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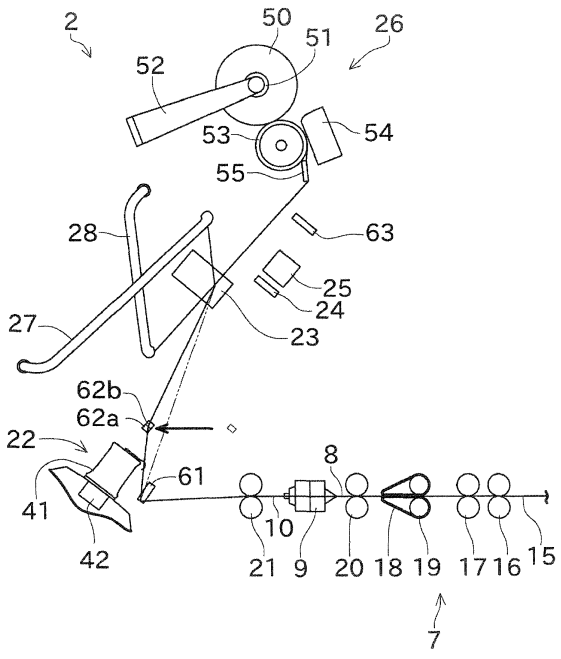
(54) Spinning machine

(57) A spinning machine includes a spinning device (9), a winding section (26), a yarn pooling device (22), a yarn joining device (23), a transporting device, and a movable guide (60). The winding section forms a package (50). The yarn pooling device (22) pools the spun yarn (10) between the spinning device (9) and the winding section (26). The yarn joining device (23) joins the spun yarns (10). The transporting device transports the spun yarn (10) to the yarn joining device (23). The yarn pooling device (22) changes a direction of a first yarn path. The yarn pooling device (22) is arranged at a position away from the second yarn path. The movable guide (60) pulls the spun yarn (10) on the second yarn path to the yarn pooling device (22).

FIG. 7



FIRST GUIDE 61	NORMAL POSITION
SECOND GUIDE 62a	RETRACTED POSITION → NORMAL POSITION

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a spinning machine having a layout in which a direction of a yarn path is greatly different between the upstream and the downstream of a yarn pooling device. The present invention more particularly relates to a structure that appropriately performs yarn joining in the spinning machine having this layout.

2. Description of the Related Art

[0002] A spinning machine including a yarn pooling device that temporarily pools a spun yarn by winding the spun yarn around a rotatable roller is known in the art. Japanese Patent Application Laid-open No. 2004-277944 discloses this type of spinning machine.

[0003] The spinning machine disclosed in Japanese Patent Application Laid-open No. 2004-277944 includes a yarn joining carrier that has a yarn joining device that joins a spun yarn from a spinning device and a spun yarn from a package. When a yarn breakage occurs in a spinning unit, or when a yarn-quality monitoring device detects a yarn defect and cuts the yarn with a cutter, the yarn joining carrier moves to the corresponding spinning unit and performs yarn joining using the yarn joining device.

[0004] When performing the yarn joining, the spun yarn is supplied to the yarn pooling device. When supplying the spun yarn to the yarn pooling device, as explained in Japanese Patent Application Laid-open No. 2004-277944, for example, a movable guide can be used. The spinning machine disclosed in Japanese Patent Application Laid-open No. 2004-277944 includes a movable guide, which is driven by an air cylinder or the like, on either the upstream or the downstream of the yarn pooling device. By guiding the spun yarn to the yarn pooling device with the movable guide, the spun yarn can be re-pooled in the yarn pooling device.

[0005] In recent years, as disclosed in Japanese Patent Application Laid-open No. 2012-31523, a spinning machine in which a direction of a yarn path is greatly different between the upstream and the downstream of a yarn pooling device has been proposed. In the spinning machine disclosed in Japanese Patent Application Laid-open No. 2012-31523, the yarn path on the upstream of the yarn pooling device is headed for the rear upper direction (see FIG. 1 of Japanese Patent Application Laid-open No. 2012-31523). On the other hand, the yarn path on the downstream of the yarn pooling device is headed for the front upper direction. That is, the yarn path changes by about 90 degrees between the upstream and the downstream of the yarn pooling device.

[0006] It should be noted that the spinning machine disclosed in Japanese Patent Application Laid-open No. 2012-31523 does not include a yarn joining device. With this layout, because the yarn path is greatly different between the upstream and the downstream of the yarn pooling device, it becomes difficult to guide the spun yarn to the yarn pooling device after starting the yarn joining or the like.

[0007] In the layout of the spinning machine disclosed in Japanese Patent Application Laid-open No. 2004-277944, basically, the direction of the yarn path does not change between the upstream and the downstream of the yarn pooling device. Therefore, the spun yarn can be guided to the yarn pooling device by bringing one movable guide close to the yarn pooling device.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to provide a structure that appropriately performs yarn joining in a spinning machine in which a direction of a yarn path changes between the upstream and the downstream of a yarn pooling device.

[0009] According to an aspect of the present invention, a spinning machine includes a spinning device that forms a spun yarn by twisting a fiber bundle; a winding section that forms a package by winding the spun yarn around a winding tube; a yarn pooling device that pools the spun yarn between the spinning device and the winding section; a yarn joining device that joins the spun yarn from the spinning device and the spun yarn from the winding section; a transporting device that transports the spun yarns to the yarn joining device; and a movable guide that pulls the spun yarn toward the yarn pooling device. A direction of a first yarn path, which is a yarn path during winding of the package by the winding section, is changed by the yarn pooling device, the yarn pooling device is arranged at a position located away from a second yarn path that is a yarn path before the pulling of the spun yarn is performed by the movable guide after the spun yarns are transported to the yarn joining device by the transporting device, and the movable guide pulls the spun yarn on the second yarn path to the yarn pooling device.

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

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a side view of a spinning unit including a yarn pooling device according to an embodiment of the present invention;

FIG. 2 is a perspective view of the yarn pooling de-

vice and a yarn guide arranged near the yarn pooling device;

FIG. 3 is a perspective view of a first guide and a stopper;

FIG. 4 is a side view of a spinning device illustrating a state of a transporting device when catching an end of a spun yarn;

FIG. 5 is a side view of a spinning device illustrating a state of a transporting device when guiding a spun yarn to a yarn joining device;

FIG. 6 is a side view of a spinning device illustrating a state of a first guide before and after moving; and

FIG. 7 is a side view of a spinning device illustrating a state of a second guide before and after moving.

DETAILED DESCRIPTION

[0012] Exemplary embodiments of the present invention are explained in detail below with reference to the accompanying drawings. In this specification, the "upstream" and the "downstream", respectively, mean the upstream and the downstream in a traveling direction of a fiber bundle and a spun yarn at the time of spinning.

[0013] A spinning machine (not shown) includes a plurality of spinning units 2 arranged in parallel and a main control device (not shown) that manages the spinning units 2 in a centralized manner. Each spinning unit 2 forms a spun yarn 10 by spinning a fiber bundle 8 supplied from a drafting device 7 using a spinning device 9, and forms a package 50 by winding the spun yarn 10 using a winding section 26.

[0014] As illustrated in FIG. 1, each spinning unit 2 includes the drafting device 7, the spinning device 9, a yarn pooling device 22, a yarn joining device 23, a yarn monitoring device 25, and the winding section 26, arranged sequentially from the upstream to the downstream. The structural components included in the spinning unit 2 are controlled by a unit controller (not shown) arranged in the spinning unit 2.

[0015] The drafting device 7 includes, sequentially from the upstream, four draft rollers, namely, a back roller 16, a third roller 17, a middle roller 19 with a rubber apron belt 18, and a front roller 20. Each of the draft rollers is driven to rotate at a predetermined rotation speed. The drafting device 7 further includes opposing rollers arranged respectively facing the draft rollers.

[0016] The drafting device 7 transports a sliver 15 supplied from a sliver case (not shown) via a sliver guide (not shown) by nipping the sliver 15 between the rotating draft rollers and the opposing rollers respectively facing the draft rollers, thus forming a fiber bundle 8 by stretching (drafting) the sliver 15 until a predetermined fiber amount (or thickness) is obtained.

[0017] The spinning device 9 is arranged immediately downstream of the front roller 20. The fiber bundle 8 drafted by the drafting device 7 is supplied to the spinning device 9. The spinning device 9 forms the spun yarn 10 by twisting the fiber bundle 8 supplied from the drafting device 7. According to the present embodiment, an air spinning device is employed, which twists the fiber bundle 8 by using a swirling airflow. Specifically, the spinning device 9 includes a fiber guiding section, a swirling airflow generating nozzle, and a hollow guide shaft, although a detailed description and drawing thereof are omitted. The fiber guiding section guides the fiber bundle 8 supplied from the drafting device 7 to a spinning chamber inside the spinning device 9. The swirling airflow generating nozzle is arranged around a path of the fiber bundle 8, and generates a swirling airflow inside the spinning chamber. Ends of fibers of the fiber bundle 8 inside the spinning chamber is reversed and swirled by the swirling airflow. The hollow guide shaft guides the spun yarn 10 that is spun in the above manner from the spinning chamber to outside the spinning device 9.

[0018] A delivery roller 21 and a nip roller, which can be brought into contact with or separated from the delivery roller, are arranged downstream of the spinning device 9. By nipping the spun yarn 10, which is discharged from the spinning device 9, between the delivery roller 21 and the nip roller and driving the delivery roller 21 to rotate, the spun yarn 10 is sent toward the winding section 26.

[0019] A first guide 61 that guides the spun yarn 10 is arranged downstream of the delivery roller 21. The first guide 61 guides the spun yarn 10 to the yarn pooling device 22. The first guide 61 is movable to pull the spun yarn 10 to the yarn pooling device 22 when yarn joining or the like is necessary to be performed. As illustrated in FIGS. 2 and 3, the first guide 61 includes an arm portion 61a, a guide portion 61b, and a contact portion 61c.

[0020] The arm portion 61a is an elongated flat plate including a base end (root end) that is rotatably supported. The first guide 61 is rotatable in a direction of an arrow (upward direction in a height direction of the device) illustrated in FIG. 3 by being driven by a guide driving motor (driving section, not shown) as a driving source. With this configuration, a position of the first guide 61 is switchable between a normal position (position illustrated in FIG. 2) that is a position when winding the spun yarn 10 and a retracted position that is a position retracted from the normal position.

[0021] A guide groove is formed on the guide portion 61b to guide the spun yarn 10. A stopper (regulating member) 70 that prevents the first guide 61 from excessively rotating (regulates the first guide 61 to be appropriately positioned at the normal position) is arranged near the yarn pooling device 22. At the normal position, the contact portion 61c of the first guide 61 is in contact with the stopper 70.

[0022] The yarn pooling device 22 is arranged downstream of the first guide 61. The yarn pooling device 22 includes a yarn pooling roller 41, an electric motor 42 that drives the yarn pooling roller 41 to rotate, and a yarn hooking member 43. The spun yarn 10 is temporarily pooled by being wound around the outer circumferential surface of the yarn pooling roller 41.

[0023] The yarn hooking member 43 is mounted on a downstream end portion of the yarn pooling roller 41. The yarn hooking member 43 is supported in a rotatable manner relatively to the yarn pooling roller 41. A permanent magnet is attached to any one of the yarn hooking member 43 and the yarn pooling roller 41, and a magnetic hysteresis member is attached to the other of the yarn hooking member 43 and the yarn pooling roller 41. These magnetic means generate a torque against a relative rotation of the yarn hooking member 43 with respect to the yarn pooling roller 41. Therefore, only when a force overcoming the torque is applied (when a tension of a predetermined amount or larger is applied) on the yarn hooking member 43, the yarn hooking member 43 is rotated relatively to the yarn pooling roller 41 so that the spun yarn 10 wound around the yarn pooling roller 41 can be unwound. On the other hand, when such a force is not applied to the yarn hooking member 43, the yarn pooling roller 41 and the yarn hooking member 43 are integrally rotated so that the spun yarn 10 is wound around the yarn pooling roller 41.

[0024] In this manner, the yarn pooling device 22 operates such that the spun yarn 10 is unwound when the yarn tension on the downstream is increased, and the spun yarn 10 is prevented from being unwound when the yarn tension is decreased (when the spun yarn 10 is about to have a slack). With this operation, the yarn pooling device 22 can remove the slack of the spun yarn 10 and apply an appropriate tension on the spun yarn 10. Furthermore, because the yarn hooking member 43 operates to absorb a variation of the tension applied on the spun yarn 10 between the yarn pooling device 22 and the winding section 26, the variation of the tension is prevented from affecting the spun yarn 10 between the spinning device 9 and the yarn pooling device 22.

[0025] Although the yarn traveling direction on the upstream of the yarn pooling device 22 is substantially a horizontal direction with respect to a machine installation surface, the yarn traveling direction on the downstream of the yarn pooling device 22 is an obliquely upward direction. That is, a direction of a yarn path (first yarn path) of the spun yarn 10 that is being wound greatly changes (bent) (by 90 degrees or larger) by the yarn pooling device 22.

[0026] A regulating guide 62, which suppresses a behavior of the spun yarn 10 unwound from the yarn pooling roller 41, is arranged downstream of the yarn pooling roller 41. As illustrated in FIG. 2, the regulating guide 62 includes a second guide 62a and a third guide 62b. Moreover, a separate regulating guide (for example, a regulating guide having an opening larger than that of the regulating guide 62) can be arranged in addition to the second guide 62a and the third guide 62b.

[0027] As illustrated in FIG. 2, the second guide 62a is rotatable on a plane perpendicular to the yarn traveling direction. With this configuration, a position of the second guide 62a is switchable between a normal position (indicated by a solid line in FIG. 2), which is a position at the time of winding the spun yarn 10, and a retracted position (indicated by a dashed double-dotted line in FIG. 2), which is a position retracted from the normal position. By moving from the retracted position to the normal position, the second guide 62a pulls the spun yarn 10 to the yarn pooling device 22 together with the first guide 61. A method and structure for moving the second guide 62a is not limited. In the present embodiment, the second guide 62a is moved by transmitting the driving force of the above-mentioned guide driving motor via a cam or the like. A guide groove for guiding the spun yarn 10 is formed on the second guide 62a.

[0028] The third guide 62b is arranged further downstream of the second guide 62a and adjacent to the second guide 62a. The third guide 62b is fixed to a frame of the spinning unit 2 or the like. Similar to the second guide 62a, a guide groove is formed on the third guide 62b. When the second guide 62a is at the normal position, the guide groove of the second guide 62a and the guide groove of the third guide 62b face each other. With this configuration, the spun yarn 10 can be guided by the guide groove of the second guide 62a and the guide groove of the third guide 62b.

[0029] The yarn joining device 23 is arranged downstream of the regulating guide 62. When a breakage of the spun yarn 10 occurs between the spinning device 9 and the package 50, the yarn joining device 23 joins the spun yarn 10 (first yarn) from the spinning device 9 and a yarn (second yarn) from the package 50. In the present embodiment, the yarn joining device 23 is a slicer device that twists ends of the yarns together by a swirling airflow generated by a compressed air. However, the yarn joining device 23 is not limited to the above-mentioned slicer device, but can be a mechanical knotter or the like, for example.

[0030] The spinning unit 2 includes a transporting device that transports the spun yarn 10 to the yarn joining device 23. The transporting device includes a first transporting device 27 that transports the first yarn, and a second transporting device 28 that transports the second yarn to the yarn joining device 23.

[0031] The first transporting device 27 includes a base portion that is pivotably supported, and can pivot in a vertical direction around the base portion as a center. The first transporting device 27 is hollow, connected to a not shown blower, and can generate a suction airflow. The first transporting device 27 catches an end of the first yarn sent by the delivery roller 21 by pivoting in the vertical direction (see a dashed double-dotted line in FIG. 1). At this time, according to the present embodiment, the delivery roller 21 and the nip roller are in contact with each other. However, it is not necessary that the delivery roller 21 and the nip roller are in contact with each other. After catching the first yarn, the first transporting device 27 transports the first yarn to the yarn joining device 23 by pivoting in the vertical direction.

[0032] The second transporting device 28 includes a base portion that is pivotably supported, and can pivot in

the vertical direction around the base portion as a center. The second transporting device 28 is also hollow, connected to a not shown blower, and can generate a suction airflow. The second transporting device 28 catches an end of the second yarn from the package 50 by pivoting in the vertical direction (see a dashed double-dotted line in FIG. 1). After catching the second yarn, the second transporting device 28 transports the second yarn to the yarn joining device 23 by pivoting in the vertical direction.

[0033] By driving the yarn joining device 23 in this state, the first yarn and the second yarn are joined to bring the spun yarn 10 in a continuous state between the spinning device 9 and the package 50. Due to this, the winding of the spun yarn 10 can be resumed to form the package 50.

[0034] A yarn detection sensor can be arranged on at least one of the first transporting device 27 or the second transporting device 28 to determine whether the spun yarn 10 is successfully caught. Upon determining, based on a detection result of the yarn detection sensor arranged on the first transportation device 27, that catching of the first yarn has failed, the unit controller stops a drafting operation performed by the drafting device 7 and a spinning operation performed by the spinning device 9. If the first transporting device 27 has already started to move toward the normal position, the unit controller moves the first transporting device 27 to a catching position again. In contrast, if the first transporting device 27 has remained at the catching position, the unit controller controls the first transporting device 27 to stand by as it is. At the same time or before or after this operation, the unit controller performs a cleaning operation of the spinning device 9. Specifically, the unit controller separates the hollow guide shaft and the fiber guiding section from each other, thus opening the spinning chamber. The unit controller controls the spinning device 9 to clean an end of the hollow guide shaft by blowing air to the end of the hollow guide shaft exposed by opening the spinning chamber. Thereafter, the unit controller returns the hollow guide shaft and the fiber guiding section to the spinning position (resolves a separated state), and controls the drafting device 7 and the spinning device 9 to resume the drafting operation of the drafting device 7 and the spinning operation performed by the spinning device 9. By performing the above-mentioned processes, a failure can be prevented from occurring when catching the first yarn by the first transporting device 27 again.

[0035] On the other hand, upon determining, based on a detection result of the yarn detection sensor arranged on the second transporting device 28, that catching of the second yarn has failed, the unit controller judges that guiding out of the second yarn from the package 50 has failed and controls the spinning device 9 to not resume the spinning operation. The unit controller then controls operations to be performed by the winding section 26, a yarn guiding-out device 54, and the second transporting device 28 to retry guiding out of the second yarn from the package 50.

[0036] When catching of the first yarn or the second yarn has continuously failed a predetermined number of times or more even after performing the above-mentioned processes, the unit controller displays an alarm on a not shown display device and stops the operation of the spinning unit 2. An operator takes a measure on the spinning unit 2 to resume the operation of the spinning unit 2.

[0037] The yarn monitoring device 25 is arranged downstream of the yarn joining device 23. The yarn monitoring device 25 monitors the thickness of the traveling spun yarn 10 with a not shown capacitance type sensor. When a yarn defect of the spun yarn 10 (a place where a thickness of the spun yarn 10 or the like is abnormal) is detected, the yarn monitoring device 25 transmits a yarn-defect detection signal to the unit controller. Upon receiving the yarn-defect detection signal, the unit controller drives a cutter 24 (yarn cutting device) arranged near the yarn monitoring device 25 to cut the spun yarn 10. The yarn monitoring device 25 is, for example, a capacitance type sensor, but can be, for example, an optical transmission type sensor that monitors the thickness of the yarn. Even a foreign matter included in the spun yarn 10 can be monitored as the yarn defect.

[0038] The winding section 26 is arranged downstream of the yarn pooling device 22. The winding section 26 includes a cradle arm 52, a winding drum 53, and the yarn guiding-out device 54. A direction of a yarn path from the yarn pooling device 22 to the winding section 26 is changed (bent) and guided by a downstream guide 63.

[0039] The cradle arm 52 rotatably supports a winding tube 51 on which the spun yarn 10 is to be wound. The cradle arm 52 is pivotable around a base portion as a center of pivoting. With this configuration, even when a diameter of the package 50 is increased by winding the spun yarn 10 around the winding tube 51, the winding of the spun yarn 10 can be appropriately continued.

[0040] The winding drum 53 rotates while being in contact with an outer circumferential surface of the winding tube 51 or the package 50 by a driving force transmitted from a not shown winding-drum driving motor. A not shown traverse groove is formed on the outer circumferential surface of the winding drum 53 and the spun yarn 10 can be traversed to a predetermined width using this traverse groove. With this configuration, the winding section 26 can form the package 50 by winding the spun yarn 10 around the winding tube 51 while traversing the spun yarn 10.

[0041] The yarn guiding-out device 54 and a guide plate 55 are arranged near the winding drum 53. The yarn guiding-out device 54 guides out the end of the yarn on a surface of the package 50 when performing yarn joining or the like. Upon receiving an instruction for performing yarn joining or the like, the yarn guiding-out device 54 generates an airflow along the surface of the package 50. The end of the yarn on the surface of the package 50 is extracted and then guided in the downward direction. The end of the yarn guided out by the yarn

guiding-out device 54 is guided along the guide plate 55, and hence catching of the spun yarn 10 by the second transporting device 28 can be reliably performed. Alternately, the second transporting device 28 can be configured to perform guiding out of the end of the yarn instead of arranging the yarn guiding-out device 54.

[0042] A process performed by each structural member when performing the yarn joining, particularly, a process of guiding (pulling) the spun yarn 10 to the yarn pooling device 22 by the first guide 61 and the second guide 62a (collectively referred to as a "movable guide 60" in some cases) is explained below. As illustrated in FIGS. 4 to 7, to simplify the drawings, the processes are explained one after another, that is, the next process is performed after the current process is completed. However, the next process can be started before the current process is completed.

[0043] When a yarn breakage occurs during winding of the package 50 or when the cutter 24 cuts the spun yarn 10, the spun yarn 10 is in a cut state, and hence the yarn joining is performed. At this time, the winding operation of the package 50 performed by the winding section 26, the drafting operation performed by the drafting device 7, and the spinning operation performed by the spinning device 9 are also stopped. As illustrated in FIG. 4, the movable guide 60 is moved from the normal position to the retracted position. The end of the yarn of the package 50 is then guided out by the yarn guiding-out device 54.

[0044] Subsequently, the second transporting device 28 catches the end of the second yarn guided out by the yarn guiding-out device 54 by rotating in the vertical direction. Thereafter, the second transporting device 28 returns to the original position (normal position) while suctioning the second yarn guided out by the yarn guiding-out device 54 so that the second yarn is guided to a position where the second yarn can be joined with the first yarn by the yarn joining device 23. Next, it is preferable to resume the drafting operation performed by the drafting device 7 and the spinning operation performed by the spinning device 9. With this configuration, an amount of the first yarn that is not wound into the package 50 can be reduced. The first transporting device 27 rotates in the downward direction to catch the end of the first yarn sent by the delivery roller 21. Upon catching the end of the first yarn, the first transporting device 27 returns to the original position (normal position) while suctioning the first yarn. With this configuration, as illustrated in FIG. 5, the first yarn and the second yarn can be guided to the yarn joining device 23.

[0045] If the second yarn is guided by the second transporting device 28 when the second transporting device 28 has returned to the normal position, the second yarn passes through a monitoring area of the yarn monitoring device 25. Therefore, at this time, the yarn monitoring device 25 can determine whether the second yarn has been guided out by the second transporting device 28. Upon the yarn monitoring device 25 determining that the second yarn has not been guided, the unit controller judges that the guiding-out of the second yarn from the package 50 has failed and controls the spinning device 9 to not resume the spinning operation. The unit controller then controls the operations to be performed by the winding section 26, the yarn guiding-out device 54, and the second transporting device 28 to retry guiding out of the second yarn from the package 50.

[0046] In the present embodiment, the first transporting device 27 guides the first yarn after the second transporting device 28 guides the second yarn. However, the first transporting device 27 can perform the guiding operation first.

[0047] A thin solid line in FIG. 5 indicates a trajectory of the first transporting device 27 when the first transporting device 27 returns to the original position. The yarn joining device 23, the first guide 61, and the regulating guide 62 are arranged near the trajectory of the first transporting device 27. A positional relationship between the members is determined such that the first transporting device 27 does not collide with these members even when the first transporting device 27 rotates in the upward direction or the downward direction.

[0048] The yarn pooling device 22 is widely separated from the yarn path (second yarn path) along which the first transporting device 27 transports the first yarn to the yarn joining device 23. In the structure disclosed in Japanese Patent Application Laid-open No. 2004-277944, the yarn pooling device cannot be separated from the second yarn path because the upstream guide or the downstream guide of the yarn pooling device remains as guiding the spun yarn even on the same second yarn path.

[0049] After the first transporting device 27 and the second transporting device 28, respectively, transport the first yarn and the second yarn to the yarn joining device 23, the first guide 61 is moved from the retracted position to the normal position by driving of the guide driving motor (see FIG. 6). With this operation, the first guide 61 guides the spun yarn 10 with the guide groove of the guide portion 61b of the first guide 61 catching the spun yarn 10. As a result, the spun yarn 10 can be brought close to the yarn pooling device 22. As illustrated in FIG. 6, the spun yarn 10 is not guided (not pulled) to the yarn pooling device 22 (specifically, the yarn hooking member 43) only with the movement of the first guide 61 to the normal position.

[0050] Further, as illustrated in FIG. 4, a position of the first transporting device 27 when the first transporting device 27 catches the first yarn at downstream of the delivery roller 21 is lower than the retracted position of the first guide 61 in a device height direction (vertical direction in FIG. 4). In other words, the retracted position of the first guide 61 in the device height direction is between the first transporting device 27 at the time of catching the first yarn and the yarn joining device 23. With this configuration, the spun yarn 10 becomes positioned between the first guide 61 and the yarn pooling device 22.

Therefore, the first guide 61 can reliably catch the spun yarn 10.

[0051] Furthermore, the first transporting device 27 can cause the first guide 61 to move to the normal position at the same time when it transports the first yarn to the yarn joining device 23. In this case, trajectories of the first transporting device 27 and the first guide 61 are set not to intersect with each other so that the first transporting device 27 and the first guide 61 do not collide with each other.

[0052] Subsequently, the second guide 62a moves from the retracted position to the normal position (see FIG. 7). With this operation, the spun yarn 10 can be brought closer to the yarn pooling device 22. This enables the spun yarn 10 to be hooked at the yarn hooking member 43 of the yarn pooling device 22 so that the spun yarn 10 is pooled by the yarn pooling roller 41 and the slack of the spun yarn 10 formed during the yarn joining can be removed.

[0053] In this state, when the yarn joining is completed, the unit controller drives again the winding drum 53 and the like that have been stopped. With this operation, winding of the package 50 can be resumed.

[0054] As explained above, the spinning machine according to the present embodiment includes the spinning device 9, the winding section 26, the yarn pooling device 22, the yarn joining device 23, the transporting device, and the movable guide 60. The spinning device 9 forms the spun yarn 10 by twisting the fiber bundle 8. The winding section 26 winds the spun yarn 10 formed by the spinning device 9 around the winding tube 51 to form the package 50. The yarn pooling device 22 pools the spun yarn 10 between the spinning device 9 and the winding section 26. The yarn joining device 23 joins the spun yarn 10 from the spinning device 9 and the spun yarn 10 from the winding section 26. The transporting device transports the spun yarn 10 to the yarn joining device 23. The movable guide 60 pulls the spun yarn 10 to the yarn pooling device 22. The direction of the first yarn path is changed by the yarn pooling device 22. The yarn pooling device 22 is arranged at a position separated from the second yarn path. The movable guide 60 pulls the spun yarn 10 on the second yarn path to the yarn pooling device 22.

[0055] With this configuration, the spun yarn 10 can be pulled to the yarn pooling device 22 by the movable guide 60 even in the spinning machine having the above-mentioned layout, and hence the yarn joining can be performed automatically.

[0056] The movable guide 60 includes the first guide 61 arranged upstream of the yarn pooling device 22 in the yarn traveling direction and the second guide 62a arranged downstream of the yarn pooling device 22 in the yarn traveling direction. The position of each of the first guide 61 and the second guide 62a is switchable between the normal position, which is the position when the winding section 26 winds the spun yarn 10, and the retracted position, which is the position retracted from the normal position.

[0057] With this configuration, the spun yarn 10 can be pulled to the yarn pooling device 22 by the two guides located upstream and downstream of the yarn pooling device 22. Therefore, the spun yarn 10 can be reliably guided to the yarn pooling device 22 even with the above-mentioned layout.

[0058] The spinning machine includes the guide driving motor that drives the first guide 61 from the retracted position to the normal position and then drives the second guide 62a from the retracted position to the normal position.

[0059] With this configuration, by the driving force of the guide driving motor, the second guide 62a can be moved to guide the spun yarn 10 to the yarn pooling device 22 after moving the first guide 61 to bring the spun yarn 10 close to the yarn pooling device 22.

[0060] The yarn pooling device 22 includes the yarn pooling roller 41 and the yarn hooking member 43. The yarn pooling roller 41 winds the spun yarn 10 thereabout. The yarn hooking member 43 winds the spun yarn 10 around an outer circumferential surface of the yarn pooling roller 41 by integrally rotating with the yarn pooling roller 41 in a state in which the yarn hooking member 43 is in contact with the spun yarn 10. The movable guide 60 pulls the spun yarn 10 to a position, where the yarn hooking member 43 is not in contact with the spun yarn 10 at a timing when the first guide 61. arrives at the normal position from the retracted position and pulls the spun yarn 10, to a position, where the yarn hooking member 43 is in contact with the spun yarn 10 at a timing when the first guide 61 arrives at the normal position and the second guide 62a arrives at the normal position from the retracted position.

[0061] With this configuration, the spun yarn 10 can be pulled to the yarn pooling device 22 after the two guides are moved to the normal position (position when the winding is performed).

[0062] A height of the first guide 61 in the device height direction when the first guide 61 is at the retracted position is between a height at which the transporting device (first transporting device 27) catches the end of the spun yarn 10 from the spinning device 9 and a height at which the yarn joining device 23 is arranged.

[0063] With this configuration, after the first transporting device 27 catches the first yarn from the spinning device 9 and transports the first yarn to the yarn joining device 23, the first guide 61 is moved from the retracted position to the normal position so that the spun yarn 10 can be reliably caught and pulled to the yarn pooling device 22.

[0064] The trajectory of the first guide 61 when the first guide 61 is moved from the retracted position to the normal position and the trajectory of the transporting device when the transporting device transports the spun yarn 10 from the spinning device 9 to the yarn joining device 23 do not overlap with each other.

[0065] With this configuration, for example, even when

the first guide 61 is driven while the first transporting device 27 is transporting the first yarn to the yarn joining device 23, the first transporting device 27 and the first guide 61 will not collide with each other. Therefore, the time required for the yarn joining can be shortened.

[0066] The exemplary embodiments of the present invention are explained above. However, the above-mentioned configuration can be modified, for example, as follows.

[0067] Shapes of the first guide 61, the second guide 62a, and the third guide 62b are optional, and can be modified appropriately. Furthermore, the driving source of the first guide 61 and the second guide 62a and a mechanism for transmitting the driving force are also optional, and can be modified appropriately. Preferably, the first guide 61 and the second guide 62a are driven by the same driving source. However, the first guide 61 and the second guide 62a can be driven by separate driving sources. In the above embodiments, each of the first guide 61 and the second guide 62a performed an arc motion (rotational motion); however, they can be configured to perform a sliding motion.

[0068] Instead of the configuration in which the yarn joining device 23 is arranged for each spinning unit 2, a configuration can be adopted in which a work carrier that is movable between the spinning units 2 is arranged and the work carrier performs the yarn joining.

[0069] In the above embodiments, the delivery roller 21 is arranged downstream of the spinning device 9; however, the delivery roller 21 can be omitted from the configuration. In this case, because the spun yarn 10 with inconsistent quality may be sent out when the operation of the spinning device 9 is resumed, it is preferable that a mechanism for suctioning and removing the yarn having the inconsistent quality be provided.

[0070] According to an aspect of the present invention, a spinning machine includes a spinning device, a winding section, a yarn pooling device, a yarn joining device, a transporting device, and a movable guide. The spinning device forms a spun yarn by twisting a fiber bundle. The winding section forms a package by winding the spun yarn around a winding tube. The yarn pooling device pools the spun yarn between the spinning device and the winding section. The yarn joining device joins the spun yarn from the spinning device and the spun yarn from the winding section. The transporting device transports the spun yarns to the yarn joining device. The movable guide pulls the spun yarn to the yarn pooling device. A direction of a first yarn path, which is a yarn path during the winding of the package by the winding section, is changed (bent) by the yarn pooling device. The yarn pooling device is arranged at a position located away from a second yarn path, which is a yarn path before the pulling of the spun yarn is performed by the movable guide, after the spun yarns are transported to the yarn joining device by the transporting device. The movable guide pulls the spun yarn on the second yarn path to the yarn pooling device.

[0071] With this configuration, the spun yarn can be pulled to the yarn pooling device by the movable guide even in a spinning machine in which the direction of the yarn path is changed by the yarn pooling device during the winding of the spun yarn and the yarn path is separated from the yarn pooling device when performing the yarn joining, and hence the yarn joining can be performed automatically.

[0072] In the above spinning machine, the movable guide includes a first guide that is arranged further upstream of the yarn pooling device in a yarn traveling direction, and a second guide that is arranged further downstream of the yarn pooling device in the yarn traveling direction. A position of each of the first guide and the second guide is switchable between a normal position that is a position when the winding section winds the spun yarn and a retracted position that is a position retracted from the normal position.

[0073] With this configuration, the spun yarn can be pulled to the yarn pooling device at upstream and downstream of the yarn pooling device by using the two guides. Therefore, the spun yarn can be reliably guided to the yarn pooling device even in a layout in which the yarn pooling device is separated from the yarn path.

[0074] The spinning machine preferably further includes a driving section that drives the first guide from the retracted position to the normal position and then drives the second guide from the retracted position to the normal position.

[0075] With this configuration, by driving the driving section, the spun yarn can be brought closer to the yarn pooling device by moving the first guide, and then the spun yarn can be guided to the yarn pooling device by moving the second guide.

[0076] In the above spinning machine, the yarn pooling device preferably includes a yarn pooling roller that winds the spun yarn therearound, and a yarn hooking member that winds the spun yarn around an outer circumferential surface of the yarn pooling roller by integrally rotating with the yarn pooling roller in a state in which the yarn hooking member is in contact with the spun yarn. The movable guide pulls the spun yarn to a position where the yarn hooking member does not come into contact with the spun yarn at a timing when the first guide arrives at the normal position from the retracted position, and pulls the spun yarn to a position where the yarn hooking member is in contact with the spun yarn at a timing when the first guide arrives at the normal position and the second guide arrives at the normal position from the retracted position.

[0077] With this configuration, after the two guides are moved to the normal positions (positions at the time of performing the winding), the spun yarn can be brought into contact with the yarn hooking member and wound around the yarn pooling device.

[0078] In the above spinning machine, a height of the first guide in a device height direction when the first guide is at the retracted position is preferably between a height

at which the transporting device catches the spun yarn from the spinning device and a height at which the yarn joining device is arranged.

[0079] With this configuration, after the spun yarn from the spinning device is caught by the transporting device and transported to the yarn joining device, the first guide moves from the retracted position to the normal position so that the spun yarn can be reliably pulled to the yarn pooling device.

[0080] In the above spinning machine, a trajectory of the first guide when the first guide moves from the retracted position to the normal position and a trajectory of the transporting device when the transporting device transports the spun yarn from the spinning device to the yarn joining device preferably do not overlap with (be different from) each other.

[0081] With this configuration, for example, even when the first guide is driven while the transporting device transports an end of the spun yarn to the yarn joining device, the transporting device and the first guide can be prevented from colliding with each other. Therefore, the time required for the yarn joining can be shortened.

[0082] The above spinning machine preferably further includes a regulating member that regulates the normal position of the first guide.

[0083] With this configuration, the normal position of the first guide can be determined with accuracy, and hence the spun yarn can be appropriately guided by the first guide at the normal position.

[0084] In the above spinning machine, the second guide preferably includes a guide groove for guiding the spun yarn. The spinning machine preferably further includes a third guide that guides the spun yarn that is guided by the guide groove of the second guide when the second guide is at the normal position.

[0085] With this configuration, a structural member for pulling the spun yarn to the yarn pooling device and a structural member (regulating guide) for guiding the spun yarn when being wound can be commonly arranged, and hence the number of structural components can be reduced.

[0086] The above spinning machine preferably further includes a yarn guiding-out device that guides out the spun yarn (yarn end) from the package. The transporting device includes a first transporting device and a second transporting device. The first transporting device catches the spun yarn (yarn end) guided out by the yarn guiding-out device and transports the spun yarn to the yarn joining device. The second transporting device catches the spun yarn (yarn end) from the spinning device and transports the spun yarn to the yarn joining device.

[0087] With this configuration, the end of the spun yarn can be reliably guided out by the yarn guiding-out device, and hence failure in guiding out the spun yarn by the first transporting device can be prevented. Therefore, the yarn joining can be performed more reliably.

[0088] The above spinning machine preferably includes a plurality of spinning units. Each of the spinning units includes the spinning device, the winding section, the yarn pooling device, the movable guide, the yarn joining device, and the transporting device.

[0089] With this configuration, the yarn joining device is arranged for each spinning unit, and hence it is not necessary to wait for an arrival of a yarn joining carrier, and as a result, the yarn joining can be promptly performed.

[0090] Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching of the claims.

Claims

1. A spinning machine comprising:

a spinning device (9) adapted to form a spun yarn (10) by twisting a fiber bundle (8);
a winding section (26) adapted to form a package (50) by winding the spun yarn (10) around a winding tube (51);
a yarn pooling device (22) adapted to pool the spun yarn (10) between the spinning device (9) and the winding section (26);
a yarn joining device (23) adapted to join the spun yarn (10) from the spinning device (9) and the spun yarn (10) from the winding section (26);
a transporting device (27, 28) adapted to transport the spun yarns (10) to the yarn joining device (23); and
a movable guide (60) adapted to pull the spun yarn (10) to the yarn pooling device (22),
wherein, a direction of a first yarn path, which is a yarn path during winding of the package (50) by the winding section (26), is changed by the yarn pooling device (22),
the yarn pooling device (22) is arranged at a position located away from a second yarn path, which is a yarn path before the pulling of the spun yarn (10) is performed by the movable guide (60) after the spun yarns (10) are transported to the yarn joining device (23) by the transporting device (27, 28), and
the movable guide (60) is adapted to pull the spun yarn (10) on the second yarn path to the yarn pooling device (22).

2. The spinning machine according to Claim 1, wherein the movable guide (60) includes
a first guide (61) arranged further upstream of the yarn pooling device (22) in a yarn traveling direction, and
a second guide (62a) arranged further downstream

of the yarn pooling device (22) in the yarn traveling direction, and
a position of each of the first guide (61) and the second guide (62a) is switchable between a normal position that is a position when the winding section (26) winds the spun yarn (10) and a retracted position that is a position retracted from the normal position.

3. The spinning machine according to Claim 2, further comprising a driving section adapted to drive the first guide (61) and the second guide (62a), wherein
the driving section is adapted to drive the first guide (61) from the retracted position to the normal position and then to drive the second guide (62a) from the retracted position to the normal position.

4. The spinning machine according to Claim 3, wherein
the yarn pooling device (22) includes
a yarn pooling roller (41) adapted to wind the spun yarn (10) therearound, and
a yarn hooking member (43) adapted to wind the spun yarn (10) around an outer circumferential surface of the yarn pooling roller (41) by integrally rotating with the yarn pooling roller (41) in a state in which the yarn hooking member (43) is in contact with the spun yarn (10),
wherein the movable guide (60) is adapted to pull the spun yarn (10) to a position where the yarn hooking member (43) is not in contact with the spun yarn (10) at a timing when the first guide (61) arrives at the normal position from the retracted position, and the movable guide (60) is adapted to pull the spun yarn (10) to a position where the yarn hooking member (43) is in contact with the spun yarn (10) at a timing when the first guide (61) arrives at the normal position and the second guide (62a) arrives at the normal position from the retracted position.

5. The spinning machine according to any one of Claims 2 to 4, wherein a height of the first guide (61) in a device height direction when the first guide (61) is at the retracted position is between a height at which the transporting device (27) catches the spun yarn (10) from the spinning device (9) and a height at which the yarn joining device (23) is arranged.

6. The spinning machine according to any one of Claims 2 to 4, wherein a trajectory of the first guide (61) when the first guide (61) moves from the retracted position to the normal position and a trajectory of the transporting device when the transporting device (27) transports the spun yarn (10) from the spinning device (9) to the yarn joining device (23) do not overlap with each other.

7. The spinning machine according to any one of Claims 2 to 6, further comprising a regulating member (70) adapted to regulate the normal position of the first guide (61).

8. The spinning machine according to any one of Claims 2 to 7, further comprising a third guide (62b), wherein
the second guide (62a) includes a guide groove adapted to guide the spun yarn (10), and
the third guide (62b) is adapted to guide the spun yarn (10) that is guided by the guide groove of the second guide (62a) when the second guide (62a) is at the normal position.

9. The spinning machine according to any one of Claims 1 to 7, further comprising a yarn guiding-out device (54) adapted to guide out the spun yarn (10) from the package (50), wherein
the transporting device includes
a first transporting device (27) adapted to catch the spun yarn (10) from the spinning device (9) and to transport the spun yarn (10) to the yarn joining device (23), and
a second transporting device (28) adapted to catch the spun yarn (10) guided out by the yarn guiding-out device (54) and to transport the spun yarn (10) to the yarn joining device (23).

10. The spinning machine according to any one of Claims 1 to 8, comprising a plurality of spinning units (2), wherein
each of the spinning units (2) includes the spinning device (9), the winding section (26), the yarn pooling device (22), the movable guide (60), the yarn joining device (23), and the transporting device (27, 28).

FIG. 1

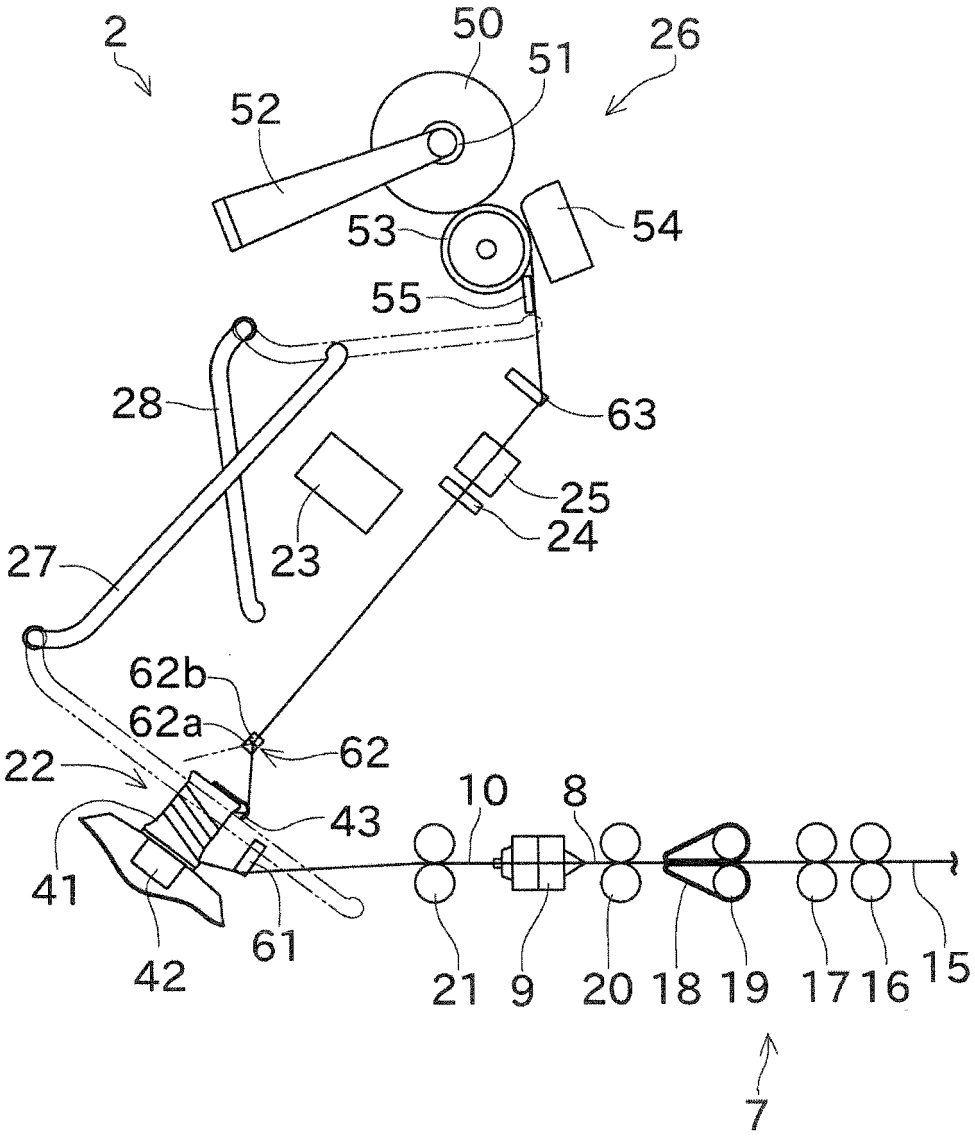
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FIG. 2

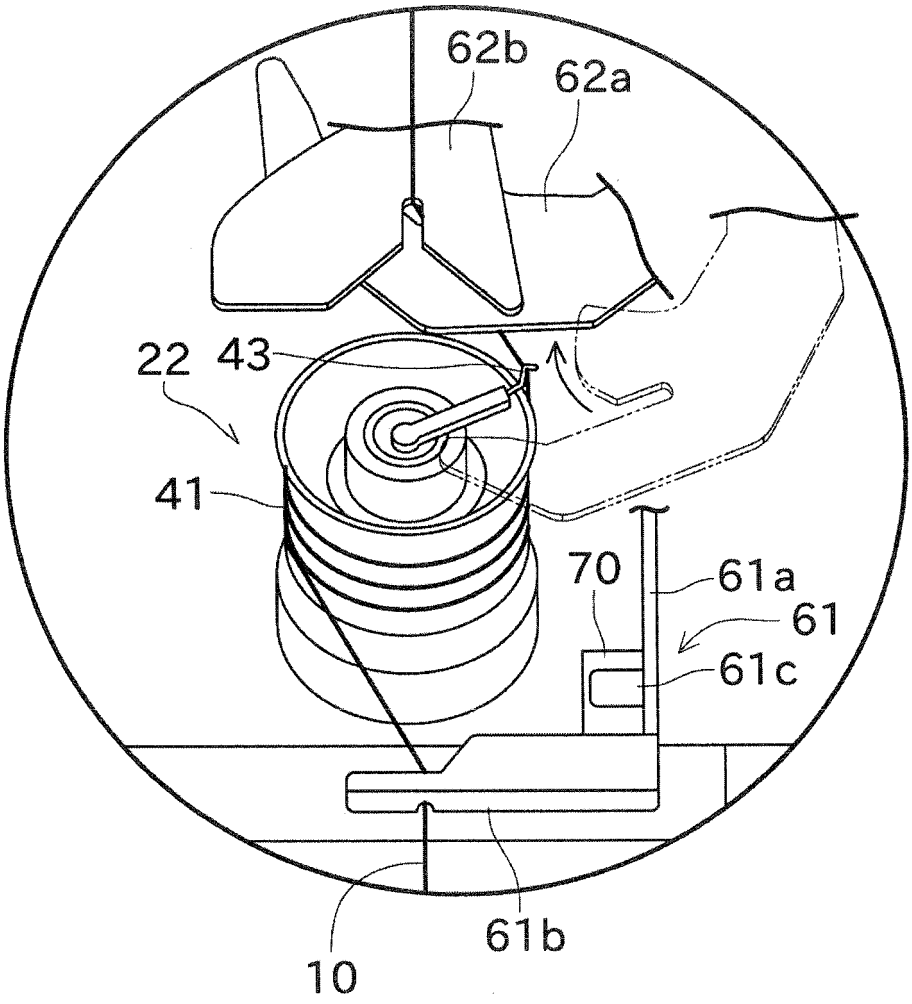


FIG. 3

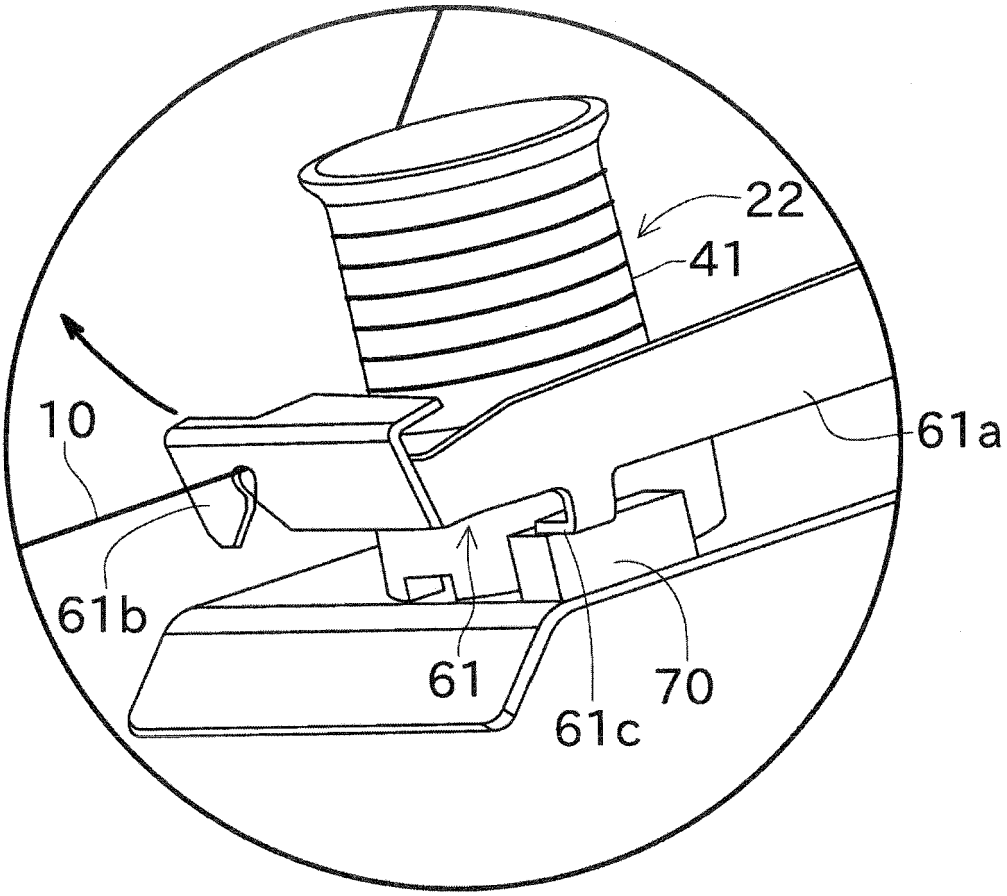
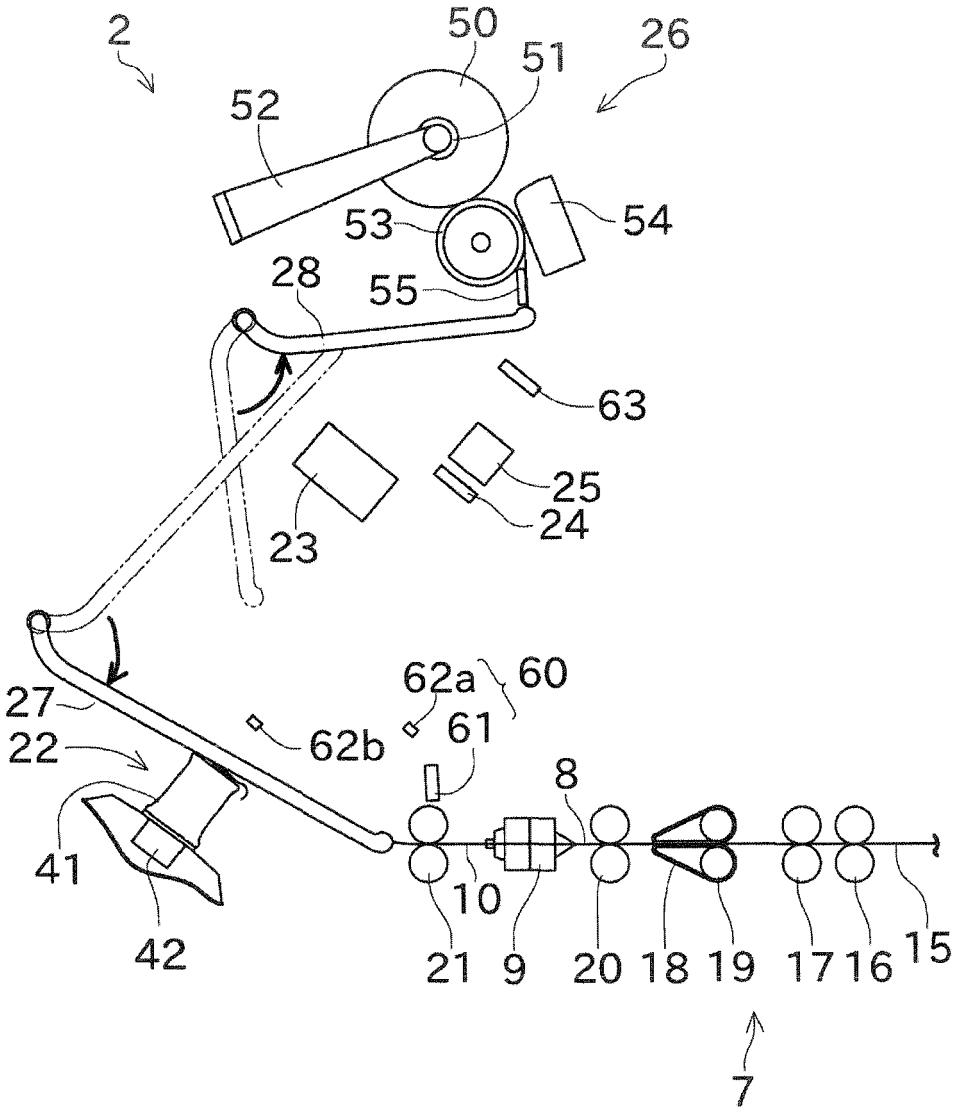
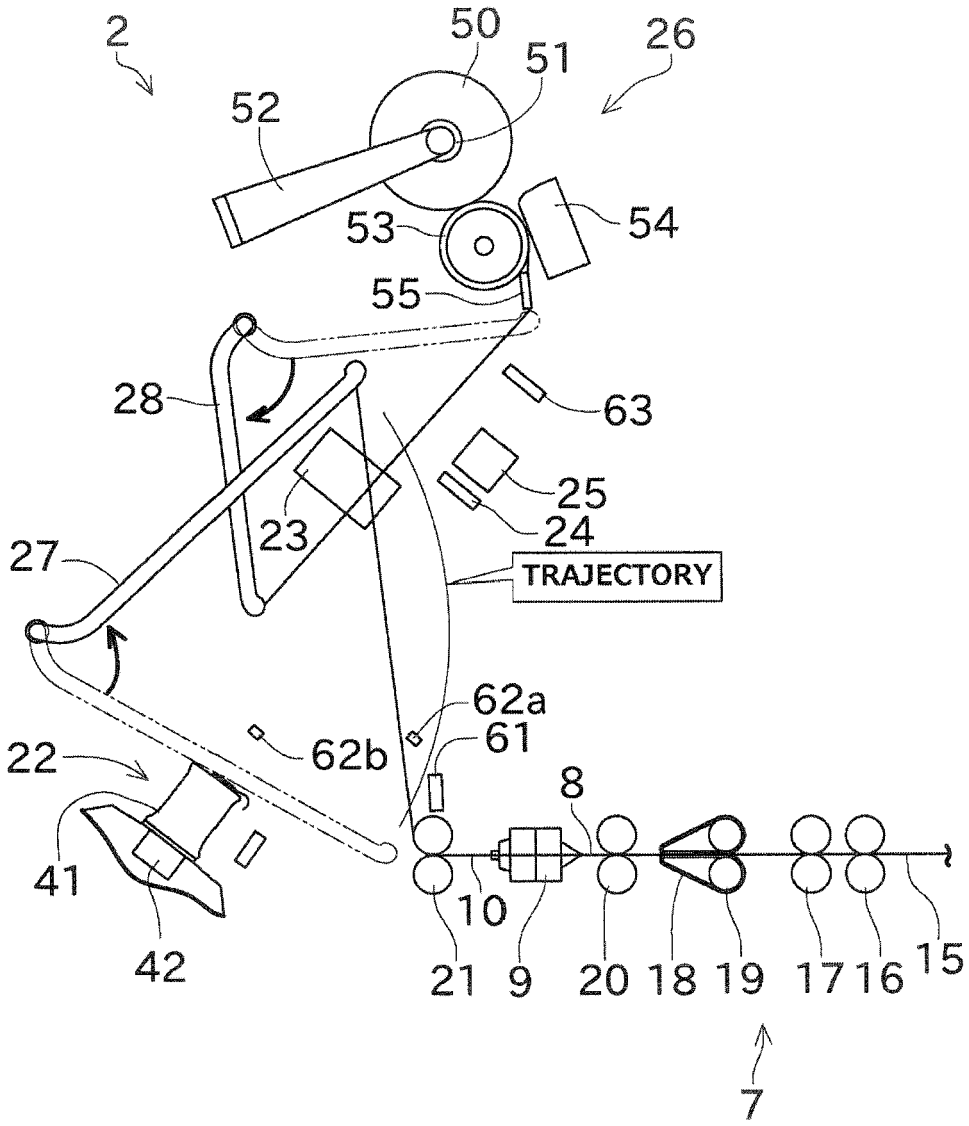


FIG. 4



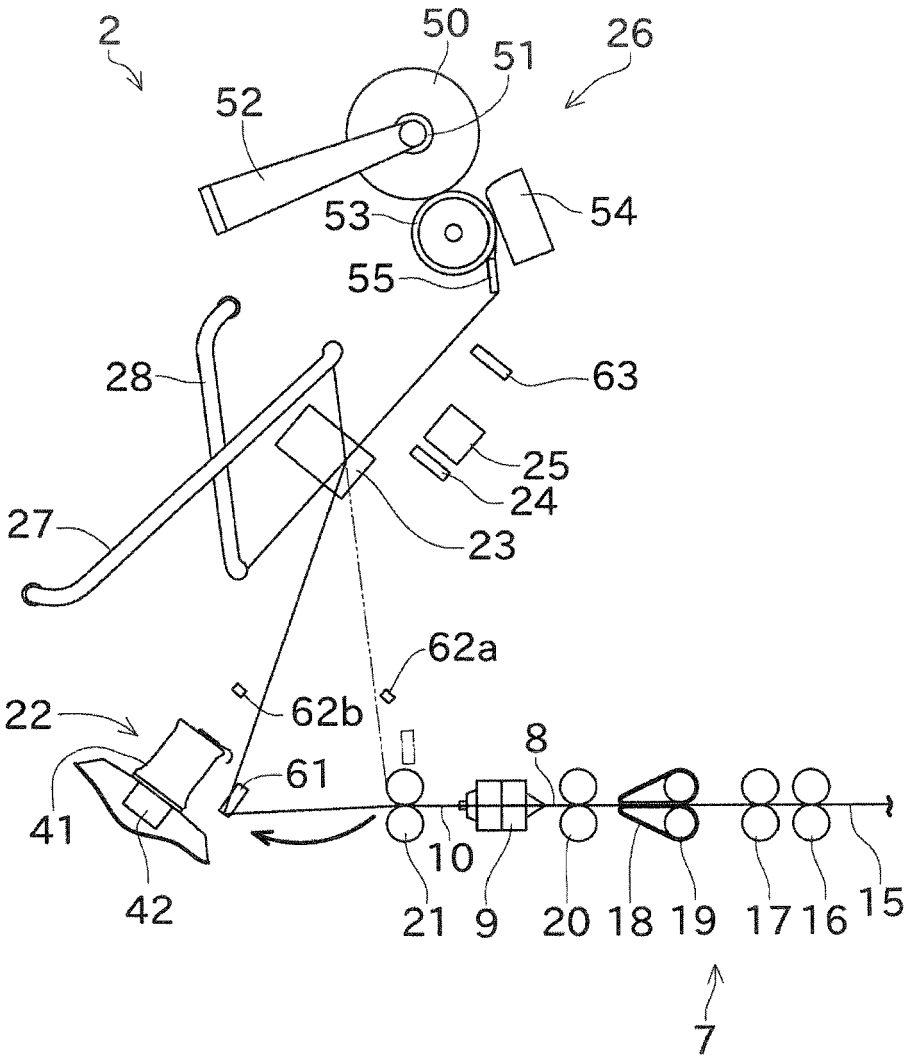
FIRST GUIDE 61	RETRACTED POSITION
SECOND GUIDE 62a	RETRACTED POSITION

FIG. 5



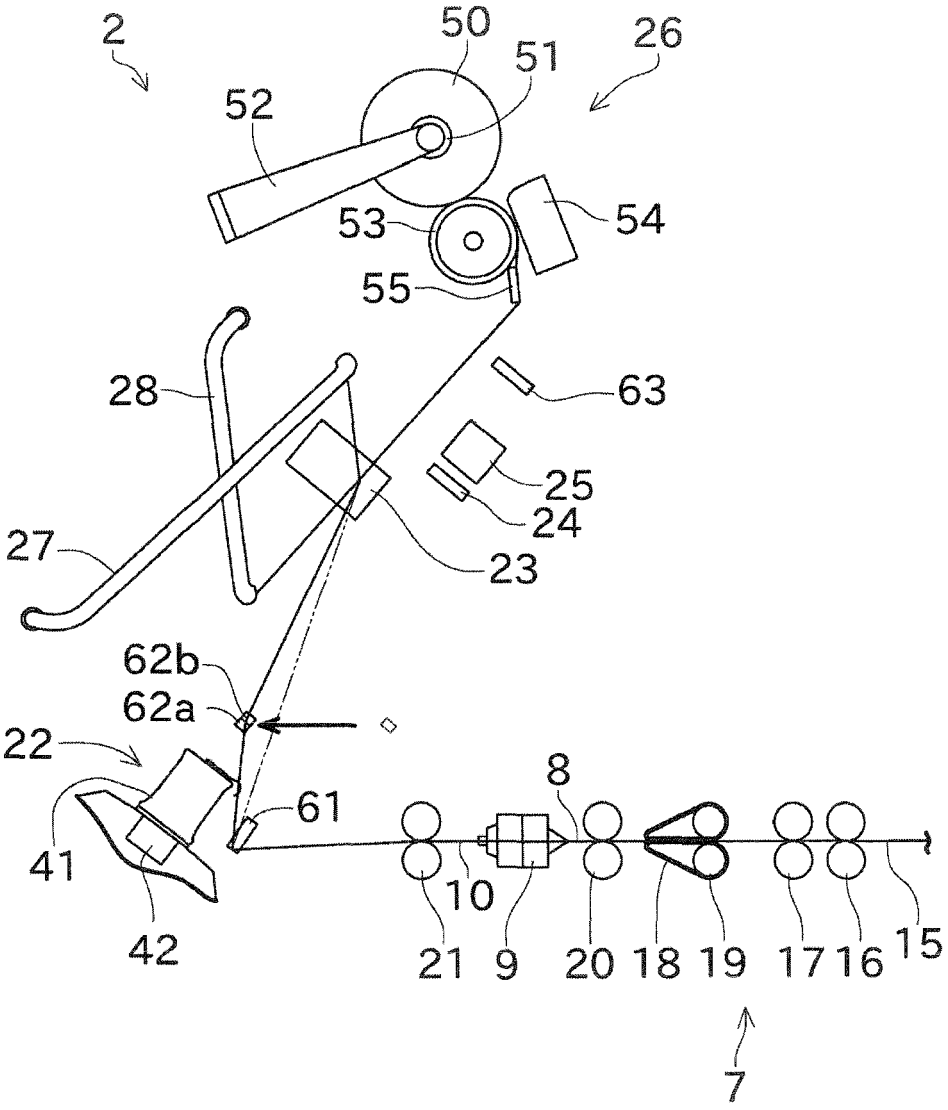
FIRST GUIDE 61	RETRACTED POSITION
SECOND GUIDE 62a	RETRACTED POSITION

FIG. 6



FIRST GUIDE 61	RETRACTED POSITION→ NORMAL POSITION
SECOND GUIDE 62a	RETRACTED POSITION

FIG. 7



FIRST GUIDE 61	NORMAL POSITION
SECOND GUIDE 62a	RETRACTED POSITION → NORMAL POSITION

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EUROPEAN SEARCH REPORT

Application Number
EP 13 19 6501

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B65H D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 March 2014	Humbert, Thomas

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EPO FORM 1503 03.82 (P04C01)

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27-03-2014

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