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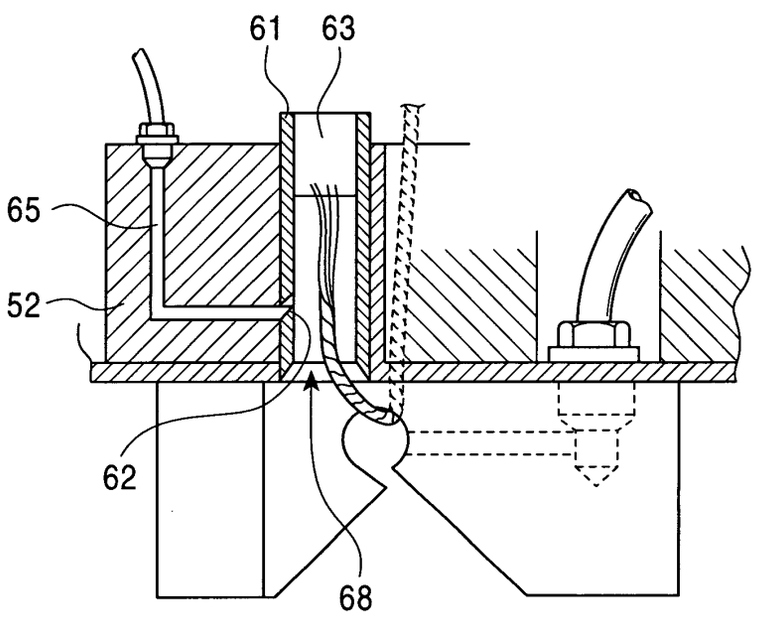
(54) Splicer and splicing method

(57) To provide a splicer that can obtain a joint having enough strength even for a spun yarn that is difficult to be untwisted such as hard twist yarn of wool, by preventing protrudent section from being formed. The untwisting nozzles 43, 44 include a nozzle pipe 61, a fluid fluid jet hole 62 which has an opening at the inner surface of the nozzle pipe 61 for generating whirling flow within the nozzle pipe 61, and a collision member 63 provided at a position prescribed distance away from the fluid jet hole 61 to the downstream side of the fluid flowing direction. The collision member 63 is provided such that the yarn end being swung by the whirling flow collides against the upstream side edge of the fluid flowing direction.

FIG. 5



EP 1 384 696 A1

Description

Field of the Invention

[0001] The present invention relates to a splicer and a splicing method for splicing spun yarns, and especially to fluid-typed splicer and splicing method for splicing the yarns without forming knot, by joining yarn ends that are untwisted by fluid such as compressed air or the like, placing in overlapping relationship one on the other, and applying fluid such as compressed air or the like to the overlapping section.

Background of the Invention

[0002] In case a slub catcher detects a yarn breakage or detects a yarn defect while the yarn is being wound by a spinning machine or a winder, the splicer carries out splicing in the following way. The splicer pulls each of an upper yarn end and a lower yarn end and clamps the yarn ends, and leads each of the yarn ends to different untwisting nozzles to untwist the yarn ends by compressed fluid so that the yarn ends become suitable for splicing. In addition, the splicer pulls each of the yarn ends into a splicing nozzle, places in overlapping and presses the yarn ends by a yarn pressing lever, and carries out splicing by the function of the compressed air. Such a splicer is well known by, for example, the Unexamined Japanese Patent Application Publication (Tokkai-shou) No.64-26742. For untwisting mechanism in such a fluid-typed splicer, a tubular pipe (nozzle pipe), which inner wall surface is smooth, is used for the untwisting nozzle.

[0003] The above-mentioned well-known splicer is suitable for splicing of the spun yarns that is formed by twisting short fibers, which the fiber length is short, such as a general cotton yarn. However, when splicing hard twist yarn such as wool (spun woolen yarn), which the fiber length is longer than cotton, by the well-known splicer, there were many cases in which splicing is not carried out properly. That is, when the yarn ends in the untwisting nozzle are untwisted by applying compressed air, the yarn ends are not eliminated with a prescribed amount of fiber by the yarn ends being completely loosed as a cotton yarn. As shown in Figure 10, a non-untwisted section (a) generates due the tip side of untwisted section in the yarn end being not untwisted (or retwisted).

[0004] That is, the untwisted state is formed, such that in order from the yarn end, a leading end side untwisted section (k1) which the length is short, the non-untwisted section (a), and a root side untwisted section (k2) which the length is long, are formed. Therefore, when overlapping and splicing the yarn ends that are incompletely untwisted, as shown in Figure 11, hairiness-like protrudent sections (h) that can be considered as a result of each leading end side untwisted section (k1), are formed by being extended to the sides from the edges of the joined section (b) as a result of each root side untwisted section (k2). As a result, the joint was insufficient in appearance and in yarn strength.

[0005] The object of the present invention is to provide a splicer and splicing method that can obtain joints having enough strength, even for spun yarn that is difficult to be untwisted, such as hard twist yarn of wool, by preventing the above-mentioned protrudent sections from being formed.

Summary of the Invention

[0006] According to a first aspect of the present invention, in a splicer comprising an untwisting nozzle for untwisting introduced yarn end, the untwisting nozzle includes a nozzle pipe, a fluid jet hole that has an opening at inner surface of the nozzle pipe for generating whirling flow within the nozzle pipe, and a collision member that is provided at a position that is prescribed distance away from the fluid jet hole, to downstream side in fluid flowing direction. The collision member is provided in a state such that the yarn end swung by the whirling flow collides against the upstream side edge of the fluid flowing direction.

[0007] According to the first aspect of the present invention, the twist of the yarn end is untwisted by being swung by the whirling flow of the compressed air, between the jet hole and the collision member within the untwisting nozzle. The yarn end section, which is untwisted by the whirling flow, collides vigorously against the edge (and the side) of the collision member flutteringly, and the yarn leading end section is blown off and eliminated by shock. In other words, a section to the tip from the non-untwisted section (refer to Figure 10) in the conventional hard twist yarn can be eliminated during untwisting action by the collision with the collision member. As a result, the protrudent sections can be prevented from being remained at both sides of the joint after the splicing operation of overlapping the yarn ends that are eliminated with the section to the tip from the non-untwisted section. In addition, the splicing can be carried out satisfactorily.

[0008] According to a second aspect of the present invention, in a splicer comprising an untwisting nozzle for untwisting introduced yarn end, the untwisting nozzle includes a nozzle pipe, a fluid jet hole which has an opening at internal surface of the nozzle pipe for generating whirling flow within the nozzle pipe, and a compartment member which is provided at a position that is prescribed distance away from the fluid jet hole, to downstream side in the fluid flowing direction. In addition, the compartment member divides the internal space of the nozzle pipe into a plurality of sectional spaces substantially.

[0009] According to the second aspect of the present invention, the twist of the yarn end is untwisted by being swung by the whirling flow of the compressed air, between the jet hole and the compartment member within

the untwisting nozzle. In addition, turbulent flow generates in the internal space of the nozzle pipe that is divided by the compartment member. As a result of the turbulent flow, the fiber can be blown off and eliminated by the shock being applied to the leading end section of the yarn end section that is untwisted by the whirling flow, or by the shock due to the collision with the compartment member. In other words, the section to the tip from the non-untwisted section (refer to Figure 10) in the conventional hard twist yarn can be eliminated during the untwisting operation as a result of the turbulent flow by the compartment member. As a result, the protrudent sections are prevented from being remained at both sides of the joint after the splicing operation of overlapping the yarn ends that are eliminated with the section to the tip from the non-untwisted section. In addition, the splicing can be carried out satisfactorily.

[0010] According to a third aspect of the present invention, the collision member of first aspect of the present invention or the compartment member of the second aspect of the present invention is formed of a plate material that extends from a position that is prescribed distance away from the jet hole in the downstream side of the fluid flowing direction, to the downstream side.

[0011] According to the third aspect of the present invention, since the collision member and the compartment member are formed as a plate material that extends to the downstream side in the fluid flowing direction, the collision effect with the yarn end, or the turbulent flow effect by the compartment can be generated reliably, while minimizing the narrowing of the internal space of the nozzle pipe.

[0012] According to a fourth aspect of the present invention, a ratio between a distance from a center of the jet hole to the collision member according to the first aspect or the compartment member according to the second aspect, and an inner diameter of the nozzle pipe in the jet hole section is set within a range of 1.5:1～3.5:1.

[0013] According to the fourth aspect of the present invention, since the ratio between the distance from the center of the jet hole to the collision member or the compartment member, and an inner diameter of the nozzle pipe in the jet hole section is set within the range of 1.5:1～3.5:1, while executing the untwisting function of the yarn end by the whirling flow sufficiently, the effect according to the first aspect or the effect according to the second aspect can be obtained.

[0014] According to a fifth aspect of the present invention, in a splicer comprising an untwisting nozzle for untwisting introduced yarn end, the untwisting nozzle comprises a nozzle pipe, and a fluid jet hole which has an opening at internal surface of the nozzle pipe for generating whirling flow within the nozzle pipe. In addition, the nozzle pipe includes a whiling flow generating range that is formed as an internal space, which is approximately circular-shaped in cross section, at a prescribed range in the downstream side of the fluid flowing direction from the fluid jet nozzle, and a turbulent flow generating range that is formed as an internal space, which is noncircular-shaped in cross section, at the downstream side of the whirling flow generating range.

[0015] According to the fifth aspect of the present invention, in the whirling flow generating range that is formed as a nozzle pipe internal space, which is circular-shaped in cross section, at a prescribed range at the downstream side of the fluid flowing direction from the jet hole, the twist of the yarn end is untwisted by the yarn end being swung by the whirling flow of the compressed air. In addition, at the downstream side of the whirling flow generating range, in the turbulent flow generating range that is formed as a nozzle pipe internal space which is noncircular shaped in cross section, a shock due to the turbulent flow is applied to the tip end of the yarn end, and the fiber is blown off and eliminated. In other words, the section to the tip from the non-untwisted section in the conventional untwisted hard twist yarn can be eliminated by the turbulent flow as a result of the compartment member at the untwisting operation. As a result, the protrudent sections are prevented from being remained at both sides of the joint after the splicing operation of overlapping the yarn ends that are eliminated with the section to the tip from the non-untwisted section. In addition, the splicing can be carried out satisfactorily.

[0016] A sixth aspect of the present invention relates to a splicing method for carrying out splicing by untwisting yarn end by using whirling flow within the untwisting nozzle, overlapping the yarn ends to form overlapping section, and applying fluid to the overlapping section. In such a method, the leading end section of the yarn end that whirls within the untwisting nozzle by the whirling flow, rotates on its axis while colliding against a member provided within the untwisting nozzle, and as a result, the yarn end is untwisted while a prescribed amount of fiber among the fiber that composes the leading end section of the yarn end is sucked and eliminated.

[0017] According to the sixth aspect of the present invention, the structure of the fifth aspect is made into methods, and same effects can be obtained as the effects of the fifth aspect.

Brief Description of the Drawings

[0018]

Figure 1 is a schematic view showing configuration of a winding unit of an automatic winder.

Figure 2 is a front view showing an air-typed splicer.

Figure 3 is a plane view of Figure 2.

Figure 4 is a cross-sectional view showing an example of a splicing member.

Figure 5 is a plane view showing one part of untwisting mechanism, which shows a relation between a splicing member and an untwisting nozzle.

Figures 6A～6C show configuration of the untwist-

ing nozzle. Figure 6A is a sectional side view, Figure 6B is a side view, and Figure 6C is a partial plane view.

Figure 7A is a side view showing untwisting action within the untwisting nozzle, and Figure 7B is a view showing an action of a whirling flow.

Figure 8 is a view showing a relationship of positions of Z-twisted yarn and the untwisting nozzle.

Figure 9 is a view showing a relationship of positions of S-twisted yarn and the untwisting nozzle.

Figure 10 is a side view showing untwisted state of a hard twist yarn by the conventional untwisting mechanism.

Figure 11 is a side view showing a state in which a hard twist yarn is spliced by the conventional splicer.

Figure 12 is a view for explaining yarn shifting and yarn cutting processes.

Figure 13 is a view for explaining yarn end untwisting process.

Figure 14 is a view for explaining splicing process.

Figure 15 is a view showing the untwisting nozzle of a first different structure.

Figure 16 is a view showing the untwisting nozzle of a second different structure.

Figure 17 is a view showing the untwisting nozzle of a third different structure.

Detailed Description of the Preferred Embodiments

[0019] An embodiment of the present invention will be described in accordance with the drawings.

[0020] Figure 1 shows a schematic view of configuration of one of winding units of an automatic winder, which is provided with a splicer of the present invention.

[0021] A rewinding from a spinning bobbin (supply yarn winding body) B to a winding package P in a winding unit U, is carried out by a yarn Y drawn out from the spinning bobbin B that is set on a tray (transporting medium) 1 being wound on the winding package P, which is rotated by a traverse drum 5 with a groove, via an unwinding auxiliary device 2, a tension applying device 3, and a slub catcher (yarn defect detecting device) 4. At this time, in the case the slub catcher 4 detects yarn defects such as a slub or the like in the running yarn Y, a cutter provided inside or in proximity to the slub catcher 4 operates to cut the running yarn Y. After the winding is stopped, the splicing operation is carried out.

[0022] Such a splicing operation is carried out by a winding side yarn end guiding means 10, a supply yarn side yarn end guiding means 11, and a splicer 12. When the running yarn Y is cut, the lower yarn is sucked by a suction mouth 11a of the supply yarn side yarn end guiding means 11. The upper yarn is wound to the winding package P. The winding side yarn end guiding means 10 swings from bottom up with a shaft 10b as the center, such that the suction mouth 10a is along the winding package P. At that time, the traverse drum 5 with a groove rotates backward, and the yarn end is sucked by the suction mouth 10a. When the winding side yarn end guiding means 10, which sucked the yarn end, swings from top down, the upper yarn of the winding side is guided to the splicer 12. Meanwhile, when the supply yarn side yarn end guiding means 11 swings from bottom up with a shaft 11b as the center, the lower yarn at the supply yarn side is guided to the splicer 12. Then, the splicer 12 splices the yarn ends, and the rewinding is restarted.

[0023] Figure 2 and Figure 3 show the schematic configuration of the splicer 12. During the normal rewinding, the yarn YS takes a path from the bobbin B, via a fixed guide 16 that is provided at one side of the slub catcher 4 and rotating guides 17, 18 that are provided at both sides of the slub catcher 4, and above the splicer 12, to the package P.

[0024] The splicer 12 joins the yarn ends of the spun yarns that are formed by twisting fibers. The splicer 12 is basically provided with a splicing member 41, a yarn pressing device 42, untwisting nozzles 43, 44, a yarn shifting lever 45, yarn cutting devices 46, 47, and yarn clamp devices 48, 49. The guiding of the yarn ends by the winding side yarn end guiding means 10 and the supply yarn side yarn end guiding means 11 are not carried out simultaneously, and are carried out with some time lag. That is, first, a yarn end YP at the package P side is guided to the splicer 12. The yarn end YP at the package side is sucked and trapped by the winding side yarn end guiding means 10 that is swung to a trapping position in proximity to the package P. Approximately at the same time as the winding side yarn end guiding means 10 swings and stops at below the splicer 12, a rotating lever 20 of the clamp device 49 at the package P side rotates by a control cam (not shown in the drawings), contacts against a supporting block 21 that is fixed in a place, and stops. At that time, the yarn YP is threaded to the rotating lever 20 and transfers, and the yarn YP is clamped between the supporting block 21 and the rotating lever 20.

[0025] Meanwhile, the yarn YP that is located at the fixed guide 16 and the rotating guides 17, 18 while the rotating lever 20 is operating, advances along slanting edges 16a, 17a, 18a of the guides 16, 17, 18, and into a guide channel 19. Then, the slub catcher 4 that is located at the same position as the guide channel 19 checks presence or absence of the yarn YP, and checks whether or not two yarns are sucked by the winding side yarn end guiding means 10 by a mistake.

[0026] After checking the yarn YP, the rotating guides 17, 18 rotate in a counterclockwise direction with a shaft 22 as a pivot by a control cam (not shown in the drawings). Then, the yarn YP falls off from the slub catcher 4, and is inserted into thread undercuts 17b, 18b of the rotating guides 17, 18.

[0027] Furthermore, approximately at the same time as the rotation of the rotating guides 17, 18, the yarn end YB at the supply yarn side that is sucked and

trapped by the supply yarn side yarn end guiding means 11 directly after the yarn cut, is guided to above the splicer 12 by the swing of the supply yarn side yarn end guiding means 11. Approximately at the same time as the swing of the supply yarn side yarn end guiding means 11 stops, a supporting plate 23a of the clamp device 48 hooks and transfers the yarn YB in the same direction as the rotating lever 20 along the guide plate 24 by a control cam (not shown in the drawings). The supporting plate 23a contacts against a supporting block 23b that is fixed in a place, and the yarn YB is clamped between the supporting plate 23a and the supporting block 23b.

[0028] The splicing member 41 is provided at approximately the center of the splicer 12, and as shown in Figure 2, yarn end control plates 25, 26, the yarn pressing device 42, the untwisting nozzles 43, 44, guide plates 27a, 27b, guide rods 28a, 28b, the yarn cutting devices 46, 47, and fork guides 29, 30 are provided sequentially. In addition, the yarn shifting lever 45, which is comprised of a shaft 31 and levers 32, 33 that rotate with the shaft 31 as the pivot, is provided to the side of the splicing member 41. The yarn shifting lever 45 guides the yarn ends YP, YB to the direction to the splicer 12, after the supply yarn side yarn end guiding means 11 and the winding side yarn end guiding means 10 guide each of the yarn ends YP, YB to outside the splicer 12. Further, the rotating range of the yarn shifting lever 45 is a range that the yarn shifting lever 45 contacts against a stopper 34 that is provided between the fork guide 29 and the yarn clamp device 48.

[0029] As shown in Figure 4, the splicing member 41 is secured to a bracket 52 by using a bolt 53 via a front plate 51. A cylindrical splicing hole 54 is formed at approximately the center of the splicing member 41, and a slit 55 that is suitable for inserting the yarns YP, YB from outside is formed along the entire tangential direction of the splicing hole 54. Fluid jet nozzle holes 56, 57 are drilled at the splicing hole 54 so that to be opened and connected to the splicing hole 54. The nozzle holes 56, 57 are provided at positions that are to be different in a right angle direction of the page of Figure 4, such that the whirling directions of the fluid that are blown out from the nozzle holes 56, 57 are to be the opposite of one another.

[0030] That is, the splicer 12 includes the splicing member 41 that is provided with a fluid jet nozzle for splicing. The splicer 12 untwists the twist of the tip sections of both yarn ends (the section that are to be joined during splicing) by the untwisting nozzle 43 for the yarn end at the winding side and the untwisting nozzle 44 for the yarn end at the supply yarn side. Then, the splicer 12 joins the yarn ends by applying whirling flow of fluid such as the compressed air or the like at the splicing member 41. The untwisting nozzle 43 is provided to the lower side of the splicing member 41, and the untwisting nozzle 44 is provided to the upper side of the splicing member 41.

[0031] Next, the untwisting nozzle will be described. Further, an "upstream side " and a "downstream side" to be mentioned in the description below are defined by a direction in which the fluid blown out from a fluid jet hole 62 flows within a nozzle pipe 61. That is, the upstream side within the nozzle pipe 61 is closer to a nozzle opening 68 (inlet), and the downstream side is away from the nozzle opening 68 (inlet).

[0032] The untwisting nozzles 43, 44 are the same, and it will be described of one of the nozzles, the nozzle 43. As shown in Figure 6, at a position that is prescribed distance from the nozzle opening 68 of the nozzle pipe 61, the untwisting nozzle 43 is provided with the fluid jet hole 62 that is opening at the inner surface of the nozzle pipe 61, a whirling flow generating range SR that is formed as an internal space 61a, which is circular shaped in cross section, at a prescribed range at the downstream side from the jet hole 62, and a turbulent flow generating range LR that is formed as sectional spaces 66, 66 to be hereinafter described, which are internal spaces having non-circular shape in cross section, at the downstream side of the whirling flow generating range SR. Further, the fluid jet hole 62 is formed slanting toward the downstream side in relation to the orthogonal direction of the pipe shaft center, so as to blow the fluid into the nozzle pipe 61 in a direction slanting to the downstream side.

[0033] When describing in a further detail, the untwisting nozzle 43 is formed of a cylindrical nozzle pipe 61 that includes an inlet section 61A, which the inner diameter is approximately constant along the entire length, and a taper section 61B, which is provided continuously to the downstream side of the inlet section 61A and which the inner diameter is tapered out toward the downstream side. In addition, the fluid jet hole 62 for compressed air is formed at a section located prescribed distance away from the upstream side end (yarn inlet) of the inlet section 61A. That is, the fluid jet hole 62 is formed along the inlet section 61A. In addition, a compartment plate 63 is provided at the taper section 61B for dividing the internal space in a direction intersecting with a third shaft center (z), which is the pipe shaft center.

[0034] The fluid jet hole 62 is slanting at α in relation to the third shaft center (z) in the sectional view direction shown in Figure 6A. The fluid hole 62 is slanting at β in relation to the third shaft center (z) in the plane view direction shown in Figure 6C. In this example, it is set such that α=45 degrees, and β=16 degrees respectively. The compartment plate 63 is inserted and fixed by being pressed in at slits 64, 64 that are formed to penetrate through the nozzle pipe 61, under a state in which extending in the diameter direction passing through the third shaft center (z). The compartment plate 63 is set at a range from some point in the taper section 61B to a pipe outlet 67, and as shown in Figure 6B, the compartment plate 63 is slanting γ (=21 degrees) in relation to a first shaft center (x). In addition, from the view in the third shaft center direction, the fluid jet hole 62 is slanting

in relation to a second shaft center (y) that is orthogonal to the first shaft center (x), in other words, the fluid fluid jet hole 62 is slanting to the side to approach to the slanting direction of the compartment plate 63 (refer to Figure 6B).

[0035] For reference, the length of the compartment plate 63 is set at a value that is 40% of the entire length of the nozzle pipe 61. In addition, a ratio between a distance (w) in the shaft direction between the center of the fluid jet hole 62 at the inner diameter section of the nozzle pipe and the compartment plate 63, and an inner diameter (d) of the nozzle pipe 61 is set at (w):(d)≒5:2. The ration (w):(d) may be set at within the range of 3:2～7:2. Further,the above description is for the case in which the twisting direction of the yarn Y is Z typed (Z-twist). In the case the twisting direction of the yarn Y is S typed (S-twist), as shown with an imaginary line in Figure 6, the angle β of the fluid jet hole 62 is set at - β , and the angle γ of the compartment plate 63 is set at -γ respectively. Other features are the same as in the Z typed.

[0036] According to the untwisting nozzle 43 of the above-mentioned structure, as shown in Figure 7A, when compressed air is blown out from the fluid jet hole 62, due to its slanting edges, a large whirling flow (arrow (m)) and a small whirling flow (arrow (n)) are formed. The small whirling flow ceases in proximity to the fluid jet hole 62, and becomes under control of the whirling flow shown with the arrow m substantially in the internal space 61a, which is circular shaped in cross section. Such a section corresponds to the afore-mentioned whirling flow generating range SR. The normal whirling flow does not generate in the section of the compartment plate 63 (downstream side than the downstream end of the whirling flow generating range SR), and changes into a turbulent air flow that is not a whirling flow in a pair sectional spaces 66, 66, which are semicircle shaped in cross section and divided by the compartment plate 63. The sectional space 66 (an area from the upstream side edge of the compartment plate 63 to the pipe outlet 67) corresponds to the afore-mentioned turbulent flow generating range LR.

[0037] Referring to Figure 7 through Figure 9, untwisting operation of the yarn ends by the untwisting mechanism will be described. In Figure 7, the compressed air being supplied from the air supplying path 65 is blown from the fluid jet hole 62 of the nozzle pipe 61, toward a direction of an arrow q into the pipe, and flows toward the pipe outlet 67 as a whole. As a result, suction air flow by a negative pressure generates in the nozzle opening 68 (pipe inlet), and the yarn end YT is sucked into the nozzle pipe 61 by the suction air flow.

[0038] The twist of the sucked yarn end YT is untwisted by being whirled in the whirling flow generating range SR. Then, due to the shock by the collision with an edge 63a (upstream side edge) of the compartment plate 63, and bent by irregular movement resulting from turbulent flow, the collision with a side 63b of the compartment plate 63, or the generation of fluttering movement, and the like, the yarn end YT that reached the compartment plate 63 is applied with strong effect such that the leading end section of the yarn YT is untwisted while being blown off in the turbulent flow generating range LR.

[0039] That is, the compartment plate (an example of compartment member) 63 is provided at a position that is a prescribed distance away to the downstream side from the fluid jet hole 62. In addition, the compartment plate 63 is provided to divide the internal space of the nozzle pipe 61 into two sectional spaces 66, 66, substantially. Moreover, the compartment plate 63 functions as a collision member where a part of the yarn end YT collides, wherein the yarn end YT is swung around by the whirling flow due to the compressed air from the fluid jet hole 62. In addition, the edge 63a of the compartment plate 63 is also the upstream side edge of the collision member.

[0040] As a result, as shown in Figure 7A, even in the case of a spun yarn that is difficult to be untwisted, such as a hard twist yarn of wool which the fiber length is long, the yarn end YT becomes untwisted such that the twisting is untwisted satisfactorily, and the non-untwisted section (a) as shown in Figure 10 does not generate. Therefore, even when the yarn ends are spliced by using the whirling flow of compressed air thereafter, the generation of protrudent section (h), as shown in Figure 11, is prevented from being formed at both ends of the joined section (b), and the splicing can be carried out satisfactorily. Further, Figure 8 shows a state in which the Z-twisted yarn is untwisted, and Figure 9 shows a state in which the S-twisted yarn is untwisted. In either state, the direction of the fluid fluid jet hole 62 is provided slanting such that the large (strong) whirling flow m is to blow in the untwisting direction.

[0041] The matters relating to the compartment plate 63 will be described in the following.

① When the compartment plate 63 is approached too close to the nozzle opening 68 (yarn end inlet), the suction air flow toward the inside of the nozzle pipe 61 decreases in proximity to the nozzle opening 68, and it becomes difficult for the yarn end to be sucked into the nozzle pipe 61.

② By dividing the internal space of the nozzle pipe 61 by the compartment plate 63, the cross section area of the internal space decreases (a chamber becomes narrow), and the rotation of the yarn end on its axis is accelerated within the nozzle pipe 61. Accordingly, the untwisting function is accelerated.

③ The compartment plate 63 can be made desorbed-typed, and not adhered-type. As a result, according to condition, the compartment plate 63 can be attached or not attached.

④ It is preferable such that there is no space between the compartment plate 63 and the nozzle pipe 61. As a result, it becomes possible to prevent air leakage, and the fiber from being caught.

⑤ The leading end section of the yarn end does not collide intermittently at the upstream side of the compartment plate 63 (the leading end section does not enter and leave the sectional space). However, the leading end section collides against the upstream side of the compartment plate 63 when first entering into the sectional space 66, and the leading end section rotates on its axis in the sectional space 66 and the fiber is eliminated (untwisted). That is, the leading end section does not collide in pitter-patter at the upstream side edge of the compartment plate 63, but the leading end section rotates on its axis by the whirl of the upstream side (whirling section) of the leading end section. As a result, a predetermined amount of fiber among the fiber of the leading end section can be eliminated reliably.

[0042] Next, the outline of the splicing operation by the splicer 12 will be described.

<yarn preparation, clamp process>

[0043] In Figure 1, when a detecting device detects that the yarn YS during rewinding is cut or that the yarn of the bobbin B has run out, the drum 5 stops rotating, and a one-rotation crutch (not shown in the drawings) functions. Then, the splicing operation is carried out by various control cam that is provided on a shaft that rotates via the crutch, or by various control cam that couples with the shaft.

[0044] First, the winding side yarn end guiding means 10 swings downward from a state in which sucking the yarn end at the imaginary line position in Figure 1. In addition, the supply yarn side yarn end guiding means 11 swings to the upper imaginary line position from a state in which sucking the yarn end at the solid line position in Figure 1. As a result, each of the yarn YP of the package P side and the yarn YB of the bobbin B side pass through the side of the splicer 12 while intersecting with one another, and stop at an outer position. That is, after the winding side yarn end guiding means 10 swings from the upper sucking position to the lower guiding position, until the supply yarn side yarn end guiding means 11 starts its swing, the yarn clamp device 49 of the package P side in Figure 2 operates and clamps the yarn YP between the rotating lever 20 and the supporting block 21. In addition, the yarn YP is guided to the guide channel 19 of the fixed guide 16 and the rotating guides 17, 18 that are provided in proximity to the slub catcher 4. Then, the slub catcher 4 checks the presence and the thickness of the yarn YP.

[0045] Next, the rotating guides 17, 18 rotate in a counterclockwise direction in Figure 3 with the shaft 22 as the pivot, and the yarn YP is eliminated by the slub catcher 4 and is inserted into the thread undercuts 17b, 18b. Then, the supply yarn side yarn end guiding means 11, which is sucking the yarn YB at the bobbin B side, swings to the outside position (upper position) of the splicer 12 and stops. At that time, the yarn YB is clamped between the supporting plate 23a and the supporting block 23b of the yarn clamp device 48.

<yarn shifting, cutting process>

[0046] When the yarn clamp process completes, as shown in Figure 2 and Figure 3, the levers 32, 33 of the yarn shifting lever 45 rotate with the shaft 31 as the pivot. The yarns YP, YB at both sides are guided separately to each guide channel 29a, 29b, 30a, 30b of the fork guides 29, 30, and are inserted into the splicing hole 54 of the splicing member 41 shown in Figure 4 by passing through the slit 55.

[0047] Next, yarn breakages YP2, YB2 are carried out by the yarn cutting devices 46, 47, at positions that are prescribed distance away from the yarn clamp devices 49, 48 as shown in Figure 12. That is, in Figure 12, the yarns YP, YB at both sides of the splicing member 41 are clamped by the yarn clamp devices 49, 48. In addition, the yarn shifting lever 45 operates, a rod 31a shown in Figure 3 transfers in the direction of an arrow 31b by a control cam (not shown in the drawings), and the levers 32, 33 swing in counterclockwise direction with the shaft 31 as the center. Under such a state, the yarn breakage is carried out. Further, during the operation of the yarn shifting lever 45 and the yarn cutting devices 46, 47, the yarn pressing device 42 is in standby at a position shown in Figure 12.

<yarn end untwisting process>

[0048] As shown in Figure 13, at the same time or almost simultaneously as the yarn ends YP1, YB1 are sucked by the untwisting nozzles 43, 44, the yarn shifting lever 45 transfers in a direction R to depart from the yarn, and the yarn ends YP1, YB1 are sucked deep into the untwisting nozzle. In addition, the twist of the yarn ends is untwisted by blowing compressed air so that the yarn ends become suitable for splicing, and the fiber of the leading end section corresponding to the conventional non-untwisting section (a) is scattered and eliminated. Further, the suction start time by the untwisting nozzles 43, 44 (jet start time from the fluid jet hole 62) is preferable to be set at just before the yarn breakage by the yarn cutting devices 46, 47.

<splicing process>

[0049] When the twist of the yarn ends YP1, YB1 are untwisted by the yarn end untwisting nozzles 43, 44 so that the yarn ends YP1, YB1 become suitable for splicing, at the same time or approximately at the same time as the suction by the untwisting nozzles 43, 44 and the fluid jet hole 62 are stopped, as shown in Figure 14, the yarn shifting lever 45 operates again to guide each of the yarn ends YP1, YB1, and the untwisted yarn ends that are drawn out from the untwisting nozzles 43, 44

are joined at a prescribed position at the splicing member 41.

[0050] At that time, one of the lever 32 of the yarn shifting lever 45 swings to a position contacting against the stopper 35. In addition, the yarn pressing device 42 operates, and swings to the state shown in Figure 14. The yarn pressing plates 42a, 42b and the guide rods 28a, 28b apply bent to the yarns YP, YB between the splicing hole 54 and the clamp devices 48, 49, more specifically, between the splicing hole 54 and the levers 32, 33.

[0051] The yarn ends YP1, YB1 that are inserted in the nozzle pipe 61 of the untwisting nozzles 43, 44, are pulled into the splicing hole 54 of the splicing member 41 by the yarn shifting lever 45 and the yarn pressing device 42. Then, the yarn ends YP1, YB1 are set at a position such that the yarn ends are contacting against one another, by the control plates 25, 26 and the yarn pressing device 42 which are shown in Figure 3 and Figure 4. Then, after the setting of the yarn ends is completed, the splicing is carried out by the whirling flow of the compressed air that is blown out from the fluid jet holes 56, 57 shown in Figure 4.

<another embodiment 1>

[0052] As shown in Figure 15, the compartment member 63 that is provided in the nozzle pipe 61 is to be made as a partition plate 70, which has a shape of letter "T" laid down, such that only the downstream side end of the partition plate 70 is supported in a cantilever by being inserted to a downstream side edge slit 69, which is formed only at the pipe downstream side end. A small space s1 can be formed between the partition plate 70 and the pipe inner surface 61a over approximately the entire length of the partition plate 70. Even in such a case, the internal space of the nozzle pipe 61 is divided into several sectional spaces by the partition plate 70 substantially.

<another embodiment 2>

[0053] As shown in Figure 16, two separate sheets of partition plates 71, 71 that are supported along the entire length of a pair of slits 64, 64, which are formed at the nozzle pipe 61, can be provided at a prescribed position of the nozzle pipe 61 such that a space s2 is formed along the third shaft center (z) between the partition plates 71, 71. Even in such a case, the internal space of the nozzle pipe 61 is divided into several sectional spaces by the partition plates 71, 71 substantially.

<another embodiment 3>

[0054] As shown in Figure 17, the compartment member 63 can be formed from two sheets of plates 72, 72 such that the plates 72, 72 form a cross-shaped when viewing from the direction of the third shaft center (z). Even in such a case, the internal space of the nozzle pipe 61 is divided into several sectional spaces by two plates 72, 72 substantially.

[0055] As described above, according to the splicer and the splicing method of the present invention, the untwisting nozzle, which untwists the twist of the yarn end by sucking the yarn end and by applying fluid flow, can eliminate the fiber at the leading end of the yarn end by blowing off the fiber reliably. As a result, even in the case when it is difficult to carry out untwisting as in the hard twist yarn of wool, non-untwisted section is prevented from being formed after the untwisting as in the prior art, and satisfying splicing can be carried out without the protrudent sections being generated at both sides of the joint.

Claims

1. A splicer comprising an untwisting nozzle for untwisting twist of introduced yarn end;

   wherein the untwisting nozzle includes a nozzle pipe, a fluid jet hole which has an opening at internal surface of the nozzle pipe for generating whirling flow within the nozzle pipe, and a collision member which is provided at a position prescribed distance away from the fluid jet hole to downstream side in fluid flowing direction; and the collision member is provided under a state in which the yarn end being swung by the whirling flow collides against the upstream side edge in the fluid flowing direction.

2. A splicer comprising an untwisting nozzle for untwisting twist of introduced yarn end;

   wherein the untwisting nozzle includes a nozzle pipe, a fluid jet hole which has an opening at internal surface of the nozzle pipe for generating whirling flow within the nozzle pipe, and a compartment member which is provided at a position prescribed distance away from the fluid jet hole to downstream side in fluid flowing direction; and the compartment member is provided to divide an internal space of the nozzle pipe into a plurality of sectional spaces substantially.

3. A splicer, wherein the collision member according to claim 1 or the compartment member according to claim 2 is formed of a plate material that extends from a position prescribed distance away from the jet hole to downstream side in the fluid flowing direction, to the downstream side.

4. A splicer, wherein a ratio between a distance from a center of the jet hole to the collision member according to claim 1 or the compartment member according to claim 2, and an inner diameter of the nozzle pipe in the jet hole section is set within a range of 1.5:1～3.5:1.

5. A splicer comprising an untwisting nozzle for untwisting twist of introduced yarn end;

wherein the untwisting nozzle includes a nozzle pipe, and a fluid jet hole which has an opening at internal surface of the nozzle pipe for generating whirling flow within the nozzle pipe; and the nozzle pipe includes a whiling flow generating range, which is approximately circular shaped in cross section, that is formed as an internal space at a prescribed range in downstream side of fluid flowing direction from the fluid jet hole, and a turbulent flow generating range, which is non-circular shaped in cross section, that is formed as an internal space at the downstream side to the whirling flow generating range.

6. A splicing method for carrying out splicing by untwisting twist of yarn end by using whirling flow in the untwisting nozzle, overlapping the yarn ends to form a overlapping section, and applying fluid to the overlapping section;

wherein by a leading end section of the yarn end that whirls in the untwisting nozzle by the whirling flow being collided against a member provided in the untwisting nozzle, and by being rotated on its axis, a prescribed amount of fiber is sucked and eliminated from the fiber that composes the leading end section and the yarn end is untwisted.

FIG. 1

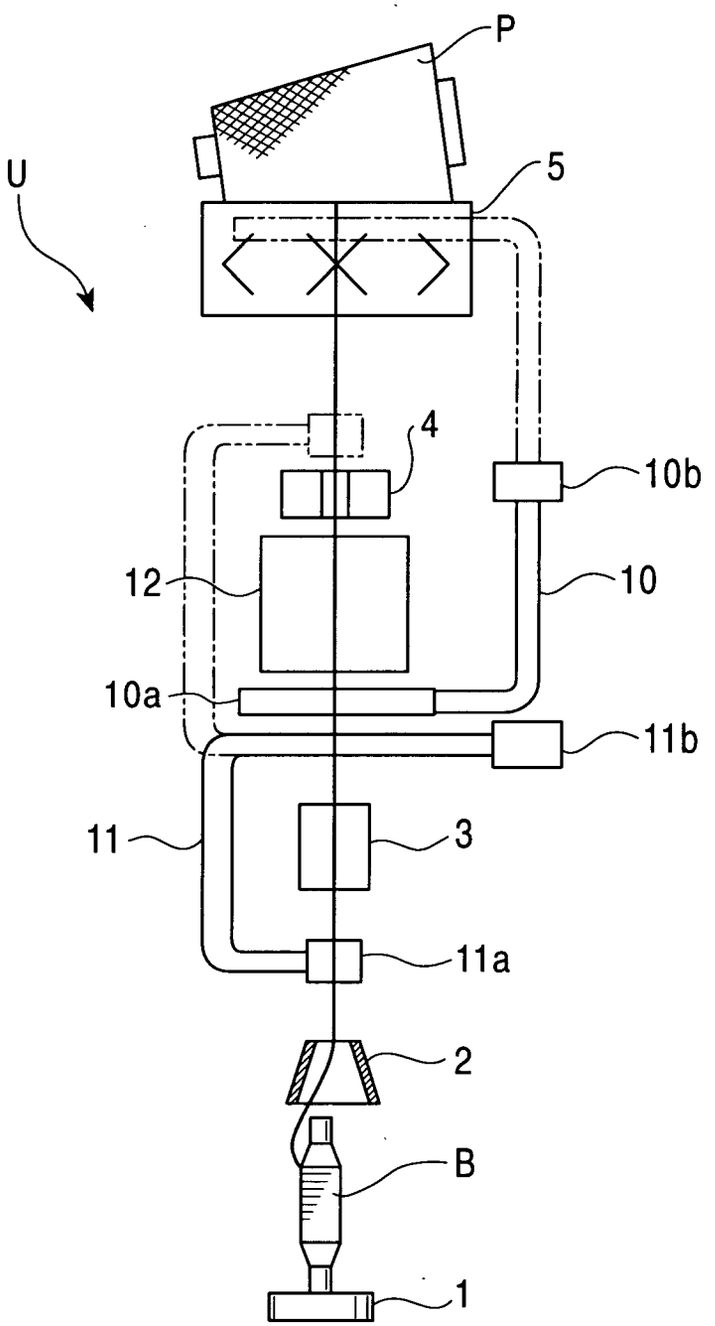


FIG. 2

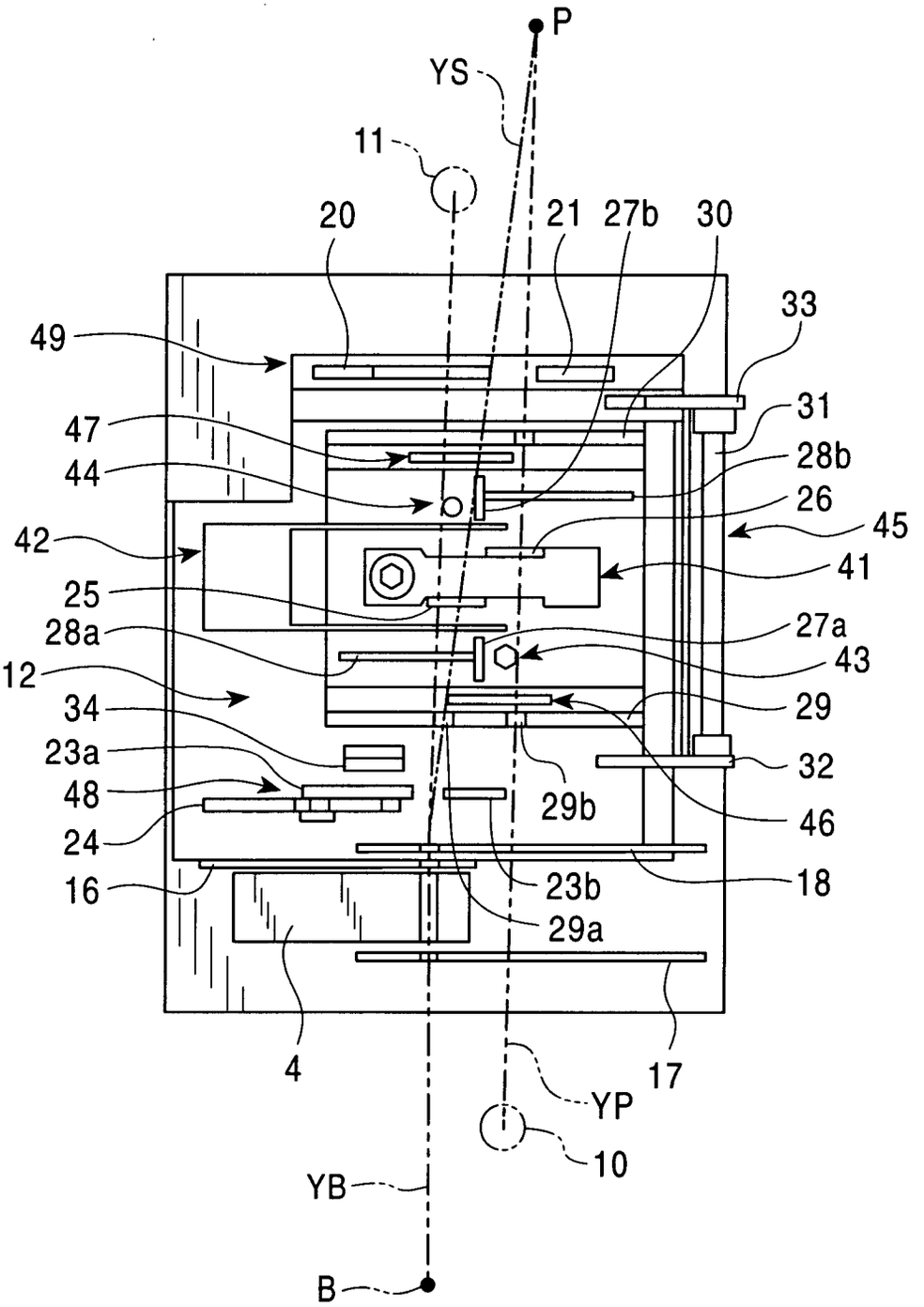

P
YS
11
20
21
27b
30
33
49
31
47
28b
44
26
45
42
41
25
27a
28a
43
12
29
34
23a
32
48
29b
46
24
16
23b
18
29a
4
17
YP
10
YB
B

FIG. 3

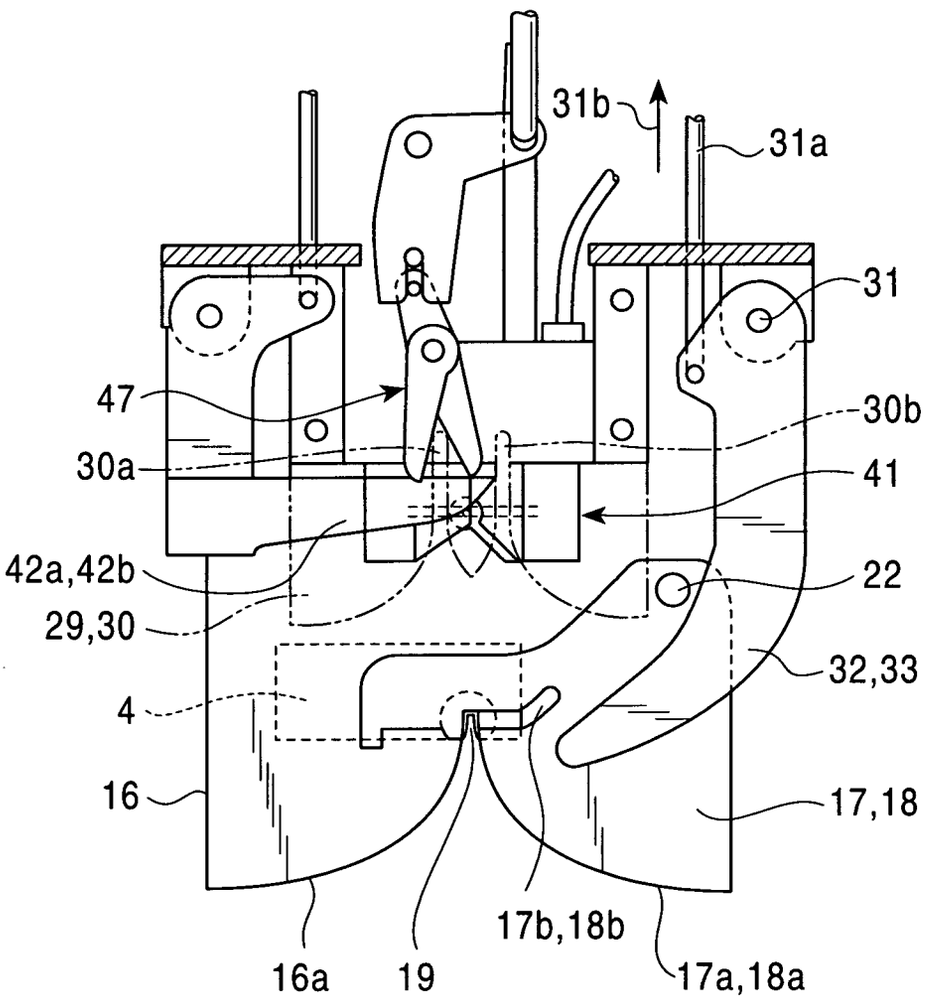

31b
31a
31
47
30b
30a
41
42a,42b
22
29,30
32,33
4
16
17,18
17b,18b
16a
19
17a,18a

FIG. 4

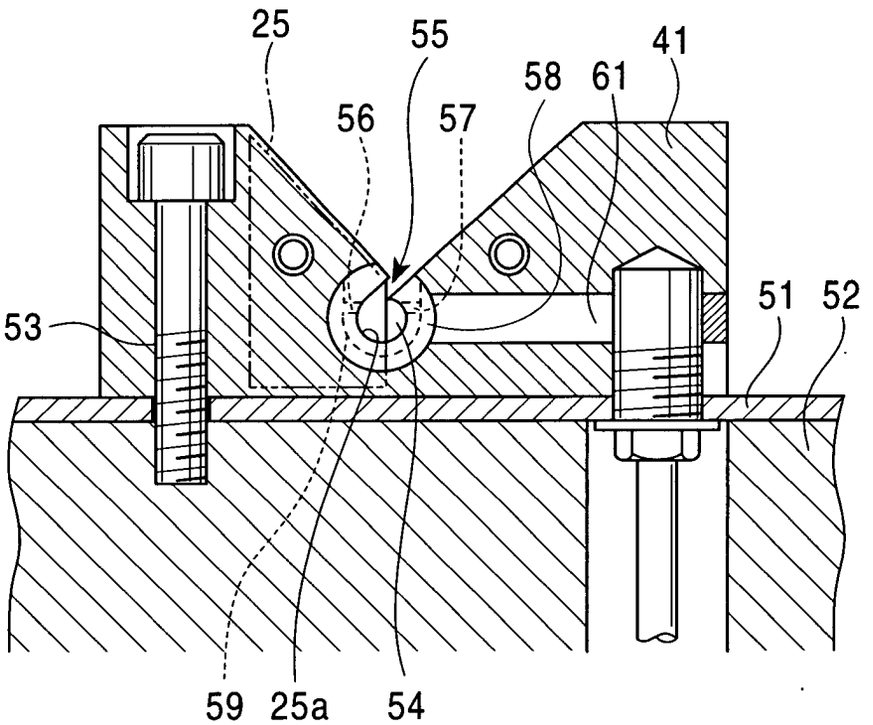


FIG. 5

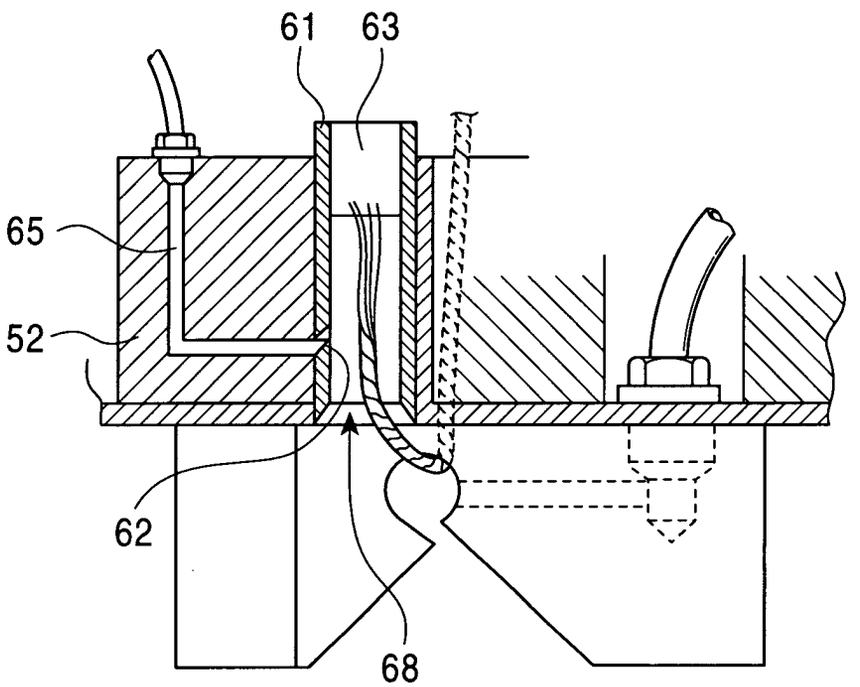


FIG. 6A

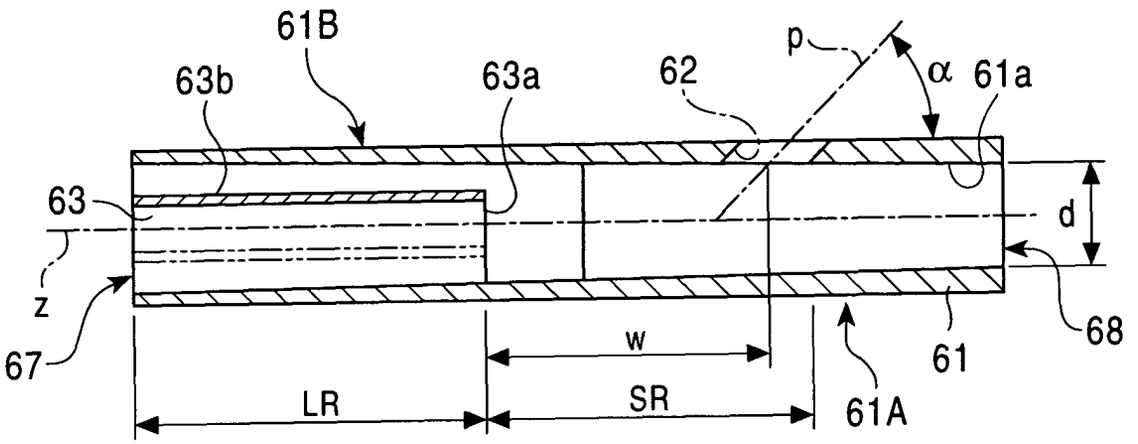


FIG. 6B

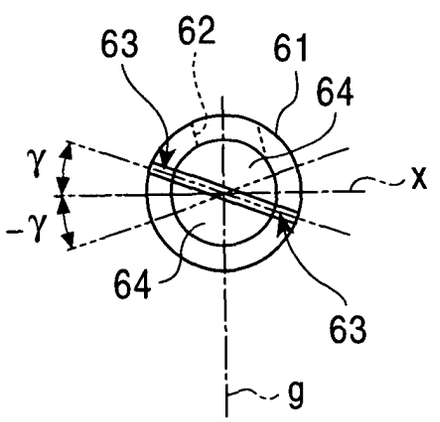


FIG. 6C

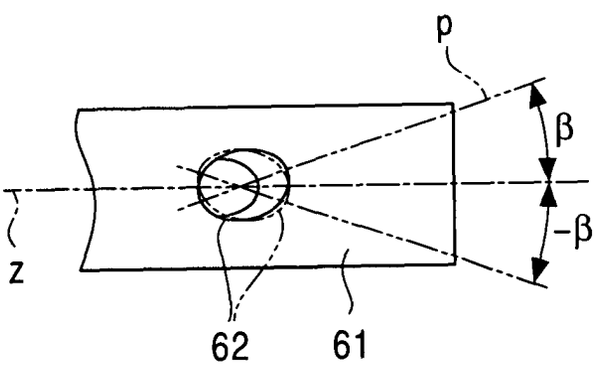


FIG. 7A

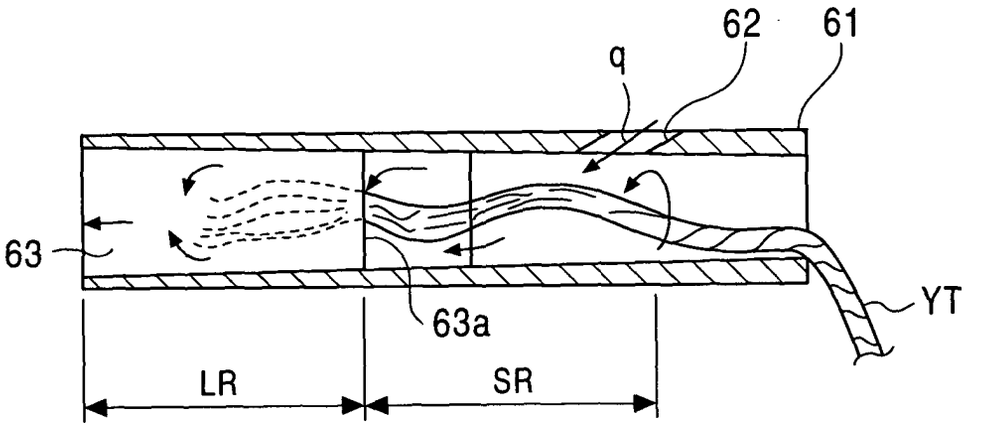


FIG. 7B

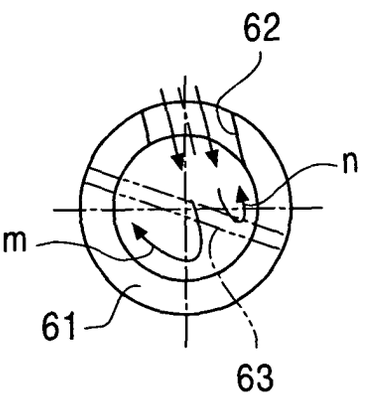


FIG. 8

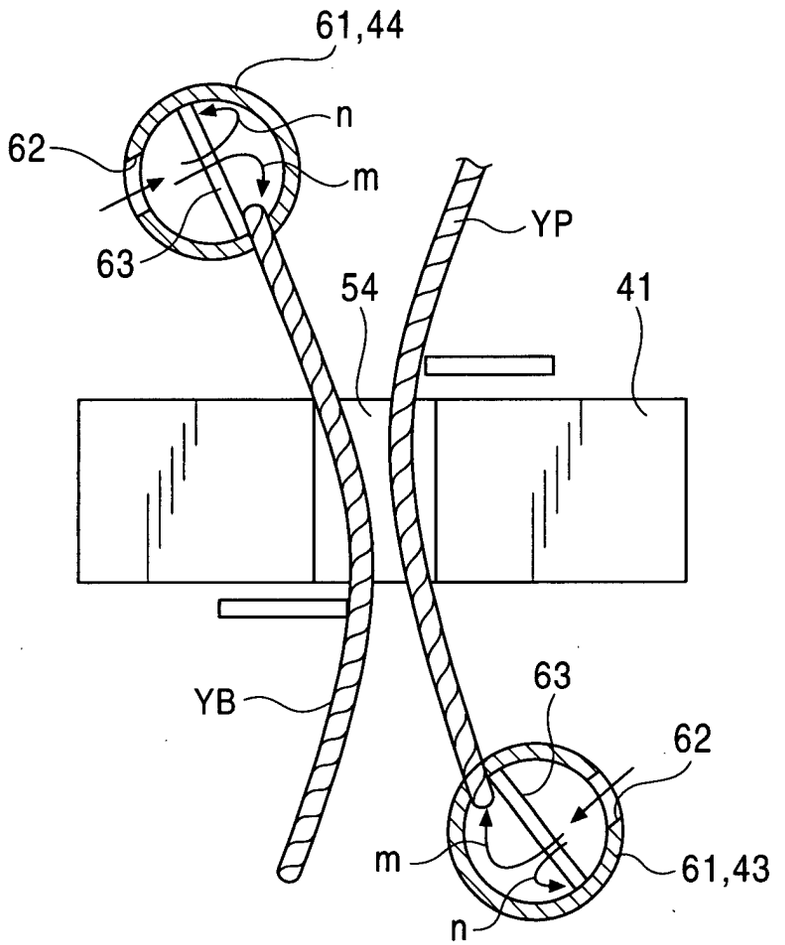


FIG. 9

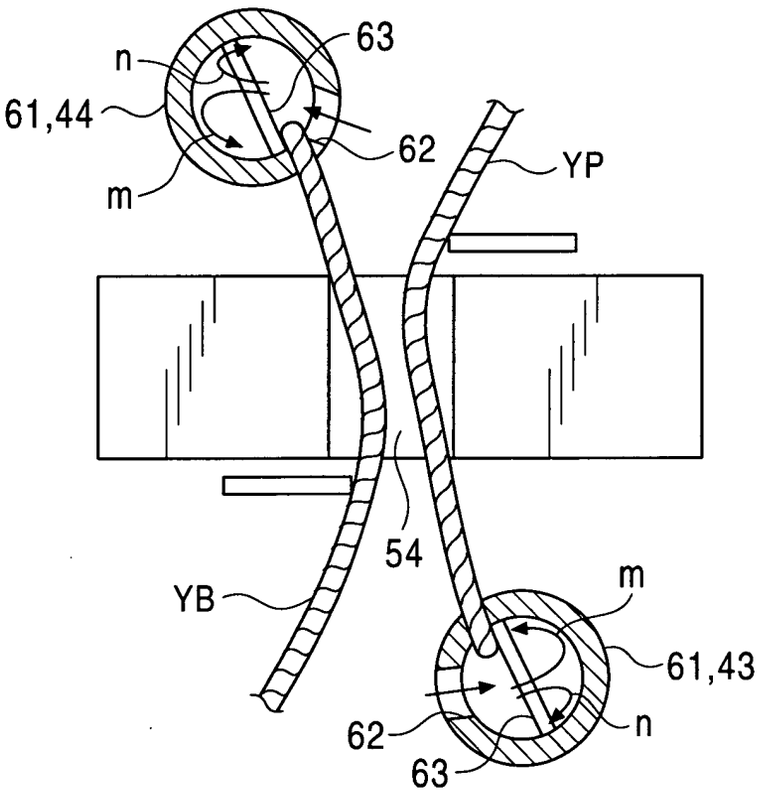


FIG. 10
PRIOR ART

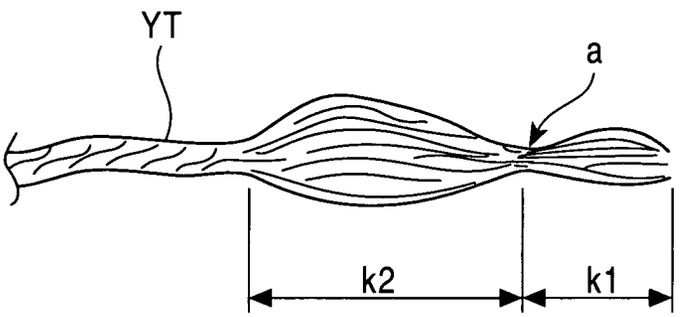


FIG. 11
PRIOR ART

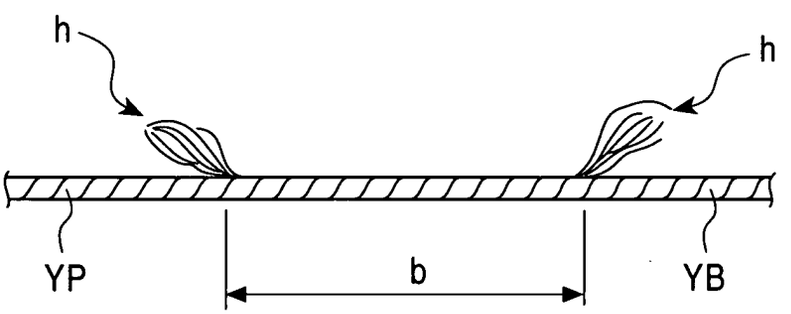


FIG. 12

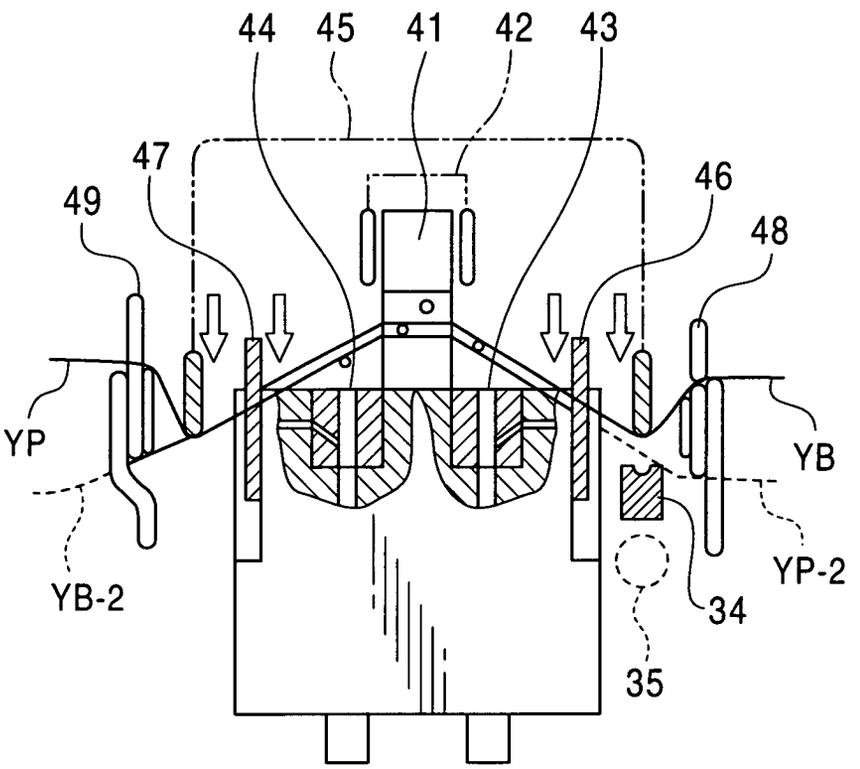


FIG. 13

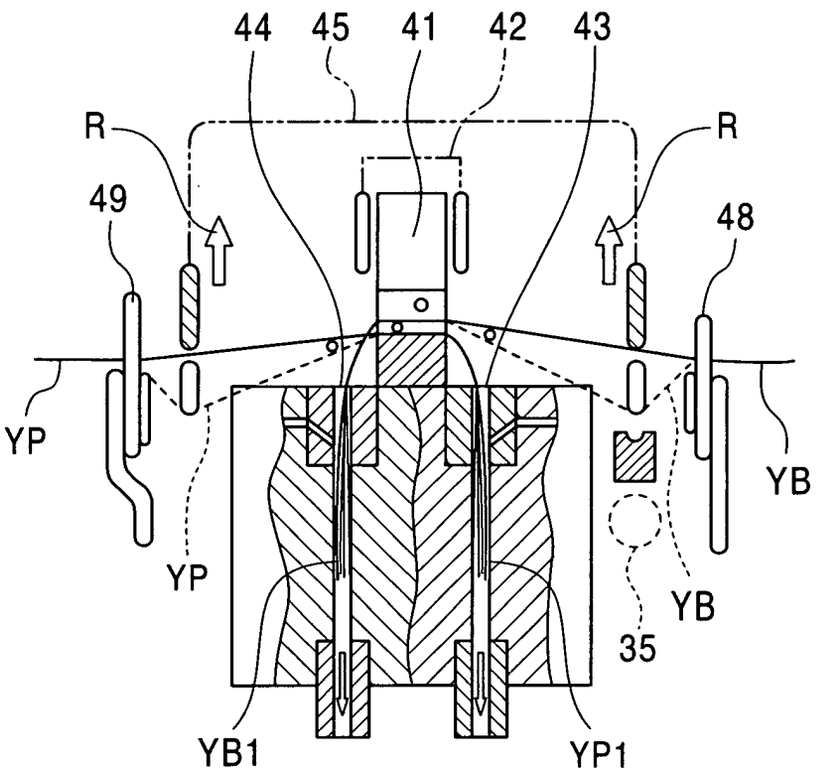


FIG. 14

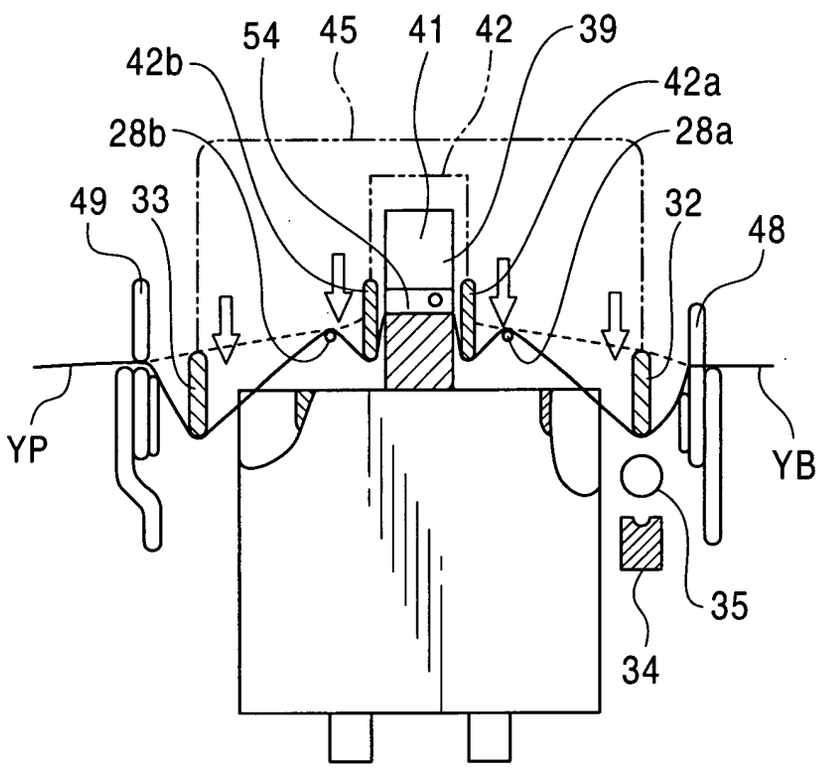


FIG. 15A

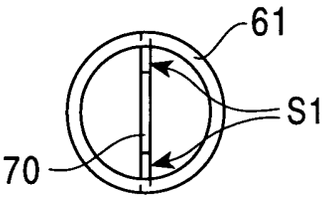


FIG. 15B

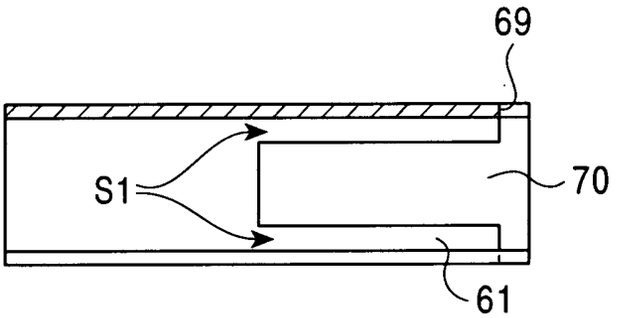


FIG. 16A

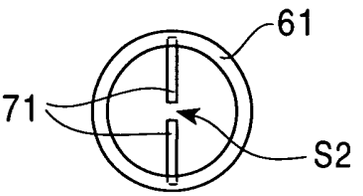


FIG. 16B

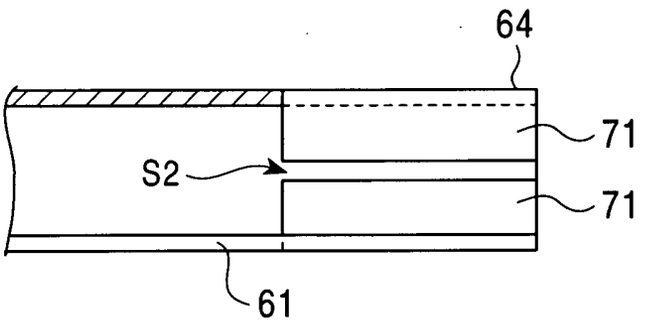
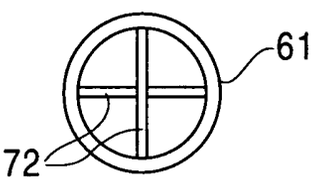


FIG. 17



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 01 6318

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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X	* claim 1; figures *	6	
A	US 4 549 392 A (H. KIMURA) 29 October 1985 (1985-10-29)	1-3,5	
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B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 December 2002	D'Hulster, E

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 01 6318

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