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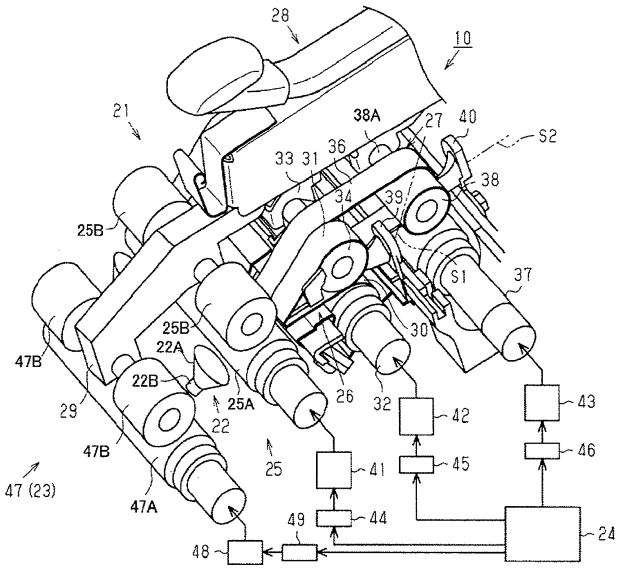
(54) SPECIAL YARN SPINNING APPARATUS IN SPINNING MACHINE

(57) A special yarn spinning apparatus adapted for use in a spinning machine includes a plurality of apron draft devices that are configured to switch fiber bundles to be fed, respectively. The special yarn spinning apparatus further includes a joining device and an anti-twist device. The joining device joins a training end of the fiber bundle fed from at least one of the apron draft devices which has operated before switching the feed and a leading end of the fiber bundle fed from another of the apron draft device which has started after switching the feed. The anti-twist device holds and delivers the fiber bundle at a position downstream of the joining device to prevent propagation of twist from a twist device to the joined fiber bundles in the joining device.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a special yarn spinning apparatus in a spinning machine and, more specifically, to an apparatus for spinning a special yarn having different colors or different kinds of fibers in a spinning machine by controlling the feeding of fiber bundles fed from a plurality of fiber bundle supply sources.

[0002] Fig. 14 shows a device for the production of assorted or patterned yarn in a spinning machine that is disclosed in the PTC International Publication No. 2011/018685 and spins a yarn while changing the blend ratio of two different kinds of rovings. The draft device includes three bottom rollers 81, 82, 83, press rollers 81A, 83A corresponding to the bottom rollers 81, 83, respectively, aprons (or belt) 82A, 82B for a press roller corresponding to the bottom roller 82 and a compactor device 85 that is arranged downstream of the bottom roller 81. In this draft device, the press roller 81A is used for both a base roving S and a colored roving T. The base roving S is drafted through the bottom rollers 81, 82, 83 and their corresponding press roller 81A, the apron 82A and the press roller 83A, while the colored roving T is drafted and delivered by the bottom rollers 81, 82 and their corresponding press roller 81A and the apron 82B. After passing through a roller pair that is formed by the bottom roller 81 and the press roller 81A, the base roving S and the colored roving T are combined by the compactor device 85 to form a patterned yarn. The compactor device 85 is any one of an aspirator, a fixed bar and a member rotatable on its axis at a position away from yarn path, which is disposed at a position corresponding to the exit of the colored roving T. A yarn guide member 87 is disposed downstream of the compactor device 85.

[0003] In the device of the above-cited publication, when the rotation speed of the bottom roller 82 for the colored roving T is zero, a yarn is spun only from the base roving S without blending the colored roving T. When the colored roving T is supplied with the rotation of the bottom roller 82, a blended yarn of the base roving S and the colored roving T is produced. The blend ratio of the colored roving T per unit length of the spun yarn is changed by controlling the rotation speed of the bottom roller 82. In this device, however, the twist created in the yarn by a twisting device (not shown) is propagated to the rovings passing through the compactor device 85 and the yarn guide member 87 or to a position where the roving is held by the roller pair including the bottom roller 81 and the press roller 81A. When feeding of the roving is switched from the base roving S to the colored roving T, the untwisted end of the colored roving T needs to be joined to the twisted end of the base roving S. However, it is difficult to join the untwisted colored roving T to the twisted base roving S successfully and, therefore, it is extremely difficult to produce a yarn that is made by switching the feeding between the base roving S and the colored roving T.

[0004] The present invention, which has been made in light of the problems, is directed to provide a special yarn device of a spinning machine that can changes raw material fiber bundles when spinning a special yarn containing various colors and materials

SUMMARY OF THE INVENTION

[0005] In accordance with an aspect of the present invention, there is provided a special yarn spinning apparatus adapted for use in a spinning machine including a plurality of apron draft devices that are configured to switch fiber bundles to be fed, respectively. The special yarn spinning apparatus further includes a joining device and an anti-twist device. The joining device joins a training end of the fiber bundle fed from at least one of the apron draft devices which has operated before switching the feed and a leading end of the fiber bundle fed from another of the apron draft device which has started after switching the feed. The anti-twist device holds and delivers the fiber bundle at a position downstream of the joining device to prevent propagation of twist from a twist device to the joined fiber bundles in the joining device.

[0006] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The invention together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1 is a perspective view of a special yarn spinning apparatus according to a first embodiment of the present invention;

Fig. 2 is a schematic side view of a spinning machine having the special yarn spinning apparatus of Fig. 1;

Fig. 3A is a schematic diagram of the special yarn spinning apparatus of Fig. 1, showing a state in which a yarn is being spun from a first roving;

Fig. 3B is a schematic diagram similar to Fig. 3A, but showing a state in which the first roving has been cut and feeding of a second roving is started;

Fig. 4A is a schematic diagram of the special yarn spinning apparatus of Fig. 1, showing a state in which the leading end of the second roving and the trailing end of the first roving are both present in a guide member;

Fig. 4B is a schematic diagram similar to Fig. 4A, but showing a state in which the leading end of the second roving is being joined to the trailing end of the first roving;

Fig. 5 is schematic diagram of the special yarn spinning apparatus of Fig. 1, showing a state in which the second roving and the first roving that have been joined together are passing through an anti-twist member;

Fig. 6 is a schematic side view of a special yarn spinning apparatus according to a second embodiment;

Fig. 7 is a schematic diagram of the special yarn spinning apparatus of Fig. 6, showing a state corresponding to Fig. 3A;

Fig. 8 is a schematic side view of a special yarn spinning apparatus according to a third embodiment;

Fig. 9 is a schematic diagram of the special yarn spinning apparatus of Fig. 8, showing a state corresponding to Fig. 3A;

Fig. 10 is a schematic side view of a special yarn spinning apparatus according to a fourth embodiment;

Fig. 11 is a schematic diagram showing a shape of a suction slit;

Figs. 12A and 12B are schematic diagrams showing shapes of the suction slit according to other embodiments;

Fig. 13 is a schematic side view of a special yarn spinning apparatus according to yet another embodiment;

Fig. 14 is a schematic plan view of a conventional draft device.

DETAILED DESCRIPTION OF THE EMBODIMENTS

(First embodiment)

[0008] The following will describe a special yarn spinning apparatus in a spinning machine that spins a special yarn from a plurality of rovings (two rovings in the present invention) that are suspended from a creel of the spinning machine according to a first embodiment of the present invention with reference to Figs. 1 to 5.

[0009] Referring to Fig. 2, the special yarn spinning apparatus, which is designated by numeral 10, is adapted for use in a spinning machine. The spinning machine has a fiber bundle supply source 11 from which a plurality of fiber bundles, namely a first roving S1 and a second roving S2 in the illustrated embodiment, are supplied independently and intermittently. The fiber bundle supply source 11 has two roving bobbins 13A, 13B that are suspended from a creel 12 of the spinning machine. The special yarn spinning apparatus 10 has a twisting device 18 having a traveler 17 that travels on a ring 16 with the rotation of a bobbin 15 mounted on a spindle 14 for twisting a yarn Y.

[0010] The special yarn spinning apparatus 10 includes a draft device 21 that is provided downstream of the fiber bundle supply source 11, a joining device 22 that connects the ends of the first and second rovings S1, S2 fed from the draft device 21, an anti-twist device 23 that prevents the propagation of twist from the twisting device 18 to the first and second rovings S1, S2 in the joining device 22 and a control device 24 (shown in Fig. 1) that controls the feeding of the first and second rovings S1, S2 to the draft device 21 and the anti-twist device 23.

[0011] The following will describe the special yarn spinning apparatus 10 in detail. As shown in Fig. 1, the draft device 21 of the special yarn spinning apparatus 10 includes a front roller pair 25, a first apron pair 26 that is provided upstream of the front roller pair 25 and feeds the first roving S1 to the front roller pair 25 and a second apron pair 27 that is also provided upstream of the front roller pair 25 and feeds the second roving S2 to the front roller pair 25. In other words, the draft device 21 includes the first and second apron pairs 26, 27 for the first and second rovings S1, S2, respectively, and the front roller pair 25 that is shared in common by the first and second apron pairs 26, 27.

[0012] In the spinning machine, one draft device 21 and one weighting arm 28 are provided for any two adjacent spinning stations. The front roller pair 25 includes a front bottom roller 25A and a front top roller 25B, and the front top roller 25B is supported by the weighting arm 28 via a support arm 29.

[0013] The first apron pair 26 includes a middle bottom apron 30 and a middle top apron 31. The middle bottom apron 30 is wound around a tensor bar, a middle bottom roller 32 and a tensioner. The middle top apron 31 is wound around a middle top roller 34 that is rotatably supported by the opposite ends of a support shaft supported by a support arm 33 fixed to the weighting arm 28 and an apron cradle that is supported by a support shaft. The first apron pairs 26 and the front roller pair 25 cooperate to form the apron draft device of the present invention.

[0014] The second apron pair 27 includes a back bottom apron 35 (shown in Figs. 3, 4 and 5) and a back top apron 36. The back bottom apron 35 that shares the tensor bar and the tensioner with the middle bottom apron 30 is wound on a back bottom roller 37 while passing the outer periphery of the middle bottom roller 32. The second apron pairs 26 and the front roller pair 25 also cooperate to form the apron draft device of the present invention.

[0015] The back top apron 36 is wound on a back top roller 38 that is rotatably supported by the opposite ends

of a support bearing 38A supported by the support arm fixed to the weighting arm 28 and the tensioner that is formed in the apron cradle of the middle top roller 34. The back top apron 36 sharing the tensioner with the middle top apron 31 is wound on the back top roller 38 while passing the outer periphery of the middle top roller 34.

[0016] The first roving S1 is fed to the first apron pair 26 via a first trumpet 39 and the second roving S2 is fed to the second apron pair 27 via a second trumpet 40. A front roller motor 41 that drives the front bottom roller 25A, a middle roller motor 42 that drives the middle bottom roller and a back roller motor 43 that drives the back bottom roller 37 are independently controlled by the control device 24 via inverters 44, 45, 46, respectively.

[0017] The joining device 22 has a funnel shape including a guide portion 22A that is tapered downstream and a cylindrical portion 22B that is connected to the tapered exit end of the guide portion 22A. The guide portion 22A has at the entrance thereof a diameter that is greater than the maximum spaced distance between the first and second rovings S1, S2 fed from the front roller pair 25.

[0018] The anti-twist device 23 is formed by a delivery roller pair 47 functioning as a delivery roller, and the delivery roller pair 47 includes a bottom roller 47A that is driven by a delivery roller motor 48 and a top roller 47B. The delivery roller motor 48 is controlled by the control device 24 via an inverter 49. The top roller 47B of the delivery roller pair 47 is supported by the support arm 29 that also supports the front top roller 25B.

[0019] The control device 24 is provided with a microcomputer and operates in accordance with program data stored in a memory of the microcomputer, thus controlling the motors 41, 42, 43 via the inverters 44, 45, 46 and the delivery roller motor 48 via the inverter 49. The control device 24 controls feeding of the first roving S1 and the second roving S2 by controlling the middle roller motor 42 and the back roller motor 43, respectively.

[0020] The following will describe the operation of the above-described special yarn spinning apparatus 10. In the special yarn spinning apparatus 10, the first roving S1 unwound from the first roving bobbin 13A suspended from the creel 12 is fed to the first apron pair 26 via the first trumpet 39 and the second roving S2 unwound from the second roving bobbin 13B is fed to the second apron pair 27 via the second trumpet 40. The first roving S1 and the second roving S2 are made of fibers of the same material and the same thickness, but having different colors.

[0021] In spinning a yarn Y from the first roving S1, the front roller pair 25, the first apron pair 26 and the delivery roller pair 47 are driven, but the second apron pair 27 is kept a stop. With the first apron pair 26 being driven, the first roving S1 from the first roving bobbin 13A is fed to the first apron pair 26 and drafted into a fleece between the front roller pair 25 and the first apron pair 26. The fleece coming out from the front roller pair 25 then travels through the joining device 22, the anti-twist device 23 (delivery roller pair 47), a snail wire 19 (shown in Fig. 2) and the traveler 17, to be spun into a yarn Y. The spun yarn is then wound around the bobbin 15.

[0022] In spinning a yarn Y from the second roving S2, the front roller pair 25, the second apron pair 27 and the delivery roller pair 47 are driven. With the second apron pair 27 being driven, the second roving S2 from the second roving bobbin 13B is fed to the second apron pair 27 and drafted into a fleece between the front roller pair 25 and the second apron pair 27. The fleece coming out from the front roller pair 25 then travels through the joining device 22, the anti-twist device 23 (delivery roller pair 47), the snail wire 19 and the traveler 17, to be spun into a yarn Y.

[0023] The feeding of the first roving S1 and the second roving S2 is switched at controlled timing, and only either one of the first roving S1 and the second roving S2 is fed to the front roller pair 25 except during the feeding switch operation. The length of the first roving S1 fed per unit time is determined by the apron speed of the first apron pair 26, and the length of the second roving S2 fed per unit time is determined by the apron speed of the second apron pair 27.

[0024] In stopping the feeding of first roving S1, the middle bottom roller 32 is stopped. Stopping the middle bottom roller 32, the first apron pair 26 is stopped. Accordingly, the first roving S1 which is then being spun is cut at a position between the nip point of the first apron pair 26 and the nip point of the front roller pair 25. In resuming the feeding of the first roving S1, the middle bottom roller 32 is restarted thereby to drive the first apron pair 26, so that the first roving S1 is drafted smoothly between the front roller pair 25 and the first apron pair 26.

[0025] In stopping the feeding of the second roving S2, the back bottom roller 37 is stopped. Stopping the back bottom roller 37, the second apron pair 27 is stopped. Accordingly, the second roving S2 which is then being spun is cut at a position between the nip point of the second apron pair 27 and the nip point of the front roller pair 25. In resuming the feeding of the second roving S2, the back bottom roller 37 is restarted thereby to drive the second apron pair 27, so that the second roving S2 is smoothly drafted between the front roller pair 25 and the second apron pair 27.

[0026] The following will describe the procedure for switching from the spinning from the first roving S1 to the spinning from the second roving S2, with reference to Figs. 3A, 3B, 4A, 4B to 5. It is noted that in the drawings the middle top apron 31 of the first apron pair 26 and the back top apron 36 of the second apron pair 27 are omitted from the illustration.

[0027] In the state of Fig. 3A in which a yarn Y is being spun from the first roving S1, the first roving S1 passes through the first apron pair 26 (only the middle bottom apron 30 being shown), the front roller pair 25, the joining device 22 and the delivery roller pair 47 to be drafted into a fleece, while the second roving S2 is at a stop with the leading end S2A thereof positioned between the front

roller pair 25 and the second apron pair 27 (only the back bottom apron 35 being shown).

[0028] In switching the feeding from the first roving S1 to the second roving S2, the feeding of the first roving S1 is stopped by stopping the first apron pair 26 and the feeding of the second roving S2 is started by starting the second apron pair 27. With the first apron pair 26 thus stopped, the first roving S1 is cut at a position between the nip position of the front roller pair 25 and the front end of the nip position of the first apron pair 26. The feeding of the first roving S1 is stopped at such a timing after starting of the feeding of the second roving S2 that the leading end S2A of the second roving S2 is positioned downstream of the cut trailing end S1A of the first roving S1, as shown in Fig. 3B, so that the leading end S2A and the trailing end S1A are overlapped for joining. In this state of Fig. 3B, the leading end S2A of the second roving S2 is spaced apart from the cut trailing end S1A of the first roving S1 in axial direction of the front roller pair 25.

[0029] In the state of Fig. 3B, the feeding of the second roving S2 is continued so that the leading end S2A of the second roving S2 reaches the joining device 22, as shown in Fig. 4A. The feeding of the second roving S2 is further continued so that the leading end S2A of the second roving S2 moves along the guide portion 22A of the joining device 22 and close to the cut trailing end S1A of the first roving S1. When the leading end S2A of the second roving S2 enters into the cylindrical portion 22B of the joining device 22, the leading end S2A is engaged with the cut trailing end S1A of the first roving S1 while moving together through the cylindrical portion 22B of the joining device 22, as shown in Fig. 4B. While being moved further, the cut trailing end S1A of the first roving S1 and the leading end S2A of the second roving S2 are joined together in entangled state, as shown in Fig. 5. Thus, the switching from the spinning from the first roving S1 to the spinning from the second roving S2 is completed.

[0030] In the case of switching from the second roving S2 to the first roving S2, a description in which the first roving S1 and the second roving S2 in the above description are substituted by the second roving S2 and first roving S1, respectively, is applicable.

[0031] The above-described embodiment of the present invention offers the following effects.

(1) The special yarn spinning apparatus 10 is adapted for use in a spinning machine having a plurality of apron draft devices that are configured to switch fiber bundles to be fed. The special yarn spinning apparatus 10 is provided with the joining device 22 in which the trailing end of fiber bundle fed by the apron draft devices which has been operated before the switching the feeding and the leading end of fiber bundle fed by the apron draft devices which started operating after the switching the feeding are joined, and the anti-twist device 23 that is provided downstream of the joining device 22 holds and delivers the fiber bundle to prevent the propagation of the twist from twist device 18.

[0032] In the configuration in which the special yarn spinning apparatus 10 includes the anti-twist device 23, unlike the conventional special yarn spinning apparatus, the trailing end of one of the fiber bundles and the leading end of the other fiber bundle in the joining device 22 are free from twist by the anti-twist device 23 during the switching of fiber bundle. Thus, a plurality of ends of the fiber bundles is joined in an untwisted state in the joining device 22, and the twist from the twist device 18 is transmitted to the ends of the joined fiber bundles only after passing through the anti-twist device 23. With the joined fiber bundles twisted, a yarn Y in which the trailing end of fiber bundle fed by the apron draft devices which has been operated before the switching the feeding and the leading end of fiber bundle fed by the apron draft devices which started operating after the switching the feeding are successfully joined may be formed. Thus, material fiber bundles are successfully switched when spinning a special yarn having different colors or different kinds of fibers.

(2) In the above-described embodiment, roving is used as the fiber bundle, the joining device 22 is of a funnel shape including the guide portion 22A that is tapered downstream the cylindrical portion 22B that is connected to the tapered exit end of the guide portion 22A, and the upstream side of the guide portion 22A has a diameter that is greater than the spaced distance between the first and second rovings S1, S2 coming out from the front roller pair 25. Such configuration makes possible a simple structure that allows the leading end of roving to be engaged with the cut tailing end of another roving to be fed to the anti-twist device 23.

(3) In switching the feeding of the fiber bundle, the control device 24 controls to drive the middle roller motor 42 and the back roller motor 43 so as to stop the feeding of the fiber bundle then being spun after predetermined timing after starting of the feeding of the other fiber bundle. As a result, with the leading end of the other fiber bundle positioned downstream of the cut trailing end of the fiber bundle then being spun, the ends of the rovings are joined in the joining device 22 and delivered to the anti-twist device.

(4) The delivery roller pair 47 serving as the anti-twist device 23 has a conveying function, so that the fiber bundles (first roving S1 or second roving S2) from the front roller pair 25 is delivered to the anti-twist device 23 effortlessly without having conveying function in the joining device 22.

(Second embodiment)

[0033] The following will describe a second embodiment of the present invention with reference to Figs. 6 and 7. The second embodiment differs from the special yarn spinning apparatus 10 according to the first embodiment in the configuration of the joining device 22. For the sake of description, like or same parts or elements are designated by the same reference numerals as the counterparts which have been used in the first embodiment, and the description thereof will be omitted..

[0034] As shown in Figs. 6 and 7, a joining device 50 includes a belt conveyer 51 for conveying the first roving S1 and the second roving S2. The belt conveyer 51 corresponds to the conveyer of the present invention. The belt conveyer 51, which conveys the fiber bundle from the front roller pair 25 to the delivery roller pair 47, includes a drive shaft 52, an idle shaft and a belt 53 that is wound around the drive shaft 52 and the idle shaft. The belt 53 is tilted so that the upper surface of the belt 53 extends tangentially to both of the front bottom roller 25A and the bottom roller 47A of the delivery roller pair 47. The drive shaft 52 is driven to rotate by the front bottom roller 25A via a transmission mechanism (not shown).

[0035] A guide member 54 is disposed above the upper surface of belt conveyer 51 to guide the first roving S1 and the second roving S2 being conveyed by the belt conveyer 51 toward the anti-twist device 23 so as to merge the first and the second rovings S1, S2 together for engagement thereof. As shown in Fig. 7, the guide member 54 includes two guide plates 54A that are arranged in merging manner along the feeding direction of the roving. The spaced distance between the guide plates 54A at the upstream end is greater than the maximum spaced distance between the first and second rovings S1 and S2.

[0036] The belt conveyer 51 transfers the first roving S1 and the second roving S2 before being twisted in the joining device 50 toward the anti-twist device 23. Thus, the joined, untwisted two rovings are moved in a stable manner until moving past the anti-twist device 23.

[0037] The above-described second embodiment of the present invention offers the following effect, as well as the above-described effects (1) and (3) according to the first embodiment.

(5) The joining device 50 that is provided with the belt conveyer 51 allows two rovings before being twisted to be moved in a stable state until moving past the anti-twist device 23.

(Third embodiment)

[0038] The following will describe a special yarn spinning apparatus according to a third embodiment with reference to Figs. 8 and 9. The third embodiment differs from the special yarn spinning apparatus 10 according to the first and second embodiments in the configuration of the delivery roller pair. In addition, the third embodiment differs from the second embodiment in that the joining device 50 is provided with the belt conveyer 51 and dispenses with the guide member 54. For the sake of description, like or same parts or elements are designated by the same reference numerals as the counterparts which have been used in the second embodiment, and the description thereof will be omitted.

[0039] As shown in Figs. 8 and 9, the delivery roller pair 55 functioning as the anti-twist device is disposed with the axes thereof extending in the direction intersecting with the axes of the rollers of the draft device 21. In this configuration, the delivery roller pair 55 in rotation applies force to the first roving S1 and the second roving S2 fed from the front roller pair 25 of the draft device 21 in such a way so as to cause the rovings S1, S2 to be connected and joined.

[0040] In switching the feeding from the first roving S1 to the second roving S2, with the feeding of the second roving S2 started and the leading end S2A of the second roving S2 placed in contact with one of the roller surfaces of the delivery roller pair 55, the second roving S2 receives such a force from the delivery roller pair 55 that causes the leading end S2A of the second roving S2 to move close to the trailing end S1A of the first roving S1. The leading end S2A of the second roving S2 is led to a position of joining with the trailing end S1A of the first roving S1, and the leading end S2A of the second roving S2 and the trailing end S1A of the first roving S1 pass through the delivery roller pair 55 in the joined state.

[0041] The third embodiment offers the following effect in addition to the above-described effects (1) and (3) according to the first embodiment and (5) according to the second embodiment.

(6) According to the configuration in which the delivery roller pair 55 is disposed with the axes thereof extending in the direction that that is perpendicular to the axes of the roller of the draft device 21, the delivery roller pair 55 in rotation applies such a force to the first roving S1 and the second roving S2 fed from the draft device 21 that causes the first and the second rovings S1, S2 to move close to each other to be combined and joined. Thus, the trailing endS1A of the first roving S1 and the leading end S2A of the second roving S2 may be smoothly joined without using the guide member 54. The delivery roller pair 55 serves as the joining device of the present invention.

(Fourth embodiment)

[0042] The following will describe a special yarn spinning apparatus according to a fourth embodiment with reference to Figs. 10 and 11. The forth embodiment differs from the previously described embodiments in the configuration of the joining device. For the sake of de-

scription, like or same parts or elements are designated by the same reference numerals as the counterparts which have been used in the second embodiment, and the description thereof will be omitted.

[0043] Referring to Fig. 10, a suction pipe 56 is disposed extending parallel to the axis of the front roller pair 25 and between the front roller pair 25 and the delivery roller pair 47. The suction pipe 56 has a generally triangular shape in cross-section, and the surface of the suction pipe 56 formed by one side of the triangle faces the passage of the fiber bundle from the front roller pair 25 to the delivery roller pair 47 and the surfaces of the suction pipe 56 formed by the other two sides of the triangle are located below the fiber bundle passage. The suction pipe 56 has a suction slit 57 in the surface that faces the passage of the fiber bundle. In addition, a drive roller 58 is provided below the suction pipe 56.

[0044] An endless conveyer belt 59 is wound on the drive roller 58 and the suction pipe 56 on the surface thereof in which the suction slit 57 is formed. The drive roller 58 is rotated in counterclockwise direction in Fig. 10. With the rotation of the drive roller 58, the conveyer belt 59 is driven to move on the surface of the suction pipe 56 having the suction slit 57 in the direction from the front roller pair 25 to the delivery roller pair 47.

[0045] As shown in Fig. 11, the suction slit 57 is formed inclined with respect to the moving direction of fiber bundle (vertical direction in Fig. 11) in the regions upstream and downstream of the suction slit 57. In the present embodiment, the suction slit 57 is inclined rightward as seen from the upstream side of the suction slit 57, or from the upper side in Fig. 11.

[0046] The suction slit 57 has an upstream edge 57A having a width W1 and a downstream edge 57B having a width W2 that is smaller than W1, and the suction slit 57 has a guide edge 60 on one lateral side in the width direction of the suction slit 57, or the right side in Fig. 11 for converging the fiber bundles. The guide edge 60 includes an upstream portion 60A and a downstream portion 60B that is formed continuous with the upstream portion 60A, and the upstream portion 60A is inclined greater than the downstream portion 60B. In addition, the upstream portion 60A and the downstream portion 60B of the guide edge 60 are smoothly connected with a curve. The other side edge, namely the side edge 61, is formed so that a part of the side edge 61 crosses an imaginary line L1 extending parallel to the moving direction of the fiber bundle and passing through the downstream end 60DP of the guide edge 60.

[0047] According to the present embodiment, the front roller pair 25 feeds the fiber bundle to an area corresponding to the width W1 of the upstream edge 57A of the suction slit 57. After passing through the area corresponding to the upstream edge 57A of the suction slit 57, the end of the fiber bundle is urged leftward in Fig. 11 by suction airstream from the suction slit 57 so that the end of the fiber bundle passes through the area corresponding to the width W2 of the downstream edge 57B of the suction slit 57. In other words, the fiber bundle is moved over the suction slit 57 by the conveyer belt 59 while passing the area corresponding to the width W2 of the downstream edge 57B of the suction slit 57.

[0048] When switching the feeding from the first roving S1 to the second roving S2, for example, the first roving S1 passes through the area corresponding to the width W1 of the upstream edge 57A of the suction slit 57, which is spaced away from the imaginary line L1 of the suction slit 57, and the trailing end S1A of the first roving S1 is moved along the guide edge 60 under the influence of the suction from the suction slit 57.

[0049] The second roving S2 starts to be fed and is moved adjacent to the imaginary line L1 in the area corresponding to the width W1 of the upstream edge 57A of the suction slit 57. The leading end S2A of the second roving S2A is moved along the guide edge 60 of the suction slit 57 under the influence of the suction from the suction slit 57.

[0050] With the first roving passing along the suction slit 57, the leading end S2A of the second roving S2 is moved in proximity to the first roving S1 under the influence of suction from the suction slit 57 after moving past the upstream edge 57A of the suction slit 57. Thus, the trailing end S1A of the first roving S1 and the leading end S2A of the second roving S2 are combined and joined. The fleece resulting from the joining of the first and second roving S1, S2 and coming out from the anti-twist device 23 is twisted.

[0051] The present invention is not limited to the above-described embodiments, which may be modified in various manners within the scope of the invention, as exemplified below.

[0052] The shape of the suction slit 57 of the joining device is not limited to that of the fourth embodiment shown in Fig. 11. For example, the side edge 61 of the suction slit 57 may not necessarily be straight, but it may include two different straight side edges, namely the downstream edge portion that extend parallel to the downstream portion 60B of the guide edge 60 and cross the imaginary line L1 and the upstream portion that extend parallel to the imaginary line L1. The downstream edge portion of the side edge 61 may be inclined at a smaller angle than the downstream portion 60B of the guide edge 60 with respect to the imaginary line L1 and the upstream portion of the side edge 61 may be inclined smaller than the upstream portion of the guide edge 60 with respect to the imaginary line L1 and cross the imaginary line L1.

[0053] As shown in Fig. 12A, the suction slit 57 may have the side edge 61 that is not straight but includes two straight side edges, namely a downstream portion 61 B extending substantially in the same direction as the downstream portion 60B of the guide edge 60 and an upstream portion 61A extending opposite direction of the upstream portion 60A of the guide edge 60 with respect to the imaginary line L1. The upstream portion 61A and the downstream portion 61B both cross the imaginary

line L1, and the upstream end of the downstream portion 61B is positioned on the side of the imaginary line L1 that is adjacent to the guide edge 60. In addition, the upstream edge 57A of the suction slit 57 crosses the imaginary line L1, and the width W1 of the upstream edge 57A is greater than that of the case in which the suction slit 57 has the upstream edge 57A that does not cross the imaginary line L1.

[0054] In switching the feed of rovings in the spinning apparatus having the suction slit of Fig. 12A in the suction pipe 56, if the leading end of the fiber bundle just entering into the suction slit 57 is located in the area corresponding to the upstream portion 61A of the side edge 61, the leading end of the fiber bundle is moved along the upstream portion 61A of the side edge 61. While moving along the upstream portion 61A, the leading end of the fiber bundle approaches to the cut trailing end of the fiber bundle to be joined therewith.

[0055] Alternatively, if the leading end of the fiber bundle just entering into the suction slit 57 is located in the area other than the above area corresponding to the upstream portion 61A of the side edge 61, or in the area generally corresponding to the upstream portion 60A and the downstream portion 60B of the guide edge 60, the leading end of the fiber bundle is moved along the upstream portion 60A of the guide edge 60. While moving along the downstream portion 60B near the downstream end 60DP, the leading end of the fiber bundle approaches to the cut trailing end of the fiber bundle to be joined therewith.

[0056] The suction slit 57 of Fig. 12A having the side edge 61 that includes the downstream portion 61 B and the upstream portion 61A may be modified in such a way the downstream portion 61 B and the upstream portion 61A are formed by two different straight sides, respectively. In each of the two straight sides forming the downstream portion 61 B and the upstream portion 61A, one of the upper and lower straight sides may be inclined at an angle that is different from that of the other of the upper and lower straight side.

[0057] As shown in Fig. 12B, the suction slit 57 may have a generally Y shape. In the suction slit 57 having such a shape, the guide edge 60 may be formed by a plurality of sides, and the upstream portion 61A and the downstream portion 61 B of the side edge 61 may also be formed by a plurality of straight sides.

[0058] The shape of the suction slit 57 is not limited to the shapes of the above-described embodiments, but the guide edge 60 may be formed by a single straight edge, including the shape of Fig. 12B, as long as the width W1 of the upstream edge 57A is larger than the width W2 of the downstream edge 57B.

[0059] The suction slit 57 may be partially curved. For example, at least a part of the guide edge 60 may be curved, at least a part of the side edge 61 may be curved, or a part of the upstream edge 57A and the downstream edge 57B of the suction slit 57 may be curved.

[0060] The suction slit 57 shown in Figs. 11, 12A and 12B may be formed in a reversed shape. For example, in case of the suction slit 57 shown in Fig. 11, the guide edge 60 on the right side and the side edge 61 on the left side as seen in the drawing may be reversed.

[0061] As shown in Fig. 13, the bottom roller 47A of the delivery roller pair 47 that forms a part of the anti-twist device 23 may act as the front bottom roller 25A of the draft device 21. The front bottom roller 25A has a diameter that is large enough to allow a guide member 64 functioning as the joining device 22 to be arranged between the front top roller 25B and the top roller 47B of the delivery roller pair 47. The guide member 64 is so configured as to narrow the spaced distance between the two rovings S1, S2 fed from the front bottom roller 25A and the front top roller 25B as in the case of the guide member 54 in the second embodiment. Although the delivery roller pair 47 shares the front bottom roller 25A with the draft device 21, the top roller 47B does not function as the draft roller.

[0062] In the joining device 50, the conveyer that conveys the rovings S1, S2 needs not be the belt conveyer 51, but the bottom apron of the apron device may be used. In such a case, as compared with the case in which the belt conveyer 51 is used, the rovings S1, S2 may be guided closer to the anti-twist device 23 because an endless apron is wound on the driving roller and the apron cradle. A meshed apron may be used for the bottom apron.

[0063] A meshed apron may be used for the conveyer, so that the conveyer may not interfere in joining fiber bundles in a case in which the fiber bundles are to be joined by using positive and negative air pressure. In addition, the conveyer may be lighter compared with the case in which a non-porous belt is used.

[0064] In the joining device 50, the conveyer that conveys the roving S1, S2 need not have the belt 53, an endless tape or an apron, but a single or a plurality of rollers may be used.

[0065] The conveyer may be driven by the bottom roller 47A of the delivery roller pair 47, the front top roller 25B, or the top roller 47B, as well as by the front bottom roller 25A. Additionally, the conveyer may be provided with its own drive.

[0066] In a case where suction air is used to join a plurality of rovings while they are being conveyed from the draft device 21 to the anti-twist device 23, an air passage may be formed in the roller and the belt forming the conveyer.

[0067] In the joining device 50 having the guide member 54 in the second embodiment, the belt conveyer 51 may be substituted with an ultrasonic vibration board. In such case, the first and second rovings S1, S2 fed from the front roller pair 25 and moved on the ultrasonic board towards the anti-twist device 23 receive significantly small contact resistance, so that the rovings S1, S1 are moved to the anti-twist device 23 by the pushing force of the front roller pair 25.

[0068] The guide plate 54A of the guide member 54

may be formed by an ultrasonic vibration board. In this case, the two rovings S1, S2 fed from the front roller pair 25 may be guided easily so as to move close to each other.

[0069] Although the special yarn spinning apparatus10 is configured to use the first and second rovings S1, S2 from the roving bobbins 13A, 13B as the fiber bundle for drafting and spinning into a yarn Y, a sliver may be used as the fiber bundle.

[0070] The fiber bundle supply source 11 may include more than two fiber bundles that can be fed independently. For example, it may be so configured that three different fiber bundles (rovings) are fed independently, so that a yarn continuously includes three fibers in any order for a predetermined length, or two kinds of fiber bundle in any order continues for a predetermined length.

[0071] A special yarn spinning apparatus adapted for use in a spinning machine includes a plurality of apron draft devices that are configured to switch fiber bundles to be fed, respectively. The special yarn spinning apparatus further includes a joining device and an anti-twist device. The joining device joins a training end of the fiber bundle fed from at least one of the apron draft devices which has operated before switching the feed and a leading end of the fiber bundle fed from another of the apron draft device which has started after switching the feed. The anti-twist device holds and delivers the fiber bundle at a position downstream of the joining device to prevent propagation of twist from a twist device to the joined fiber bundles in the joining device.

Claims

1. A special yarn spinning apparatus (10) in a spinning machine including a plurality of apron draft devices (25, 26, 27), wherein the apron draft devices (25, 26, 27) are configured to switch fiber bundles to be fed, respectively,
   characterized in that
   the special yarn spinning apparatus (10) includes a joining device (22, 50) and an anti-twist device (23), wherein the joining device (22, 50) joins a trailing end (S1A) of the fiber bundle fed from at least one of the apron draft devices (25, 26, 27) which has operated before switching the feed, and a leading end (S2A) of the fiber bundle fed from another of the apron draft devices (25, 26, 27) which has started after switching the feed, and
   wherein the anti-twist device (23) holds and delivers the joined fiber bundles at a position downstream of the joining device (22, 50) to prevent propagation of twist from a twisting device (18) to the joined fiber bundles in the joining device (22, 50).

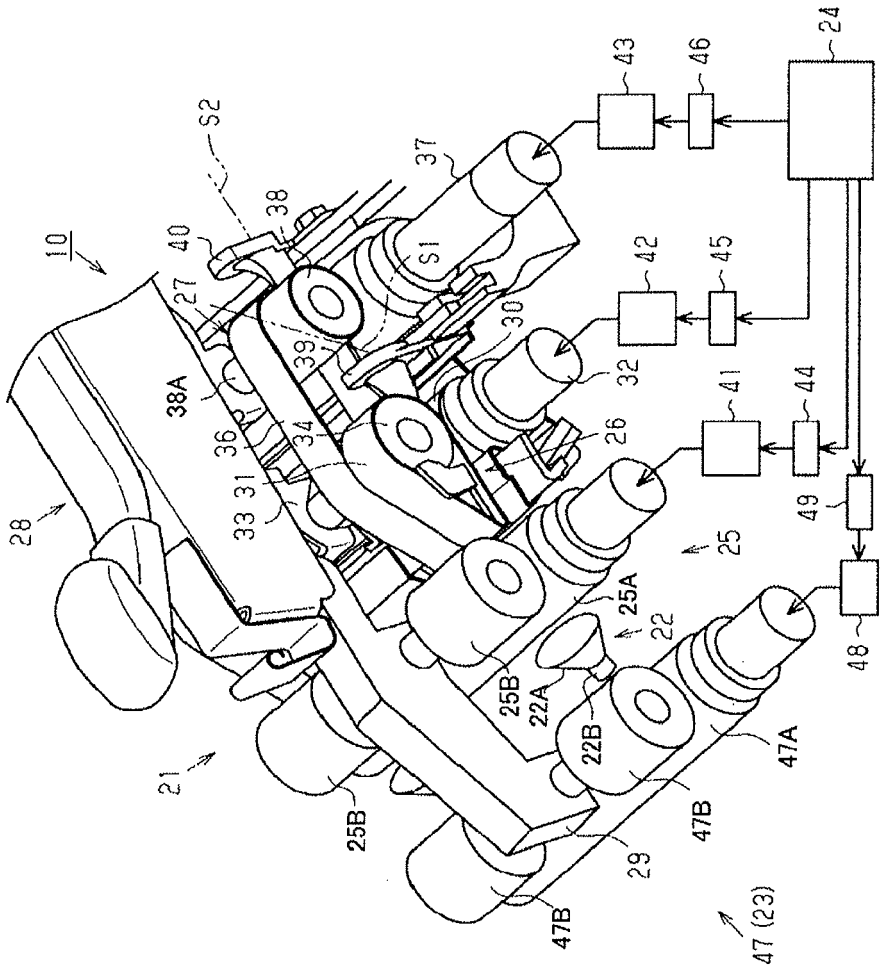
2. The special yarn spinning apparatus (10) in the spinning machine according to claim 1, **characterized in that** the joining device (22, 50) include a conveyer (51) that conveys the fiber bundle.

3. The special yarn spinning apparatus (10) in the spinning machine according to claim 2, **characterized in that** the conveyer (51) is formed by a meshed apron.

4. The special yarn spinning apparatus (10) in the spinning machine according to claim 2, **characterized in that** the anti-twist device (23) is formed by a delivery roller (55) that is disposed with an axis thereof extending in a direction intersecting with axes of rollers of the apron draft device (25, 26, 27), and the delivery roller (55) serves as the joining device (50).

5. The special yarn spinning apparatus (10) in the spinning machine according to claim 2, **characterized in that** the joining device (22, 50) is formed by a suction slit (57), wherein the suction slit (57) is formed inclined with respect to a moving direction of the fiber bundles in regions upstream and downstream of the suction slit (57), wherein the suction slit (57) has a guide edge (60) that is one of lateral side edges in width direction of the suction slit (57), and wherein when an imaginary line (L1) that extends parallel to the moving direction of the fiber bundles and passes through a downstream end (60DP) of the guide edge (60), the other the other lateral side edge crosses the imaginary line (L1).

FIG. 1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22A
22B
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38A
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46
47 (23)
47A
47B
48
49
S1
S2

FIG. 2

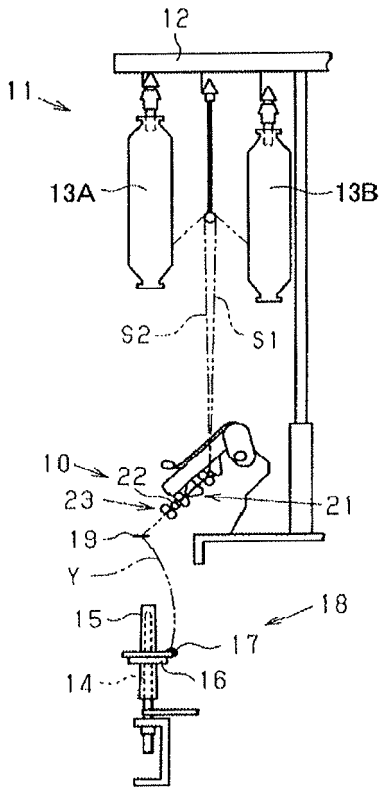


FIG. 3A

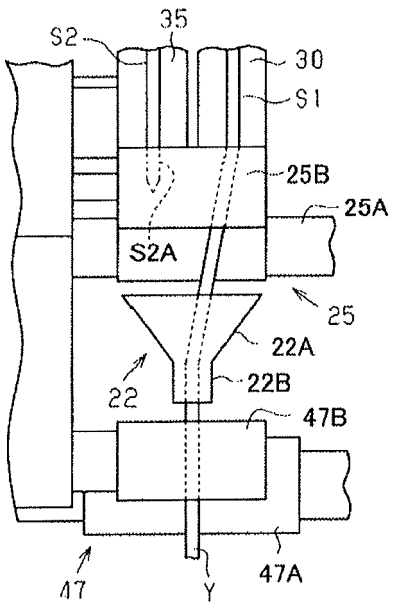


FIG. 3B

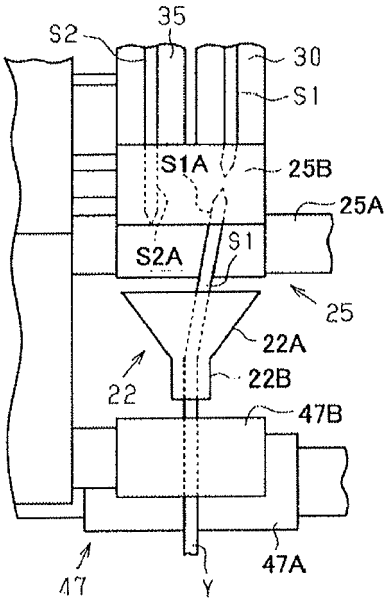


FIG. 4A

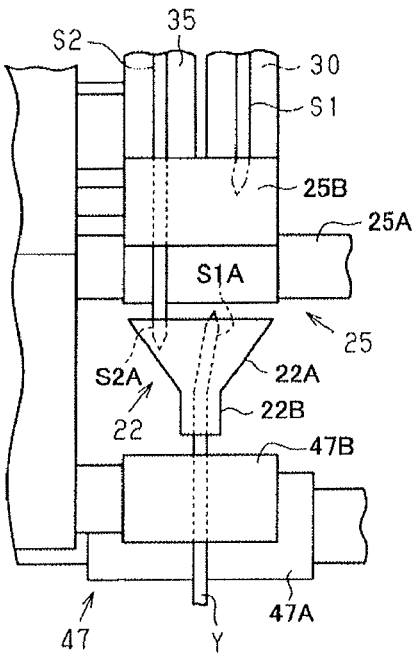


FIG. 4B

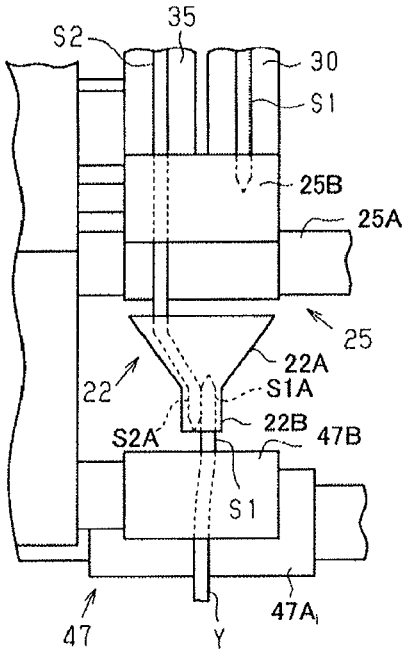


FIG. 5

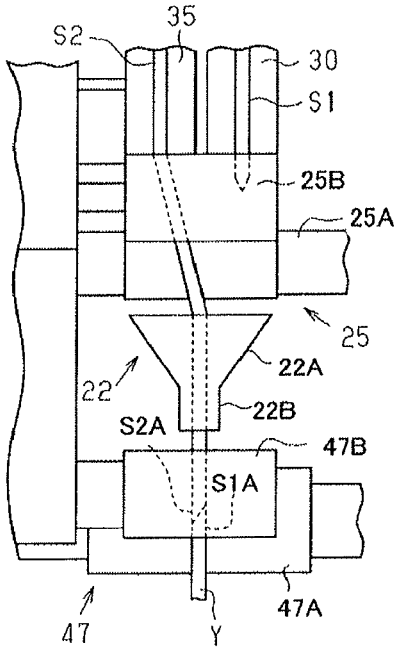
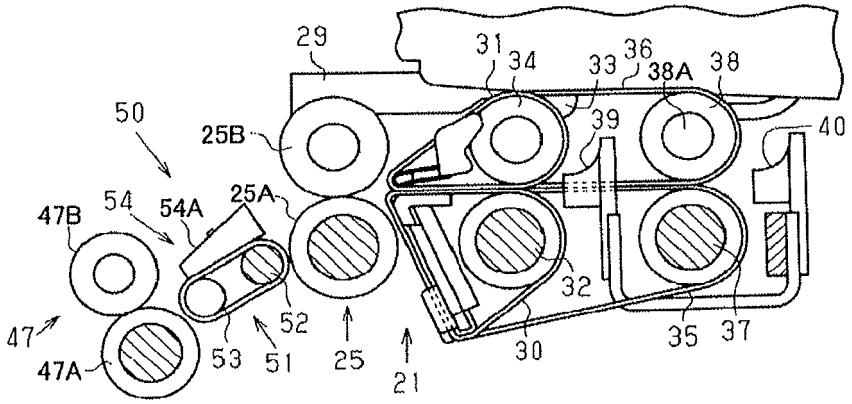


FIG. 6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36
38A
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25B
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47B
54
54A
25A
32
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25
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35
37
47A

FIG. 7

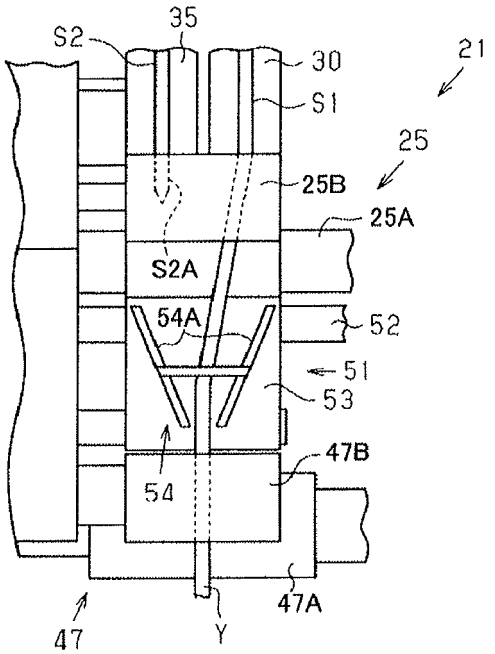
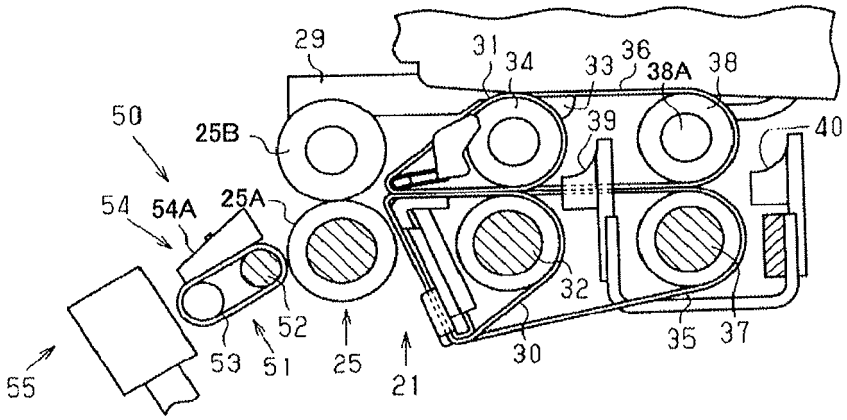

S2
35
30
21
S1
25
25B
25A
S2A
54A
52
51
53
47B
54
47
Y
47A

FIG. 8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38A
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25B
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54A
25A
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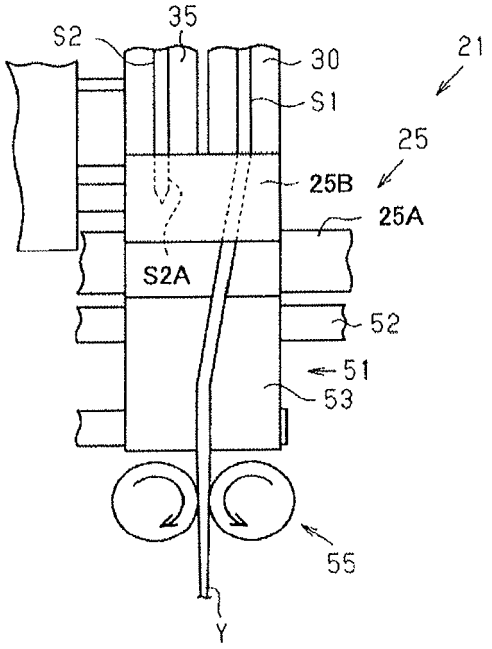
FIG. 9


S2
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21
S1
25
25B
25A
S2A
52
51
53
55
Y

FIG. 10

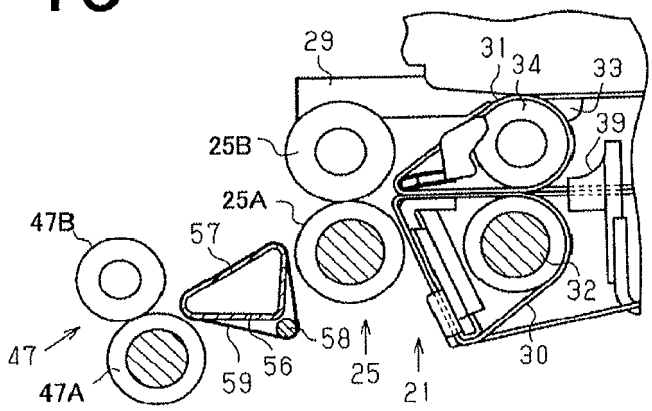


FIG. 11

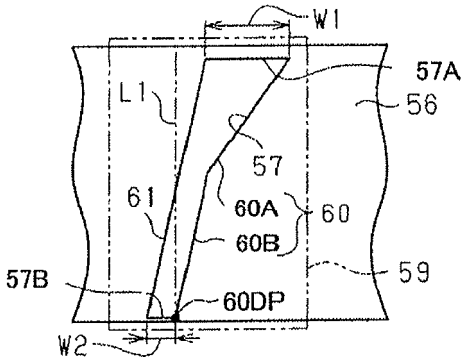


FIG. 12A

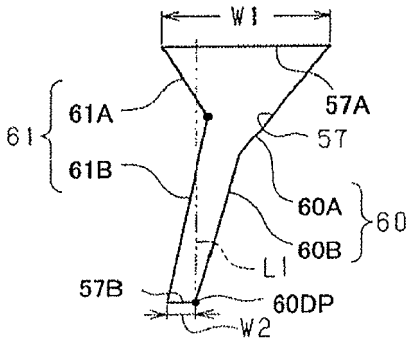


FIG. 12B

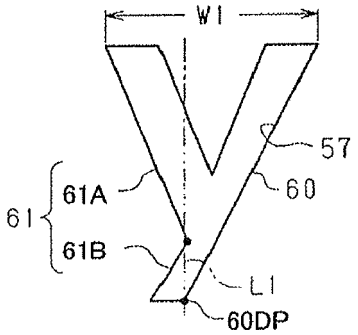


FIG. 13

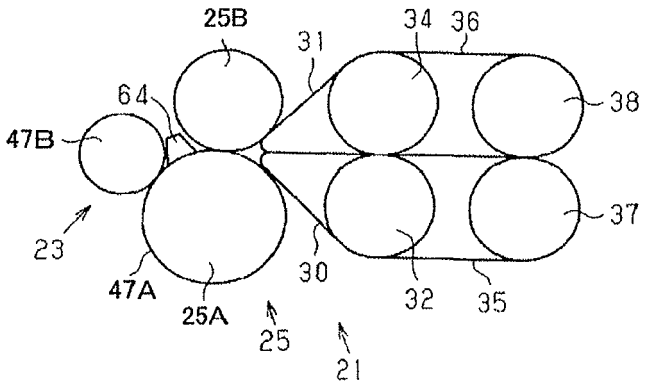
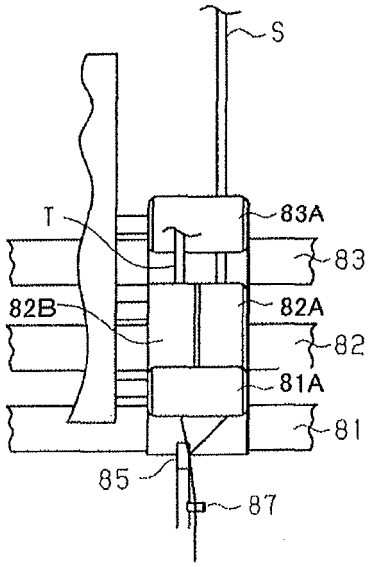


FIG. 14 (Backgroung Art)



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Patent documents cited in the description

- WO 2011018685 PCT **[0002]**