarn breakage has occurred during unwinding of the yarn from the yarn supplying bobbin B. The details of the splicing device 7 will be described later. The clearer 8 detects a defect in the spun yarn Y. An analyzer (not shown in the drawings) processes a signal from the clearer 8 corresponding to the thickness of the spun yarn Y, to detect a yarn defect such as slab. Further, the clearer 8 is provided with a cutter 8a used to cut the yarn when a yarn defect is detected.

[0054] Below and above the splicing device 7, lower yarn catching and guiding means 11 for suctioning and catching a lower yarn Y1 from the yarn supplying bobbin B and guiding it to the splicing device 7, and upper yarn catching and guiding means 12 for catching an upper yarn Y2 from the winding package P and guiding it to the splicing device 7, are provided respectively. With this configuration, when the yarn is cut or broken, a suction port 11a in the lower yarn catching and guiding means 11 catches the lower yarn Y1 at the illustrated position. The suction port 11a then swings upward around a shaft 11b to guide the lower yarn Y1 to the splicing device 7. At the same time, a suction mouth 12a in the upper yarn catching and guiding means 12 swings upward from the illustrated position around a shaft 12b. The suction mouth 12a then catches the upper yarn Y2 from the reversely rotated winding package P and further swings downward around the shaft 12b to guide the upper yarn Y2 to the splicing device 7.

[0055] A detailed configuration of the splicing device 7 described above is shown in Fig. 1, and this splicing device 7 comprises a yarn splicing device main body 21 and a yarn splicing unit 22 removably provided in the yarn splicing device main body 21. Fig. 5 shows a state in that the yarn splicing unit 22 is removed from the yarn splicing device main body 21, and the yarn splicing unit 22 has a base member 24, and a first yarn guiding member 25 and a second yarn guiding member 26 provided on a front surface side (yarn running side) of the base member 24. The first yarn guiding member 25 and the second yarn guiding member 26 are removably provided in the left side (far from the unit frame 13) and right side (closer to the unit frame 13) of the base member 24, respectively. The members 24 to 26 are formed of metal or resin, which is unlikely to be corroded by water. The members 24 to 26 form a twisting chamber 23 inside.

[0056] The yarn guiding members 25 and 26 are attached to the base member 24 so as to create a gap thin and long vertically between the yarn guiding members 25 and 26. A yarn path 27 which the upper yarn Y2 and

the lower yarn Y1 pass through is formed in this thin and long gap (see Fig. 4, too). These yarn guiding members 25 and 26 have inclined surfaces 25a and 26a, respectively, on inner side walls lying opposite to each other across the yarn path 27. As shown in Fig. 6 and Fig. 7, the inclined surfaces 25a, 26a are formed to enlarge the gap of the yarn path 27 from the yarn path 27 to the leading ends of the yarn guiding members 25 and 26, and these inclined surfaces 25a and 26a guide the upper yarn Y and the lower yarn Y1 to the yarn path 27.

[0057] As shown in Fig. 6, the first yarn guiding member 25 is formed so as to entirely open a side far from the second yarn guiding member 26, and a cover member 28 is removably provided to close this opening portion. As shown in Fig. 1, Fig. 6 and Fig. 8, an opening hole 28a is formed in a central portion of the cover member 28. The twisting chamber 23 is allowed to communicate with an exterior via the opening hole 28a. This facilitates dispersion of water used for twisting in the twisting chamber 23.

[0058] On the other hand, as shown in Fig. 5 and Fig. 6, a pass-through portion 26b is formed in an outer side wall of the second yarn guiding member 26 so that a twisting shielding member 62 of a shielding mechanism 61 (shown in Fig. 1), described later passes through the pass-through portion 26b.

[0059] The base member 24 to which the yarn guiding members 25 and 26 are attached is formed to appear rectangular in a plan view, as shown in Fig. 3. Fig. 3 shows a state in which the first yarn guiding member 25, the second yarn guiding member 26 and the cover member 28 have been removed. The base member 24 integrally has appropriate standup walls 24a, 24b, and 24c, and to the standup walls 24a, 24b, and 24c, side portions 25b and 26b of the yarn guiding members 25 and 26 are attached via a packing 29, respectively (for example, see Fig. 5).

[0060] Further, as shown in Fig. 3, a twisting member 31 is provided on a front surface of an inner side of the base member 24. The details of the twisting member 31 are shown in the perspective view of Fig. 9, and this twisting member 31 includes a twisting base 32 and a twisting portion 34 formed on a front surface of the twisting base 32. The twisting base 32 is fixedly buried in the base member 24 as shown in Fig. 6.

[0061] As shown in Fig. 9, the twisting portion 34 has a yarn splicing hole 34a as a penetrating circular hole whose longitudinal direction is facing vertically, and in this yarn splicing hole 34a, the upper yarn Y2 and the lower yarn Y1 to be twisted are set (see Fig. 3). This yarn splicing hole 34a is formed substantially circular in its cross-section as shown in Fig. 6, and the front surface side of the splicing hole 34a is opened by being cut across entirely in the longitudinal direction of the yarn splicing hole 34a so that the upper yarn Y2 and the lower yarn Y1 can be set in the yarn splicing hole 34a through this opening portion. That is, the yarn splicing hole 34a is opened in three sides of both longitudinal ends and a

front surface side.

[0062] As shown in Fig. 9, at the twisting portion 34 of the twisting member 31, two slit-like groove portions (gas release portions) 37 and 37 are formed in the horizontal direction perpendicular to the longitudinal direction of the yarn splicing hole 34a. The two groove portions 37 and 37 are arranged in the longitudinal direction (vertically) of the yarn splicing hole 34a while set parallel to each other. The respective two groove portions 37 and 37 are concaved to appropriate depths in the direction to set the upper yarn Y2 and the lower yarn Y1 in the yarn splicing hole 34a, and are connected to the yarn splicing hole 34a while crossing the yarn splicing hole 34a in a cross shape in a plan view. In detail, the concave depths of the groove portions 37 are set so that the groove portions 37 cross the entire section (flow path section) perpendicular to the longitudinal direction of the yarn splicing hole 34a.

[0063] However, the direction of the groove portions 37 and 37 is not limited to the direction perpendicular to the longitudinal direction of the yarn splicing hole 34a, and it is just required that the groove portions 37 and 37 are formed in a direction different from the longitudinal direction of the yarn splicing hole 34a. For example, the groove portions 37 and 37 can be formed in a direction inclined from the horizontal. The two groove portions 37 and 37 are not limited to be parallel to each other, and they can be disposed so as to be inclined opposite to each other in a V shape. Furthermore, the gas release portions are not limited to the groove shapes, and can be formed into, for example, through holes.

[0064] Inside the twisting member 31, a pair of air paths 34c and 34c as gas supply paths are piercedly provided while spaced from each other in the axial direction (longitudinal direction) of the yarn splicing hole 34a. The ends of the respective air paths 34c and 34c form air injection ports (openings) 34b and 34b in the inner wall of the yarn splicing hole 34a. The pair of air injection ports 34b and 34b are disposed while leaving a predetermined space from each other in the longitudinal direction of the yarn splicing hole 34a. The plurality of groove portions 37 and 37 are disposed between the two air injection ports 34b and 34b. In other words, the upper air injection port 34b is positioned higher than the upper groove portion 37 and the lower air injection port 34b is positioned lower than the lower groove portion 37. The distance from the upper (one) air injection port 34b to the upper (one) groove portion 37 and the distance from the lower (the other) air injection port 34b to the lower (the other) groove portion 37 are set equal to each other.

[0065] Furthermore, as shown in Fig. 6, the upper air injection port 34b is directed so as to match clockwise with the wall face of the yarn splicing hole 34a with a circular section. On the other hand, the lower air injection port 34b is directed so as to match counterclockwise with the wall face of the yarn splicing hole 34a. That is, the direction of one air injection port 34b is opposite that of the other air injection port 34b in the circumferential direction of the yarn splicing hole 34a.

[0066] A water supply tank 44 is connected to the air paths 34c and 34c as shown in Fig. 2, and from the upper and lower air injection ports 34b and 34b, air to which water is added is injected to the inside of the yarn splicing hole 34a as described later. As described above, the air injection ports 34b and 34b are formed facing in opposite directions from each other in the circumferential direction of the yarn splicing hole 34a, so that in the area between the two groove portions 37 and 37, whirling flows opposite to each other (their spiral axial directions are also opposite to each other and spiral circumference directions are also opposite to each other) are generated inside the yarn splicing hole 34a. As shown in Fig. 10, a part of compressed air injected into the yarn splicing hole 34a from each of the pair of air injection ports 34b and 34b is released from the longitudinal ends of the yarn splicing hole 34a, and the residual air is released from the internal space of the yarn splicing hole 34a perpendicularly (horizontally or circumferential directions of the whirling flows) to the longitudinal direction of the yarn splicing hole 34a through the respective two groove portions 37 and 37. Thereby, the twisting member 31 entangles and twists the upper yarn Y2 and the lower yarn Y1 set in the yarn splicing hole 34a by the air flows while dampening these by water.

[0067] The compressed air that was injected from the upper air injection port 34b and has reached the upper groove portion 37 is released to one side in the longitudinal direction (one horizontal side) of this groove portion 37. On the other hand, the compressed air that was injected from the lower air injection port 34b and has reached the lower groove portion 37 is released to the other longitudinal side (the other horizontal side) of this groove portion 37. Furthermore, the groove portions 37 are formed so as to cross the entire flow path section of the yarn splicing hole 34a, so that the whirling flows inside the yarn splicing hole 34a are smoothly released in the whirling directions via the groove portions 37.

[0068] Thus, the two whirling flows are released opposite to each other via the respective groove portions 37, and the air is smoothly released via the respective groove portions 37, so that balanced smooth whirling flows opposite to each other are realized, and a joint with an excellent external appearance is formed.

[0069] The twisting member 31 configured as described above is provided on a front surface side of the base member 24 so that the yarn splicing hole 34a is aligned with the yarn path 27 as shown in Fig. 6. On the other hand, on the rear side of the base member 24, a twisting plug 35 is provided, and an outlet side of this twisting plug 35 is connected to the back face of the twisting member 31 and the outlet is in communication with the air injection ports 34b and 34b via the air paths 34c and 34c formed inside the twisting member 31. On the other hand, the inlet side of the twisting plug 35 is communicated with a twisting valve 41 via the first air path 36a formed of such as piping, and then communicated with a compressed air supplying device 42 that supplies

compressed air as shown in Fig. 2. A branch 36b is connected to the first air path 36a and the branch 36b is in communication with the water supply tank (liquid supply source) 44 via a water supply valve 43.

[0070] As shown in Fig. 7 and Fig. 8, a plurality of suction ports 24d which are opened to the twisting chamber 23 are formed in the base member 24. Each suction port 24d is in communication with a suction device 46 via a suction valve 45 as shown in Fig. 2. In this configuration, when the suction valve 45 is opened, the air and water used for twisting can be sucked from the twisting chamber 23 via the suction ports 24d and then discharged to the exterior of the device.

[0071] As shown in Fig. 1 and Fig. 4, a yarn handling lever 54 that draws the upper yarn Y2 and the lower yarn Y1 to the yarn splicing unit 22, a cutter 55 that cuts the yarn guided by the cut yarn guide 53a, and a clamp mechanism 56 that fixes the yarn guided by the fixed yarn guide 53b are provided in this order both above and below the untwisting members 53 and 53 disposed across the yarn splicing unit 22.

[0072] The yarn handling levers 54 are formed into an arched member rotatively movable around a position located aside from the yarn splicing unit 22 so as to properly rotatively move when splicing yarns.

[0073] Further, a shielding mechanism 61 is disposed to one side of the yarn splicing unit 22. The shielding mechanism 61 has a twisting shielding member 62 that prevents water from scattering toward the front surface side during a twisting operation, a base member wall shielding member 63 that supports the twisting shielding member 62, and a shielding member rotative moving mechanism 64 that swings and rotatively moves the shielding members 62 and 63. As shown in Fig. 3, the twisting shielding member 62 has a shielding portion 65 having a leading end surface formed like a plane, and a shielding support member 66 that supports a trailing end of the shielding portion 65. The shielding portion 65 is formed to be able to entirely cover the opening on the front surface side of the yarn splicing hole 34a in the twisting member 31. The shielding member rotative moving mechanism 64 is formed so as to rotatively move the respective members to close the opening on the front surface side of the yarn splicing hole 34a by the shielding portion 65 at twisting and prevent water used for twisting from scattering around the yarn splicing hole 34a.

[0074] The above-described components of the yarn winding unit main body 14 are supported by the unit frame 13 shown in Fig. 11. The unit frame 13 has a built-in unit control device (not shown in the drawings), and this unit control device includes a storage part that stores rewritable programs described so as to operate the components, and an arithmetic part that can execute the programs. The unit control device further includes an input/output part connected to the winding unit main body 14 so as to input signals from the yarn winding unit main body 14 to the input/output part and to output signals to the winding unit main body 14, and a communications

part connected to the frame control device so as to transmit and receive data to and from the frame control device.

[0075] A description will be given of operations of the splicing device 7 in the above configuration. While the spun yarn Y unwound from the yarn supplying bobbin B is being wound around the takeup bobbin Bf to form a winding package P while being traversed, for example, when yarn breakage occurs or a yarn defect is detected by the clearer 8 and the spun yarn Y is cut and the lower yarn Y1 from the yarn supplying bobbin B is separated from the upper yarn Y2 from the winding package P, the splicing device 7 starts yarn splicing.

[0076] In detail, the suction port 11a of the lower yarn catching and guiding means 11 catches the lower yarn Y1 at the illustrated position, and the lower yarn catching and guiding means 11 then swings upward around the shaft 11b to guide the lower yarn Y1 to front of the splicing device 7. At the same time, the upper yarn catching and guiding means 12 swings upward from the illustrated position around the shaft 12b, and the suction mouth 12a then catches the upper yarn Y2 from the winding package P and further swings downward around the shaft 12b to guide the upper yarn Y2 to front of the splicing device 7.

[0077] Subsequently, a water supplying operation and a first yarn handling operation are performed. During a water supplying operation, the water supplying valve 43 remains open for a predetermined period. Thereby, a predetermined amount of water from the water supply tank 44 shown in Fig. 2 is supplied to the first air path 36a. Further, during a first yarn handling operation, the upper and lower yarn handling levers 54 and 54 shown in Fig. 3 are rotatively moved from the illustrated standby position, and the upper yarn Y2 and lower yarn Y1 located in front side of the splicing device 7 are drawn toward the yarn splicing unit 22 and collected in the yarn path 27. Thus, as shown in Fig. 4, the upper yarn Y2 passes through the yarn path 27 and the yarn splicing hole 34a, and the upper yarn Y2 is guided between the side of the fixed yarn guide 53b of the untwisting member 53 located above and the cut yarn guide 53a of the untwisting member 53 located below. On the other hand, the lower yarn Y1 passes through the yarn path 27 and the yarn splicing hole 34a, and the lower yarn Y1 is guided between the side of the fixed yarn guide 53b of the untwisting member 53 located below and the cut yarn guide 53a of the untwisting member 53 located above.

[0078] Subsequently, a clamping operation is performed, and the upper yarn Y2 and the lower yarn Y1 guided by the fixed yarn guide 53b are respectively fixed by the upper and lower clamp mechanisms 56. Then, a cutting operation is performed to cut the lower yarn Y1 and the upper yarn Y2 guided by the cut yarn guide 53a by the cutter 55.

[0079] Once the clamping operation and the cutting operation are completed, an untwisting operation is performed. Specifically, the untwisting valve 47 is opened to allow compressed air to flow from the untwisting air port 53d to the untwisting chamber 53c. Then, the lower

yarn Y1 and the upper yarn Y2 guided by the cut yarn guide 53a are drawn into the untwisting chambers 53c of the upper and lower untwisting members 53. The yarn ends are then untwisted.

[0080] Once the untwisting operation is completed, the shielding mechanism 61 is activated to shield the front surface side of the yarn splicing hole 34a by the shielding portion 65. Subsequently, the yarn handling levers 54 are further appropriately rotatively moved to position the ends of the upper yarn Y2 and lower yarn Y1 cut by the cutter 55 in the yarn splicing hole 34a in the twisting member 31. In this case, the shielding portion 65 just makes contact with the front surface of the twisting portion 34 of the twisting member 31, and the longitudinal ends of the yarn splicing hole 34a are left open, so that the shielding portion 65 does not contact with the yarn. Therefore, the ends of the upper yarn Y2 and the lower yarn Y1 do not deviate from the regular position.

[0081] Subsequently, a twisting operation is performed to open the twisting valve 41. Thus, as shown in Fig. 2, compressed air flows through the first air path 36a to atomize a predetermined amount of water supplied to the first air path 36a during the water supplying operation. The water is then injected to the yarn splicing hole 34a through the air injection ports 34b and 34b together with the compressed air. Then, the misty water dampens the ends of the upper yarn Y2 and lower yarn Y1, and compressed air injected from the two air injection ports 34b and 34b whirl in directions opposite to each other inside the yarn splicing hole 34a, whereby entangling the ends of the upper yarn Y2 and lower yarn Y1 with each other for sufficient twisting. Then, the compressed air is released to the exterior of the yarn splicing hole 34a by passing through the inside of the groove portions 37 and 37. During this twisting operation, the front surface side of the yarn splicing hole 34a is shielded by the shielding portion 65, so that water is not injected forward from the yarn splicing hole 34a. As described above, the compressed air injected from the respective air injection ports 34b and 34b is flown opposite to each other inside the respective grooves 37 and 37 and then released.

[0082] Once the twisting operation is completed as described above, the shielding mechanism 61 is activated to return into the original standby position that opens the front side of the yarn path 27, and the yarn handling levers 54 are rotatively moved to return to their standby positions. Then, the traversing drum 3 shown in Fig. 11 is rotated and winding of the yarn Y around the takeup bobbin Bf is restarted.

[0083] An external appearance of a joint formed by thus splicing the upper yarn Y2 and the lower yarn Y1 (both are linen yarns) is shown in Fig. 12, and as shown in Fig. 12, the joint formed by the splicing device 7 of this embodiment includes two twisted portions T and T formed by the above-described whirling flows and two interlaced portions C and C that are disposed between the two twisted portions T and T and spaced from each

other. The number (two) and forming positions of the interlaced portions C and C correspond to the number (two) and positions of the groove portions 37 and 37 in the twisting portion 34.

[0084] Thus, the two interlaced portions C and C are formed while spaced from each other, so that the size of one interlaced portion C can be made smaller than that of the joint (Fig. 13) of the Document 1. Therefore, the joint becomes inconspicuous and the external appearance of the yarn spliced portion can be avoided from becoming remarkably different from other portions. In addition, the two interlaced portions C and C are formed, so that excellent strength of the joint can be secured.

[0085] Conversely, the two interlaced portions C and C are formed, so that even when the slit widths of the groove portions 37 and 37 of the twisting member 31 are reduced and each of the interlaced portions C and C is made smaller, sufficient strength necessary at the joint can be secured.

[0086] As described above, the twisting member 31 of the splicing device 7 of this embodiment includes a yarn splicing hole 34a in which an upper yarn Y2 and a lower yarn Y1 to be twisted are set, air paths 34c and 34c that form openings in the yarn splicing hole 34a and are provided in a pair to form whirling flows opposite to each other inside the yarn splicing hole 34a, and two groove portions 37 and 37 connected to the yarn splicing hole 34a for releasing compressed air that is supplied to the yarn splicing hole 34a from the air paths 34c and 34c perpendicularly to the longitudinal direction of the yarn splicing hole 34a. Between the air injection ports 34b and 34b formed in the yarn splicing hole 34a by the respective air paths 34c and 34c, the plurality of groove portions 37 and 37 are disposed. In other words, the air injection ports 34b and 34b formed in a pair are positioned further outside than the two groove portions 37 and 37 (the sides of the longitudinal ends of the yarn splicing hole 34a) so that one of these is positioned higher than the upper groove portion 37 and the other air injection port 34b is positioned lower than the lower groove portion 37.

[0087] Looking at the splicing device 7 from another viewpoint, it is regarded as a configuration using the following method for yarn splicing. That is, an upper yarn Y2 and a lower yarn Y1 to be twisted are set in the yarn splicing hole 34a formed in the twisting member 31, and in this state, compressed air is injected from the respective air paths 34c and 34c provided in a pair in the twisting member 31 to the yarn splicing hole 34a, whereby whirling flows opposite to each other are formed inside the yarn splicing hole 34a. At least a part of the injected compressed air passes through the plurality of groove portions 37 and 37 provided in parallel to each other between the points of injection (the air injection ports 34b and 34b) to the yarn splicing hole 34a from the air paths 34c and 34c, and is then released to the exterior.

[0088] A joint formed by the splicing device 7 or the above-described yarn splicing method includes, as shown in Fig. 12, two twisted portions T and T and two

interlaced portions C and C disposed between the two twisted portions T and T and spaced from each other.

[0089] Therefore, yarn splicing can be performed while forming a joint that has an inconspicuous external appearance and excellent strength. Furthermore, as shown in Fig. 12, no twisted portion is formed between the two interlaced portions C and C, so that the joint becomes more inconspicuous.

[0090] A preferred embodiment of the invention is described above, and the embodiment can be further modified as follows.

[0091] In the embodiment, linen yarns are spliced, however, without limiting to this, the splicing device 7 can also be used for splicing yarns other than linen yarns. However, the splicing device of the embodiment can splice yarns that are difficult to be twisted/untwisted such as the illustrated linen yarns, core yarns, ply yarns (that is, so-called special yarns) by joints that are excellent in strength and inconspicuous, so that the splicing device of the embodiment is especially preferable for splicing these yarns.

[0092] The splicing device 7 is configured for performing yarn splicing by using compressed air to which water is added, however, the liquid is not limited to water, and the gas to be injected is not limited to the compressed air. It is also possible that a splicing device which splices yarns by using only compressed air without water added is provided with the twisting member 31 of Fig. 9 to perform yarn splicing.

[0093] In the embodiment, the number of groove portions 37 and 37 of the twisting member 31 is two, however, it can be three or more. For example, when four groove portions are provided, the four groove portions 37 are disposed between the pair of air injection ports 34b and 34b. However, as in the case of the embodiment, it is preferable that two groove portions 37 and 37 are provided because this simplifies the shape of the twisting member 31.

[0094] The distance between the groove portions 37 and 37, the forming depths and slit widths of the groove portions 37 and 37 are not limited to those of Fig. 9. The air injection ports 34b and 34b are not limited to one pair, and two or more pairs can be provided.

[0095] The splicing device 7 can also be applied to textile machineries with other configurations as well as the automatic winder illustrated in Fig. 11.

Claims

1. A splicing device (7) comprising a twisting member (31), wherein the twisting member (31) comprising:

a yarn splicing hole (34a) in which yarns to be twisted (Y, Y1, Y2) are set;
a pair of gas supply paths (34c, 34c), respectively having an opening (34b) formed in the yarn

splicing hole (34a), wherein a pair of openings (34b, 34b) are spaced from each other in a longitudinal direction of the yarn splicing hole (34a); and

a plurality of gas release portions (37, 37) that are connected to the yarn splicing hole (34a) to release a gas supplied from the gas supply paths (34c, 34c) into the yarn splicing hole (34a), in directions different from the longitudinal direction of the yarn splicing hole (34a), and a direction of one (34b) of the pair of openings (34b, 34b) is opposite to that of the other opening (34b) in a circumferential direction of the yarn splicing hole (34a), and the plurality of gas release portions (37, 37) are disposed between the pair of openings (34b, 34b).

2. The splicing device (7) according to Claim 1, wherein the number of gas release portions (37, 37) is two.
3. The splicing device (7) according to Claim 2, wherein a distance from one (34b) of the openings (34b, 34b) to one (37) of the gas release portions (37, 37) is equal to a distance from the other opening (34b) to the other gas release portion (37).
4. The splicing device (7) according to any one of Claims 1 through 3, wherein each gas release portion (37) is formed as a groove (37) crossing an entire flow path section of the yarn splicing hole (34a).
5. The splicing device (7) according to any one of Claims 1 through 4, wherein a liquid supply source (44) is connected to the gas supply paths (34c, 34c).
6. The splicing device (7) according to any one of Claims 1 through 5, wherein yarns to be twisted (Y, Y1, Y2) are linen yarns, ply yarns, or core yarns.
7. A yarn splicing method wherein, yarns to be twisted (Y, Y1, Y2) are set in a yarn splicing hole (34a) formed in a twisting member (31), in this state, a gas is injected into the yarn splicing hole (34a) from respective gas supply paths (34c, 34c) provided in a pair in the twisting member (31) to form whirling flows opposite to each other inside the yarn splicing hole (34a), and at least a part of the injected gas is released to the exterior through a plurality of gas release portions (37, 37) provided between points of injection from the gas supply paths (34c, 34c) to the yarn splicing hole (34a).
8. The yarn splicing method according to Claim 7, wherein the number of gas release portions (37, 37) is two.

9. The yarn splicing method according to Claim 7 or 8, wherein a direction of releasing the gas through one (37) of the two gas release portions (37, 37) is almost opposite to a direction of releasing the gas through the other gas release portion (37). 5
10. The yarn splicing method according to any one of Claims 7 through 9, wherein a liquid is added to a gas to be injected into the yarn splicing hole (34a). 10
11. The yarn splicing method according to any one of Claims 7 through 10, wherein yarns to be twisted (Y, Y1, Y2) are linen yarns, ply yarns, or core yarns.
12. A joint formed by splicing yarns, comprising: two twisted portions (T, T); and a plurality of interlaced portions (C, C) that are disposed between the two twisted portions (T, T) and spaced from each other. 15

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FIG. 1

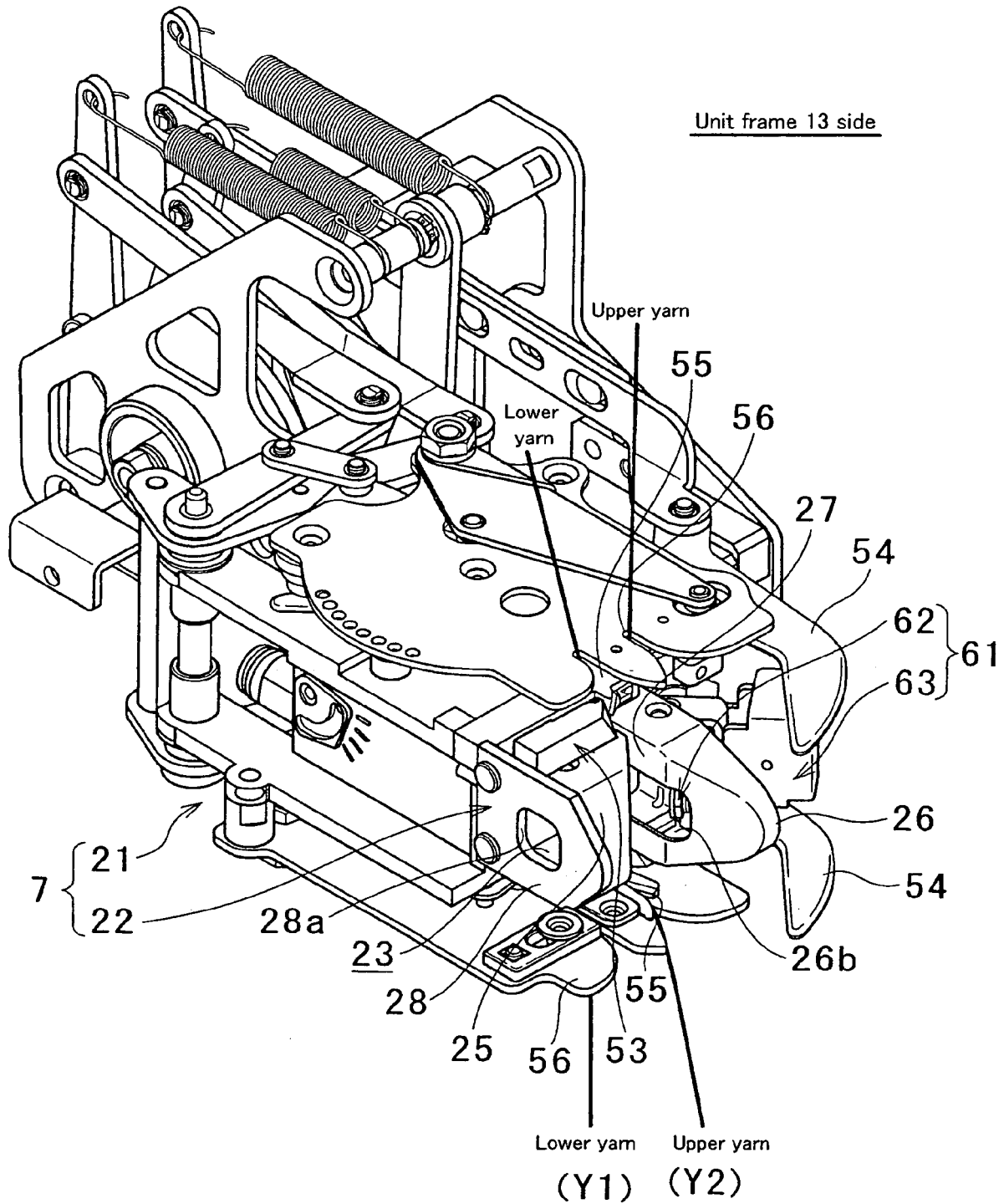


FIG. 2

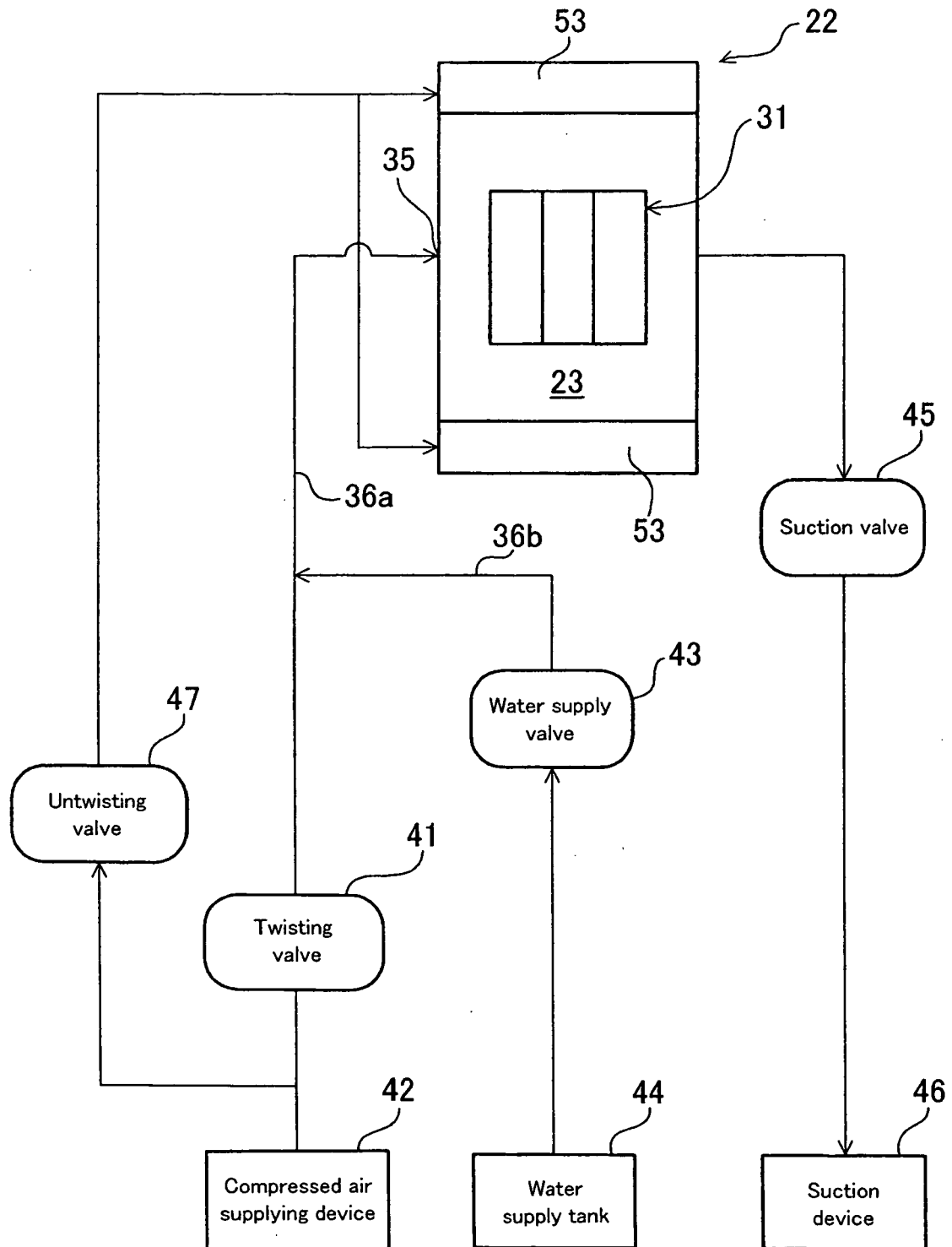
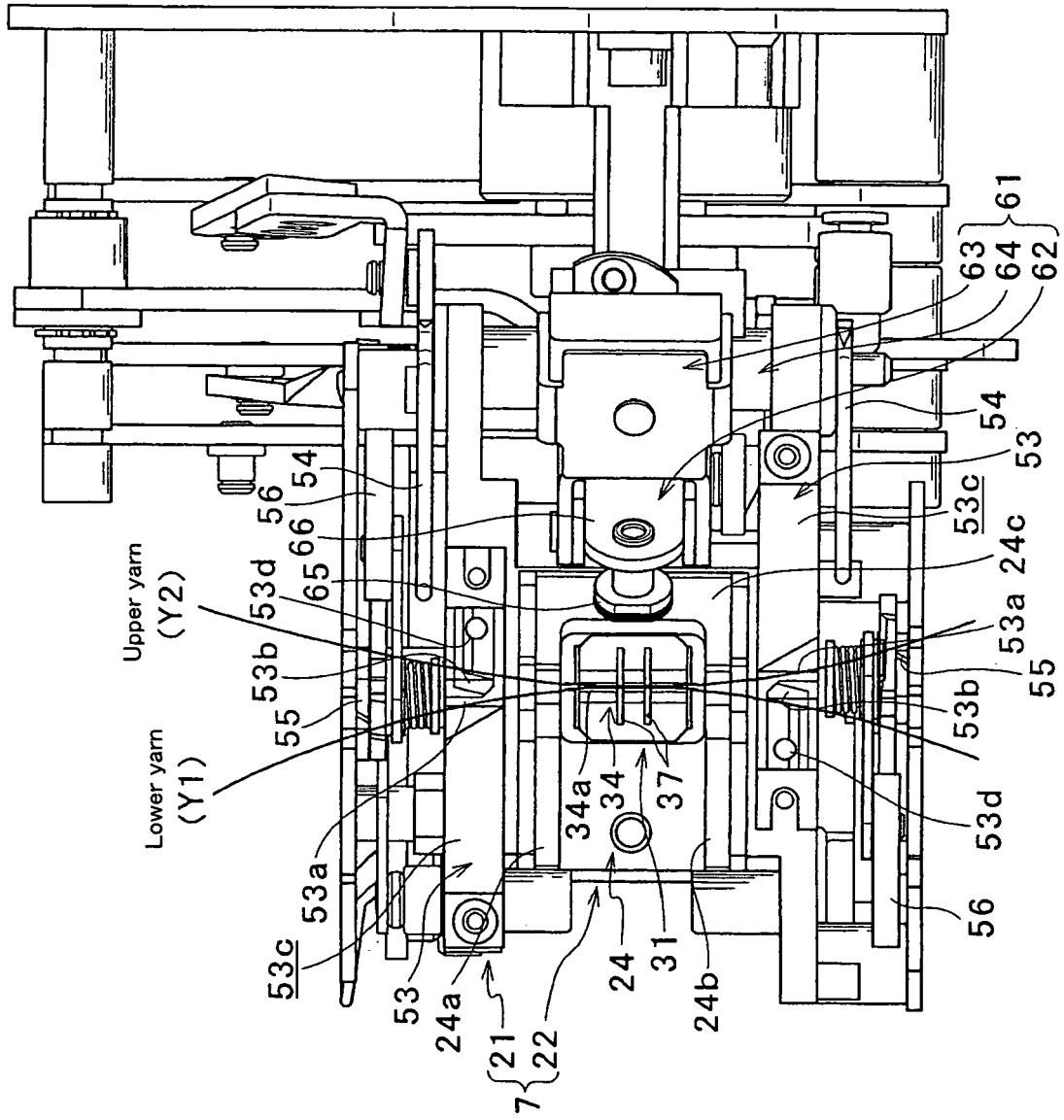


FIG. 3



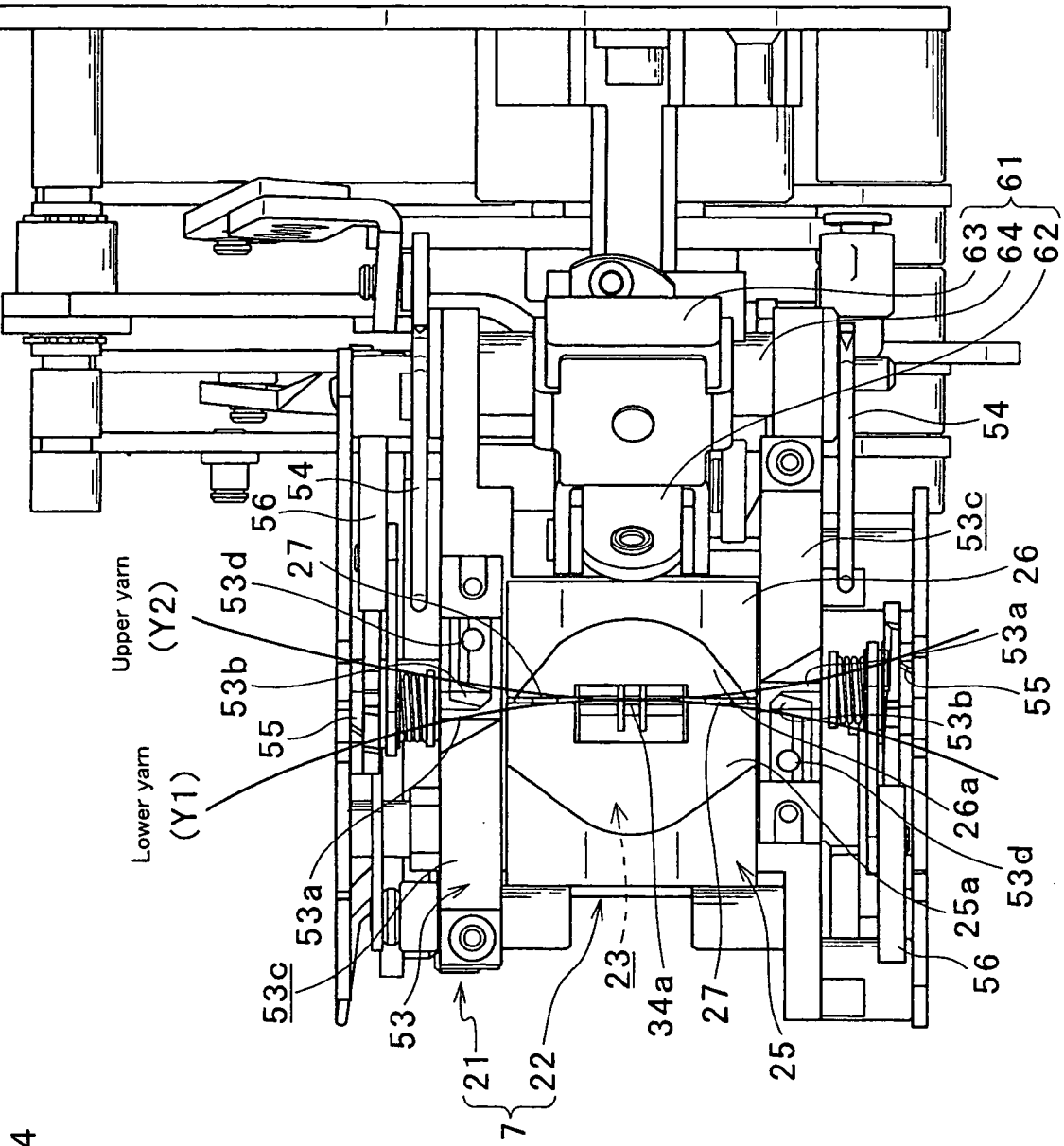


FIG. 4

FIG. 5

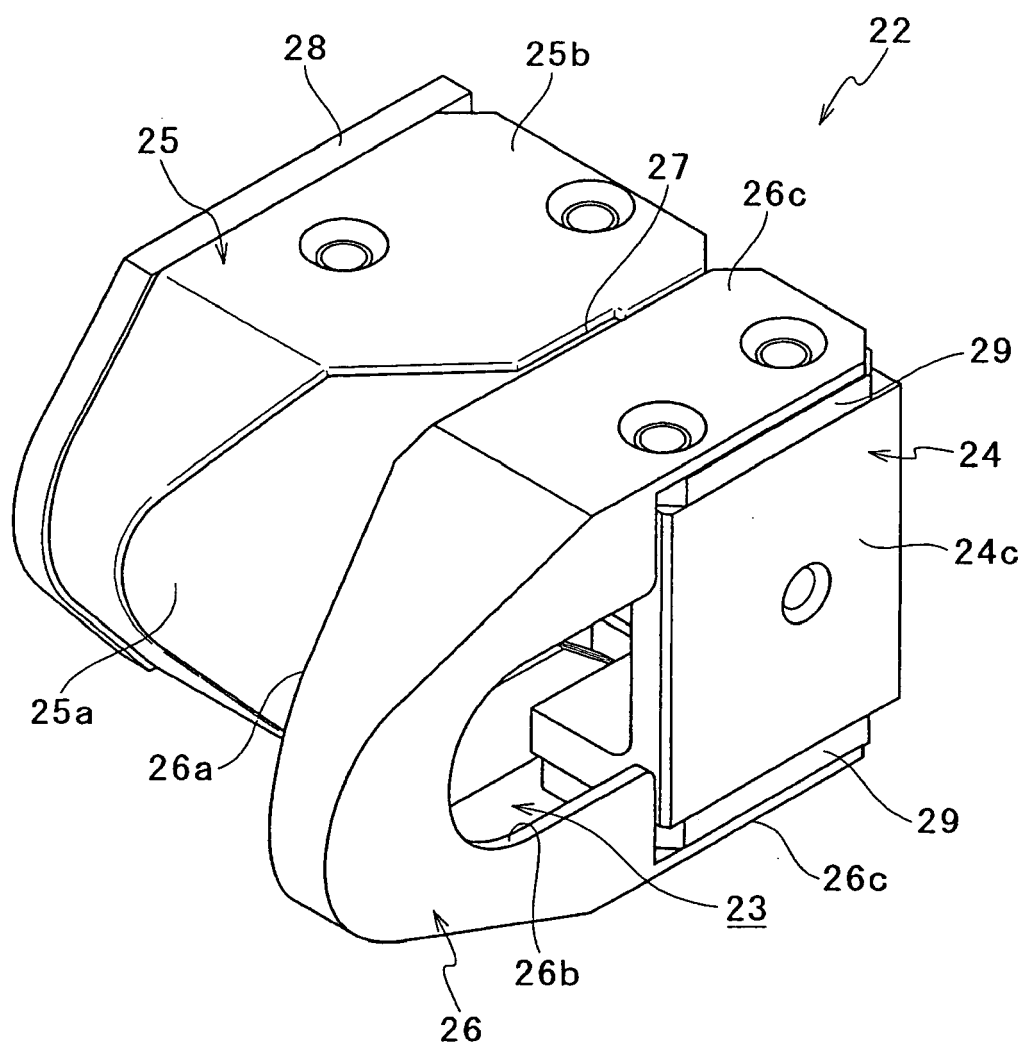


FIG. 6

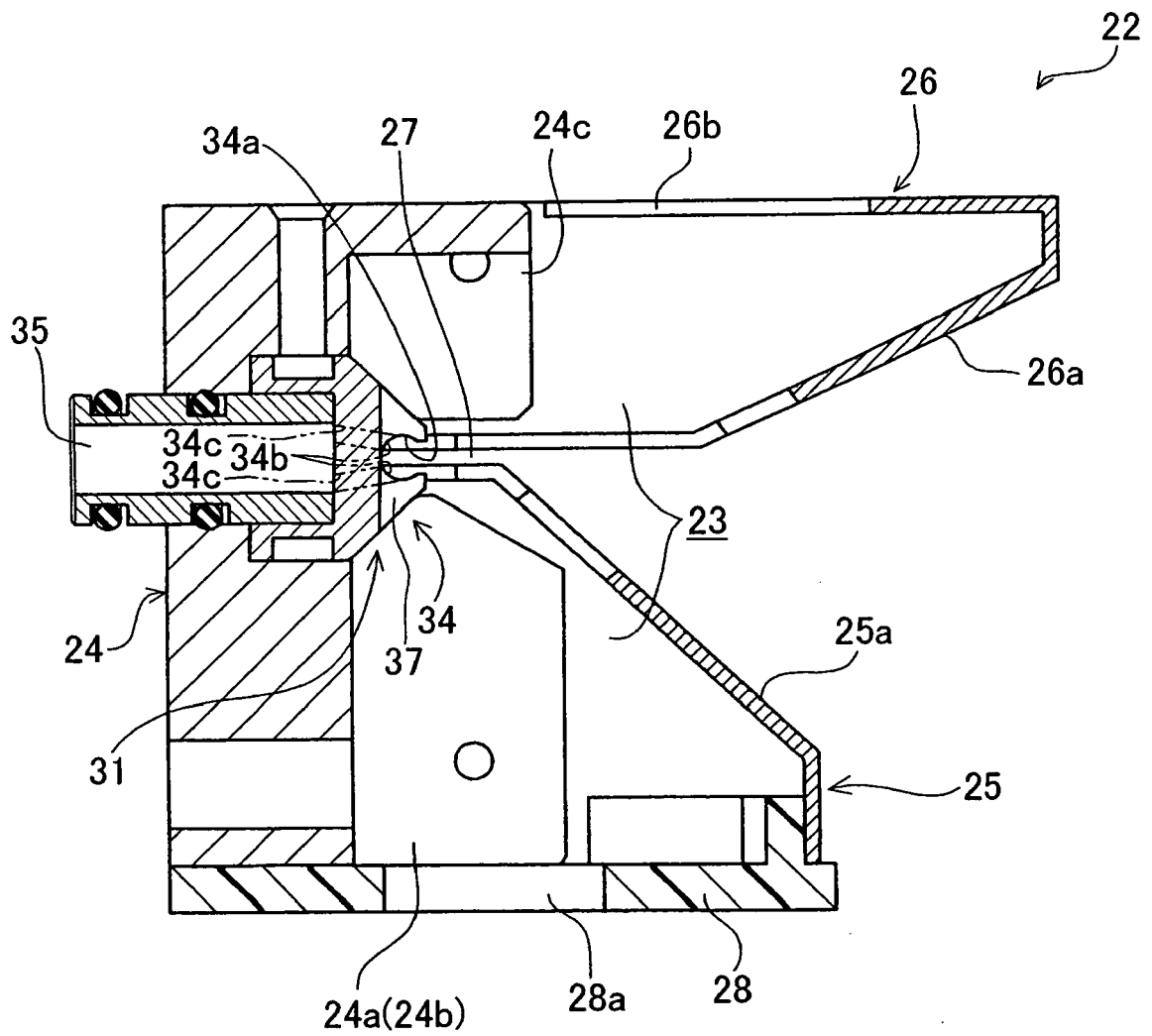


FIG. 7

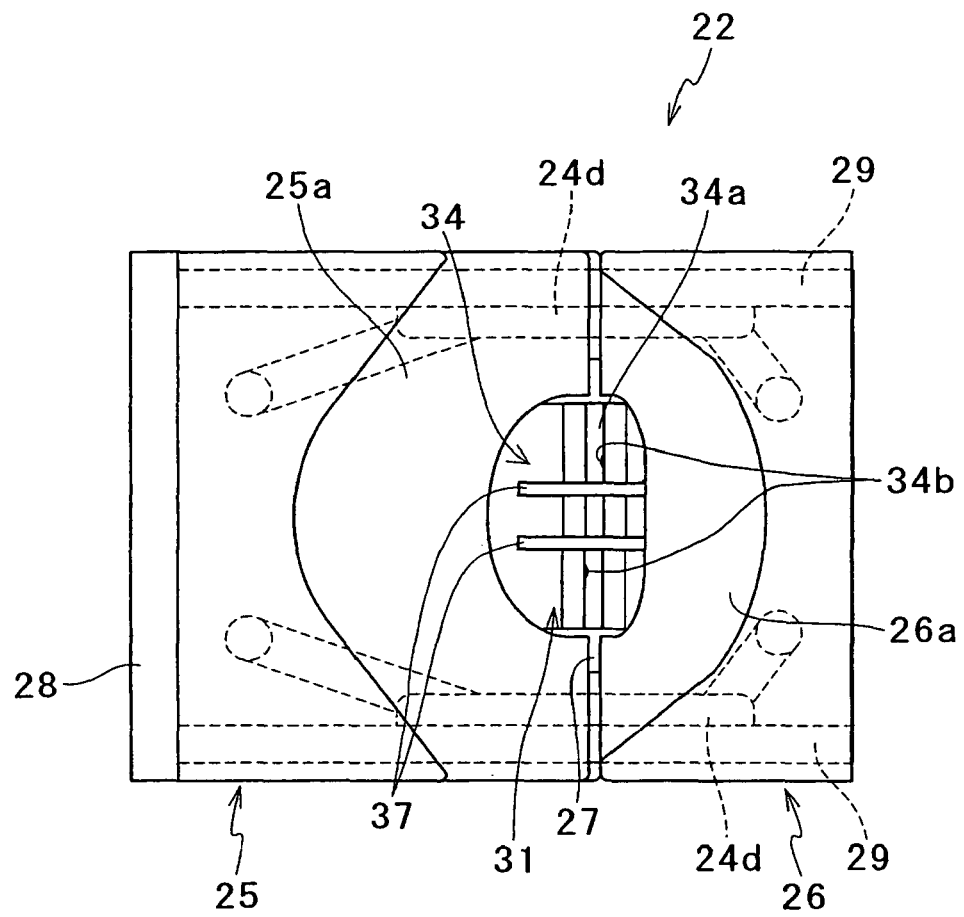


FIG. 8

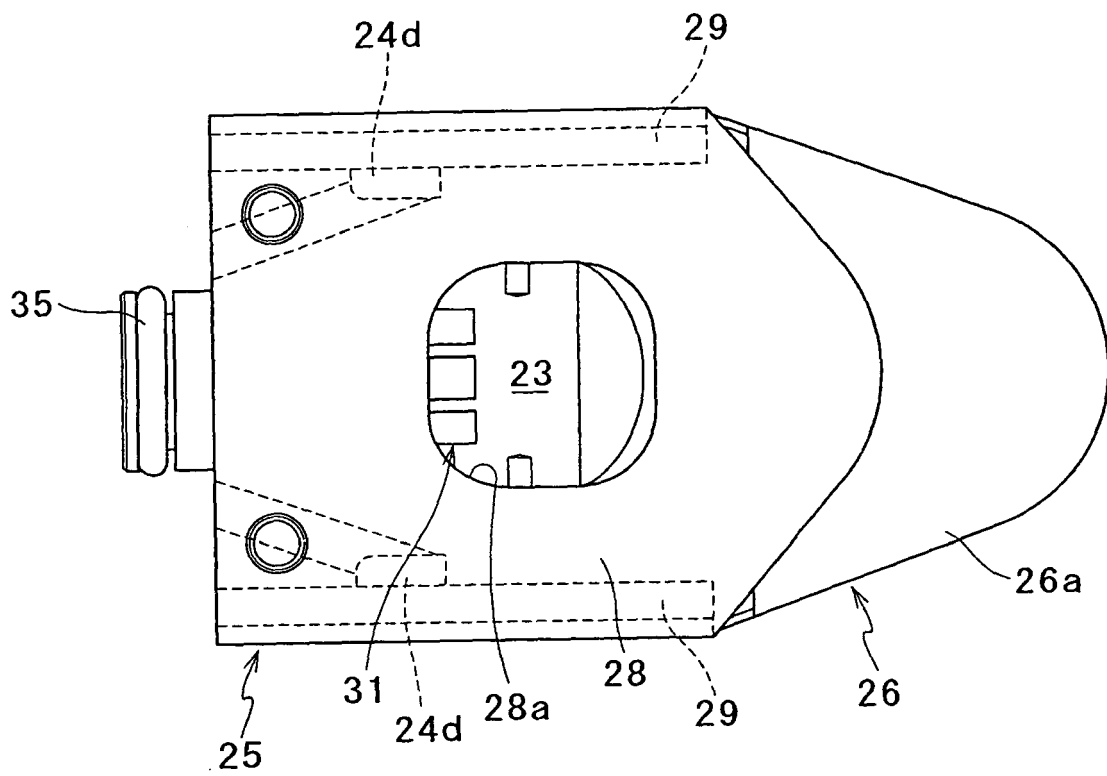


FIG. 9

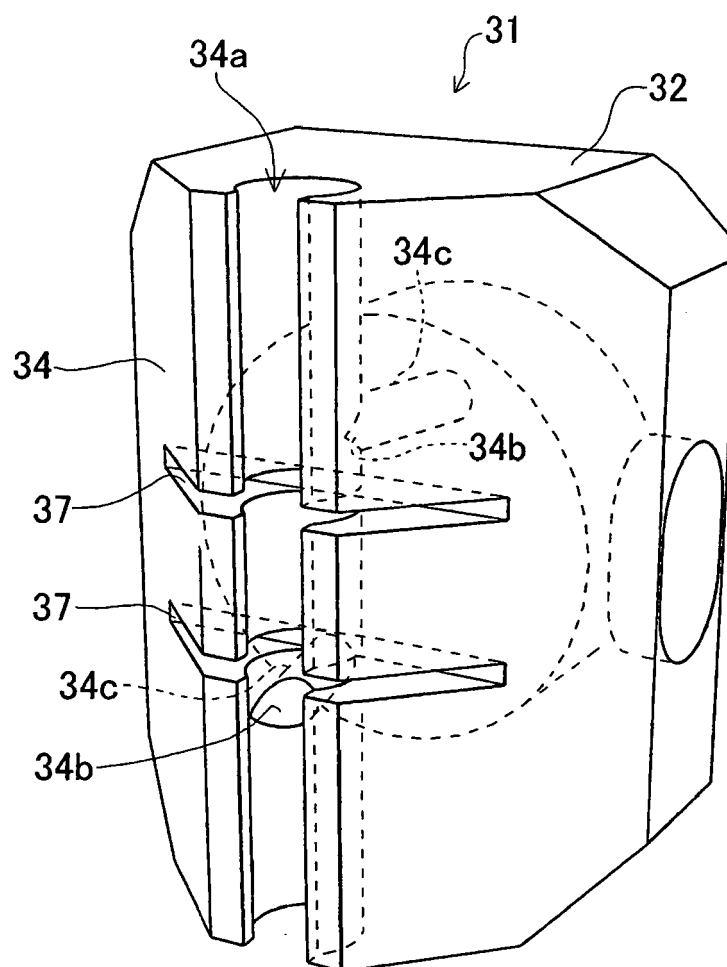


FIG. 10

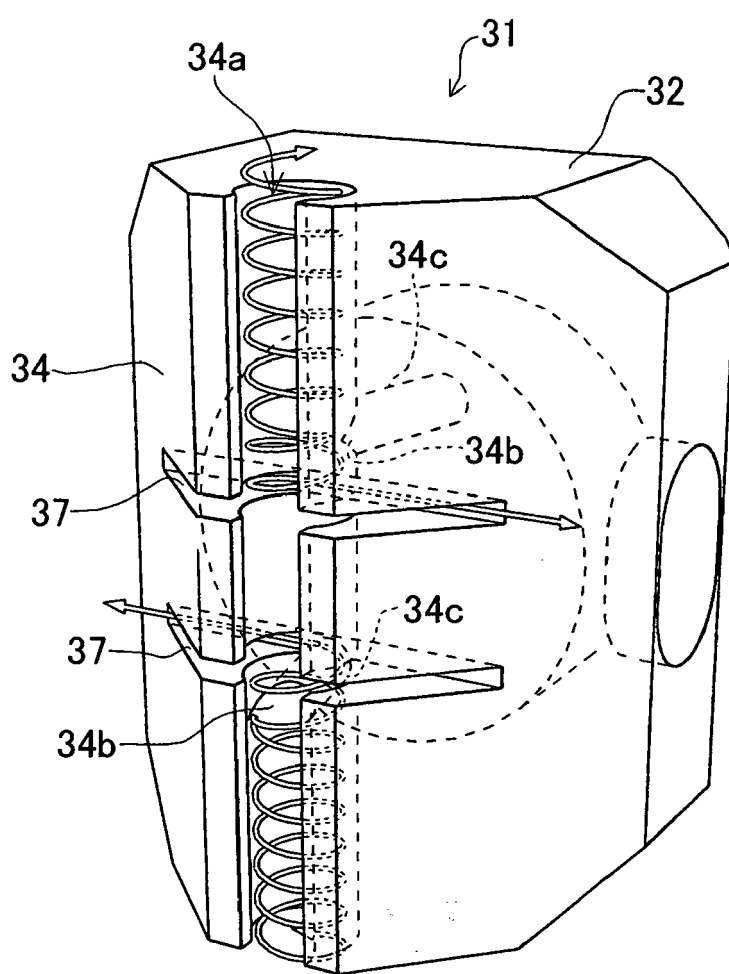


FIG. 11

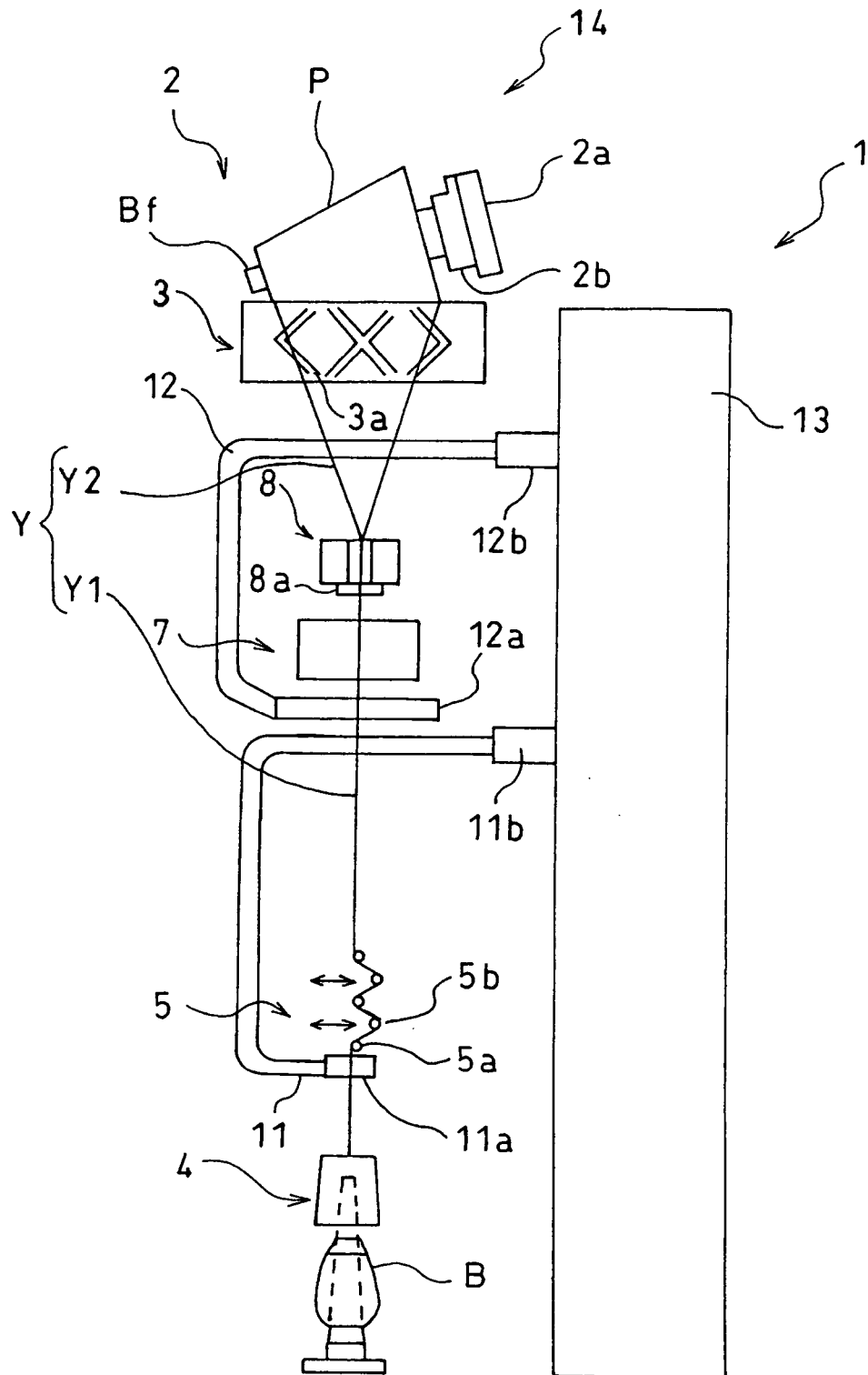


FIG. 12

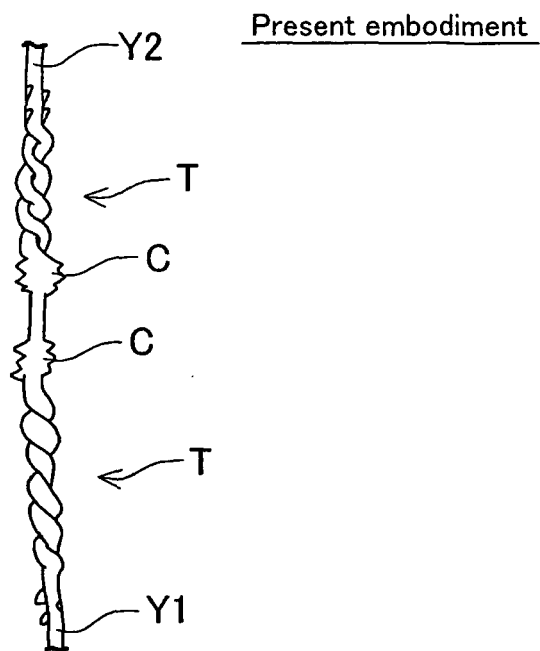
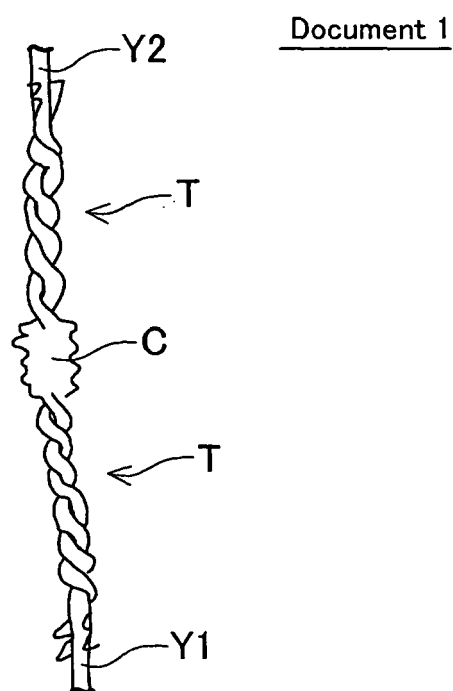


FIG. 13



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005113314 A [0002]