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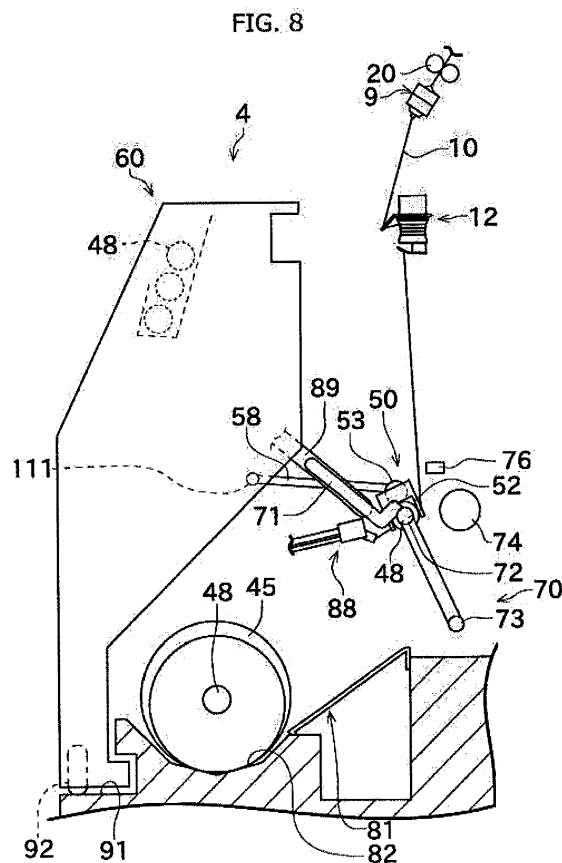
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(54) **Bobbin installation device and yarn winding apparatus including the same**

(57) A bobbin installation device (60) includes a bobbin supplying section (50) and a suction pipe (88). The bobbin supplying section (50) supplies a bobbin (48), onto which a spun yarn (10) is to be wound, to bobbin holders (72) (specifically, a position between two bobbin holders (72)) that defines a target position. The suction pipe (88) holds and guides the spun yarn (10) to be wound on the bobbin (48) supplied by the bobbin supplying section (50). The bobbin (48) and the spun yarn (10) are supplied to the bobbin holders (72) by moving the bobbin supplying section (50) and the suction pipe (88) while the spun yarn (10) is held at the end of the bobbin (48) in a shaft direction by the suction pipe (88).



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to a bobbin installation device that installs a bobbin, onto which a yarn is to be wound, at a target position.

2. Description of the Related Art

[0002] Bobbin installation devices that, before starting yarn winding by a spinning machine or after a spinning machine has discharged a fully wound package, or in similar situations, supply a bobbin to a bobbin holding section of the spinning machine or the like to make preparation (bunch winding or the like) to start a winding operation are known in the art. An example of a spinning machine known to the inventor that includes a bobbin installation device of this type is disclosed in Japanese published unexamined application No. 2005-219880.

[0003] The spinning machine disclosed in Japanese published unexamined application No. 2005-219880 performs bunch winding onto a bobbin after the bobbin is supplied to a cradle. The bunch winding is performed in the following manner. The cradle includes a bobbin holder that holds the two ends of the bobbin. An arrangement is made so that, when the bobbin is supplied to the cradle, a distance that is longer than the length of the bobbin in its shaft direction is secured between the two bobbin holders. Consequently, a predetermined gap occurs between the bobbin and the bobbin holders when the bobbin is supplied to the cradle.

[0004] A suction pipe provided in a bobbin installation device holds by suction a yarn supplied from the spinning machine, and guides the yarn in the gap that has occurred between the bobbin and the bobbin holders. In this state, the yarn is tucked between the bobbin holders and the bobbin by bringing the bobbin holders together so as to eliminate the gap. The bobbin installation device performs bunch winding by causing a driving roller for bunch winding to come into contact with the bobbin and causing the bobbin to rotate.

[0005] However, in the structure disclosed in Japanese published unexamined application No. 2005-219880, when supplying the bobbin to the cradle, a positional relation between the bobbin and the bobbin holders needs to be adjusted so that the bobbin does not impinge upon the bobbin holders. Because even thereafter an appropriate gap needs to be maintained between the bobbin and the bobbin holders to guide the yarn in the gap, the positional relation among the bobbin, the bobbin holders, and the yarn needs to be adjusted continuously even after the bobbin has been supplied to the cradle. Thus, a complicated adjustment operation is required, which not only makes the structure of the bobbin installation device complex but also makes it difficult to

realize a short cycle time.

[0006] The gap between the bobbin and the bobbin holder cannot be increased from the viewpoint of keeping the overall size of the spinning machine compact. Because the gap is narrow, the bobbin installation device is required to perform a highly precise operation to guide the yarn in a narrow gap, leading to increased cost. In some instances the bobbin installation device fails to properly guide the yarn in the gap. When this happens, a winding unit cannot start winding the yarn on the bobbin to form a package.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide a bobbin installation device that has a simple structure and that connects a yarn to a bobbin supplied at a target position.

[0008] A bobbin installation device according to a first aspect of the present invention includes a bobbin supplying section, a yarn holding and guiding device, and a moving means. The bobbin supplying section is adapted to supply a bobbin, onto which a yarn is to be wound, to a target position. The yarn holding and guiding device is adapted to hold and guide the yarn that is to be wound on the bobbin supplied by the bobbin supplying section. The moving means, when supplying the bobbin and the yarn to the target position, moves the bobbin supplying section and the yarn holding and guiding device while the yarn is held at an end of the bobbin in a shaft direction by the yarn holding and guiding device.

[0009] If the yarn is guided in after the bobbin is supplied to the target position, a positional relation among three elements, namely, the bobbin, the target position, and the yarn, would need to be taken into consideration, leading to a complicated structure of the bobbin installation device. With the above structure, a positional relation is established between two elements, namely, the bobbin and the yarn, and then the bobbin and the yarn, which have an established positional relation, are supplied to the target position. Consequently, the structure of the bobbin installation device can be simplified, and furthermore, the bobbin and the yarn can be properly guided to the target position.

[0010] In the bobbin installation device, the moving means moves the yarn holding and guiding device to a standby position, and the yarn holding and guiding device stands-by at a standby position while holding the yarn. The bobbin supplying section catches the yarn held by the yarn holding and guiding device standing-by at the standby position en route to supplying the bobbin to the target position, and positions the yarn at the end of the bobbin in the shaft direction.

[0011] Thus, the bobbin installation device performs the tasks of arranging the yarn at the end of the bobbin in the shaft direction and supplying the bobbin to the target position in a single operation. Thus, the bobbin installation device can quickly install the bobbin at the tar-

get position.

[0012] In the bobbin installation device, the bobbin supplying section preferably includes a yarn guiding section adapted to guide the yarn up to the end of the bobbin in the shaft direction. Thus, because the yarn is easily positioned at the end of the bobbin in the shaft direction of the bobbin by the yarn guiding section, anomalous guiding of the yarn can be further reduced in the bobbin installation device.

[0013] In the bobbin installation device, the bobbin supplying section includes a cutting unit adapted to cut the yarn at a position between the bobbin supplied to the target position and the yarn holding and guiding device. Because of the provision of the cutting unit in the bobbin supplying section, the bobbin installation device can quickly perform a cutting operation after the bobbin is supplied to the target position. If the cutting unit is not provided in the bobbin supplying section, a separate mechanism would be required for moving the cutting unit to the cutting position of the yarn and retracting the cutting unit thereafter. Thus, by having a structure such as described above, and not requiring additional mechanisms, an overall compactness of the bobbin installation device can be achieved.

[0014] In the bobbin installation device, the yarn holding and guiding device preferably holds the yarn by suction flow, and sucks up and discards yarn scrap of the yarn cut by the cutting unit. By this, the yarn scrap can be prevented from littering the floor when the bobbin and the yarn are supplied to the target position.

[0015] In the bobbin installation device, the bobbin supplying section preferably includes a bunch winding roller adapted to perform bunch winding on the bobbins. Because the bunch winding roller is provided in the bobbin supplying section, a bunch winding operation can be started quickly after the bobbin is supplied to the target position. If the bunch winding roller is not provided in the bobbin supplying section, a mechanism would be required to cause the bunch winding roller to come into contact with the bobbin and to retract the bunch winding roller when it is not required so as not to cause any hindrance. Thus, by having a structure such as described above, and not requiring additional mechanisms, an overall compactness of the bobbin installation device can be achieved.

[0016] In the bobbin installation device, the bobbin supplying section preferably includes a yarn regulating unit adapted to guide the yarn to a position between the two ends in the shaft direction of the bobbin supplied to the target position during the bunch winding performed by the bunch winding roller. Thus, the yarn regulating unit demonstrates effectiveness both when aligning the yarn at one end in the shaft direction of the bobbin to maintain the position of the yarn and when guiding the yarn to a predetermined position on the bobbin during bunch winding. Consequently, a compact bobbin installation device can be realized as compared to when separate members are provided to attain the effects de-

scribed above.

[0017] According to a second aspect of the present invention, a yarn winding apparatus includes the bobbin installation device and a plurality of winding units. Each of the winding units includes a bobbin holding section adapted to hold the bobbin supplied by the bobbin installation device, and a winding device adapted to form a package by winding the yarn on the bobbin held by the bobbin holding section.

[0018] Thus, the bobbin installation device can supply the bobbin and the yarn at the same time to the bobbin holding section. Consequently, the instances of anomalous guiding of the bobbin and the yarn by the bobbin installation device can be reduced, and the winding efficiency of the yarn winding apparatus can be improved.

[0019] In the yarn winding apparatus, the bobbin installation device preferably includes an operating unit adapted to operate the bobbin holding section and removes the package from the bobbin holding section. When removing the package from the bobbin holding section, as a rule, another bobbin needs to be supplied to the bobbin holding section to form a new package. Because both the tasks can be performed with the structure described above, the compactness of the yarn winding apparatus can be maintained.

[0020] In the yarn winding apparatus, the bobbin installation device preferably includes an adjusting unit adapted to enable adjustment of a path that the bobbin follows when the bobbin is being supplied to the bobbin holding section by the bobbin supplying section. Thus, the yarn winding apparatus can adjust the path to be followed by the bobbin depending on the shape, etc., of the bobbin. The path adjustment prevents the bobbin supplied by the bobbin installation device from impinging upon the bobbin holding section.

[0021] In the yarn winding apparatus, the winding units are arranged in a line in a specific direction, and the bobbin installation device is enabled to run along the direction in which the winding units are arranged. Thus, the number of bobbin installation devices that needs to be installed, and therefore the cost, can be reduced as compared to a case where one bobbin installation device is installed for each winding unit.

[0022] The above and other objects, features, advantages and 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

[0023]

FIG. 1 is a schematic elevation view of an overall structure of a spinning machine according to an embodiment of the present invention;

FIG. 2 is a longitudinal cross-sectional view of the

spinning machine shown in FIG. 1;

FIG. 3 is a perspective view of a structure of a bobbin supplying section, shown in FIG. 2, when supplying a bobbin;

FIGS. 4A and 4B are drawings showing an arrangement of a yarn guiding section, a yarn regulating groove, and a cutter;

FIG. 5 is a longitudinal cross-sectional view of the spinning machine in a state where a spun yarn is caught by a suction pipe shown in FIG. 1 while a doffing operation of a fully wound package is being performed;

FIG. 6 is a longitudinal cross-sectional view showing the suction pipe holding the spun yarn by suction and standing-by at a standby position;

FIG. 7 is a longitudinal cross-sectional view showing the spun yarn arranged at the end of the bobbin in its shaft direction while supplying the bobbin to a cradle;

FIG. 8 is a longitudinal cross-sectional view showing the bobbin with the spun yarn arranged at the end thereof in the shaft direction at the instant when the bobbin is supplied to the cradle; and

FIG. 9 is a drawing showing the spun yarn being guided during bunch winding.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] A spinning machine (yarn winding apparatus) according to an embodiment of the present invention is described below. Note that "upstream" and "downstream" used in this specification are upstream and downstream, respectively, with respect to a running direction of a yarn during spinning. FIG. 1 is a schematic elevation view of an overall structure of a spinning machine 1 according to the embodiment. FIG. 2 is a longitudinal cross-sectional view of the spinning machine 1.

[0025] The spinning machine 1 shown in FIG. 1 includes a plurality of spinning units (winding units) 2 arranged in a line. The spinning machine 1 also includes a splicer carrier 3, a doffer carrier 4, a blower box 93, and a motor box 5.

[0026] As shown in FIG. 1, each of the spinning units 2 includes a drafting device 7, a spinning device 9, a yarn pooling device 12, and a winding device 13, which are arranged from upstream to downstream. The drafting device 7 is provided near a top end of a frame 6 of the spinning machine 1. A fiber bundle 8 fed from the drafting device 7 is spun by the spinning device 9 into a spun yarn 10. The spun yarn 10 from the spinning device 9 passes through a yarn clearer 49, which will be described later, and then passes through the yarn pooling device 12. The winding device 13 winds the spun yarn 10 on a bobbin 48 to form a package 45.

[0027] The drafting device 7 drafts a sliver 15 into the fiber bundle 8. As shown in FIG. 2, the drafting device 7 includes four pairs of rollers, or, more specifically, a pair

of back rollers 16, a pair of third rollers 17, a pair of middle rollers 19 around each of which an apron belt 18 is laid, and a pair of front rollers 20.

[0028] Although a detailed structure of the spinning device 9 is not shown, in the present embodiment, an air-jet-spinning-type spinning device is employed as the spinning device 9. More specifically, the spinning device 9 twists the fiber bundle 8 by using a swirling airflow to form the spun yarn 10.

[0029] The yarn pooling device 12 is arranged downstream of the spinning device 9. The yarn pooling device 12 has a function of drawing out the spun yarn 10 from the spinning device 9 while applying a predetermined tension on the spun yarn 10, a function of pooling the spun yarn 10 fed from the spinning device 9 to prevent a slack in the spun yarn 10 during splicing performed by the splicer carrier 3, and a function of adjusting a yarn tension so that variations in the yarn tension on the side of the winding device 13 are not transmitted to the spinning device 9. As shown in FIG. 2, the yarn pooling device 12 includes a yarn pooling roller 21, a yarn hook member 22, an upstream guide 23, and an electric motor 25.

[0030] The yarn hook member 22 is capable of hooking (catching) the spun yarn 10. The yarn hook member 22 rotates in one piece with the yarn pooling roller 21 in a state where the spun yarn 10 is hooked by the yarn hook member 22 so that the spun yarn 10 is carried onto an outer peripheral surface of the yarn pooling roller 21.

[0031] The yarn pooling roller 21 pools the spun yarn 10 by winding the spun yarn 10 on an outer peripheral surface of the yarn pooling roller 21. The yarn pooling roller 21 is rotated at a predetermined rotational speed by the electric motor 25.

[0032] The yarn hook member 22 is rotatably supported relative to the yarn pooling roller 21. On the yarn hook member 22, a torque (resisting torque) against rotation of the yarn hook member 22 relative to the yarn pooling roller 21 is applied by a torque generating section (not shown) implemented as, for example, a magnetic-torque generating section. In a situation where the spun yarn 10 is hooked by the yarn hook member 22, if a tension applied to the spun yarn 10 is large enough to overcome the resisting torque, the yarn hook member 22 rotates independently of the yarn pooling roller 21, thereby unwinding the spun yarn 10 from the yarn pooling roller 21. On the contrary, if the tension applied to the spun yarn 10 is weaker than the resisting torque, the yarn hook member 22 rotates in one piece with the yarn pooling roller 21, thereby winding the spun yarn 10 on the yarn pooling roller 21.

[0033] As described above, the yarn pooling device 12 winds the spun yarn 10 when the tension applied to the spun yarn 10 decreases (i.e., when a slack is likely to be given to the spun yarn 10), while the yarn pooling device 12 unwinds the spun yarn 10 when the tension applied to the spun yarn 10 increases. Accordingly, the yarn pooling device 12 is capable of taking up a slack in the spun yarn 10 and applying an appropriate tension on the spun

yarn 10. As described above, the yarn hook member 22 acts to accommodate variations in the tension applied to the spun yarn 10 between the yarn pooling device 12 and the winding device 13. Accordingly, it is possible to prevent the variations in the tension from influencing the spun yarn 10 between the spinning device 9 and the yarn pooling device 12. Thus, the yarn pooling device 12 can draw out the spun yarn 10 from the spinning device 9 at a relatively steady velocity.

[0034] The upstream guide 23 is arranged at a position slightly upstream with respect to the yarn pooling roller 21. The upstream guide 23 serves as a guide member for an appropriate carriage of the spun yarn 10 to the outer peripheral surface of the yarn pooling roller 21. The upstream guide 23 also serves as a twist preventer that prevents propagation of twisting of the spun yarn 10 to a downstream side beyond the upstream guide 23.

[0035] The yarn clearer 49 is arranged on a front-surface side of the frame 6 of the spinning machine 1 at a position between the spinning device 9 and the yarn pooling device 12. The spun yarn 10 spun by the spinning device 9 passes through the yarn clearer 49 before the spun yarn 10 is wound by the yarn pooling device 12. The yarn clearer 49 monitors the thickness of the running spun yarn 10. Upon detecting a yarn defect of the spun yarn 10, the yarn clearer 49 transmits a yarn-defect detection signal to a unit controller (not shown). The yarn clearer 49 can be configured to detect, in addition to an abnormal thickness of the spun yarn 10, a foreign matter in the spun yarn 10.

[0036] Upon receiving the yarn-defect detection signal from the yarn clearer 49, the unit controller stops driving of the drafting device 7 while causing the winding device 13 to continue driving, thereby cutting the spun yarn 10. The unit controller then stops the drafting device 7, the spinning device 9, and the like. The unit controller transmits a control signal to the splicer carrier 3. Upon receiving the control signal, the splicer carrier 3 travels to a position in front of the corresponding spinning unit 2. Thereafter, the unit controller resumes driving of the spinning device 9 and the like and causes the splicer carrier 3 to perform splicing to resume winding. At this time, the yarn pooling device 12 successively pools the spun yarn 10, which is continuously fed from the spinning device 9, on the yarn pooling roller 21 to take up a slack in the spun yarn 10 over a period from when the spinning device 9 resumes spinning until when winding is resumed.

[0037] As shown in FIGS. 1 and 2, the splicer carrier 3 includes a splicer (yarn splicing device) 43, a suction pipe 44, a suction mouth 46, and wheels 42. When yarn breakage or yarn cutting occurs in one of the spinning units 2, the splicer carrier 3 runs on a travel lane 41 fixed to the frame 6 by driving the wheels 42. The splicer carrier 3 then stops in front of the spinning unit 2 where the yarn breakage or yarn cutting has occurred to perform the splicing.

[0038] The suction pipe 44 is vertically pivotable about a shaft. The suction pipe 44 sucks and catches a yarn

end (upper yarn) of the spun yarn 10 fed from the spinning device 9, and carries the yarn end to the splicer 43. The suction mouth 46 is vertically pivotable about a shaft. The suction mouth 46 sucks and catches a yarn end (lower yarn) of the spun yarn 10 extending from the package 45, and carries the yarn end to the splicer 43. Although description about a detailed structure of the splicer 43 is omitted, the upper yarn and the lower yarn can be spliced by twisting yarn ends by using a swirling airflow.

[0039] The winding device 13 includes a cradle 70. The cradle 70 includes a support shaft 73, a cradle arm 71 that is pivotable about the support shaft 73, and bobbin holders (bobbin holding section) 72 capable of holding the bobbin 48 at the ends of the bobbin 48.

[0040] The winding device 13 includes a winding drum 74 and a traverse guide 76, on which the spun yarn 10 can be hooked. The winding drum 74 is driven in contact with either an outer peripheral surface of the bobbin 48 or an outer peripheral surface of the package 45 that is formed by winding the spun yarn 10 on the bobbin 48. The winding device 13 causes an electric motor (not shown) to drive the winding drum 74, thereby rotating the package 45 that is in contact with the winding drum 74. Simultaneously, the winding device 13 causes the traverse guide 76 to reciprocate by using a drive mechanism (not shown). Thus, the winding device 13 winds the spun yarn 10 on the package 45 while causing the spun yarn 10 to traverse.

[0041] A spring (not shown) is coupled to the cradle arm 71. The spring constantly applies an urging force in an upright direction onto the cradle arm 71. Accordingly, as the thickness of the package 45 increases with an increasing amount of the spun yarn 10 wound on the bobbin 48, the cradle arm 71 tilts toward the front-surface side of the device, and hence a position of the axis of the package 45 is moved forward. A driving section (not shown) (e.g., a cylinder) is coupled to the cradle arm 71. It is also possible to perform control according to an instruction fed from the unit controller so as to actively cause the cradle arm 71 to pivot in a direction away from the winding drum 74 and in a direction toward the winding drum 74.

[0042] As shown in FIGS. 1 and 2, the doffing cart 4 includes a bobbin installation device 60. The bobbin installation device 60 performs a bobbin installing operation and a doffing operation. The bobbin installing operation is an operation of supplying the bobbin 48 to the cradle 70 to prepare for winding of the spun yarn 10 onto the bobbin 48. The doffing operation is an operation of dismounting the package 45 that is fully wound from the cradle 70. The doffing cart 4 includes wheels 92 at a bottom of the doffing cart 4. Upon receiving an instruction to perform the bobbin installing operation or the doffing operation on one of the spinning units 2, the doffing cart 4 travels on a travel lane 91 formed on the frame 6 to the corresponding spinning unit 2. The doffing cart 4 stops in front of the spinning unit 2 for which the instruction was issued, and then performs any one (or both) of the bobbin

installing operation and the doffing operation.

[0043] The bobbin installation device 60 includes, as the elements for performing the bobbin installing operation, a bobbin supplying section 50, a suction pipe (yarn catching-and-carrying device) 88, and a cradle operating arm (operating section) 89.

[0044] The suction pipe 88 has a pivotable and telescopic structure. The suction pipe 88 catches the spun yarn 10 discharged from the spinning device 9 by sucking the spun yarn 10 and carries the spun yarn 10 to the winding device 13.

[0045] The bobbin supplying section 50 that includes a bobbin gripping section 52 is pivotable about a rocker shaft 111 and is capable of gripping the bobbin 48 with the bobbin gripping section 52. The bobbin installation device 60 causes the bobbin supplying section 50, in which the bobbin gripping section 52 grips the bobbin 48, to pivot to supply the bobbin 48 to a position (target position) between the bobbin holders 72 of the cradle 70. The bobbin supplying section 50 includes a bunch winding roller 53 for performing bunch winding. Bunch winding means winding the spun yarn 10 in a straight winding manner around the bobbin 48 to fix the spun yarn 10 onto the bobbin 48 at the start of winding to form a package. A detailed structure of the bobbin supplying section 50 is described later.

[0046] The cradle operating arm 89 can operate the cradle arm 71 such that one of the bobbin holders 72 is moved away from the other bobbin holder 72 (separating operation). Meanwhile, as described above, as the thickness of the package 45 increases with increasing amount of the spun yarn 10 wound on the bobbin 48, the orientation of the cradle arm 71 changes. The position of the cradle operating arm 89 can be changed by using a not-shown cam mechanism or the like. Accordingly, the cradle operating arm 89 can perform the separating operation during each of the doffing operation (see FIG. 5) of dismounting the fully wound package 45 and the bobbin installing operation (see FIG. 6).

[0047] The bobbin installation device 60 includes, as the elements for performing the doffing operation, a transport section 61 shown in FIG. 2 in addition to the cradle operating arm 89. The transport section 61 receives the fully wound package 45 from the cradle 70 and put it on a sloping member 81. Accordingly, the fully wound package 45 is carried to a receptacle 82. The transport section 61 includes, as relevant elements, a guiding plate 69, a bobbin guiding cylinder 62, and a roller member 67. The transport section 61 is pivotable about a rotary shaft 101.

[0048] The guiding plate 69 includes a plate-like contact member and one or more plate-like restricting members. The plate-like contact member is in contact with the outer peripheral surface of the fully wound package 45 received from the cradle 70 to guide the package 45. The plate-like restricting members restrict a movement of the package 45 in its shaft direction so that the package 45 does not fall from the contact member.

[0049] The bobbin guiding cylinder 62 applies a force on an acting shaft 104 by extending or shortening a cylinder of the bobbin guiding cylinder 62, thereby causing the guiding plate 69 to pivot about a rotary shaft 103 upward or downward. Thus, the transport section 61 is capable of adjusting the position of the guiding plate 69 that is carrying the package 45 or stopping an inertial rotation of the package 45 after completion of winding of the package 45.

[0050] The roller member 67 rolls on the sloping member 81 when the package 45 is carried along the sloping member 81. Accordingly, the transport section 61 can carry the package 45 smoothly.

[0051] The bobbin supplying section 50 is explained in detail below with reference to FIG. 3 and FIGS. 4A and 4B. FIG. 3 is a perspective view of a structure of the bobbin supplying section 50 when the bobbin 48 is supplied to the cradle 70. FIGS. 4A and 4B are drawings showing an arrangement of a yarn guiding section 31, a yarn regulating groove (yarn regulating section) 32, and a cutter 33.

[0052] As shown in FIG. 3, the bobbin supplying section 50 includes, in addition to the bobbin gripping section 52 and the bunch winding roller 53, a fixed arm 57, a pivot arm 58, a bobbin supplying cylinder 56, a bunch winding motor 54, and a gripping-section driving cylinder 55.

[0053] The fixed arm 57 includes a flat path adjusting plate 59. Selection holes 115 are formed in the path adjusting plate 59. A fixing member, such as a bolt, is inserted into an appropriate one of the selection holes 115 to thereby lock the bobbin supplying section 50 onto the doffing cart 4. Several selection holes 115 are formed in the path adjusting plate 59. A position and an orientation of the path adjusting plate 59 (accordingly, a position and an orientation of the rocker shaft 111) can be adjusted as desired by inserting the fixing member in an appropriate selection hole 115. A trajectory traced by a distal end of the pivot arm 58 is changed by adjusting the position and the orientation of the rocker shaft 111 as mentioned above. Thus, the path along which the bobbin 48 is supplied to the bobbin holders 72 can be changed by virtue of the path adjusting plate 59 and the fixing member which together function as an adjusting unit.

[0054] As described above, the bobbin supplying section 50 is pivotable about the rocker shaft 111. A torsion spring 112 is wound around the rocker shaft 111. The torsion spring 112 urges the pivot arm 58 in a direction (in which the bobbin gripping section 52 approaches the doffing cart) opposite from a direction in which the pivot arm 58 is pivoted to supply the bobbin 48.

[0055] The bobbin supplying cylinder 56 is a cylinder that can be extended or shortened in response to an instruction issued by the bobbin installation device 60. One end of the bobbin supplying cylinder 56 is attached to a basal end of the fixed arm 57. The pivot arm 58 that is pivotable about the rocker shaft 111 is pivotably attached to the other end of the bobbin supplying cylinder 56.

[0056] Thus, by extending the bobbin supplying cylinder 56 so as to counter a bias force of the torsion spring 112, the pivot arm 58 is made to pivot about the rocker shaft 111.

[0057] The bunch winding motor 54 generates a driving force for rotating the bunch winding roller 53. This driving force is transmitted through a transmission mechanism (not shown) (e.g., a belt and a pulley) to the bunch winding roller 53.

[0058] Meanwhile, to perform the bunch winding, it is necessary to bring the bunch winding roller 53 into contact with the bobbin 48. For this reason, the bobbin supplying section 50 includes a moving mechanism (more specifically, the gripping-section driving cylinder 55, which will be described later) that moves the bunch winding roller 53 so that it comes into contact with the bobbin 48.

[0059] The bobbin gripping section 52 includes a fixed gripping member 113 and a movable gripping member 114. The movable gripping member 114 is coupled to the gripping-section driving cylinder 55. The movable gripping member 114 is moved toward or away from the fixed gripping member 113 by an action of the gripping-section driving cylinder 55. The bobbin gripping section 52 can grip or ungrip the bobbin 48 in this way.

[0060] In the present embodiment, switching between a state where the bunch winding roller 53 is in contact with the bobbin 48 and a state where the bunch winding roller 53 is away from the bobbin 48 can be performed by using the gripping-section driving cylinder 55. The action of the bobbin gripping section 52 is linked to the action of the bunch winding roller 53. More specifically, when the bobbin 48 is gripped by the bobbin gripping section 52, simultaneously the bunch winding roller 53 is separated from the bobbin 48. When the bobbin 48 is un-gripped by the bobbin gripping section 52, simultaneously the bunch winding roller 53 is brought into contact with the bobbin 48.

[0061] As shown in FIG. 4A, the yarn guiding section 31 and the yarn regulating groove 32 are formed near a part of the fixed gripping member 113 of the bobbin gripping section 52 that grips a large-diameter end of the bobbin 48. FIG. 4A is a view of the fixed gripping member 113 in the state shown in FIG. 3 as viewed from the spinning unit 2.

[0062] The yarn regulating groove 32 is a groove for regulating the spun yarn 10 when supplying the bobbin 48 so that the spun yarn 10 does not slip from the end of the bobbin 48 in its shaft direction. The yarn guiding section 31 guides the spun yarn 10 into the yarn regulating groove 32.

[0063] FIG. 4B is a view of a large-diameter side of the bobbin 48 shown in FIG. 3 as viewed from the shaft direction of the bobbin 48. FIG. 4B corresponds to FIG. 8 described later; however, the direction of the view is opposite to that of FIG. 8. As shown in FIG. 4B, the bobbin supplying section 50 includes the cutter (cutting unit) 33 that can cut the spun yarn 10. Operations of the yarn

guiding section 31, the yarn regulating groove 32 and the cutter 33 are explained later.

[0064] A sequence of the doffing operation and a sequence of the bobbin installing operation performed by the bobbin installation device 60 are described below with reference to FIGS. 5 to 8. The doffing operation is described first with reference to FIG. 5. FIG. 5 is a longitudinal cross-sectional view of the spinning machine 1 in a state where the spun yarn 10 is caught by the suction pipe 88 while the doffing operation of the fully wound package 45 is being performed.

[0065] When it is detected by a sensor (not shown) that the package 45 of one of the spinning units 2 is fully wound, the unit controller causes the corresponding spinning device 9 to stop, and simultaneously commands the doffing cart 4 to travel to the corresponding spinning unit 2. Substantially concurrently therewith, the unit controller performs control operations to cause the cradle arm 71 of the corresponding winding device 13 to pivot leftward of FIG. 2 (toward a front-surface side of the spinning unit 2), thereby separating the fully wound package 45 from the corresponding winding drum 74, and to provide control so as to not apply the rotational force to the package 45.

[0066] Even after the package 45 is separated from the winding drum 74, the package 45 continues the inertial rotation. The bobbin installation device 60 extends the bobbin guiding cylinder 62 of the transport section 61, thereby causing the guiding plate 69 to pivot upward to come into contact with the package 45. As a result, the inertial rotation of the package 45 is stopped.

[0067] Until the inertial rotation of the package 45 is stopped completely, the bobbin installation device 60 moves the cradle operating arm 89 to a position shown in FIG. 5. When the inertial rotation of the package 45 is stopped completely, the bobbin installation device 60 causes the cradle operating arm 89 to move the cradle arm 71 in a manner that one of the bobbin holders 72 moves away from the other bobbin holder 72, thereby dismounting the fully wound package 45 from the cradle 70.

[0068] The dismounted fully wound package 45 is conveyed to the sloping member 81 while the weight of the package 45 is supported by the guiding plate 69 (more specifically, the contact member) of the transport section 61. The transport section 61 causes the package 45 to roll down the sloping member 81 to thereby move the package 45 while remaining in the state of contacting the package 45. At this time, the roller member 67 of the transport section 61 rolls on the sloping member 81. Thereafter, the package 45 is carried to the receptacle 82.

[0069] In the present embodiment, the receptacle 82 functions as a conveyor. The receptacle 82 conveys the package 45 in the direction in which the spinning units 2 are arranged to thereby automatically gather the packages 45 at one place. Alternatively, a configuration can be employed in which the receptacle 82 does not function as a conveyor and the package 45 on the receptacle 82

is manually collected by an operator. The doffing operation is performed as described above.

[0070] The bobbin installing operation is explained below with reference to FIGS. 6 to 8. FIG. 6 is a longitudinal cross-sectional view showing the suction pipe 88 holding the spun yarn 10 by suction and standing-by at a standby position. FIG. 7 is a longitudinal cross-sectional view showing the spun yarn 10 arranged at the end of the bobbin 48 in its shaft direction while supplying the bobbin 48 to the cradle 70. FIG. 8 is a longitudinal cross-sectional view showing the bobbin 48 with the spun yarn 10 placed at the end thereof in the shaft direction at the instant when it is supplied to the cradle 70. The bobbin installing operation and the doffing operation described above are performed concurrently.

[0071] When the doffing cart 4 reaches a position in front of the corresponding spinning units 2 as commanded, the unit controller of the spinning unit 2 causes the drafting device 7 and the spinning device 9 to resume driving. Substantially simultaneously therewith, the suction pipe 88 is extended upward (see FIG. 5). The suction pipe 88 catches the spun yarn 10 by sucking a yarn end of the spun yarn 10 discharged from the spinning device 9.

[0072] The bobbin installation device 60 moves the suction pipe 88 downward with the spun yarn 10 remaining sucked by the suction pipe 88. At this time, the unit controller performs control operations so that the spun yarn 10 sucked by the suction pipe 88 is wound around the yarn pooling device 12. Meanwhile, a suction force of the suction pipe 88 is relatively small and does not overcome the resisting torque of the yarn pooling device 12. Accordingly, as shown in FIG. 6, the spun yarn 10 is pooled on the yarn pooling device 12.

[0073] In the bobbin installation device 60, the suction pipe 88 continues to stand by at the standby position after it is moved downward (see FIG. 6). As a result, the spun yarn 10 is guided so as to form a predetermined yarn path between the distal end of the suction pipe 88 and the yarn pooling device 12. Substantially concurrently with the movement of the suction pipe 88, the cradle operating arm 89 is moved and positioned for operating the cradle 70, and the cradle arm 71 is operated so as to cause one bobbin holder 72 to be moved away from the other bobbin holder 72 before the bobbin 48 is supplied.

[0074] The bobbin installation device 60 then grips the bobbin 48 stacked in an upper portion of the doffing cart 4 using the bobbin supplying section 50 (bobbin gripping section 52). Thereafter, the bobbin installation device 60 extends the bobbin supplying cylinder 56 causing the pivot arm 58 to rotate so that the bobbin supplying section 50 is advanced to supply the bobbin 48. A design and a layout of the bobbin installation device 60 according to the present embodiment are adjusted such that the yarn path of the spun yarn 10 comes into contact with the yarn guiding section 31 of the bobbin installation device 60 en route of the supply operation. Accordingly, the spun yarn 10 that is in contact with the yarn guiding section 31 is

automatically led to the yarn regulating groove 32 as the pivot arm 58 rotates subsequently. Consequently, at a stage before the bobbin 48 is supplied to the cradle 70, the spun yarn 10 is brought to lie at a position that passes near the end of the bobbin 48 in the shaft direction.

[0075] The bobbin supplying section 50 supplies the bobbin 48 to the bobbin holders 72 with the spun yarn 10 inside the yarn regulating groove 32 (see FIG. 8). That is, the bobbin 48 and the spun yarn 10 are supplied at the same time to the position between the two bobbin holders 72. After the bobbin 48 is supplied, the spun yarn 10 comes to be positioned to traverse the bobbin 48 at the end of the bobbin 48 in the shaft direction, as shown in FIGS. 4B and 8. In this state, the cradle operating arm 89 operates the cradle arm 71 so as to move one bobbin holder 72 in a direction toward the other bobbin holder 72, whereby the spun yarn 10 is fixed by being sandwiched between the bobbin 48 and the end of the bobbin holder 72.

[0076] The cutter 33 provided in the bobbin supplying section 50 cuts the spun yarn 10 at a position between the bobbin 48 and the suction pipe 88. The spun yarn 10 cut by the cutter 33 is sucked into the suction pipe 88 by suction, thus preventing yarn scrap from littering the floor, etc.

[0077] Thereafter, the bobbin installation device 60 operates the gripping-section driving cylinder 55 to cause the bobbin gripping section 52 to release its grip on the bobbin 48, and causes the bunch winding roller 53 to come into contact with the bobbin 48 to perform bunch winding. Thus, the mechanism of the bobbin installation device 60 can be simplified by coupling the operations of the bobbin gripping section 52 and the bunch winding roller 53 as explained above.

[0078] As the bobbin 48 is held between the two bobbin holders 72 by the action of the cradle arm 71 after the spun yarn 10 and the bobbin 48 are simultaneously supplied to the bobbin holders 72, as shown in FIG. 4A, the bobbin 48 moves slightly in its shaft direction. Consequently, as shown in FIG. 9, the yarn regulating groove 32 provided in the bobbin supplying section 50 faces slightly more towards the center of the bobbin 48 rather than the end of the bobbin 48 in the shaft direction. Thus, when the bobbin 48 is rotated by the bunch winding roller 53 with the yarn regulating groove 32 guiding the spun yarn 10, bunch winding is formed near the end of the bobbin 48 in the shaft direction. Because the yarn regulating groove 32 also serves as a yarn guide during the bunch winding in the bobbin installation device 60 according to the present embodiment, a separate guiding member for bunch winding does not need to be provided.

[0079] When the bunch winding is completed, the bobbin supplying cylinder 56 contracts and the bobbin supplying section 50 retracts to the doffing cart 4 side. Substantially concurrently with the retraction of the bobbin supplying section 50, the unit controller causes the cradle 70 to pivot so as to bring the bobbin 48 into contact with the winding drum 74. Thus, a winding tension is applied

on the spun yarn 10, causing the spun yarn 10 to be gradually unwound from the yarn pooling roller 21 and winding of the package 45 to be started.

[0080] As described above, the bobbin installation device 60 according to the present embodiment includes the bobbin supplying section 50 and the suction pipe 88. The bobbin supplying section 50 supplies the bobbin 48, onto which the spun yarn 10 is to be wound, to the bobbin holders 72 (specifically, a position between the two bobbin holders 72) that is the target position. The suction pipe 88 holds and guides the spun yarn 10 to be wound on the bobbin 48 supplied by the bobbin supplying section 50. The bobbin 48 and the spun yarn 10 are supplied to the bobbin holders 72 by moving the bobbin supplying section 50 and the suction pipe 88 while the spun yarn 10 is held by suction at the end of the bobbin 48 in the shaft direction by the suction pipe 88.

[0081] Thus, the spun yarn 10 need not be guided into the narrow gap that occurs between the supplied bobbin 48 and the bobbin holder 72. Consequently, instances of anomalous guiding of the spun yarn 10 by the bobbin installation device 60 can be reduced and the winding efficiency of the spinning machine 1 can be improved. Furthermore, because no mechanism is required for precisely guiding the spun yarn 10 into the narrow gap, a compact bobbin installation device 60 can be realized.

[0082] In the bobbin installation device 60 according to the present embodiment, the suction pipe 88 moves to and stands-by at the standby position while holding the spun yarn 10. The bobbin supplying section 50 catches the spun yarn 10 held by the suction pipe 88 standing-by at the standby position en route to supplying the bobbin 48 to the bobbin holders 72, and positions the spun yarn 10 at the end of the bobbin 48 in the shaft direction.

[0083] Thus, the bobbin installation device 60 performs the tasks of arranging the spun yarn 10 at the end of the bobbin 48 in the shaft direction and supplying the bobbin 48 to the bobbin holders 72 in a single operation. As a result, the bobbin installation device 60 can quickly install the bobbin 48 in the bobbin holders 72.

[0084] In the bobbin installation device 60 according to the present embodiment, the bobbin supplying section 50 includes the yarn guiding section 31 that guides the spun yarn 10 up to the end of the bobbin 48 in the shaft direction. Thus, because the spun yarn 10 is positioned at the end of the bobbin 48 in the shaft direction by the yarn guiding section 31, anomalous guiding of the spun yarn 10 can be further reduced in the bobbin installation device 60.

[0085] In the bobbin installation device 60 according to the present embodiment, the bobbin supplying section 50 includes the cutter 33 that cuts the spun yarn 10 at a position between the bobbin 48 supplied to the bobbin holders 72 and the suction pipe 88. Because of the provision of the cutter 33 in the bobbin supplying section 50, the bobbin installation device 60 can quickly perform the cutting operation after the bobbin 48 is supplied to the bobbin holders 72. If the cutter is not provided in the bob-

bin supplying section 50 (that is, if the cutter is provided away from the bobbin supplying section 50), a separate mechanism would be required for moving the cutter to the cutting position of the spun yarn 10 and retracting the cutter thereafter. Thus, by having a structure such as described above, and not requiring additional mechanisms, the compactness of the spinning machine 1 can be achieved.

[0086] In the bobbin installation device 60 according to the present embodiment, the suction pipe 88 holds the spun yarn 10 by suction flow, and when the spun yarn 10 is cut by the cutter 33, the suction pipe 88 sucks in yarn scrap of the spun yarn 10 by suction and discards it. Thus, the bobbin installation device 60 prevents the yarn scrap from littering the floor, etc., when the bobbin 48 is supplied to the bobbin holders 72.

[0087] In the bobbin installation device 60 according to the present embodiment, the bobbin supplying section 50 includes the bunch winding roller 53 that performs bunch winding on the bobbin 48. Because the bunch winding roller 53 is provided in the bobbin supplying section 50, the bunch winding operation can be started quickly after the bobbin 48 is supplied to the bobbin holders 72. If the bunch winding roller is not provided in the bobbin supplying section 50 (that is, if the bunch winding roller is provided away from the bobbin supplying section 50), a mechanism would be required to cause the bunch winding roller to come into contact with the bobbin 48 and to retract the bunch winding roller when it is not required so as not to cause any hindrance. Thus, by having a structure such as described above, and not requiring additional mechanisms, the compactness of the spinning machine 1 can be achieved.

[0088] In the bobbin installation device 60 according to the present embodiment, the yarn regulating groove 32 provided in the bobbin supplying section 50 guides the spun yarn 10 to a position between the ends in the shaft direction of the bobbin 48 that is supplied to the bobbin holders 72 when the bunch winding is performed on the bobbins 48 by the bunch winding roller 53. Thus, the yarn regulating groove 32 demonstrates effectiveness both when aligning the spun yarn 10 at one end in the shaft direction of the bobbin 48 to maintain the position of the spun yarn 10 and when guiding the spun yarn 10 to the predetermined position on the bobbin 48 during bunch winding. Consequently, a compact bobbin installation device 60 can be realized as compared to when separate members are provided to attain the effects described above.

[0089] The spinning machine 1 according to the present embodiment includes the bobbin installation device 60 and a plurality of the spinning units 2. Each of the spinning units 2 includes the bobbin holders 72 that hold the bobbin 48 supplied by the bobbin installation device 60 and the winding device 13 that forms the package 45 by winding the spun yarn 10 on the bobbin 48 held by the bobbin holders 72.

[0090] Thus, the bobbin installation device 60 can sup-

ply both the bobbin 48 and the spun yarn 10 at the same time to the bobbin holders 72. Consequently, the instances of anomalous guiding of the bobbin 48 and the spun yarn 10 by the bobbin installation device 60 can be reduced, and the winding efficiency of the spinning machine 1 can be improved.

[0091] In the spinning machine 1 according to the present embodiment, the bobbin installation device 60 includes the cradle operating arm 89 that operates the cradle 70 (specifically, the cradle arm 71) and removes the package 45 from the bobbin holders 72. When removing the package 45 from the bobbin holders 72, as a rule, another bobbin 48 needs to be supplied to the bobbin holders 72 to form a new package 45. Because both the tasks can be performed with the structure described above, the compactness of the spinning machine 1 can be maintained.

[0092] In the spinning machine 1 according to the present embodiment, the bobbin installation device 60 preferably includes the path adjusting plate 59 and the fastening member for adjusting the path of the bobbin 48 when it is being supplied to the bobbin holders 72 by the bobbin supplying section 50. Thus, the spinning machine 1 can adjust the path to be followed by the bobbin 48 depending on the shape, etc., of the bobbin 48. The path adjustment prevents the bobbin 48 supplied by the bobbin installation device 60 from impinging upon the bobbin holders 72. Furthermore, by adjusting the path to be followed by the bobbin 48, the spun yarn 10 held by the suction pipe 88 at the standby position can be held more reliably by the bobbin supplying section 50.

[0093] In the spinning machine 1 according to the present embodiment, the spinning units 2 are arranged in one direction. The bobbin installation device 60 can travel in the direction in which the spinning units 2 are arranged. Such a structure allows reduction in the number of the bobbin installation devices 60 that need to be provided as compared to a structure in which the bobbin installation devices 60 are provided on a per-spinning-unit-2 basis, thereby achieving cost reduction.

[0094] Although the embodiments of the present invention are described above, the structures discussed above can be modified as described below, for example.

[0095] The structure of the spinning machine 1 can be modified appropriately according to a situation. For example, the structure can be modified to a structure in which a yarn feeding device including a pair of rollers is provided in lieu of the yarn pooling device 12 of the spinning machine 1 according to the embodiments or in addition to the yarn pooling device 12 downstream of the spinning device 9.

[0096] The scope of application of the present invention is not limited to spinning machines. The present invention is applicable to any yarn winding apparatus, other than a spinning machine, so long as the yarn winding apparatus supplies a bobbin and winds a yarn onto the bobbin.

[0097] Although a cone-shaped package is shown as

an example in the embodiment described above, the package can be formed into various other shapes, for example, cheese shape, taper shape, etc.

[0098] The position of the bunch winding roller 53 is not restricted to where it is installed in the present embodiment. The mechanism for bunch winding can be provided independent of the bobbin gripping section 52, and can also be provided away from the bobbin gripping section 52. However, by providing the bunch winding roller 53 near the bobbin gripping section 52, as in the present embodiment, compactness of the bobbin installation device 60 can be achieved.

[0099] In the embodiment described above, when a yarn defect is detected or when a like situation occurs, the spun yarn 10 is cut by stopping the drafting device 7 with the winding device 13 continuing driving. However, a structure in which a cutter is provided near the yarn clearer 49 and the cutter cuts the spun yarn 10 can alternatively be employed.

[0100] In the embodiment described above, moving the transport section 61 away from the bobbin holders 72 and moving the bobbin supplying section 50 toward the bobbin holders 72 are performed concurrently and simultaneously. Alternatively, the bobbin installing operation can be performed after completion of the doffing operation. However, from a viewpoint of operation efficiency of the spinning machine 1, the doffing operation and the bobbin installing operation are desirably performed concurrently and simultaneously.

[0101] 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 herein set forth.

Claims

1. A bobbin installation device (60) comprising:

a bobbin supplying section (50) adapted to supply a bobbin (48), onto which a yarn (10) is to be wound, to a target position;

a yarn holding and guiding device (88) adapted to hold a yarn (10), which is to be wound on the bobbin (48) supplied by the bobbin supplying section (50), and guide the held yarn (10); **characterized by**

a moving means for, when supplying the bobbin (48) and the yarn (10) to the target position, moving the bobbin supplying section (50) and the yarn holding and guiding device (88) while the yarn (10) is held at an end of the bobbin (48) in a shaft direction of the bobbin (48) by the yarn holding and guiding device (88).

2. The bobbin installation device (60) according to Claim 1, wherein
the moving means moves the yarn holding and guiding device (88) to a standby position, and the yarn holding and guiding device (88) stands-by at the standby position while holding the yarn (10), and the bobbin supplying section (50) catches the yarn (10) held by the yarn holding and guiding device (88) standing-by at the standby position en route to the target position, and positions the yarn (10) at the end of the bobbin (48) in the shaft direction. 5
3. The bobbin installation device (60) according to Claim 1 or 2, wherein the bobbin supplying section (50) includes a yarn guiding section (31) adapted to guide the yarn (10) held by the yarn holding and guiding device (88) up to the end of the bobbin... (48) in the shaft direction. 10
4. The bobbin installation device (60) according to any one of Claims 1 to 3, wherein the bobbin supplying section (50) includes a cutting unit (33) adapted to cut the yarn (10) at a position between the bobbin (48) supplied to the target position and the yarn holding and guiding device (88). 15
5. The bobbin installation device (60) according to Claim 4, wherein the yarn holding and guiding device (88) holds the yarn (10) by suction flow, and when the yarn (10) is cut by the cutting unit (33), the yarn holding and guiding device (88) sucks and discards yarn scrap of the yarn (10) cut by the cutting unit (33). 20
6. The bobbin installation device (60) according to any one of Claims 1 to 5, wherein the bobbin supplying section (50) includes a bunch winding roller (53) adapted to perform bunch winding on the bobbin (48). 25
7. The bobbin installation device (60) according to Claim 6, wherein the bobbin supplying section (50) includes a yarn regulating unit (32) adapted to guide the yarn (10) to a position between two ends in the shaft direction of the bobbin (48) supplied to the target position during the bunch winding performed by the bunch winding roller (53). 30
8. A yarn winding apparatus (1) comprising:
a winding unit (2) that includes
a bobbin holding section (72) adapted to hold a bobbin (48); and
a winding device (13) adapted to form a package (45) by winding a yarn (10) on the bobbin (48) held by the bobbin holding section (72); and
a bobbin installation device (60) that includes a bobbin supplying section (50) adapted to supply the bobbin (48), onto which the yarn (10) is to be wound, to the bobbin holding section (72) that is a target position;
a yarn holding and guiding device (88) adapted to hold a yarn (10), which is to be wound on the bobbin (48) supplied by the bobbin supplying section (50), and guides the held yarn (10);
characterized by
a moving means for, when supplying the bobbin (48) and the yarn (10) to the target position, moving the bobbin supplying section (50) and the yarn holding and guiding device (88) while the yarn (10) is held at an end of the bobbin (48) in a shaft direction of the bobbin (48) by the yarn holding and guiding device (88). 35
9. The yarn winding apparatus (1) according to Claim 8, wherein
the moving means moves the yarn holding and guiding device (88) to a standby position, and the yarn holding and guiding device (88) stands-by at a standby position while holding the yarn (10), and the bobbin supplying section (50) catches the yarn (10) held by the yarn holding and guiding device (88) standing-by at the standby position en route to the target position, and positions the yarn (10) at the end of the bobbin (48) in the shaft direction. 40
10. The yarn winding apparatus (1) according to Claim 8 or 9, wherein the bobbin supplying section (50) includes a yarn guiding section (31) adapted to guide the yarn (10) held by the yarn holding and guiding device (88) up to the end of the bobbin (48) in the shaft direction. 45
11. The yarn winding apparatus (1) according to any one of Claims 8 to 10, wherein the bobbin supplying section (50) includes a cutting unit (33) adapted to cut the yarn (10) at a position between the bobbin (48) supplied to the target position and the yarn holding and guiding device (88). 50
12. The yarn winding apparatus (1) according to Claim 11, wherein the yarn holding and guiding device (88) holds the yarn (10) by suction flow, and when the yarn (10) is cut by the cutting unit (33), the yarn holding and guiding device (88) sucks and discards yarn scrap of the yarn (10) cut by the cutting unit (33). 55
13. The yarn winding apparatus (1) according to any one of Claims 8 to 12, wherein the bobbin supplying section (50) includes a bunch winding roller (53) adapted to perform bunch winding on the bobbin (48).
14. The yarn winding apparatus (1) according to Claim 13, wherein the bobbin supplying section (50) includes a yarn regulating unit (32) adapted to guide the yarn (10) to a position between two ends in the shaft direction of the bobbin (48) supplied to the target position.

get position during the bunch winding performed by the bunch winding roller (53).

15. The yarn winding apparatus (1) according to any one of Claims 8 to 14, wherein the bobbin installation device (60) includes an operating unit adapted to operate the bobbin holding section (72) and remove the package (45) from the bobbin holding section (72). 5
16. The yarn winding apparatus (1) according to any one of Claims 8 to 15, wherein the bobbin installation device (60) includes an adjusting unit adapted to enable adjustment of a path that the bobbin (48) follows when being supplied to the bobbin holding section (72) by the bobbin supplying section (50). 10
17. The yarn winding apparatus (1) according to any one of Claims 8 to 16, wherein the winding units (2) are arranged in a line in a specific direction, and the bobbin installation device (60) is enabled to run along the direction in which the winding units (2) are arranged. 15
18. Method for operating bobbin installation device (60) with
a bobbin supplying section (50) supplying a bobbin (48), onto which a yarn (10) is to be wound, to a target position;
a yarn holding and guiding device (88) holding a yarn (10), which is to be wound on the bobbin (48) supplied by the bobbin supplying section (50), and guiding the held yarn (10); **characterized by** the step of moving, when supplying the bobbin (48) and the yarn (10) to the target position, the bobbin supplying section (50) and the yarn holding and guiding device (88) while the yarn (10) is held at an end of the bobbin (48) in a shaft direction of the bobbin (48) by the yarn holding and guiding device (88). 20 25 30 35 40
19. The method according to Claim 18, **characterized by** the steps of
moving the yarn holding and guiding device (88) to a standby position, whereby the yarn holding and guiding device (88) stands-by at the standby position while holding the yarn (10), and
catching the yarn (10) held by the yarn holding and guiding device (88) standing by at the standby position by the bobbin supplying section (50) en route to the target position, and positioning the yarn (10) at the end of the bobbin (48) in the shaft direction. 45 50
20. The method according to Claim 18 or 19, **characterized by** providing the bobbin supplying section (50) with a yarn guiding section (31) guiding the yarn (10) held by the yarn holding and guiding device (88) up to the end of the bobbin (48) in the shaft direction. 55

21. The method according to any one of Claims 18 to 20, **characterized by** providing the bobbin supplying section (50) with a cutting unit (33) for cutting the yarn (10) at a position between the bobbin (48) supplied to the target position and the yarn holding and guiding device (88). 5
22. The method according to Claim 21, wherein the yarn holding and guiding device (88) holds the yarn (10) by suction flow, and when the yarn (10) is cut by the cutting unit (33), the yarn holding and guiding device (88) sucks and discards yarn scrap of the yarn (10) cut by the cutting unit (33). 10
23. The method according to any one of Claims 1 to 5, wherein the bobbin supplying section (50) is provided with a bunch winding roller (53) adapted to perform bunch winding on the bobbin (48). 15
24. The method according to Claim 23, wherein the bobbin supplying section (50) is provided with a yarn regulating unit (32) guiding the yarn (10) to a position between two ends in the shaft direction of the bobbin (48) supplied to the target position during the bunch winding performed by the bunch winding roller (53). 20 25

FIG.1

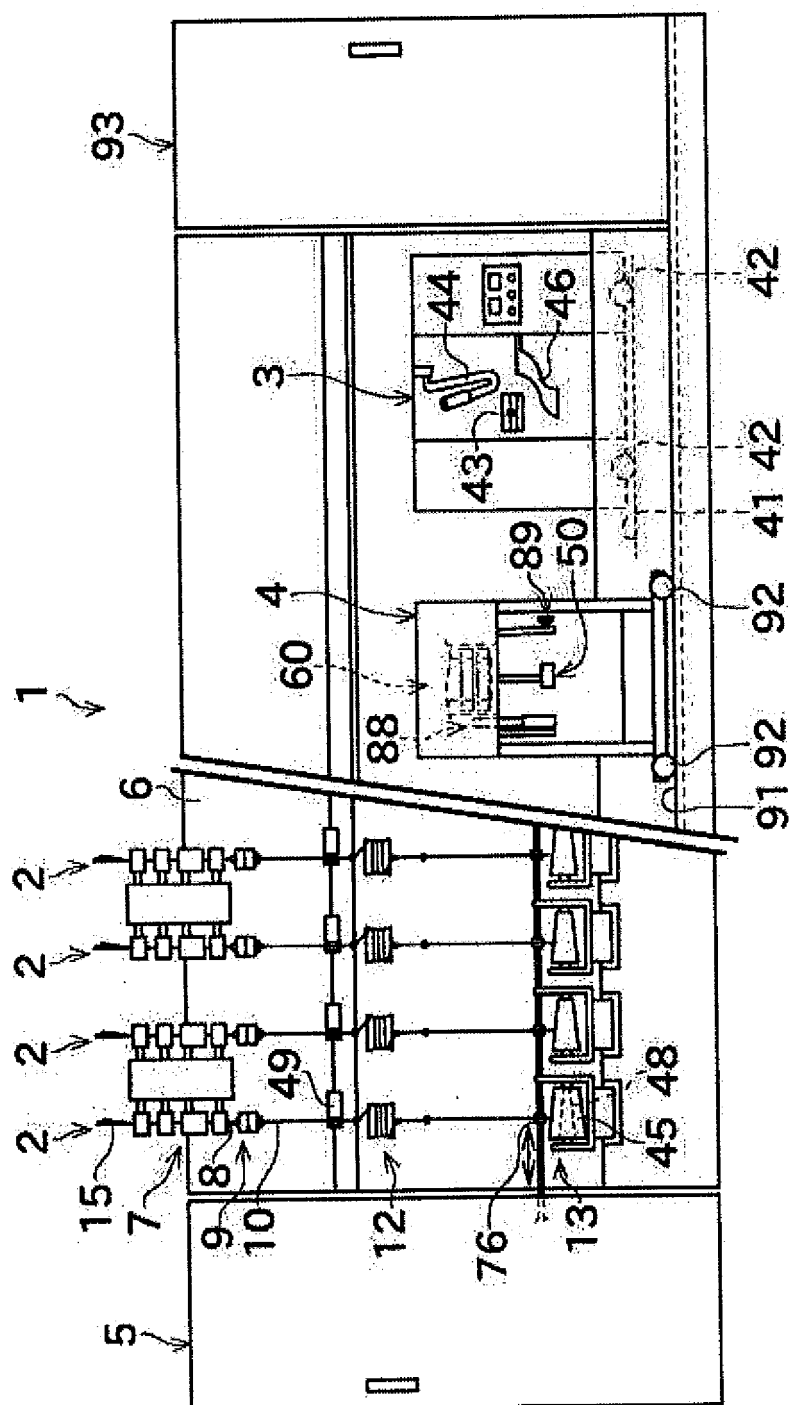
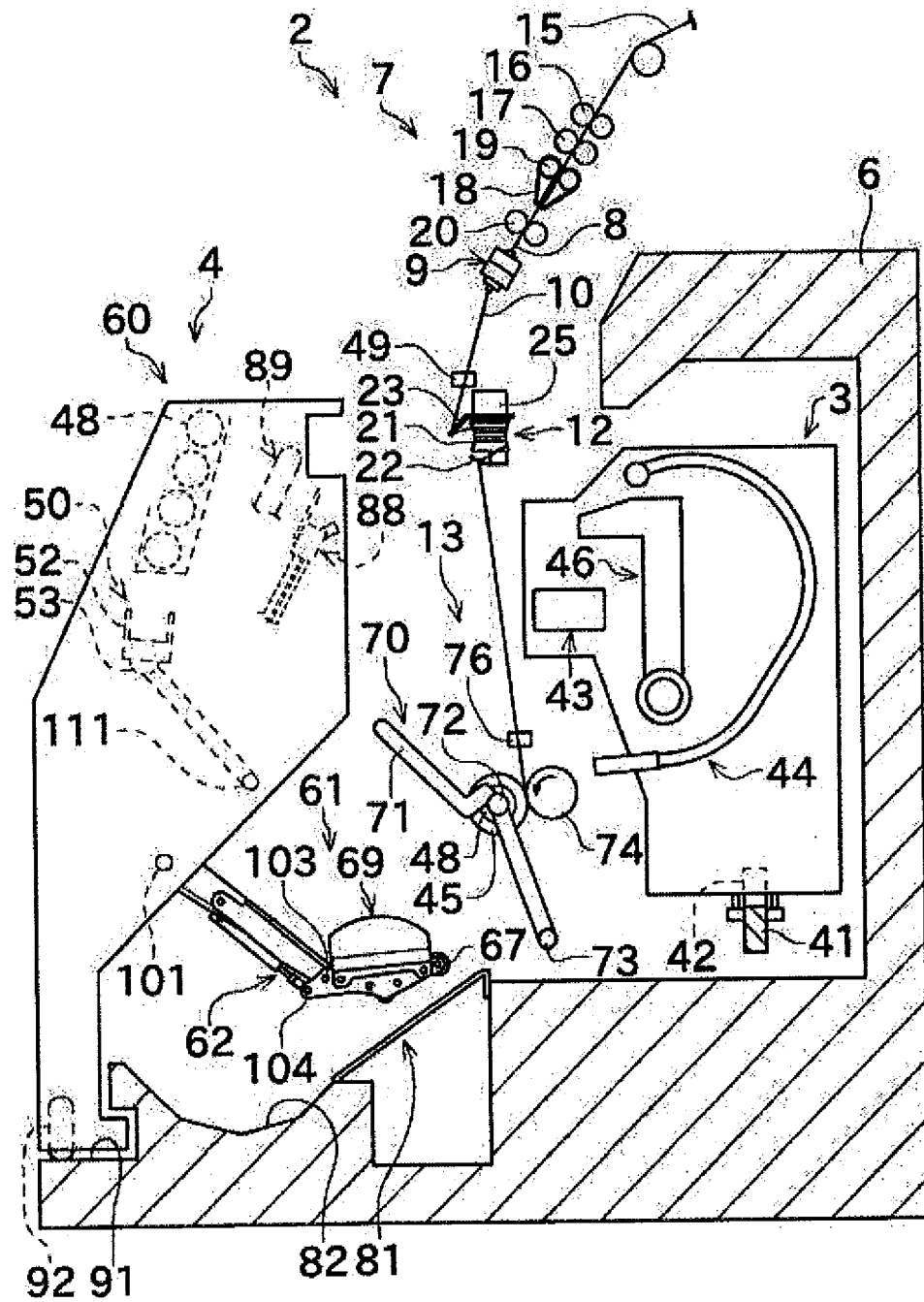


FIG. 2



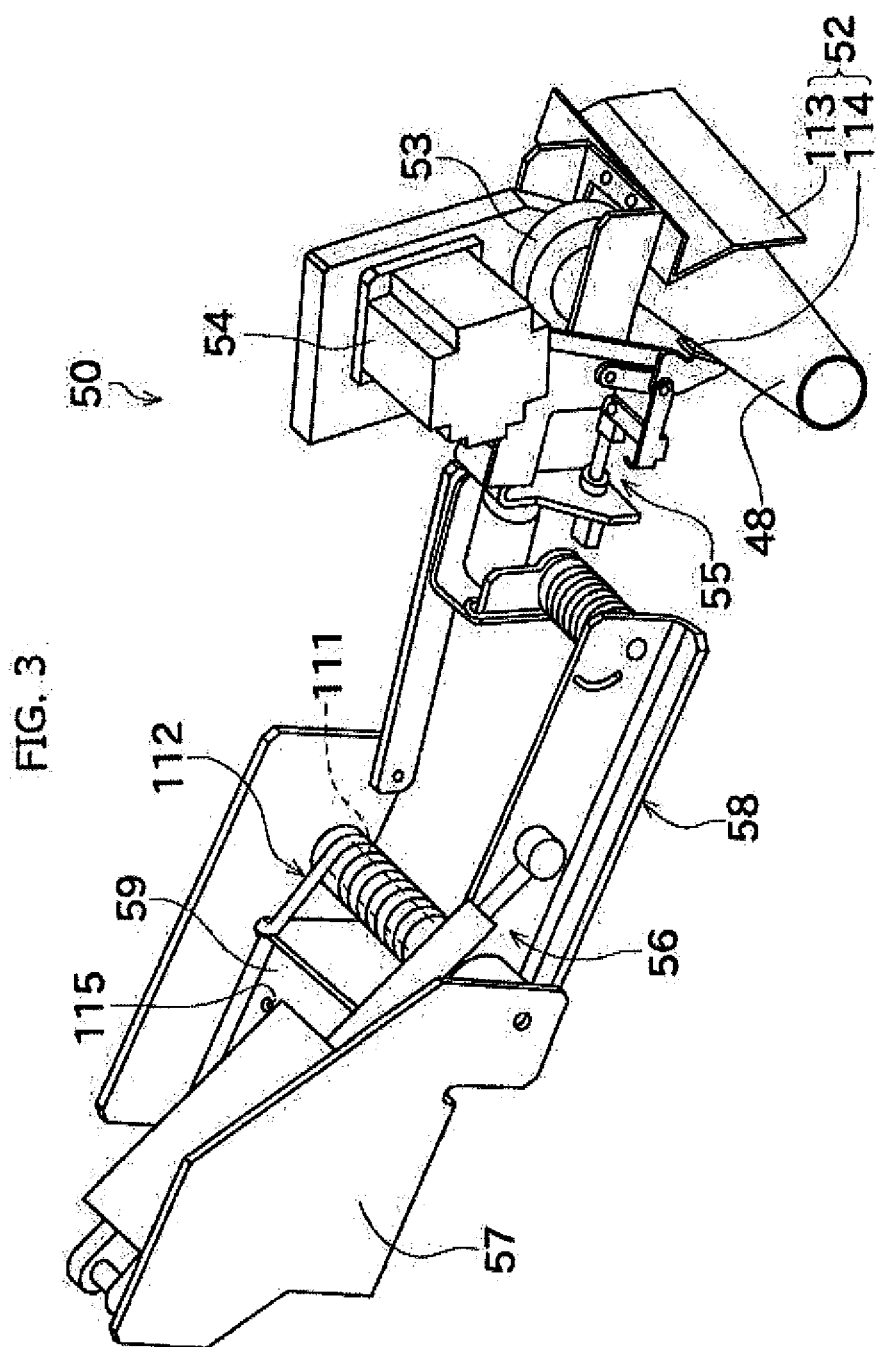


FIG. 4A

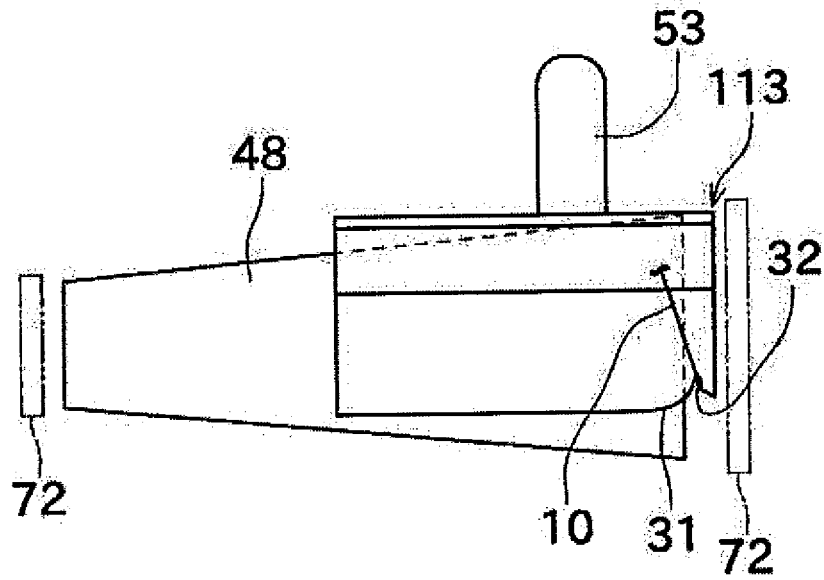


FIG. 4B

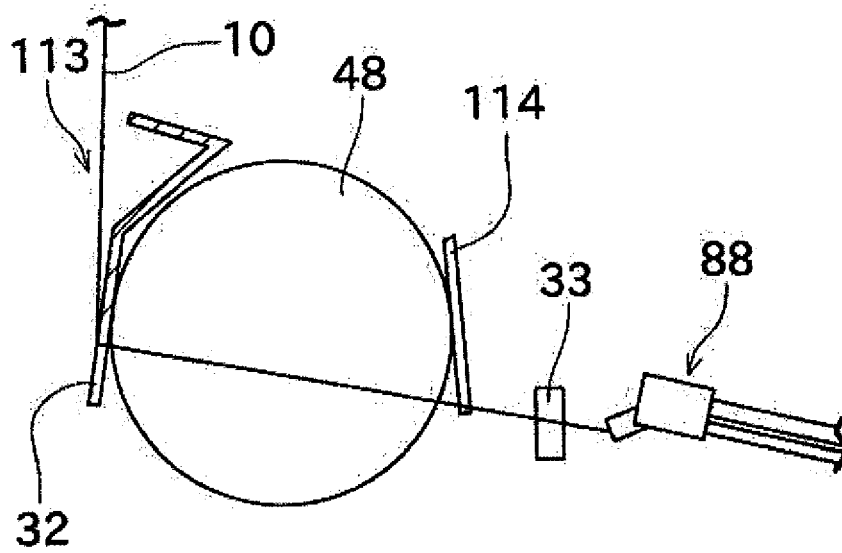


FIG. 5

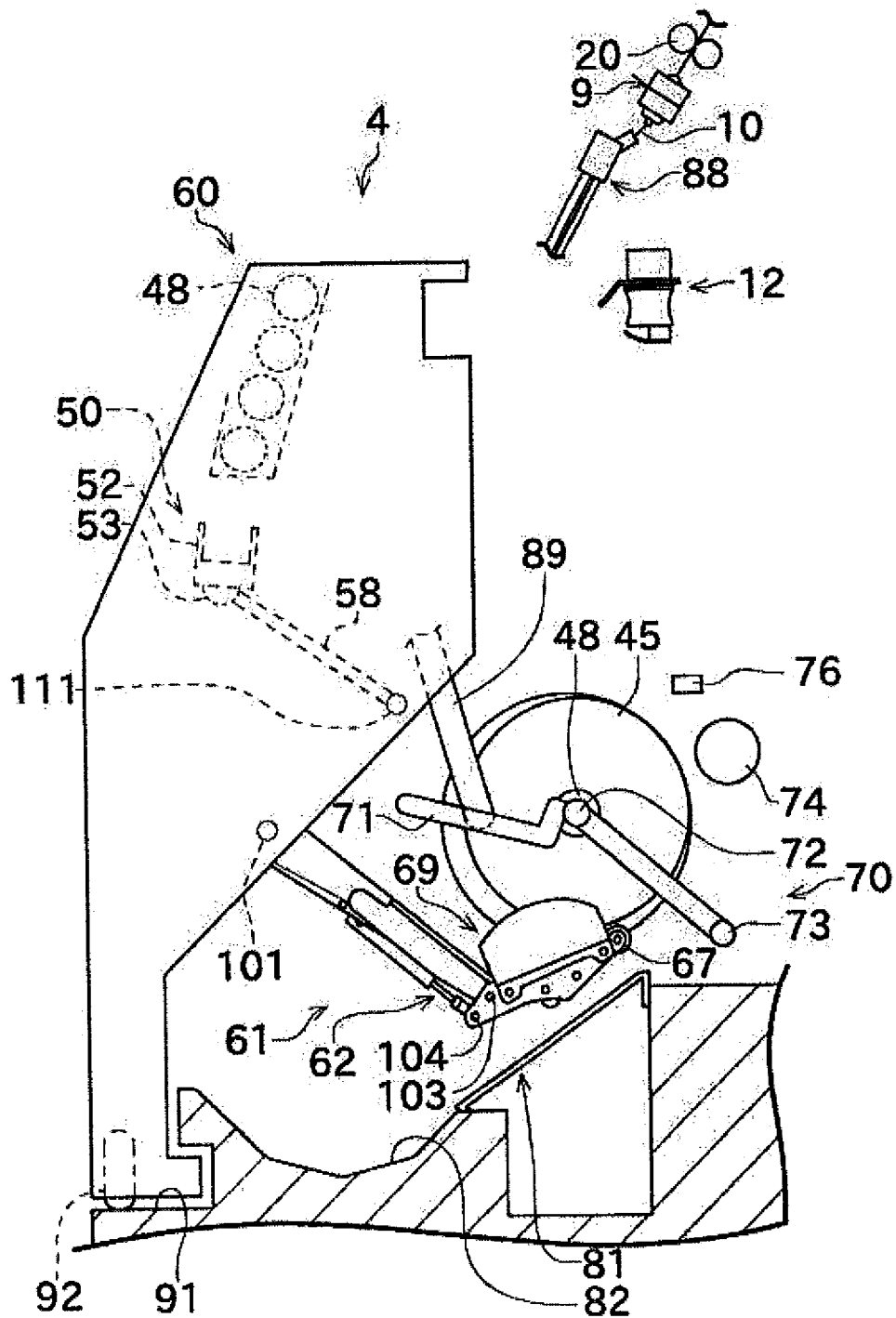


FIG. 6

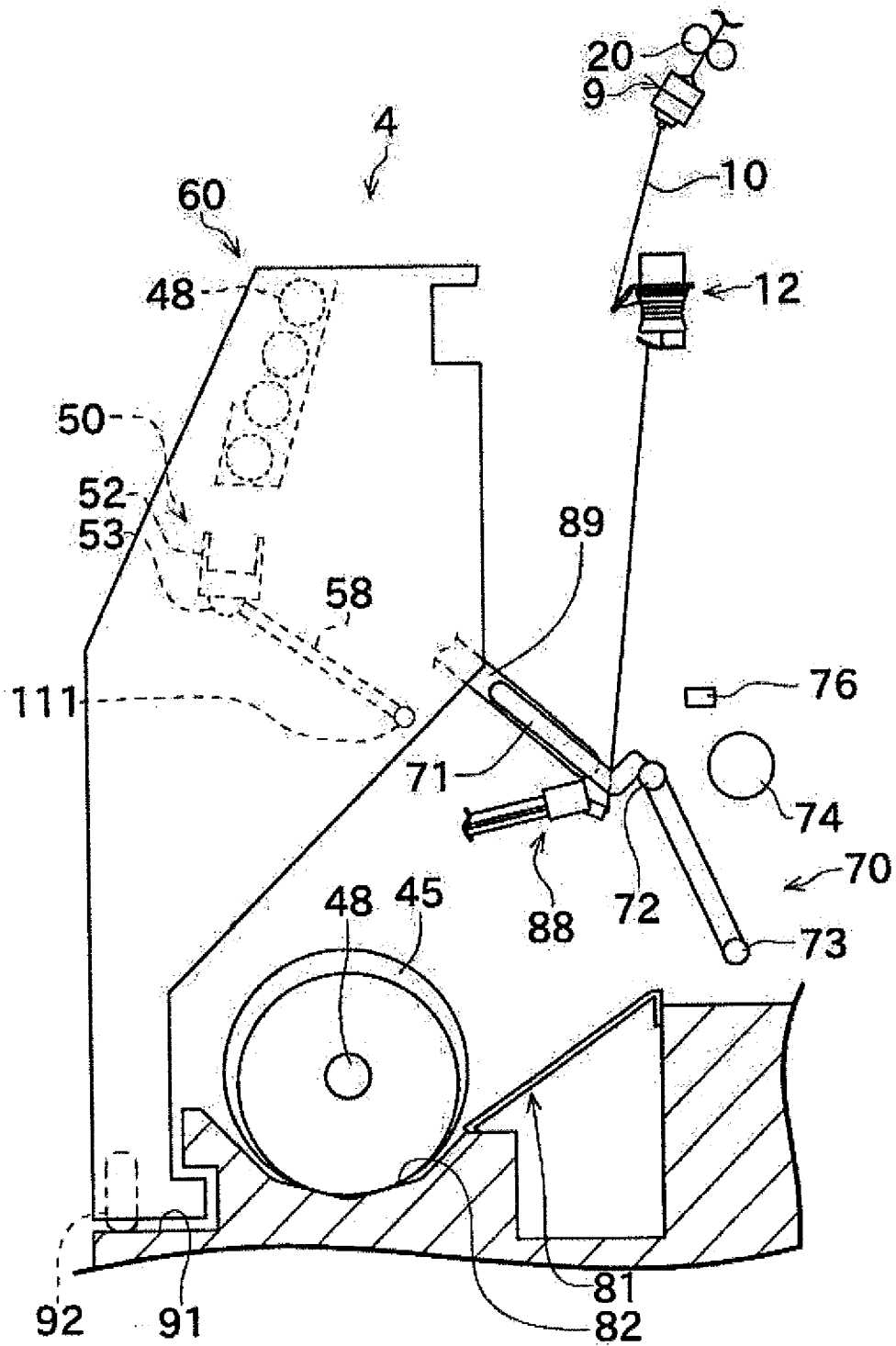


FIG. 7

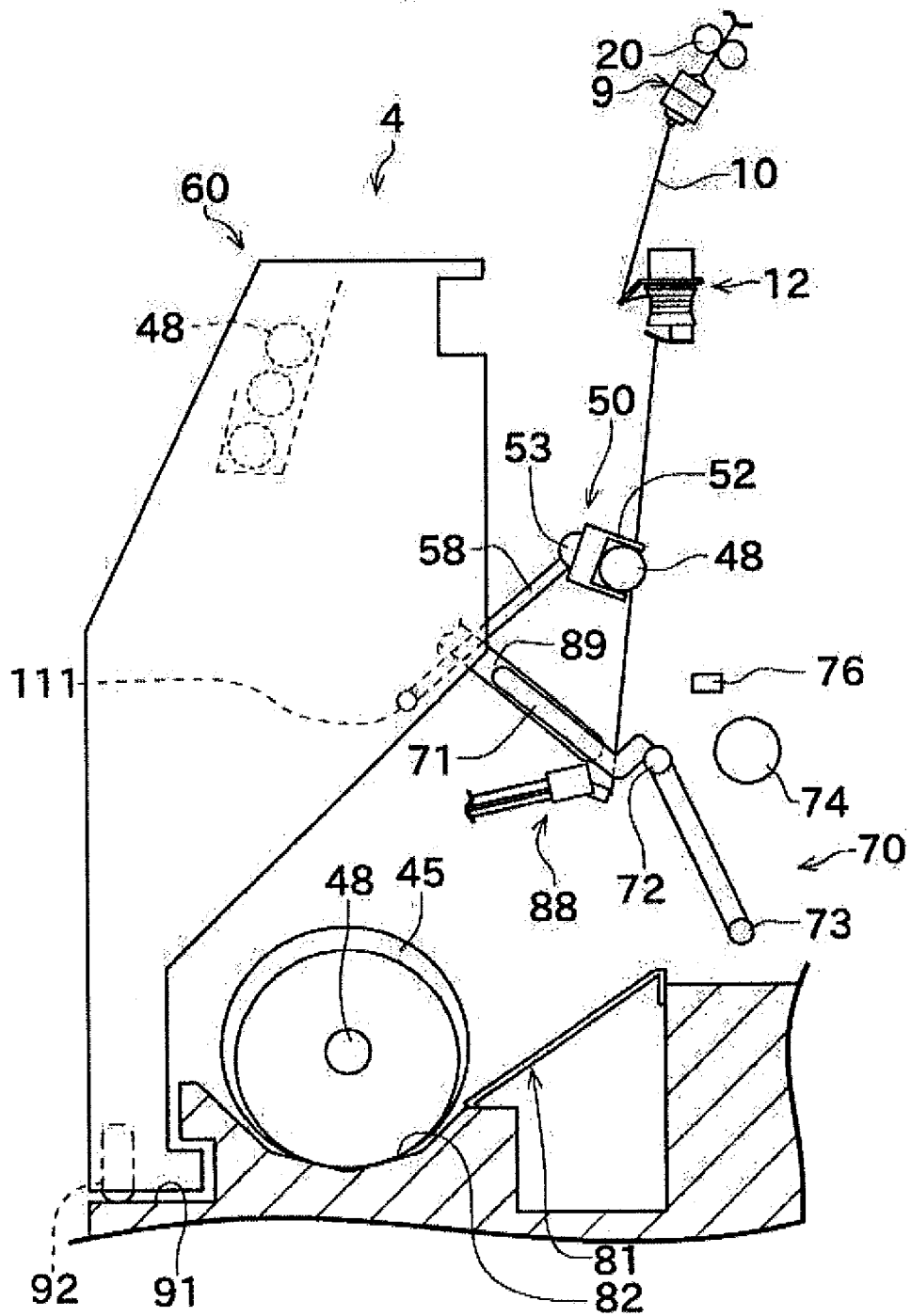


FIG. 8

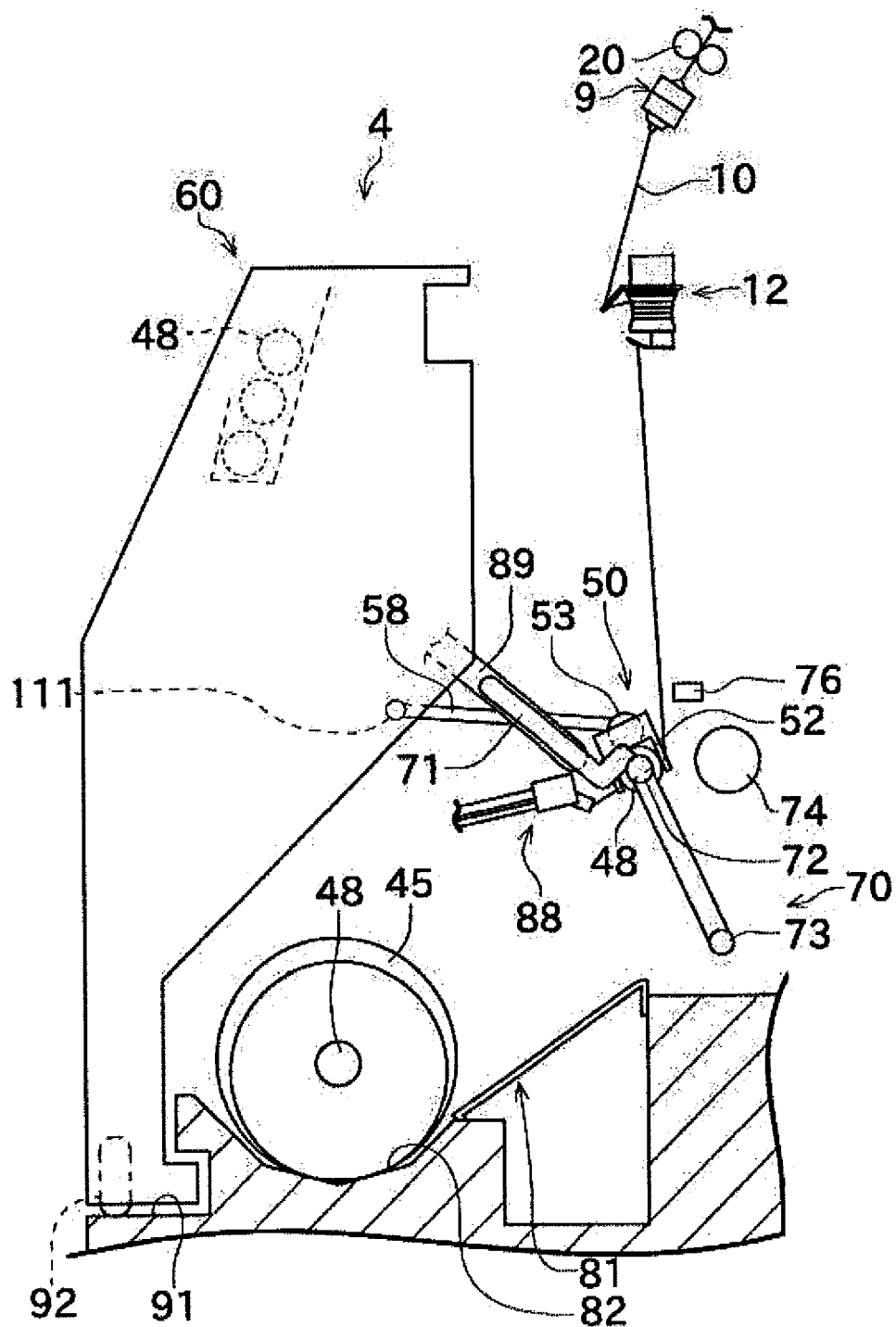
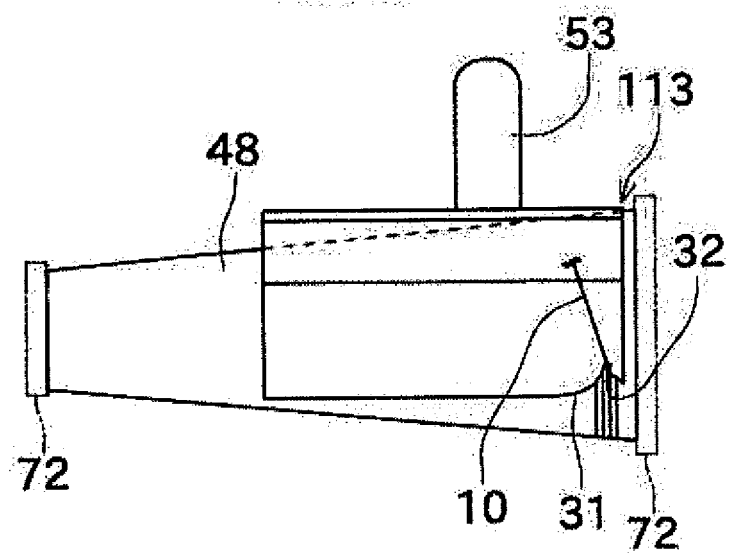


FIG. 9



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005219880 A [0002] [0003] [0005]