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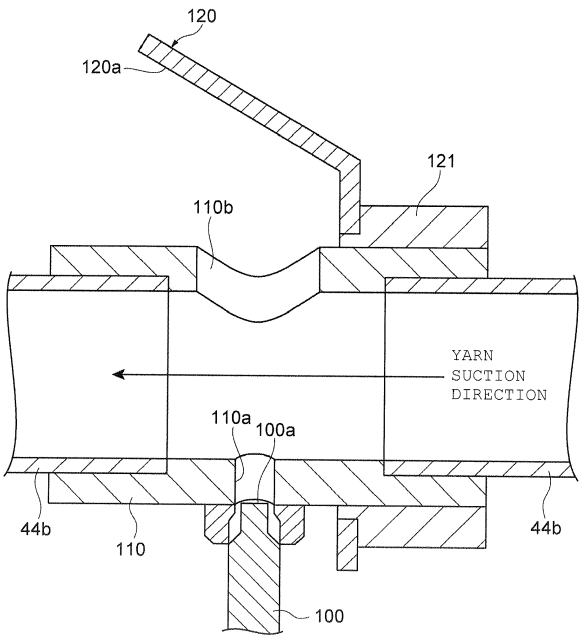
(54) Yarn catching device and yarn winding machine

(57) A yarn joining cart (3) includes a suction pipe (44) adapted to suck a spun yarn (10), and a reflective sensor (100) adapted to detect the spun yarn (10) passing through the suction pipe (44). A reflecting section (120) adapted to reflect light emitted from the reflective sensor (100) in a direction different from the reflective sensor (100) is arranged at a portion facing the reflective sensor (100) with a path of the spun yarn (10) in the suction pipe (44) therebetween.

FIG. 4



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn catching device and a yarn winding machine.

2. Description of the Related Art

[0002] A device adapted to carry out yarn processing such as producing a spun yarn is known. In such a device, an operation of joining a disconnected yarn is carried out when yarn breakage occurs. To carry out the yarn joining operation, a yarn catching device adapted to catch the disconnected yarn by a suction force is arranged in the device adapted to carry out the yarn processing. Such a yarn catching device is described in, for example, Japanese Unexamined Patent Publication No. 09-31769.

[0003] In the yarn catching device adapted to catch the yarn by the suction force, it is necessary to detect whether or not the yarn is caught. For example, in the yarn catching device described in Japanese Unexamined Patent Publication No. 09-31769, a light projecting section and a light receiving section are arranged on a path, through which the yarn passes when caught by the suction force, to detect whether or not the yarn is caught.

[0004] When the yarn is detected using the light projecting section and the light receiving section as in the yarn catching device described in Japanese Unexamined Patent Publication No. 09-31769, whether or not the yarn exists between the light projecting section and the light receiving section is detected, and hence the detection range of the yarn is narrow. Consideration is thus made to use a reflective sensor as means for detecting the yarn. It is also desirable to stabilize the path of the yarn as much as possible to detect the yarn. Thus, a piping through which the yarn passes is preferably as thin as possible. However, when the yarn is detected using the reflective sensor, the piping itself may be detected by the reflective sensor. Thus, the sensitivity of the sensor cannot be increased, and the detection of a thin yarn or a black yarn is difficult.

BRIEF SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a yarn catching device capable of reliably detecting the presence or absence of the sucked yarn even when the reflective sensor is used, and a yarn winding machine.

[0006] This object is achieved by a yarn catching device according to claim 1, and by a yarn winding machine according to claim 10.

[0007] A yarn catching device according to one aspect of the present invention includes a suction pipe adapted to suck a yarn; and a reflective sensor adapted to detect the yarn passing through the suction pipe, wherein a reflecting section adapted to reflect light emitted from the reflective sensor in a direction different from the reflective sensor is arranged at a portion facing the reflective sensor with a path of the yarn in the suction pipe therebetween.

[0008] In the yarn catching device, the reflecting section reflects the light emitted from the reflective sensor in the direction different from the reflective sensor. Thus, the light reflected at a portion facing the reflective sensor with the path of the yarn in the suction pipe therebetween can be suppressed from being detected by the reflective sensor. Therefore, the reflective sensor can suitably detect the light reflected by the yarn, and can reliably detect the presence or absence of the yarn sucked by the suction pipe.

[0009] The reflecting section may be arranged at a position projecting out toward an outer side of the suction pipe from the suction pipe. Thus, the distance between the reflective sensor and the reflecting section becomes long, whereby the light reflected by the reflecting section can be weakened. Therefore, the light is weak even when the light reflected by the reflecting section enters the reflective sensor after being reflected over a plurality of times, and hence the light reflected by the yarn can be suitably detected by the reflective sensor.

[0010] The reflecting section may be arranged on the outer side of the suction pipe, and a hole may be formed in a wall of the suction pipe between the reflecting section and the reflective sensor. In this case, the degree of freedom in the position of installing the reflecting section can be increased without being subjected to the restriction of the thickness of the suction pipe. The light reflected by the reflecting section is less likely to enter the reflective sensor again through the hole at the wall of the suction pipe, and hence the reflective sensor can suitably detect the light reflected by the yarn.

[0011] The yarn catching device may further include a connection pipe adapted to connect the reflecting section and an outer peripheral surface of the suction pipe. In this case, the air does not enter the suction pipe from the hole formed at the wall of the suction pipe, and the suction force at the time of sucking the yarn is not reduced.

[0012] The reflecting section may have an inclined surface inclined with respect to an axis of the light emitted from the reflective sensor. In this case, the light emitted from the reflective sensor can be easily reflected in the direction different from the reflective sensor by the inclined surface.

[0013] The reflecting section may have an inclined surface having a convex form projecting out toward the reflective sensor. In this case, the light that entered the reflecting section is diffused radially by being reflected by the convex inclined surface. Thus, the reflecting section can easily reflect the light emitted from the reflective sensor in the direction different from the reflective sensor by diffusing the light by the convex inclined surface.

[0014] The reflecting section may be removably attached with respect to the suction pipe. In this case, the

maintenance and the like of the surface of the reflective sensor in the suction pipe can be easily carried out by detaching the reflecting section.

[0015] A yarn winding machine according to another aspect of the present invention includes the yarn catching device described above; and a yarn winding unit including a draft device adapted to draft a fiber bundle, a spinning device adapted to apply twists to the fiber bundle drafted by the draft device to produce a spun yarn, and a winding device adapted to wind the spun yarn produced by the spinning device into a package, wherein the yarn catching device catches the spun yarn produced by the spinning device.

[0016] In the yarn winding device, the reflective sensor can suitably detect the light reflected by the spun yarn, and can reliably detect the presence or absence of the spun yarn sucked by the suction pipe.

[0017] The yarn winding device further includes an operation cart on which the yarn catching device is arranged, wherein a plurality of the yarn winding units are arranged; and the operation cart travels with respect to the plurality of yarn winding units and catches the spun yarn at each of the yarn winding units. In this case, the spun yarn spun at each of the yarn winding units can be caught by the yarn catching device by travelling the operation cart.

[0018] According to the various aspects of the present invention, the presence or absence of the sucked yarn can be reliably detected even when the reflective sensor is used.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is a view illustrating a schematic configuration of a spinning machine;

FIG. 2 is a side view of a spinning unit arranged in the spinning machine;

FIG. 3 is a schematic view illustrating an attachment position of a reflective sensor in a suction pipe;

FIG. 4 is a cross-sectional view illustrating a structure at a periphery of the reflective sensor;

FIG. 5 is a cross-sectional view illustrating a structure at the periphery of the reflective sensor in a first alternative embodiment; and

FIG. 6 is a cross-sectional view illustrating a structure at the periphery of the reflective sensor in a second alternative embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0020] One embodiment of the present invention will be described below with reference to the drawings. The same components are denoted with the same reference numerals in the description of the drawings, and the redundant description will be omitted. "Upstream" and "downstream" in the present specification respectively refer to upstream and downstream in a traveling direction of a yarn during spinning.

[0021] A spinning machine (yarn winding machine) 1 illustrated in FIG. 1 includes a plurality of spinning units (yarn winding units) 2 arranged in line, a yarn joining cart (operation cart) 3, a doffing cart (operation cart) 4, a motor box 5, and a blower box 80. The blower box 80 accommodates an air suction source for generating a suction flow and/or an air supply source for generating a whirling airflow, or the like at each section of the spinning unit 2. The motor box 5 accommodates a motor and the like for supplying power to each section of the spinning unit 2. In a factory where the spinning machine 1 is installed, an operator passage extending in a direction in which the spinning units 2 are arranged is provided at a yarn path side of a spun yarn 10 with respect to the spinning unit 2. The operator can perform operation, monitoring, and the like of each spinning unit 2 from the operator passage.

[0022] As illustrated in FIGS. 1 and 2, each spinning unit 2 includes a draft device 7, a pneumatic spinning device (spinning device) 9, a yarn accumulating device 12, a waxing device 14, and a winding device 13 arranged in this order from upstream to downstream.

[0023] The draft device 7 is arranged in proximity to an upper end of a housing 6 of the spinning machine 1 in a machine height direction of the spinning machine 1. A fiber bundle 8 (see FIG. 2) fed from the draft device 7 is spun by the pneumatic spinning device 9. The spun yarn 10 fed from the pneumatic spinning device 9 is passed through a yarn monitoring device 52, and thereafter, fed further downstream by the yarn accumulating device 12, and applied with wax in the waxing device 14. Thereafter, the spun yarn 10 is wound by the winding device 13, and a package 45 is formed.

[0024] The draft device 7 drafts a sliver 15 to obtain the fiber bundle 8. As illustrated in FIG. 2, the draft device 7 includes four roller pairs, i.e., a back roller pair 16, a third roller pair 17, a middle roller pair 19 provided with an apron belt 18, and a front roller pair 20. A bottom roller of each of the roller pairs 16, 17, 19, and 20 is driven by power from the motor box 5, or by power of drive sources (not illustrated) arranged individually. Each of the roller pairs 16, 17, 19, and 20 is driven with a different rotation speed. As a result, the draft device 7 drafts the sliver 15 supplied from the upstream into the fiber bundle 8, and feeds the fiber bundle 8 to the pneumatic spinning device 9.

[0025] The pneumatic spinning device 9 applies twists to the fiber bundle 8 using the whirling airflow to produce the spun yarn 10. Although detailed description and illustration will be omitted, the pneumatic spinning device 9 includes a fiber guiding section, a whirling airflow generating nozzle, and a hollow guide shaft body. The fiber guiding section guides the fiber bundle 8 fed from the draft device 7 to a spinning chamber formed inside the pneumatic spinning device 9. The whirling airflow generating nozzle is arranged at a periphery of a path of the

fiber bundle 8 to generate the whirling airflow in the spinning chamber. This whirling airflow causes a fiber end of the fiber bundle 8 in the spinning chamber to be reversed and to whirl. The hollow guide shaft body guides the spun yarn 10 from the spinning chamber to an outside of the pneumatic spinning device 9.

[0026] The yarn accumulating device 12 is arranged downstream of the pneumatic spinning device 9. The yarn accumulating device 12 has a function of applying a predetermined tension on the spun yarn 10 to pull out the spun yarn 10 from the pneumatic spinning device 9, a function of accumulating the spun yarn 10 fed from the pneumatic spinning device 9 during a yarn joining operation by the yarn joining cart 3 to prevent slackening of the spun yarn 10, and a function of adjusting the tension of the spun yarn 10 such that a fluctuation of the tension at the winding device 13 is not transmitted to the pneumatic spinning device 9. As illustrated in FIG. 2, the yarn accumulating device 12 includes a yarn accumulating roller 21, a yarn hooking member 22, an upstream guide 23, an electric motor 25, a downstream guide 26, and an accumulated amount detecting sensor 27.

[0027] The yarn hooking member 22 engages with the spun yarn 10 and integrally rotates with the yarn accumulating roller 21 while being engaged with the spun yarn 10 to wind the spun yarn 10 around an outer peripheral surface of the yarn accumulating roller 21.

[0028] The yarn accumulating roller 21 has a prescribed amount of the spun yarn 10 wound around the outer peripheral surface thereof to accumulate the spun yarn 10. The yarn accumulating roller 21 is rotatably driven by the electric motor 25. When the yarn accumulating roller 21 is rotated, the spun yarn 10 wound around the outer peripheral surface of the yarn accumulating roller 21 is wound to tighten the yarn accumulating roller 21, and the spun yarn 10 located upstream of the yarn accumulating device 12 is pulled. In other words, when the yarn accumulating roller 21 is rotated at a predetermined rotation speed with the spun yarn 10 wound around the outer peripheral surface of the yarn accumulating roller 21, the yarn accumulating device 12 can apply a predetermined tension on the spun yarn 10 and pull out the spun yarn 10 at a predetermined speed from the pneumatic spinning device 9, and transport the spun yarn 10 towards the downstream at a predetermined speed.

[0029] The accumulated amount detecting sensor 27 detects, in a non-contacting manner, the accumulated amount of the spun yarn 10 wound around the yarn accumulating roller 21. The accumulated amount detecting sensor 27 outputs an accumulated amount signal indicating the detected accumulated amount of the spun yarn 10 to a unit controller adapted to control the spinning unit 2, and the like.

[0030] The upstream guide 23 is arranged slightly upstream of the yarn accumulating roller 21. The upstream guide 23 appropriately guides the spun yarn 10 with respect to the outer peripheral surface of the yarn accumulating roller 21. The upstream guide 23 prevents the twists of the spun yarn 10 propagating from the pneumatic spinning device 9 from being transmitted downstream of the upstream guide 23. An air cylinder 24 is attached to the upstream guide 23. The upstream guide 23 can be appropriately moved by the drive of the air cylinder 24.

[0031] The downstream guide 26 is arranged slightly downstream of the yarn accumulating roller 21. The downstream guide 26 regulates a path of the spun yarn 10 swung around by the rotating yarn hooking member 22. The downstream guide 26 stabilizes the traveling path of the spun yarn 10 located downstream of the yarn accumulating roller 21.

[0032] The yarn monitoring device 52 is arranged on a front side (operator passage side) of the housing 6 of the spinning machine 1, and at a position between the pneumatic spinning device 9 and the yarn accumulating device 12. The spun yarn 10 spun by the pneumatic spinning device 9 is passed through the yarn monitoring device 52 before being wound by the yarn accumulating device 12. The yarn monitoring device 52 monitors abnormality in the thickness of the spun yarn 10 and/or presence or absence of foreign substances contained in the spun yarn 10. When a yarn defect of the spun yarn 10 is detected, the yarn monitoring device 52 outputs a yarn defect detection signal to the unit controller adapted to control the spinning unit 2, and the like.

[0033] A cutter 57 adapted to cut the spun yarn 10 when the yarn defect is detected is arranged upstream of the yarn monitoring device 52. The cutter 57 may be omitted, and the spun yarn 10 may be cut by stopping the supply of air to the pneumatic spinning device 9.

[0034] The waxing device 14 is arranged downstream of the yarn accumulating device 12. The waxing device 14 applies wax to the spun yarn 10 traveling from the yarn accumulating device 12 toward the winding device 13.

[0035] The winding device 13 includes a cradle arm 71, a winding drum 72, and a traverse device 75. The cradle arm 71 is supported to be swingable about a shaft 70. The cradle arm 71 rotatably holds the package 45. A bobbin holder (not illustrated) adapted to rotatably hold a bobbin 48 for winding the spun yarn 10 is arranged in the cradle arm 71.

[0036] The winding drum 72 is adapted to rotatably drive the package 45 while making contact with an outer peripheral surface of the bobbin 48 or an outer peripheral surface of the package 45. The traverse device 75 includes a traverse guide 76 that can be engaged with the spun yarn 10. The winding device 13 drives the winding drum 72 with a motor (not illustrated) while reciprocating the traverse guide 76 by driving means (not illustrated). Thus, the package 45 making contact with the winding drum 72 can be rotated and the spun yarn 10 can be wound into the package 45 while the spun yarn 10 is being traversed. A traverse guide 76 of the traverse device 75 may be commonly driven in each spinning unit 2 by a common shaft for the plurality of the spinning units 2.

[0037] As illustrated in FIG. 1 and FIG. 2, on a lower

side of the housing 6 where the draft device 7, the pneumatic spinning device 9, and the like are arranged, a rail 41 is provided along the direction in which the spinning units 2 are arranged. The yarn joining cart 3 travels on the rail 41 with wheels 42. The yarn joining cart 3 includes a splicer 43, a suction pipe 44, and a suction mouth 46.

[0038] When a yarn breakage or a yarn cut occurs in a spinning unit 2, the yarn joining cart 3 travels along the rail 41 to the relevant spinning unit 2 and stops. The suction pipe 44 sucks and catches a yarn end fed from the pneumatic spinning device 9 while being swung vertically with a shaft as a center, and guides the yarn end to the splicer 43. The suction mouth 46 sucks and catches a yarn end from the package 45 supported by the winding device 13 while being swung vertically with a shaft as a center, and guides the yarn end to the splicer 43. The splicer 43 carries out the yarn joining operation of the guided yarn ends.

[0039] As illustrated in FIG. 1 and FIG. 2, the doffing cart 4 includes a doffing device 61. The doffing device 61 includes a cradle operation arm 90, a suction pipe 88, and a bunch winding arm 91. After the package 45 is fully wound at a spinning unit 2, the doffing cart 4 travels to the relevant spinning unit 2 on a traveling path 86 formed in the housing 6, and stops.

[0040] The cradle operation arm 90 operates the cradle arm 71 of the winding device 13. The suction pipe 88 can be extended, and the suction pipe 88 sucks and catches the yarn end discharged from the pneumatic spinning device 9 and guides the yarn end to an empty bobbin 48 attached to the winding device 13. The bunch winding arm 91 fixes the spun yarn 10 to the bobbin 48 by straight winding of the spun yarn 10 around the bobbin 48.

[0041] Next, a description will be made on a reflective sensor 100 adapted to detect the spun yarn 10 sucked by the suction pipe 44 of the yarn joining cart 3. As illustrated in FIG. 3, the suction pipe 44 includes a pipe swinging portion 44a and a pipe fixing portion 44b. The pipe fixing portion 44b is fixed by a supporting portion 47b with respect to a housing 47 of the yarn joining cart 3. The pipe swinging portion 44a is swingably supported by a supporting portion 47a with respect to the housing 47 of the yarn joining cart 3. The pipe swinging portion 44a is driven by a motor 49 to swing with respect to the housing 47.

[0042] More specifically, a gear 44g fixed to an outer peripheral surface of the pipe swinging portion 44a and a gear 49g fixed to a drive shaft of the motor 49 are meshed. The pipe swinging portion 44a is swung when the gear 49g of the motor 49 is rotated. The pipe swinging portion 44a swings with an axis line direction of the pipe of the portion supported by the supporting portion 47a as an axis.

[0043] The pipe swinging portion 44a is swingably connected with respect to the pipe fixing portion 44b. A nozzle 44c that sucks the spun yarn 10 fed from the pneumatic spinning device 9 is arranged at an end on a side opposite to the side connected to the pipe fixing portion 44b in the pipe swinging portion 44a. An end on a side opposite to the side connected to the pipe swinging portion 44a in the pipe fixing portion 44b is connected with an air suction source adapted to generate a suction flow.

[0044] The reflective sensor 100 is attached to the pipe fixing portion 44b. The reflective sensor 100 detects the spun yarn 10 passing through the suction pipe 44. The pipe fixing portion 44b includes a curved part R. The reflective sensor 100 is attached to a wall in proximity to the curved part R in the pipe fixing portion 44b, the wall being on an inner side of a corner of the curved part R.

[0045] The details of the periphery of the attachment portion of the reflective sensor 100 will now be described. As illustrated in FIG. 4, the reflective sensor 100 is attached to an attachment pipe 110 arranged at an intermediate portion of the pipe fixing portion 44b. An inner diameter of the pipe fixing portion 44b and an inner diameter of the attachment pipe 110 substantially coincide with each other. In the present embodiment, the reflective sensor 100 is attached to the attachment pipe 110, but the reflective sensor 100 may be directly attached to the pipe fixing portion 44b without arranging the attachment pipe 110.

[0046] The attachment pipe 110 is formed with a hole 110a. A sensor surface 100a of the reflective sensor 100 faces a space in the attachment pipe 110 through the hole 110a. The sensor surface 100a of the reflective sensor 100 is desirably not projected from an inner peripheral surface of the attachment pipe 110. Thus, the spun yarn 10 passing through the pipe fixing portion 44b can be prevented from being hooked to the distal end of the reflective sensor 100.

[0047] The reflective sensor 100 emits light from the sensor surface 100a, and detects the light reflected by the spun yarn 10 passing through the pipe fixing portion 44b (through the attachment pipe 110) with the sensor surface 100a. If the pipe fixing portion 44b is curved, the spun yarn 10 passing through the pipe fixing portion 44b moves along the inner peripheral surface on the inner side of the corner of the curved part R. Thus, by arranging the reflective sensor 100 on the inner side of the corner of the curved part R, the distance between the sensor surface 100a of the reflective sensor 100 and the spun yarn 10 passing through the pipe fixing portion 44b can be reduced. The detection accuracy of the spun yarn 10 by the reflective sensor 100 is thereby improved.

[0048] A hole 110b is formed at a position facing the sensor surface 100a in the attachment pipe 110. The light that is not reflected by the spun yarn 10 of the light emitted from the sensor surface 100a is emitted to the outside of the attachment pipe 110 from the hole 110b.

[0049] A reflecting section 120 is attached to the outer peripheral surface of the attachment pipe 110 by a fixing section 121. The reflecting section 120 is a bent plate-like member which extends to a position facing the hole 110b of the attachment pipe 110. The reflecting section 120 has an inclined surface 120a at a position facing the hole 110b. The inclined surface 120a is inclined with re-

spect to the axis of light emitted from the sensor surface 100a of the reflective sensor 100. In other words, the inclined surface 120a reflects the light emitted from the reflective sensor 100 in a direction different from the sensor surface 100a of the reflective sensor 100. Stated differently, the reflecting section reflects light emitted from the reflective sensor in a direction different from a direction into which the reflective sensor is directed, or the reflecting section reflects light emitted from the reflective sensor substantially away from the reflective sensor.

[0050] When the yarn joining operation is carried out by the yarn joining cart 3, the reflective sensor 100 detects whether or not the yarn end fed from the pneumatic spinning device 9 is sucked by the suction pipe 44. In other words, the reflective sensor 100 detects the presence or absence of the spun yarn 10 in the suction pipe 44.

[0051] When the spun yarn 10 is being sucked by the suction pipe 44, a part of the light emitted from the sensor surface 100a of the reflective sensor 100 is reflected by the spun yarn 10 and received by the sensor surface 100a. The light not reflected by the spun yarn 10 of the light emitted from the sensor surface 100a of the reflective sensor 100 is emitted to the outside of the attachment pipe 110 through the hole 110b, and enters the inclined surface 120a of the reflecting section 120. The light that entered the reflecting section 120 is reflected in a direction (different direction) different from the sensor surface 100a of the reflective sensor 100.

[0052] When the spun yarn 10 is not successfully sucked by the suction pipe 44, the spun yarn 10 does not pass through the suction pipe 44. Thus, the light emitted from the sensor surface 100a of the reflective sensor 100 is emitted to the outside of the attachment pipe 110 through the hole 110b, and enters the inclined surface 120a of the reflecting section 120. The light that entered the reflecting section 120 is reflected in the direction different from the sensor surface 100a of the reflective sensor 100. If the spun yarn 10 is not detected by the reflective sensor 100, the yarn joining cart 3 may repeat the sucking operation (catching operation) of the spun yarn 10 by the suction pipe 44 for a predetermined number of times. A yarn catching device of the present embodiment is configured by the suction pipe 44, the reflective sensor 100, and the reflecting section 120, which are described above.

[0053] In the example illustrated in FIG. 4, the sucked spun yarn 10 is passed from the right side toward the left side in the figure. FIG. 4 illustrates an example of reflecting the light that entered the inclined surface 120a toward the advancing direction of the spun yarn 10, but the direction of reflecting the light is not limited as long as the light is reflected in the direction different from the reflective sensor 100.

[0054] The present embodiment is configured as described above, and the light emitted from the sensor surface 100a of the reflective sensor 100 is reflected in the direction different from the reflective sensor 100 by the inclined surface 120a of the reflecting section 120. Thus, the light reflected at a portion facing the reflective sensor 100 with the path of the spun yarn 10 in the attachment pipe 110 therebetween can be suppressed from being detected by the reflective sensor 100. Therefore, the reflective sensor 100 can suitably detect the light reflected by the spun yarn 10, and can reliably detect the presence or absence of the spun yarn 10 sucked by the suction pipe 44.

[0055] The light reflected at a portion other than by the spun yarn 10 is suppressed from being detected by the reflective sensor 100, and only the light reflected by the spun yarn 10 can be detected by the reflective sensor 100. Thus, the spun yarn 10 can be suitably detected even if the sensor sensitivity of the reflective sensor 100 is improved by strengthening the emitted light, and the like.

[0056] The hole 110b is formed at the portion facing the reflective sensor 100 in the attachment pipe 110. The light emitted from the sensor surface 100a of the reflective sensor 100 is emitted to the outside of the attachment pipe 110 through the hole 110b. By thus guiding the light emitted from the sensor surface 100a to the outside of the attachment pipe 110, the degree of freedom in the position of installing the reflecting section 120 can be increased without being restricted by the thickness of the attachment pipe 110. Furthermore, the light reflected by the reflecting section 120 is less likely to enter the sensor surface 100a of the reflective sensor 100 again through the hole 110b of the attachment pipe 110. Thus, the reflective sensor 100 can suitably detect the light reflected by the spun yarn 10.

[0057] Since the reflecting section 120 has the inclined surface 120a, the light emitted from the sensor surface 100a of the reflective sensor 100 can be easily reflected in the direction different from the reflective sensor 100. Thus, other members can be arranged without taking into consideration the reflection of the light emitted from the reflective sensor 100 on the back side of the reflecting section 120 (opposite side with respect to the reflective sensor 100 side in the reflecting section 120).

[0058] For example, even if the reflecting section is arranged such that the light reflected by the reflecting section enters the reflective sensor 100, the influence of the reflected light is small if the distance between the reflecting section and the reflective sensor 100 is small. However, the reflecting section and the reflective sensor 100 need to be arranged spaced apart, and hence the detection mechanism becomes large. Thus, when the reflecting section 120 is arranged so that the reflected light does not enter the reflective sensor 100 as in the present embodiment, the reflective sensor 100 and the reflecting section 120 do not need to be arranged spaced apart and the detection mechanism can be miniaturized.

[0059] Next, a description will be made on a first alternative embodiment. As illustrated in FIG. 5, in the first alternative embodiment, a reflecting section 120A is attached to the attachment pipe 110 by a connection pipe

122. One end of the connection pipe 122 is connected to an edge of the hole 110b. The other end of the connection pipe 122 is attached with the reflecting section 120A. The connection pipe 122 extends along an axis line direction of the light emitted from the sensor surface 100a of the reflective sensor 100.

[0060] The reflecting section 120A and the connection pipe 122 are connected to each other so that air does not leak from the connecting portion. The connection pipe 122 and the attachment pipe 110 are connected to each other so that air does not leak from the connecting portion. Thus, the air does not enter the attachment pipe 110 from the hole 110b formed in the attachment pipe 110.

[0061] The reflecting section 120A has an inclined surface 120a at a position facing the hole 110b. The inclined surface 120a is inclined with respect to the axis of light emitted from the sensor surface 100a of the reflective sensor 100. In other words, the inclined surface 120a reflects the light emitted from the reflective sensor 100 in the direction different from the sensor surface 100a of the reflective sensor 100. The yarn catching device of the present alternative embodiment is configured by the suction pipe 44, the reflective sensor 100, and the reflecting section 120A, which are described above.

[0062] In the first alternative embodiment as well, the light emitted from the sensor surface 100a of the reflective sensor 100 is reflected in the direction different from the reflective sensor 100 by the inclined surface 120a of the reflecting section 120A. Thus, the light reflected by the inclined surface 120a does not directly enter the sensor surface 100a of the reflective sensor 100. Therefore, the reflective sensor 100 can suitably detect the light reflected by the spun yarn 10, and can reliably detect the presence or absence of the spun yarn 10 sucked by the suction pipe 44.

[0063] Since the reflecting section 120A is attached to the attachment pipe 110 by way of the connection pipe 122, the reflecting section 120A is arranged at a position projecting out toward the outer side from the attachment pipe 110. Thus, the distance between the sensor surface 100a of the reflective sensor 100 and the inclined surface 120a of the reflecting section 120A is increased, whereby the light reflected by the inclined surface 120a can be weakened. Thus, the light is weak even when the light reflected by the inclined surface 120a enters the sensor surface 100a of the reflective sensor 100 after being reflected over a plurality of times, and hence the light reflected by the spun yarn 10 can be suitably detected by the reflective sensor 100.

[0064] One end of the connection pipe 122 is connected to the edge of the hole 110b of the attachment pipe 110, and the other end of the connection pipe 122 is attached with the reflecting section 120A. Thus, the air does not enter the attachment pipe 110 from the hole 110b formed in the attachment pipe 110, and the suction force at the time of sucking the spun yarn 10 is not lowered.

[0065] Next, a description will be made on a second alternative embodiment. As illustrated in FIG. 6, in the second alternative embodiment, a reflecting section 120B is fitted to the hole 110b of the attachment pipe 110. The reflecting section 120B is made of a material having elasticity such as rubber, by way of example. The reflecting section 120B includes a main body portion 120b and an inserting portion 120c. The main body portion 120b is formed in a plate shape, and covers the hole 110b of the attachment pipe 110 from the outer side.

[0066] The inserting portion 120c is formed to an annular shape, and is projected out toward the reflective sensor 100 from the inner surface of the main body portion 120b (surface facing the reflective sensor 100 of the plurality of surfaces of the main body portion 120b) . A diameter on an outer peripheral side of the inserting portion 120c substantially coincides with a diameter of the hole 110b of the attachment pipe 110. The inserting portion 120c is removably inserted to the hole 110b. When the spun yarn 10 is sucked, the air pressure inside the attachment pipe 110 becomes lower than the air pressure outside the attachment pipe 110. Thus, the reflecting section 120B is sucked, and the reflecting section 120B is further suppressed from falling off from the attachment pipe 110.

[0067] The main body portion 120b of the reflecting section 120 has an inclined surface 120d at a position facing the hole 110a of the reflective sensor 100. The inclined surface 120d projects out in a convex form toward the sensor surface 100a of the reflective sensor 100. In other words, the inclined surface 120d is inclined with respect to the axis of the light emitted from the sensor surface 100a of the reflective sensor 100. The light that entered the inclined surface 120d is reflected to diffuse radially since the inclined surface 120d is projected out in a convex form. The yarn catching device of the present alternative embodiment is configured by the suction pipe 44, the reflective sensor 100, and the reflecting section 120B, which are described above.

[0068] In the second alternative embodiment as well, the light emitted from the sensor surface 100a of the reflective sensor 100 is reflected to diffuse in the direction different from the reflective sensor 100 by the inclined surface 120d of the reflecting section 120B. Since the inclined surface 120d is projected out in a convex form, the light emitted from the sensor surface 100a of the reflective sensor 100 can be easily reflected in the direction different from the reflective sensor 100. Thus, the reflected light reflected by the inclined surface 120d does not directly enter the sensor surface 100a of the reflective sensor 100. Therefore, the reflective sensor 100 can suitably detect the light reflected by the spun yarn 10, and can reliably detect the presence or absence of the spun yarn 10 sucked by the suction pipe 44.

[0069] The reflecting section 120B is removably attached with respect to the attachment pipe 110. Thus, the maintenance of the sensor surface 100a and the like of the reflective sensor 100 in the attachment pipe 110 can be easily carried out by detaching the reflecting sec-

tion 120B.

[0070] As illustrated in FIG. 6, the inclined surface 120d is formed by one projection, but the inclined surface 120d having a concave-convex form may be formed by a plurality of projections.

[0071] One embodiment of the present invention has been described above, but the present invention is not limited to the above embodiment. For example, the reflective sensor 100 is arranged in proximity to the curved part R of the suction pipe 44, but the position of arranging the reflective sensor 100 is not limited thereto.

[0072] A case has been described in which the reflective sensor 100 is arranged in the suction pipe 44 of the yarn joining cart 3, but the reflective sensor 100 may be arranged in the suction pipe 88 of the doffing cart 4 with the configuration described above. The reflective sensor 100 having the above configuration may be arranged in both the suction pipe 44 of the yarn joining cart 3 and the suction pipe 88 of the doffing cart 4.

[0073] A mechanism for carrying out the yarn joining operation of the suction pipe 44, the splicer 43, and the like arranged in the yarn joining cart 3 may be arranged in each of the spinning units 2.

[0074] The inclined surface 120a (see FIG. 4) of the reflecting section 120 in the embodiment and the inclined surface 120a (see FIG. 5) of the reflecting section 120A in the first alternative embodiment are flat surfaces in FIG. 4 and FIG. 5, but the inclined surface is not limited to a flat surface. For example, the inclined surface 120a may be curved as long as the light that entered the inclined surface 120a can be reflected in a direction other than the sensor surface 100a of the reflective sensor 100.

[0075] The reflecting section 120 in the embodiment may be removably attached with respect to the attachment pipe 110. The reflecting section 120A in the first alternative embodiment may be removably attached with respect to the connection pipe 122. In such cases, the maintenance of the sensor surface 100a and the like of the reflective sensor 100 in the attachment pipe 110 can be easily carried out by detaching the reflecting sections 120 and 120A.

[0076] The reflective sensor 100, and the like are attached to the yarn joining cart 3 arranged in the spinning machine 1 with the configuration described above, but the reflective sensor 100 and the like may be attached to a device other than the spinning machine 1 with the configuration described above. For example, as long as a mechanism adapted to catch the yarn with the suction pipe during the yarn joining operation is arranged, such as an automatic winder adapted to wind the yarn, the open end spinning machine, and the like, the reflective sensor 100 and the like may be attached to such devices with the configuration described above.

Claims

1. A yarn catching device comprising:

a suction pipe (44, 88) adapted to suck a yarn; and

a reflective sensor (100) adapted to detect the yarn passing through the suction pipe (44, 88), wherein a reflecting section (120, 120A, 120B) adapted to reflect light emitted from the reflective sensor (100) in a direction different from the reflective sensor (100) is arranged at a portion facing the reflective sensor (100) with a path of the yarn in the suction pipe (44, 88) therebetween.

2. The yarn catching device according to claim 1, wherein the reflecting section (120, 120A, 120B) is arranged at a position projecting out toward an outer side of the suction pipe (44, 88) from the suction pipe (44, 88).

3. The yarn catching device according to claim 2, wherein

the reflecting section (120, 120A, 120B) is arranged on the outer side of the suction pipe (44, 88), and

a hole (110b) is formed in a wall of the suction pipe (44, 88) between the reflecting section (120, 120A, 120B) and the reflective sensor (100).

4. The yarn catching device according to claim 3, further comprising a connection pipe (122) adapted to connect the reflecting section (120A) and an outer peripheral surface of the suction pipe (44, 88).

5. The yarn catching device according to any one of claims 1 to 4, wherein the reflecting section (120, 120A, 120B) has an inclined surface (120a, 120d) inclined with respect to an axis of the light emitted from the reflective sensor (100).

6. The yarn catching device according to any one of claims 1 to 5, wherein the reflecting section (120B) has an inclined surface (120d) having a convex form projecting out toward the reflective sensor (100).

7. The yarn catching device according to any one of claims 1 to 6, wherein the reflecting section (120, 120A, 120B) is removably attached with respect to the suction pipe (44, 88).

8. The yarn catching device according to any one of claims 1 to 7, wherein the reflecting section (120, 120A, 120B) is adapted to reflect light emitted from the reflective sensor (100) in a direction different from a direction into which the reflective sensor (100) is directed.

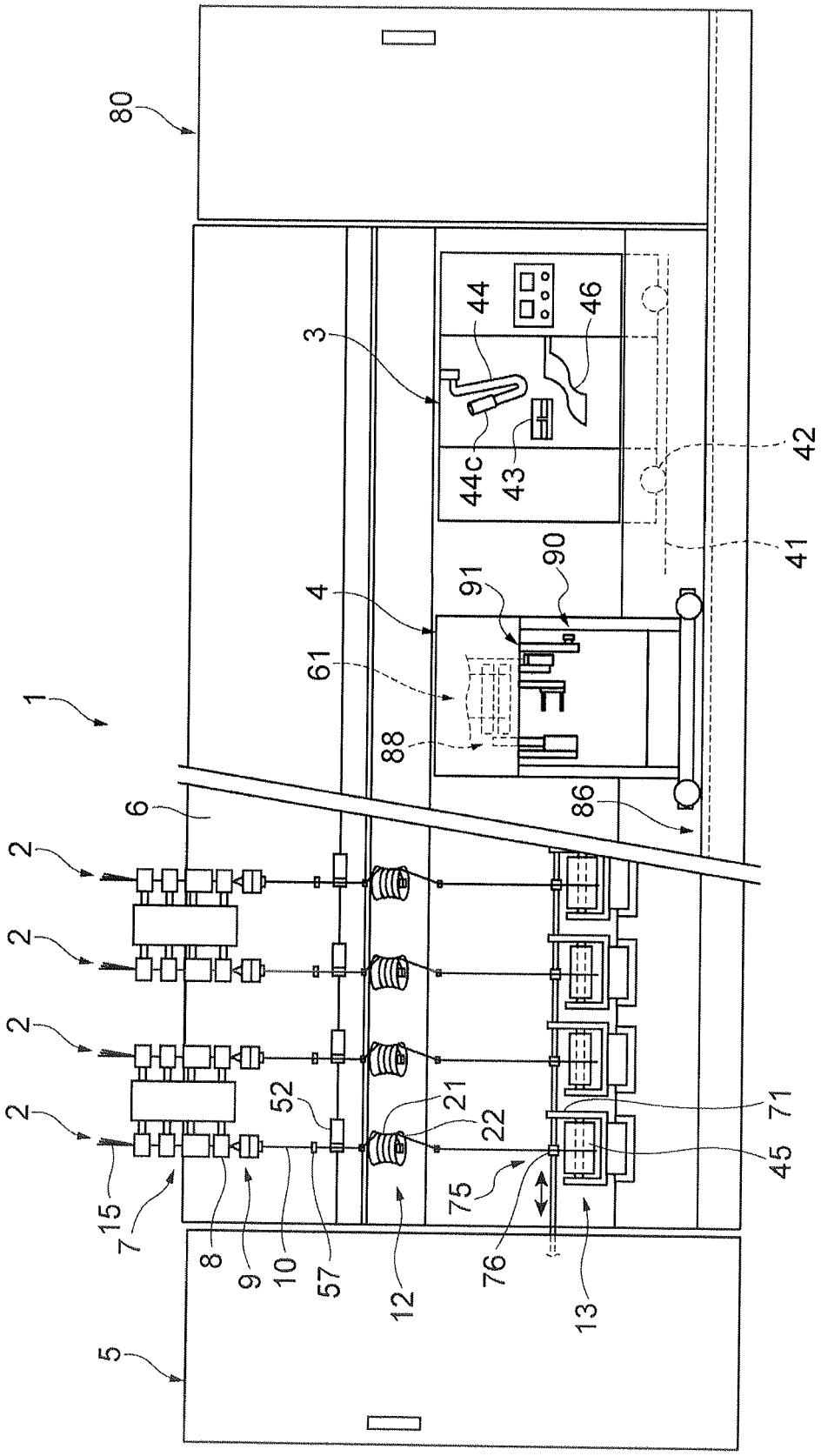
9. The yarn catching device according to any one of claims 1 to 7, wherein the reflecting section (120, 120A, 120B) is adapted to reflect light emitted from the reflective sensor (100) substantially away from the reflective sensor (100).

10. A yarn winding machine (1) comprising:

the yarn catching device according to any one of claims 1 to 9; and
a yarn winding unit (2) including a draft device (7) adapted to draft a fiber bundle, a spinning device (9) adapted to apply twists to the fiber bundle drafted by the draft device (7) to produce a spun yarn, and a winding device (13) adapted to wind the spun yarn produced by the spinning device (9) into a package,
wherein the yarn catching device catches the spun yarn produced by the spinning device (9).

11. The yarn winding machine (1) according to claim 10, further comprising an operation cart (3, 4) on which the yarn catching device is arranged,
wherein a plurality of the yarn winding units (2) are arranged, and
the operation cart (3, 4) travels with respect to the plurality of yarn winding units (2) and catches the spun yarn at each of the yarn winding units (2).

FIG. 1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44c
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42
41
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90
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86
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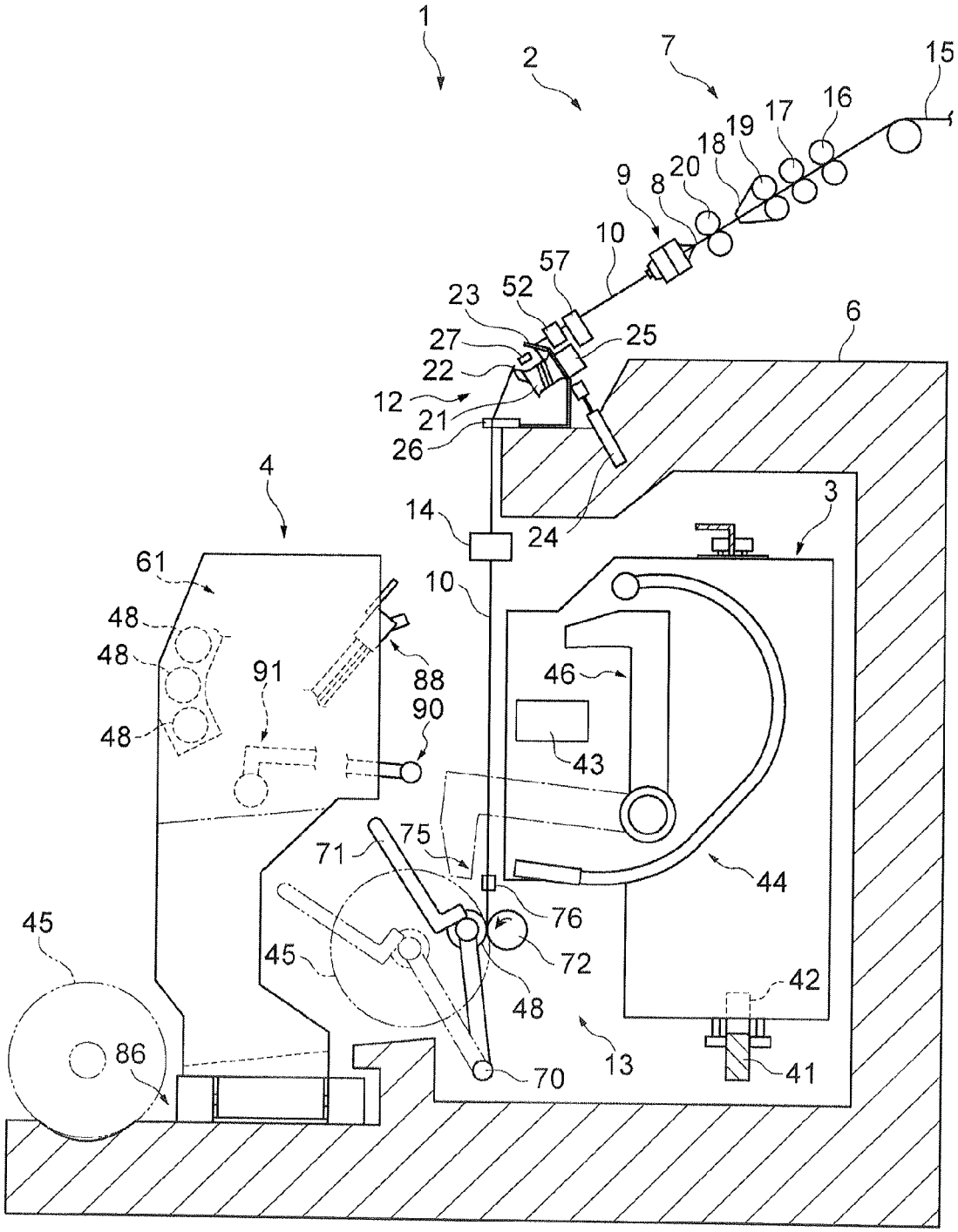
76
13
5

FIG. 2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48
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FIG. 3

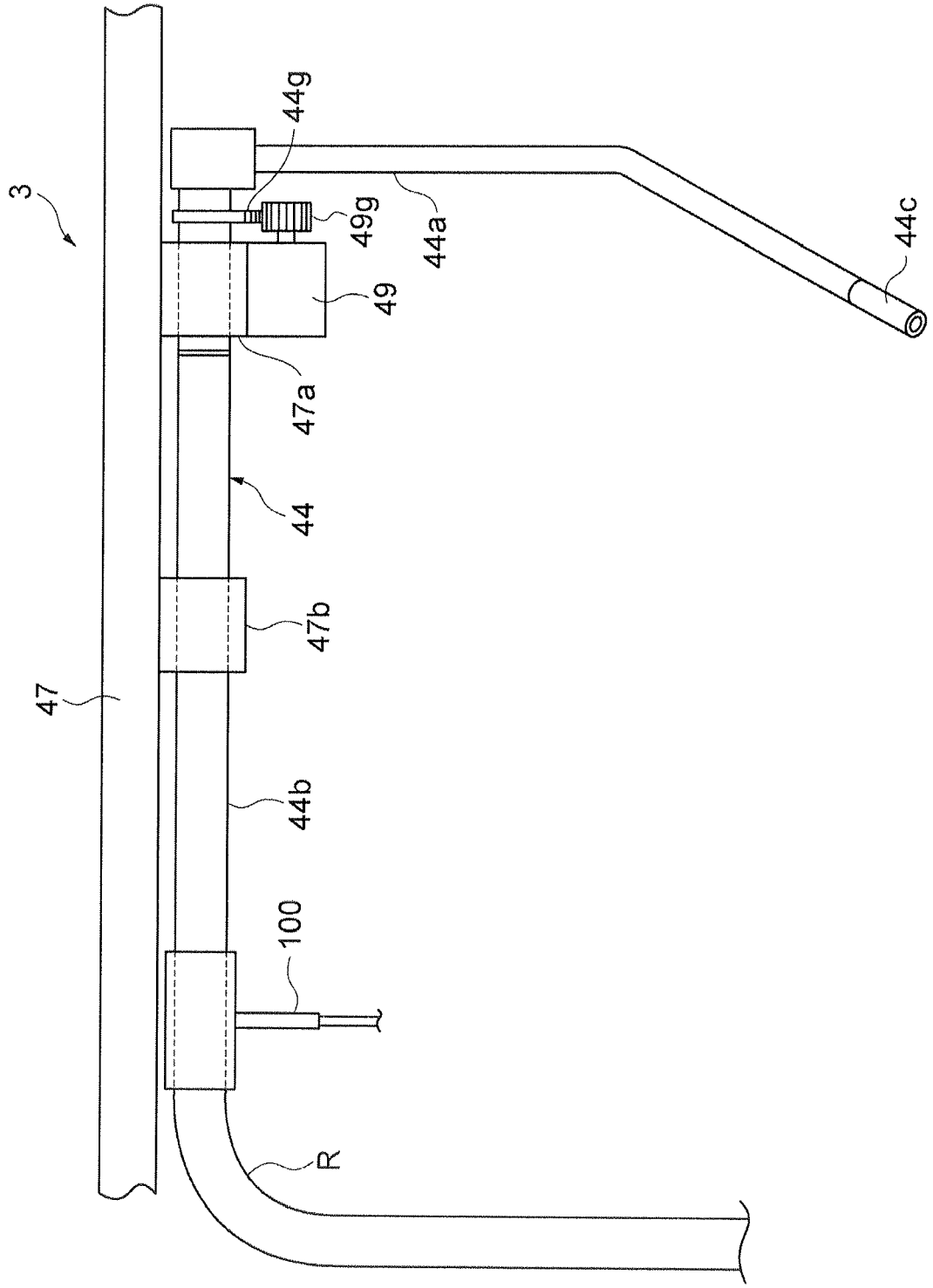
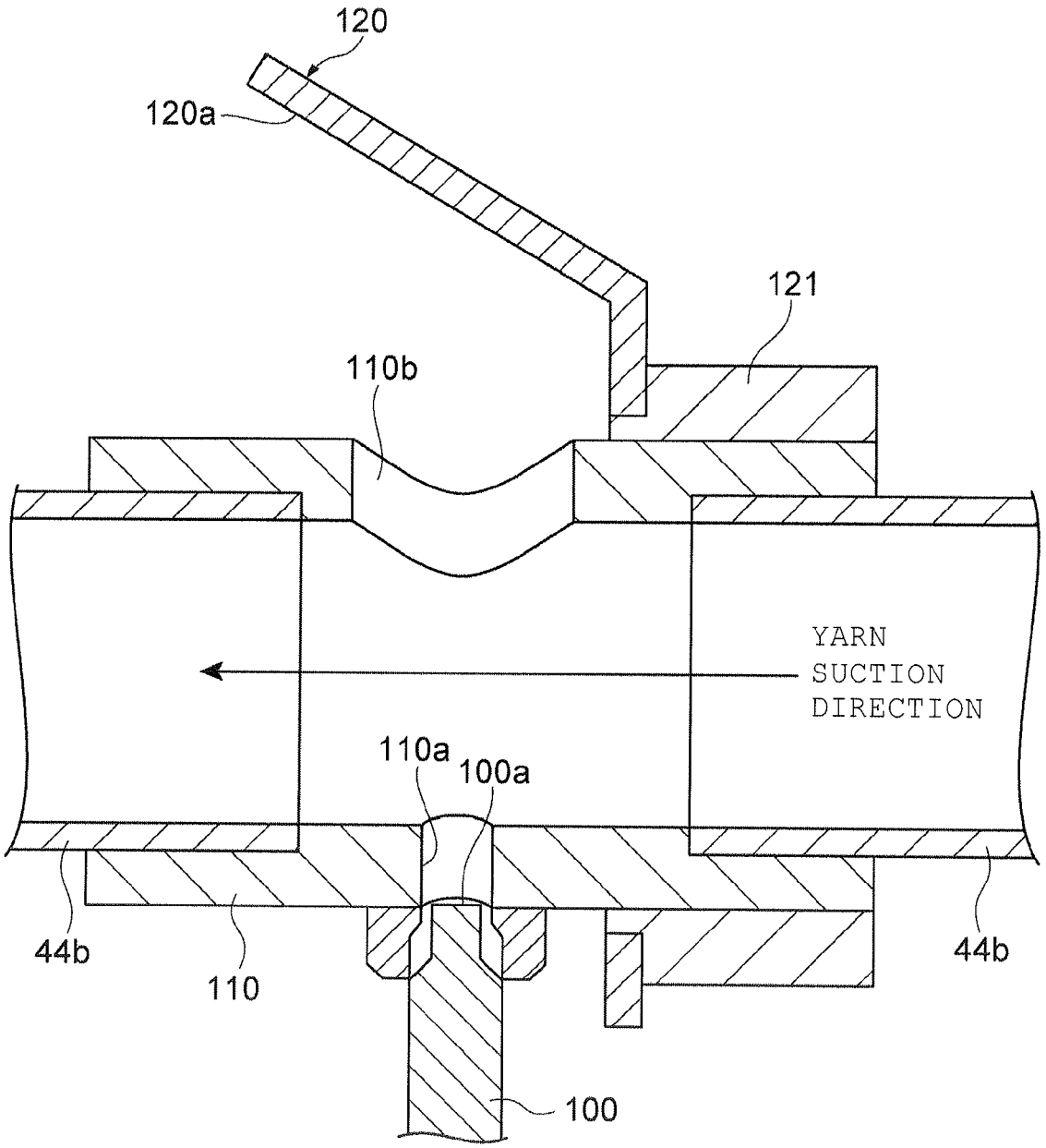


FIG. 4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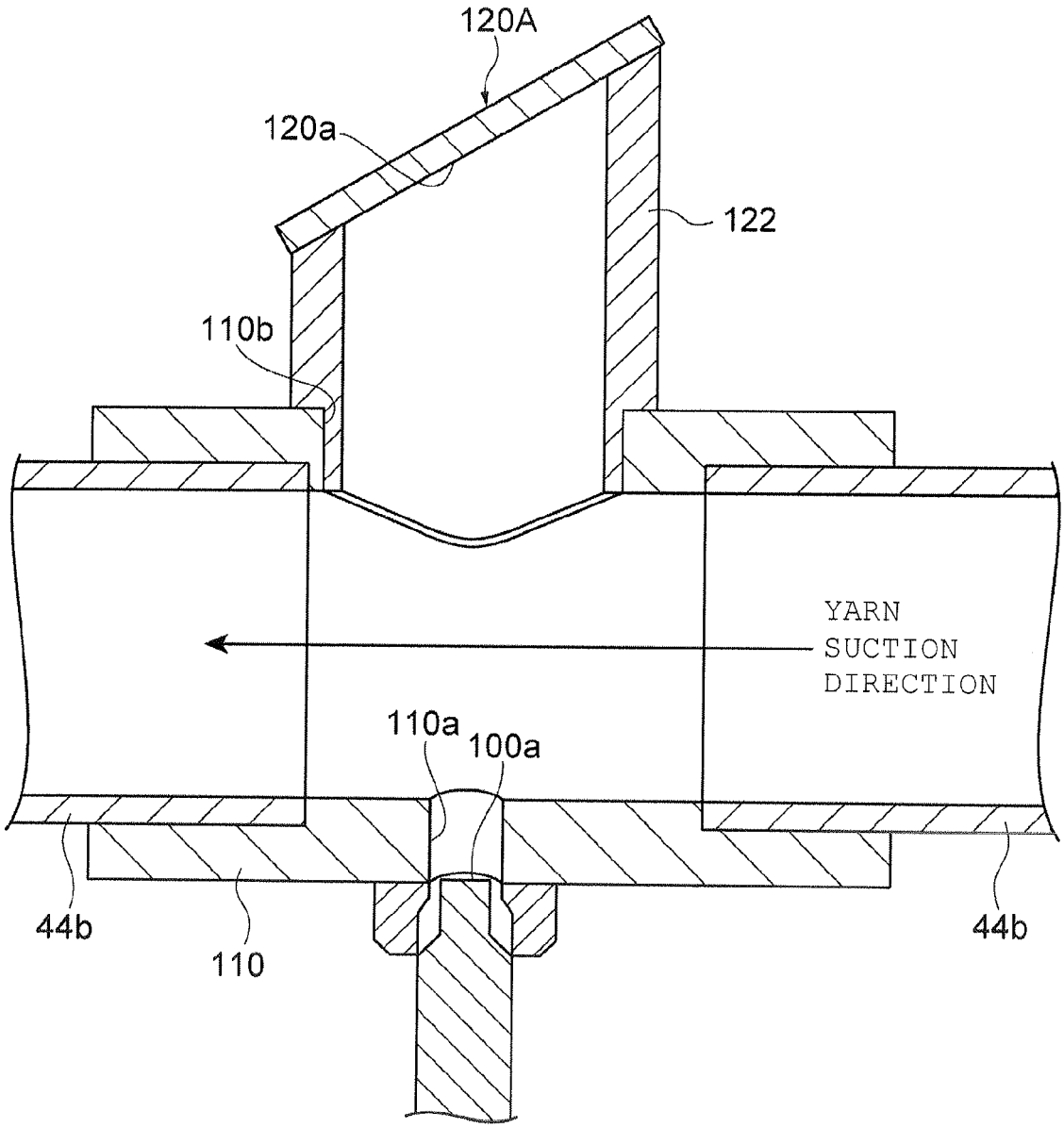
120a
121
110b
YARN
SUCTION
DIRECTION
110a
100a
44b
110
44b
100

FIG. 5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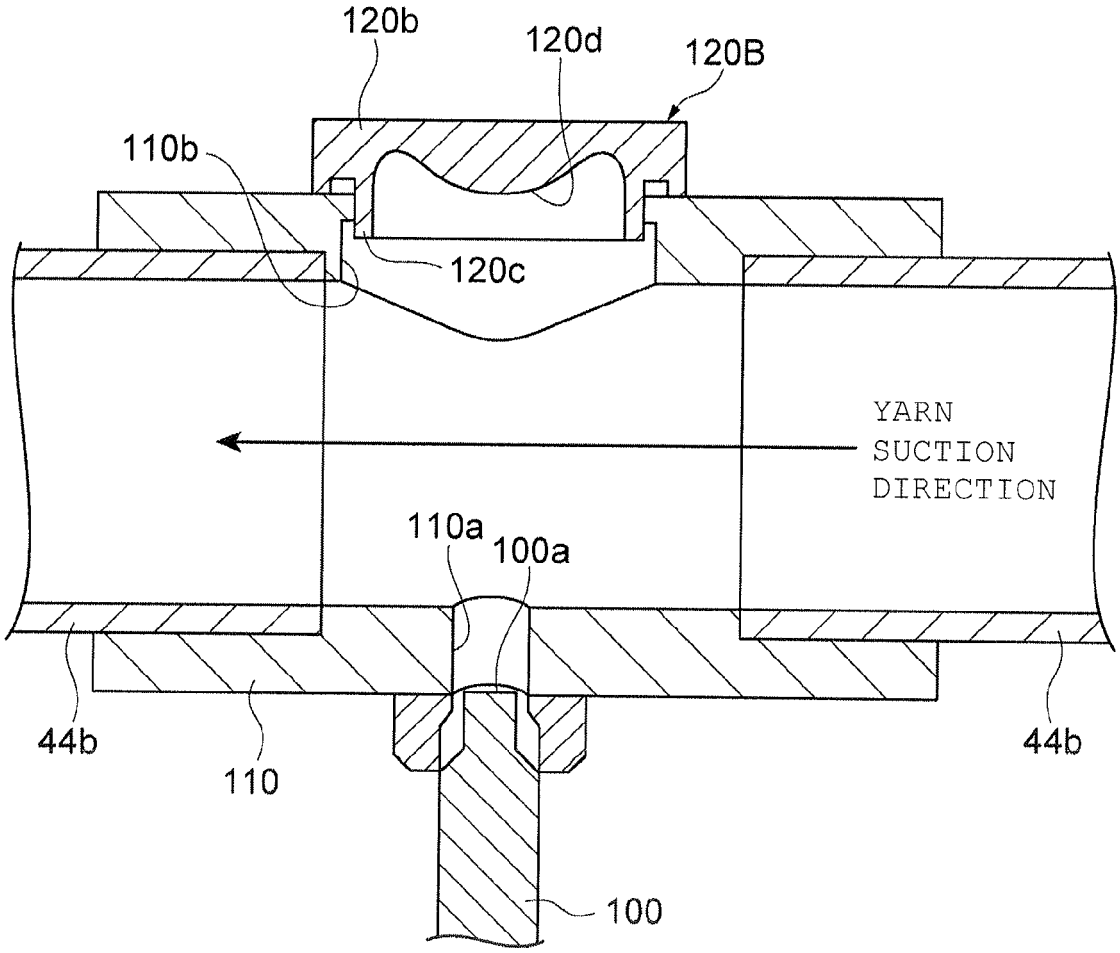
120a
122
110b
YARN
SUCTION
DIRECTION
110a
100a
44b
110
44b

FIG. 6


120b
120d
120B
110b
120c
YARN
SUCTION
DIRECTION
110a
100a
44b
110
44b
100

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EUROPEAN SEARCH REPORT

Application Number
EP 15 15 3037

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	JP H05 246626 A (MURATA MACHINERY LTD) 24 September 1993 (1993-09-24) * abstract; figures 1-3 * -----	1-11	INV. B65H63/032 B65H67/08
A	EP 0 846 641 A1 (SCHLAFHORST & CO W [DE]) 10 June 1998 (1998-06-10) * column 5, lines 7-12; figure 3 * -----	1-11	
A	DE 43 08 058 A1 (SCHLAFHORST & CO W [DE]) 15 September 1994 (1994-09-15) * the whole document * -----	1-11	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65H G01N D03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 June 2015	Pussemier, Bart

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19-06-2015

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