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(72) Inventor: **Inoue, Kei**
Kyoto, Kyoto 612-8686 (JP)

(74) Representative: **Beck, Alexander**
Hansmann & Vogeser
Patent- und Rechtsanwälte
Maximilianstrasse 4b
82319 Starnberg (DE)

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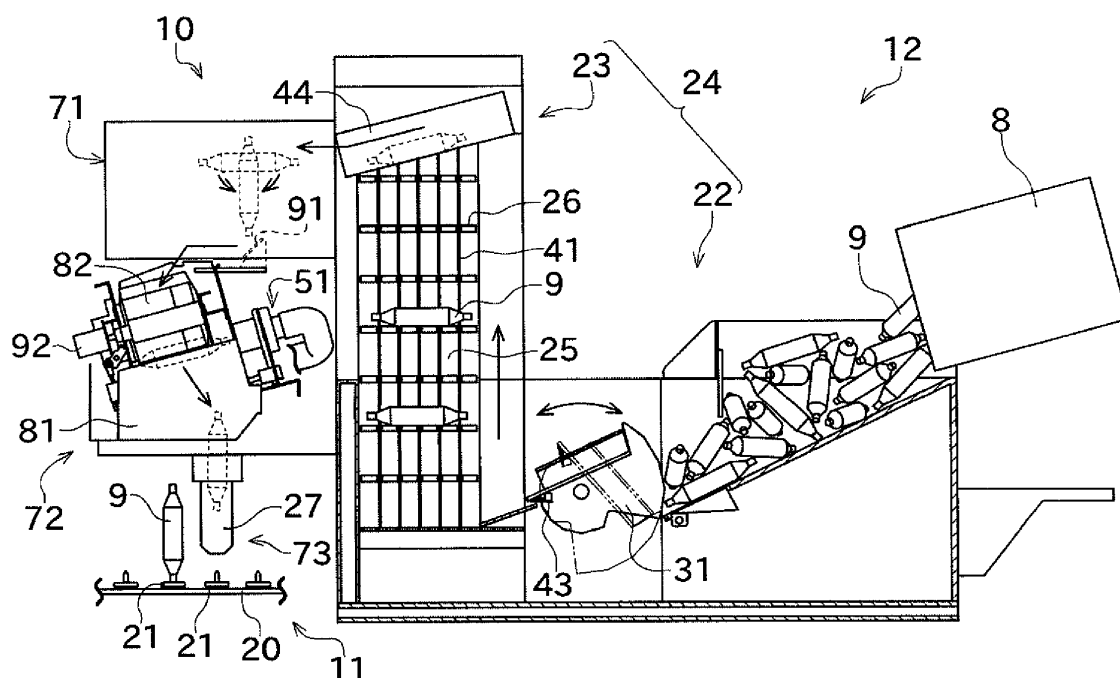
(71) Applicant: **Murata Machinery, Ltd.**
Minami-ku
Kyoto-shi
Kyoto 601-8326 (JP)

(54) **Bobbin delivering device and winding system**

(57) A bobbin separating and supplying device (12) includes a bobbin separating section (24), a bunch removing section (72), and a tray mounting section (73). The bobbin separating section (24) supplies bobbins (9) one by one. The bunch removing section (72) removes

a bunch winding (9a) from the bobbin (9) supplied by the bobbin separating section (24). The tray mounting section (73) mounts the bobbin (9) the bunch winding of which has been removed by the bunch removing section (72), onto a transporting tray (21).

FIG.1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates mainly to a bobbin delivering device that delivers to a winding device a yarn supplying bobbin formed by winding a yarn around a bobbin tube, and a winding system that includes such a bobbin delivering device.

2. Description of the Related Art

[0002] A parts feeder type delivering device disclosed in Japanese Patent Application Laid-open No. H6-16226 is known to the inventor. This delivering device delivers a spun yarn, which is spun and wound around a yarn supplying bobbin (hereinafter, it may be simply referred to as "bobbin") by a spinning machine, to a winding device such as an automatic winder.

[0003] The delivering device disclosed in Japanese Patent Application Laid-open No. 6-16226 separates the bobbins and delivers the separated bobbins to a bobbin preparing device in a bobbin preparation zone. The bobbin preparing device performs preprocessing on the bobbins to make the bobbins ready for a bobbin winding operation to be automatically performed by winding units of an automatic winder. More specifically, the bobbin preparing device removes a bottom bunch, which is a winding end portion of a bobbin produced by the spinning machine, catches a yarn end of the winding end portion that has become free due to removal of the bottom bunch, and inserts the yarn end into a bobbin tube of the bobbin. The automatic winder can blow up the yarn end that has been inserted into the bobbin tube of the bobbin by supplying compressed air into the bobbin tube of the bobbin.

[0004] The blown-up yarn end is caught by a lower yarn catching device arranged in the winding unit of the automatic winder and guided to a yarn joining device. The yarn end (of the lower yarn) guided from the bobbin to the yarn joining device is joined with a yarn end from a package (of an upper yarn), and then wound into a package.

[0005] In the bobbin preparing device, when removing the bottom bunch as described above, a yarn end of the yarn that has been wound around the bobbin tube of the yarn supplying bobbin (a winding start portion of the yarn supplying bobbin produced by the spinning machine; hereinafter, it may be referred to as "seed yarn") is also removed. The yarn is therefore prevented from being tangled when winding the entire yarn from the yarn supplying bobbin in the automatic winder, and the entire yarn wound around the yarn supplying bobbin can be smoothly unwound.

[0006] If the bobbin preparing device fails to perform suitable preprocessing thereby leaving a seed yarn or a bunch winding portion on the yarn supplying bobbin, the

seed yarn or the yarn from the bunch winding tends to tangle with the yarn unwound from the yarn supplying bobbin. The tangled yarn cannot be unwound but only causes a breakage under a tension, which tends to lower operational efficiency of the winding device.

[0007] A bunch-winding unwinding device that removes bunch winding, which is formed on a bobbin, by unwinding the bunch winding is disclosed in Japanese Patent Application Laid-open No. 2008-247517. This bunch-winding unwinding device includes a suction casing, an air duct, a rotary cutter, and a tray rotating roller.

[0008] In the bunch-winding unwinding device, a tray that supports the bobbin is brought into contact with the tray rotating roller and the tray rotating roller is driven and rotated thereby rotating the bobbin. The bottom bunch (bunch winding) formed on the bobbin is then suctioned into the suction casing having a negative pressure. The suctioned bottom bunch is cut off with the rotary cutter that is arranged inside the suction casing. A yarn from the bunch winding of the bottom bunch that is wound around the bobbin is unwound in this manner.

[0009] To install such a dedicated bunch-winding unwinding device disclosed in Japanese Patent Application Laid-open No. 2008-247517, however, a large preparation zone needs to be arranged for preprocessing on a transporting path for transporting the bobbin that has been supplied to a transport tray, to an automatic winder. This leads to an increase in an installation area of the device, which leaves room for improvement from the aspect of downsizing.

[0010] The bunch-winding unwinding device disclosed in Japanese Patent Application Laid-open No. 2008-247517 also requires a bobbin rotating mechanism and various other structures, which complicates the structure of the device. Furthermore, the yarn may be wound many times to form the bottom bunch, depending on how the yarn is wound around the bobbin. In such a case, the bunch-winding unwinding device needs to rotate the bobbin for the same number of turns as the number of turns of the yarn of the bottom bunch, which lowers operational efficiency.

SUMMARY OF THE INVENTION

[0011] The present invention has been conceived in the light of the above situation. It is an object of the present invention to provide a structure that supplies a bunch winding removed bobbin to a transport tray while realizing a small installation area.

[0012] According to an aspect of the present invention, a bobbin delivering device includes a supplying section that supplies bobbins one by one; a bunch removing section that performs a removing process on a bunch winding of the bobbin supplied by the supplying section; and a mounting section that mounts onto a transporting tray the bobbin on which the bunch removing section has performed the removing process to remove the bunch winding.

[0013] According to another aspect of the present invention, a winding system includes the bobbin delivering device; a winding device that winds a yarn from the bobbin to produce a package; and a bobbin preparing device that transports the transporting tray, onto which the bobbin is supplied by the supplying section, to the winding device, and brings the bobbin into a condition ready for the winding device to process the bobbin. The bobbin preparing device includes a bobbin supplying path along which the transporting tray, onto which the bobbin is supplied, is transported from the bobbin delivering device to the winding device, and a yarn end guiding-out device that unwinds from a surface of the bobbin a yarn end of a winding end side of the bobbin that has been wound and inserts the yarn end into a winding tube of the bobbin is arranged on the bobbin supplying path.

[0014] The above and other objects, features, advantages and the technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is a cross-sectional front view of the entire structure of a bobbin separating and supplying device according to an embodiment of the present invention;

FIG. 2 is a perspective view of the bobbin separating and supplying device;

FIG. 3 is a perspective view of a bobbin picking-up section;

FIG. 4 is an enlarged cross-sectional side view of the bobbin picking-up section;

FIG. 5 is a diagram explaining a supported side and an unwinding side, and bunch winding of a bobbin;

FIG. 6 is a front view of a bunch removing section of the bobbin separating and supplying device;

FIG. 7 is a cross-sectional view taken along arrows A-A of FIG. 6;

FIG. 8 is a cross-sectional view taken along arrows B-B of FIG. 7;

FIG. 9 is a cross-sectional front view for explaining suctioning of a bottom bunch with a supported end of a yarn supplying bobbin capped with a cylindrical body, proceeded from a state of FIG. 8;

FIG. 10 is a schematic plan view of a bobbin preparing device; and

FIG. 11 is a schematic plan view of a modification of the bobbin preparing device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Exemplary embodiments of the present inven-

tion are explained below with reference to the accompanying drawings. FIG. 1 is a cross-sectional front view of an overall structure of a bobbin separating and supplying device (bobbin delivering device) 12 according to an embodiment of the present invention. FIG. 2 is a perspective view of the bobbin separating and supplying device 12. FIG. 3 is a perspective view of a bobbin picking-up section 23. FIG. 4 is an enlarged cross-sectional side view of the bobbin picking-up section 23.

[0017] An automatic winder system (winding system) 10 according to an embodiment of the present invention includes an automatic winder (winding device) including a plurality of not shown winder units, a bobbin transporting device 11, and the bobbin separating and supplying device 12.

[0018] Each of the winder units unwinds a spun yarn from a bobbin 9, and rewinds the spun yarn around a winding bobbin to produce a package.

[0019] The bobbin transporting device 11 includes a bobbin transporting path 20, such as a conveyor, and a number of transporting trays 21 that are transported over the bobbin transporting path 20. As shown in FIG. 1, the bobbin 9 is mounted substantially upright onto the transporting tray 21. The bobbin transporting path 20 transports the transporting trays 21 carrying the bobbins 9 thereon to each of the winder units. In this manner, the bobbins 9 are delivered automatically to each of the winder units.

[0020] The bobbin 9 has a yarn wound thereon, which has been spun by a spinning machine or the like in the previous process. The bobbins 9 prepared by the spinning machine are carried in a container 8 or the like to the automatic winder. If an operator is to manually conduct a job of loading the bobbins 9 one by one from the container 8 onto the transporting trays 21, tremendous workload would be placed on the operator. To solve this issue, the bobbin separating and supplying device 12 according to the present embodiment functions to automatically separate (isolate) the bobbins 9 one by one and mount the bobbins 9 onto the transporting trays 21.

[0021] As shown in FIGS. 1 and 2, the bobbin separating and supplying device 12 according to the present embodiment includes a bobbin introducing section 22, the bobbin picking-up section 23, a bobbin orientation unifying section (orientation unifying and supplying section) 71, a bunch removing section 72, and a tray mounting section (mounting section) 73.

[0022] The bobbins 9 that have been carried in the container 8 are introduced into the bobbin introducing section 22. The bobbin picking-up section 23 picks up the bobbins 9 one by one from a bobbin pile introduced into the bobbin introducing section 22, and thereby separates the bobbins 9. This means that the bobbin introducing section 22 and the bobbin picking-up section 23 together form a bobbin separating section (supplying section) 24 that separates the introduced bobbins 9.

[0023] The bobbin introducing section 22 includes a swingable member 31. This swingable member 31

swings with strokes of a predetermined angle to hold back and break the bobbin pile introduced into the bobbin introducing section 22 so that only a certain amount of bobbins 9 can be supplied to the bobbin picking-up section 23 at a time. This prevents a large amount of bobbins 9 from being rushing into the bobbin picking-up section 23 at a time. The bobbin picking-up section 23 therefore can reliably pick up the bobbins 9 one by one.

[0024] The bobbin introducing section 22 also includes a cutter 43. This cutter 43 is shaped into a pair of scissors. The cutter 43, when it is driven by a not-shown driving source, cuts the yarn coming from the bobbin 9. Even when the yarn is coming from the bobbin 9 (causing the yarn dragging) during transport of the bobbin 9 from the bobbin introducing section 22 to the bobbin picking-up section 23, this cutter 43 can cut the yarn off. Consequently, even when the bobbins 9 that are being picked up by the bobbin picking-up section 23 are mixed-up by a bobbin plate 26, the yarn is prevented from being tangled or the like, and an isolating operation can be reliably realized.

[0025] The bobbin picking-up section 23 is a conveyor that is vertically arranged. More specifically, as shown in FIGS. 3 and 4, the bobbin picking-up section 23 includes an endless loop belt 25 and multiple bobbin plates 26 that are attached to an outer periphery of the endless loop belt 25 at substantially equal intervals in a longitudinal direction of the endless loop belt 25.

[0026] As shown in FIG. 3, the endless loop belt 25 is a band-like (sheet-like) member stretched across two rotary rollers, an upper rotary roller 37 and a lower rotary roller 37, to form a loop. The rotary rollers 37 are arranged so that their rotational shafts are parallel. The upper rotary roller 37 is coupled to an output shaft of a stepping motor 38 that serves as a driving source, via a drive transmitting belt or the like. When the stepping motor 38 is operated, the endless loop belt 25 is driven to move around, and the bobbin plates 26 that are attached to the endless loop belt 25 are moved in a vertical direction.

[0027] The bobbin plates 26 can be more stably supported when attached to the endless loop belt 25 than in a structure in which the bobbin plates are attached to, for example, an endless chain. Furthermore, because a posterior side of the device with respect to the bobbin plates 26 is covered with the sheet-like endless loop belt 25. This prevents the bobbins 9 from falling from the bobbin plates 26 to the posterior side of the device.

[0028] The bobbin plate 26 has a rectangular surface on which the bobbin 9 can ride. The rectangular bobbin plate 26 is attached to the endless loop belt 25 in such a way that a longitudinal direction of the bobbin plate 26 is parallel to a direction of the rotational shafts of the rotary rollers 37. With this structure, the bobbin 9 can ride on the bobbin plate 26 with the longitudinal axis of the bobbin 9 parallel to the rotational shafts of the rotary rollers 37. A width of the bobbin plate 26 (i.e., a length of the rectangular surface in a direction orthogonal to the longitudinal direction) is determined such that two bob-

bins 9 cannot ride side by side on one bobbin plate 26. With this structure, only one bobbin 9 from the bobbin introducing section 22 can ride on the bobbin plate 26, and transported upwardly by the loop driving of the endless loop belt 25 in a direction perpendicular to an installation surface of the device. In this manner, the bobbins 9 can be picked up (separated) one by one from the bobbin pile in the bobbin introducing section 22.

[0029] A structure as disclosed in Japanese Patent Application Laid-open No. H8-337317 has been known as a device that separates bobbins. In a cop delivering device disclosed in Japanese Patent Application Laid-open No. H8-337317, the bobbins are separated by using a feeder bowl. This feeder bowl requires large space in a horizontal direction. In contrast, the bobbin picking-up section 23 of the bobbin separating and supplying device 12 according to the present embodiment separates the bobbins 9 by transporting them in the vertical direction, and therefore requires less space in the horizontal direction. Consequently, the bobbin separating and supplying device 12 can be downsized in comparison with the conventional structure.

[0030] The cop delivering device disclosed in Japanese Patent Application Laid-open No. H8-337317 separates the bobbins by dropping them. This means that an unpacking device that unpacks a container of the bobbins has to be installed at a high position. Because of the high bobbin introducing position, the cop delivering device disclosed in Japanese Patent Application Laid-open No. H8-337317 exhibits poor visibility and workability. In contrast, in the bobbin separating and supplying device 12 according to the present embodiment, the bobbins 9 are separated by being upwardly transported. This means that the bobbins 9 can be introduced from a lower position. This significantly improves visibility and workability.

[0031] The bobbin separating and supplying device 12 includes a bobbin isolating member 41 that can be brought into contact with the bobbin 9 that is being transported on the bobbin plate 26. This bobbin isolating member 41 is a metal wire (linear member) arranged along an area in which the bobbin 9 is transported on the bobbin plate 26. The bobbin plate 26 has a slit so that this bobbin isolating member 41 can pass through. The bobbin isolating member 41 is suitably bent to create a pushing portion 42 for slightly pushing and shaking the bobbin 9 on the bobbin plate 26.

[0032] As described above, the size of the bobbin plate 26 is small enough to not carry two bobbins 9 side by side. It is possible, however, that more than one bobbin 9 ride on the bobbin plate 26, with one bobbin 9 on another bobbin 9. Because the bobbin isolating member 41 is prepared in the bobbin picking-up section 23 according to the present embodiment, even when the bobbins 9 ride on the bobbin plate 26 with one on another, the pushing portion 42 of the bobbin isolating member 41 pushes and shakes the bobbins 9 to drop the extra bobbin 9. Thus, one bobbin 9 can be reliably separated.

[0033] For example, as shown in FIG. 4, when the bobbin plate 26 carrying two bobbins 9 one on the other reaches a position of the pushing portion 42, the bobbin isolating member 41 pushes the bobbins 9, causing the bobbins 9 to lose their balance. Consequently, the bobbin 9 that is riding on the top falls off from a scooping end of the bobbin plate 26. In this manner, the extra bobbin 9 riding on the bobbin plate 26 is dropped from the bobbin plate 26 with a simple structure in which the bobbin isolating member 41 including the pushing portion 42 is arranged along the transport direction of the bobbins 9.

[0034] The bobbins 9 upwardly transported by the bobbin picking-up section 23 are supplied via a bobbin buffer section (holding section) 44, which can temporarily store the bobbins 9 in stock, to the bobbin orientation unifying section 71.

[0035] The bobbin orientation unifying section 71 determines an unwinding end and a supported end of the bobbin 9 received from the bobbin picking-up section 23. After turning the bobbin 9 so that its unwinding end faces down, the bobbin orientation unifying section 71 drops the bobbin 9 to the bunch removing section 72 arranged below.

[0036] An unwinding side and a supported side of the bobbin 9 are explained in detail below with reference to FIG. 5. FIG. 5 is a diagram explaining the supported side and the unwinding side, and the bunch winding of the bobbin 9.

[0037] The bobbin 9 is formed by winding around a bobbin tube 9t the spun yarn produced by the spinning machine in a previous process. For the sake of simplicity of drawing, FIG. 1 and the like do not show any tapered portion in bobbin tubes of the bobbins 9. As shown in FIG. 5, however, the bobbin tube 9t actually has a slightly tapered portion. The spinning machine winds the spun yarn from a larger-diameter end of the bobbin tube 9t towards a smaller-diameter end thereof.

[0038] In FIG. 5, the unwinding end of the bobbin 9 is indicated by a reference number 9p, and the supported end thereof is indicated by a reference number 9q. Because the bobbin tube 9t has a tapered portion, the unwinding end 9p is slightly thinner than the supported end 9q. The unwinding side of the bobbin 9 is a side of the bobbin tube 9t having a smaller diameter, and the yarn wound around the bobbin 9 is unwound by the winder unit in a direction toward this unwinding side. The supported side of the bobbin 9 is a side of the bobbin tube 9t having a larger diameter. The bobbin 9, when mounted on the transporting tray 21 by the later-described tray mounting section 73, is supported by the transporting trays 21 on this supported side.

[0039] A structure of determining the unwinding end and the supported end of the bobbin 9 has been known in the art and is disclosed, for example, in Japanese Patent Application Laid-open No. H8-169525. Detailed explanation of the structure is therefore omitted here.

[0040] The bobbin buffer section 44 arranged between the bobbin picking-up section 23 and the bobbin orien-

tation unifying section 71 stores, for example, several bobbins 9 therein, and supplies the bobbins 9 downstream in response to a command. With this structure, even if a bobbin 9 falls from the bobbin plate 26 and the bobbin picking-up section 23 fails to successively pick up the bobbins 9, the bobbins 9 are constantly supplied from the bobbin buffer section 44 to the downstream devices, which are the bobbin orientation unifying section 71, the bunch removing section 72, and the tray mounting section 73. The efficiency of the devices is therefore prevented from being lowered.

[0041] The bunch removing section 72 performs a process of removing the bunch winding and the seed yarn formed on the bobbin 9. The structure of the bunch removing section 72 is explained in detail below with reference mainly to FIGS. 6 to 9. FIG. 6 is front view of the bunch removing section 72 included in the bobbin separating and supplying device 12. FIG. 7 is a cross-sectional view taken along arrows A-A of FIG. 6 and FIG. 8 is a cross-sectional view taken along arrows B-B of FIG. 7. FIG. 9 is a cross-sectional front view of suctioning of a bottom bunch 9a with the supported end 9q of the bobbin 9 of FIG. 8 capped with a cylindrical body 52.

[0042] The bunch removing section 72 includes a housing 81, a rotary feeder 82, a suctioning mechanism 51, and a clamping mechanism (holding mechanism) 93, as essential structural components.

[0043] The bunch winding and the seed yarn are briefly explained with reference to FIG. 5 and the like, when necessary. If the bobbin 9 is formed simply by winding the yarn around the bobbin tube 9t from its larger-diameter side to its short-diameter side, the yarn end becomes free. In this case, if the bobbin 9 is left as it is, the yarn comes off during the transport from the spinning machine to the bobbin separating and supplying device 12 or the like, which can cause a problem of tangling with yarns from other bobbins 9.

[0044] For this reason, as shown in FIG. 5, the yarn is wound spirally around a yarn layer surface of the bobbin 9 from the smaller-diameter side to the larger-diameter side, and then wound tightly at the supported end 9q of the bobbin tube 9t to form a bunch winding. This no longer allows the yarn end to become free, and prevents the yarn from coming from the bobbin 9 that is being transported. The portion of the yarn wound spirally around the yarn layer surface of the bobbin 9 from the smaller-diameter side to the larger-diameter side is called a backwound yarn 9d, and the portion of the yarn that is tightly wound at the supported end 9q of the bobbin tube 9t is called the bottom bunch 9a.

[0045] The bottom bunch 9a is formed when the spinning machine finishes winding the yarn. A portion formed when the spinning machine starts winding around the bobbin tube 9t is sometimes called a seed yarn 9c. The seed yarn 9c can become relatively long depending on how the yarn is wound around the bobbin 9. This tendency is more visible in a spinning machine of a type in which an operator manually doffs bobbins (manual doffing and

spinning machine) instead of using an automatic doffing device. In such a manual doffing and spinning machine, the number of turns in the winding of the yarn tends to increase when tight winding is performed to form the bottom bunch 9a. This increases workload when removing the seed yarn 9c and the bottom bunch 9a and lowers production efficiency. The bobbin separating and supplying device 12 according to the present embodiment therefore includes the bunch removing section 72 that can reliably and quickly remove the bottom bunch 9a and the seed yarn 9c.

[0046] The housing 81 rotatably supports the rotary feeder 82 and includes an orientation changing plate 91. The orientation changing plate 91 is a tilted flat plate. The bobbin 9 falls from the bobbin orientation unifying section 71 onto the orientation changing plate 91 so that the unwinding side of the bobbin 9 faces down. The orientation changing plate 91 turns the orientation of the bobbin 9 by substantially 90 degrees and guides the bobbin 9 in such a manner that the unwinding side faces in a direction away from the orientation changing plate 91.

[0047] In the rotary feeder 82, plate-like partitions are combined to divide an interior of the rotary feeder 82 into six spaces, as shown in FIG. 7. Each space (hereinafter, it may be referred to as a "bobbin space 94") is formed narrow, with its longitudinal direction arranged parallel to an axial line of the rotary feeder 82. The six bobbin spaces 94 are arranged at equal intervals of 60 degrees in a peripheral direction of the rotary feeder 82. Each of the six bobbin spaces 94 is open at its outer end in a diameter direction. With this arrangement, one bobbin 9 can be inserted and stored into each of the bobbin spaces 94 from its outer end in the diameter direction of the rotary feeder 82.

[0048] The rotary feeder 82 is supported by the housing 81 with its center axis slightly tilted from the horizontal level. More specifically, the center axis of the rotary feeder 82 is tilted in such a manner that the side of the center axis located away from the orientation changing plate 91 (i.e., the left side in FIG. 1) tilts slightly downward. The bobbin spaces 94 are also arranged to tilt slightly downward in the same direction.

[0049] A bobbin path 95 is formed in the housing 81. The bobbin path 95 is formed in an arc shape around the center axis of the rotary feeder 82. A substantially L-shaped regulating member 85 is arranged along this bobbin path 95 and fixed to the housing 81. The regulating member 85 comes into contact with a surface of the bobbin 9, when the bobbin 9 tries to escape from the bobbin space 94 under its own weight, and thereby prevents the bobbin 9 from escaping from the bobbin space 94.

[0050] On the bobbin path 95, a reception position P1 at which the bobbin 9 is received from the bobbin orientation unifying section 71, a processing position P2 at which the bobbin 9 is subjected to a bunch removing process, and a discharge position P3 at which the bunch-removed bobbin 9 is dropped into the tray mount-

ing section 73 are arranged in this order in a downstream direction of the bobbin path 95.

[0051] The reception position P1 is arranged in the upper portion of the housing 81 above the center axis of the rotary feeder 82. The top portion of the housing 81 is open at this reception position P1. The bobbin 9 supplied from the bobbin orientation unifying section 71 is introduced into the bobbin space 94 of the rotary feeder 82 at the reception position P1. Thereafter, the bobbin orientation unifying section 71 and the orientation changing plate 91 function together so that the bobbin 9 is oriented with its unwinding side facing in the direction away from the orientation changing plate 91 and inserted into the bobbin space 94.

[0052] The processing position P2 is arranged in the lower portion of the housing 81, below the center axis of the rotary feeder 82. At this processing position P2, the bobbin 9 is clamped by the later-described clamping mechanism 93 at its unwinding end 9p and thereby tightly held at this position. Under this condition, the operation of removing the bunch winding (bottom bunch 9a) and the seed yarn 9c formed at the supported end 9q of the bobbin 9 is performed. A detailed structure for this bunch removing process will be discussed later.

[0053] The discharge position P3 is arranged in the lower portion of the housing 81, close to the processing position P2. Because the regulating member 85 does not extend up to the discharge position P3, the bobbin 9 in the bobbin space 94 of the rotary feeder 82 is discharged obliquely downward under its own weight. The discharged bobbin 9 is sent through a bobbin chute 27 to the tray mounting section 73.

[0054] A drive motor 92 is attached to the housing 81. This drive motor 92 rotates the rotary feeder 82 in 60-degree steps in one direction. With this arrangement, the rotary feeder 82 can sequentially send the bobbins 9 received at the reception position P1 one by one to the processing position P2, and then to the discharge position P3 along the bobbin path 95.

[0055] Next, the structure for removing the bottom bunch 9a and the seed yarn 9c at the processing position P2 is explained in detail with reference to FIG. 8 and the like.

[0056] As shown in FIG. 8, the suctioning mechanism 51 is arranged on a side of the bunch removing section 72 corresponding to the supported side of the bobbin 9 at the processing position P2 to suck and remove the bottom bunch 9a of the bobbin 9. The clamping mechanism 93 is arranged on a side of the bunch removing section 72 corresponding to the unwinding side of the bobbin 9 to stably hold the bobbin 9.

[0057] The clamping mechanism 93 includes a base member 96 having a V-shaped dent, a pressing member 97 opposing this base member 96, and an air cylinder 98 that serves as an actuator for driving this pressing member 97.

[0058] As shown in FIG. 7, the V-shaped dent formed in the base member 96 is continuously connected to an

edge portion of the regulating member 85. As shown in FIG. 6 and the like, all the six bobbin spaces 94 in the rotary feeder 82 are tilted so that the unwinding sides of the bobbins 9 therein are lowered. With this arrangement, at the reception position P1 where the bobbin 9 is inserted into the bobbin space 94, the bobbin 9 can be positioned toward the center of the bobbin space 94 or near the orientation changing plate 91. As the bobbin 9 is transported in accordance with rotation of the rotary feeder 82, however, the bobbin 9 slides downward under its own weight. Consequently, by the time when the bobbin 9 is sent to the processing position P2, the unwinding end 9p of the bobbin 9 is brought into a state suitable for being inserted and clamped between the base member 96 and the pressing member 97 of the clamping mechanism 93.

[0059] The suctioning mechanism 51 includes the cylindrical body 52 that can move in a direction extending from the longitudinal direction of the bobbin space 94. This cylindrical body 52 has an opening on an extension of the axial line of the bobbin 9 that is held by the clamping mechanism 93 at the processing position P2. The cylindrical body 52 is connected to a suitable negative pressure source (for example, a blower) via a flexible duct 53. A suction airflow can be generated in the opening and inside of the cylindrical body 52.

[0060] A shutter/cutter (shutter, opening/shutting mechanism) 84 is arranged inside the cylindrical body 52. This shutter/cutter 84 switches the inside of the cylindrical body 52 between a shut state and an open state. The shutter/cutter 84 is formed of a plate member and coupled to a not-shown actuator (cutting mechanism) that is arranged on a peripheral portion of the shutter/cutter 84. This cutting mechanism drives the shutter/cutter 84 to shut in such a manner as to pinch the yarn so that the yarn can be cut off. In an alternative structure, a member having a cutting edge can be arranged separately from the shutter/cutter 84, and the cutting mechanism can be caused to drive this member to cut the yarn off.

[0061] The bunch removing section 72 includes an air cylinder (an actuator or a driving unit) 54 to move the cylindrical body 52 forward and backward in its axial direction. With this arrangement, the cylindrical body 52, when driven by the air cylinder 54, can move between a position at which it caps the supported end 9q of the bobbin 9 (FIG. 9) and a position at which it is detached from the supported end 9q of the bobbin 9 (FIG. 8) along the longitudinal direction of the bobbin 9.

[0062] Air jetting nozzles (air nozzles) 55 are formed in the cylindrical body 52. The air jetting nozzles 55 can send jetting air into the cylindrical body 52 (toward a downstream side of the suction airflow). The air jetting nozzles 55 are arranged at six positions in the peripheral direction of the cylindrical body 52 and have opening ends on an interior wall of the cylindrical body 52.

[0063] Before removing the bunch winding from the bobbin 9 with such an arrangement, first of all, an unwinding end of the bobbin 9 is clamped and held by the

clamping mechanism 93 so as not to move at the processing position P2. Next, the shutter/cutter 84 that has been shut is opened to generate the suction airflow inside the cylindrical body 52 and near the opening thereof. Subsequently, while sending jetting air from the air jetting nozzles 55, the air cylinder 54 moves the cylindrical body 52 to cap the supported end of the bobbin 9. A capping length of this cylindrical body 52 can be suitably determined in consideration of a length of the bobbin tube 9t of the bobbin 9 or the like. For example, the capping length can be several tens of millimeters.

[0064] Thereafter, sloughing occurs where the bottom bunch 9a comes off all at once from the supported side of the bobbin 9, and the bottom bunch 9a is thereby suctioned into the cylindrical body 52. The bottom bunch 9a may not be sloughed off all at once, but can be removed as the yarn is gradually unwound from its end. In this situation, the shutter/cutter 84 is shut after a predetermined period of time elapses so that a yarn 9b that forms the bottom bunch 9a that has been suctioned into the cylindrical body 52 can be cut off.

[0065] Next, the cylindrical body 52 is returned to the position shown in FIG. 8, and then the above operation cycle is repeated for a suitable number of times. The bottom bunch 9a can be further reliably removed by performing control to repeat the operation cycle for multiple times. The number of operation cycles can be set by performing a suitable operation onto a control section that controls the bunch removing section 72. A specific example of the operation can be such that one cycle is completed in approximately one second and that two cycles are performed on each bobbin 9.

[0066] In the example of FIGS. 8 and 9, the seed yarn 9c of the bobbin 9 at the processing position P2 is originally set short and therefore is not cut with the shutter/cutter 84. If a bobbin 9 that has a substantially long seed yarn 9c is supplied, the shutter/cutter 84 cuts the seed yarn 9c short together with the yarn 9b that forms the bottom bunch 9a.

[0067] The bottom bunch 9a and the seed yarn 9c are removed from the bobbin 9 in this manner. Thereafter, the bunch removing section 72 releases the clamping mechanism 93, drives the rotary feeder 82 to send the bobbin 9 to the discharge position P3, and drops the bobbin 9 through the bobbin chute 27. The transporting tray 21 is waiting under the bobbin chute 27, and the bobbin 9 coming out of the bobbin chute 27 is mounted onto the transporting tray 21.

[0068] The bobbin separating and supplying device 12 that has the above structure picks the bobbin 9 up from the bobbin pile introduced into the bobbin introducing section 22 by scooping the bobbin 9 at the scooping end of the bobbin plate 26 (an end that is opposite the end attached to the endless loop belt 25). Consequently, the bobbins 9 can be separated while being transported, and they are mounted onto the transporting trays 21 after removing the bottom bunches 9a and the seed yarns 9c.

[0069] Next, a bobbin preparing device that is arranged

on the bobbin transporting path 20 and transports the bobbins 9 from the bobbin separating and supplying device 12 to each winder unit of the automatic winder is explained. FIG. 10 is a schematic plan view of a bobbin preparing device 17.

[0070] The bobbin preparing device 17 is arranged on the bobbin transporting path 20, in a zone between an upstream side with respect to the winder unit and a downstream side with respect to the bobbin separating and supplying device 12 (i.e., a preparation zone). This bobbin preparing device 17 includes a yarn end guiding-out device 18 that finds a yarn end of the bobbin 9 so that the winder unit can easily catch the yarn from the bobbin 9.

[0071] The structure of the yarn end guiding-out device 18 has been known in the art, and is briefly explained below. The yarn end guiding-out device 18 sends a suction airflow to the bobbin 9 riding on the transporting tray 21 and transported along the bobbin transporting path 20, and thereby unwinds the yarn from the surface of the bobbin 9. The end of the unwound yarn is inserted into the cylindrical bobbin 9. With this preparation process, the winder unit that is arranged on the downstream side with respect to the yarn end guiding-out device 18 can easily catch the yarn end of the bobbin 9 and smoothly start winding of the yarn.

[0072] As explained above, the bobbin separating and supplying device 12 according to the present embodiment includes the bobbin separating section 24, the bunch removing section 72, and the tray mounting section 73. The bobbin separating section 24 supplies bobbins 9 one by one. The bunch removing section 72 performs the removing process onto the bunch winding (bottom bunch 9a) from the bobbin 9 supplied from the bobbin separating section 24. The tray mounting section 73 mounts the bobbin 9, from which the bunch winding is removed by the bunch removing section 72, onto the transporting tray 21.

[0073] Because the bobbin separating and supplying device 12 includes the bunch removing section 72, no bunch removing mechanism is required in a subsequent process. In addition, yarn dragging, which is the yarn coming off from the bunch winding or the seed yarn of the bobbin 9 being transported on the transporting tray 21, can be prevented.

[0074] In the bobbin separating and supplying device 12 according to the present embodiment, the bunch removing section 72 performs the removing process onto the bottom bunch 9a.

[0075] The bottom bunch 9a that is formed by winding the yarn end around the bobbin tube 9t is removed in this manner, and therefore the yarn dragging that tends to occur when the bottom bunch 9a is unwound can be prevented.

[0076] In the bobbin separating and supplying device 12 according to the present embodiment, the bunch removing section 72 includes the cylindrical body (suction opening member) 52, the shutter/cutter 84, and the cut-

ting mechanism. The cylindrical body 52 that is connected to the negative pressure source has a suction opening through which a suction airflow is generated. The shutter/cutter 84 arranged inside the cylindrical body 52 opens and shuts the suction opening. The cutting mechanism cuts off the yarn 9b that forms the bottom bunch 9a suctioned away from the bobbin 9.

[0077] With this arrangement, the bottom bunch 9a of the bobbin 9 is suctioned through the suction opening, and the yarn 9b that forms the bottom bunch 9a is cut off and removed by the cutting mechanism. Especially because suctioning is performed to remove the bottom bunch 9a from the bobbin 9 before the bobbin 9 is mounted onto the transporting tray 21, the structure can be significantly simplified in comparison with a conventional structure that removes the bottom bunch while rotating the bobbin.

[0078] In the bobbin separating and supplying device 12 according to the present embodiment, the suction opening is opened and shut by the shutter/cutter 84 that is a plate member. The cutting mechanism is arranged on the peripheral portion of the plate member and cuts the yarn 9b off.

[0079] Consequently, the suction opening can be opened and shut with a simple structure. Moreover, the opening and shutting of the suction opening can be easily performed together with the cutting of the yarn 9b.

[0080] In the bobbin separating and supplying device 12 according to the present embodiment, the bunch removing section 72 includes the air cylinder 54 that moves the cylindrical body 52 forward and backward with respect to the bobbin 9 arranged at the processing position P2.

[0081] With this arrangement, because the suction opening is movable, a strong suction airflow can be sent to the bottom bunch 9a, with the supported end 9q of the bobbin 9 inserted into the suction opening and capped with the cylindrical body 52. The bottom bunch 9a can be thereby suctioned and removed. Consequently, the removal of the bottom bunch 9a can be reliably realized.

[0082] The bobbin separating and supplying device 12 according to the present embodiment includes the clamping mechanism 93 and the air jetting nozzles 55. The clamping mechanism 93 holds the unwinding end 9p of the bobbin 9 arranged at the processing position P2. The air jetting nozzles 55 are arranged inside the cylindrical body 52. The air jetting nozzles 55 send jetting air toward the downstream side of the suction airflow.

[0083] With this arrangement, the bottom bunch 9a can be reliably unwound by the jetting air from the air jetting nozzles 55. In addition, because the clamping mechanism 93 holds the unwinding end 9p of the bobbin 9 during the removal of the bottom bunch 9a, the removal of the bottom bunch 9a can be smoothly performed with the bobbin 9 maintained in a stable state (preventing the bobbin 9 itself from being suctioned and stuck at the suction opening).

[0084] In the bobbin separating and supplying device

12 according to the present embodiment, the bobbin separating section 24 that separates the introduced multiple bobbins 9, also supplies bobbins 9 one by one.

[0085] With this arrangement, the introduced multiple bobbins 9 are separated and the bottom bunches 9a are removed from these bobbins 9, and then the bobbins 9 are mounted onto the transporting trays 21. This can simplify the operations at the subsequent steps. The yarn is prevented from tangling with the transporting tray 21 because the yarn dragging does not occur.

[0086] In the bobbin separating and supplying device 12 according to the present embodiment, the bobbin separating section 24 includes the bobbin introducing section 22 and the bobbin picking-up section 23. Multiple bobbins 9 are introduced into the bobbin introducing section 22. The bobbin picking-up section 23 picks the bobbin 9 up from the pile of the bobbins introduced into the bobbin introducing section 22. The bobbin picking-up section 23 separates the bobbins 9 while transporting them upwardly in the direction substantially perpendicular to an installation surface of the bobbin picking-up section 23.

[0087] With this arrangement, the bobbins 9 are separated while being transported upwardly in a substantially vertical direction in the bobbin picking-up section 23. An area required for installation of the device that separates the bobbins 9 can be thereby reduced.

[0088] The bobbin separating and supplying device 12 according to the present embodiment includes an upward path along which the bobbins 9 are transported upwardly, and a downward path along which the bobbins 9 are transported downwardly. The bobbin picking-up section 23 is arranged on the upward path. The bunch removing section 72 and the tray mounting section 73 are arranged on the downward path.

[0089] With this arrangement, a rational layout can be realized, in which the bobbins 9 are separated while being transported upwardly, and the bunch removal and the mounting of the bobbins 9 on the transporting trays 21 are performed while the bobbins 9 are being transported downwardly. Along the downward path, the bunch removing section 72 and the tray mounting section 73 are arranged in the vertical direction, the former on the latter, and therefore the entire installation area can be significantly reduced.

[0090] In the bobbin separating and supplying device 12 according to the present embodiment, the bobbin orientation unifying section 71 that detects the orientations of bobbins 9 and unifies them into a predetermined orientation and then sends the bobbins 9 to the bunch removing section 72 is arranged on the upstream side with respect to the bunch removing section 72.

[0091] With this arrangement, the bobbin orientation unifying section 71 detects the orientation of each bobbin 9, and always supplies the bobbin 9 brought into the predetermined orientation to the bunch removing section 72. This simplifies the removing process at the bunch removing section 72. More specifically, the bobbin 9 is always supplied with its bottom bunch 9a facing a side on which

the suctioning mechanism 51 that performs the removing process onto the bottom bunch 9a is arranged, and therefore the orientation of the bobbin 9 does not need to be adjusted at the bunch removing section 72.

[0092] The automatic winder system 10 according to the present embodiment includes the bobbin separating and supplying device 12, the automatic winder, and the bobbin preparing device 17. The automatic winder winds the yarn from the bobbin 9 to produce a package. The bobbin preparing device 17 transports the transporting trays 21 onto which the bobbins 9 are supplied by the bobbin separating and supplying device 12 to the automatic winder, and prepares the bobbins 9 so that they are in a condition in which the automatic winder can start processing thereon. The bobbin transporting path 20 is arranged in the bobbin preparing device 17, along which the transporting trays 21 having the bobbins 9 thereon are transported from the bobbin separating and supplying device 12 to the automatic winder. The bobbin transporting path 20 includes the yarn end guiding-out device 18 that processes the yarn end on the winding end side of the yarn of the bobbin 9.

[0093] Because the bunch removing section 72 is arranged on the side of the bobbin separating and supplying device 12, no bottom bunch removing section is required in the bobbin preparing device 17. This can realize minimization of the device.

[0094] A modification of the above embodiment is now explained. FIG. 11 is a schematic plan view of a modification of the bobbin preparing device 17 in a bobbin supplying system. In the explanation of this modification, the same reference numbers are given to components that are the same as or similar to those of the above embodiment, and the explanation thereof may be omitted.

[0095] The bobbin preparing device 17 according to the modification includes a second bunch removing section 74 in addition to the yarn end guiding-out device 18. For this second bunch removing section 74, the one disclosed in the conventional technology of Japanese Patent Application Laid-open No. 2008-247517 can be used.

[0096] In this modification, the bobbin 9 that is being transported along a suitable path is subjected to the bunch removing process at two sections, the bunch removing section 72 and the second bunch removing section 74. In comparison with the conventional structure in which the bunch removal is performed only by a bunch removing device arranged in the bobbin preparing device, the removal of the bottom bunch 9a can be performed with a higher success rate. Any trouble therefore can be prevented in the winding operation performed by the winder units from occurring due to the bottom bunch 9a that fails to be removed.

[0097] As explained above, in the automatic winder system 10 of this modification, the bobbin preparing device 17 includes the second bunch removing section 74 that performs the removing process onto the bottom bunch 9a.

[0098] With this arrangement, the bunch removing

process is performed twice, at the bunch removing section 72 of the bobbin separating and supplying device 12 and also at the second bunch removing section 74. The bottom bunch 9a of the bobbin 9 therefore can be reliably removed.

[0099] The exemplary embodiments and the modification of the present invention have been explained; however, the above structures can be changed as follows.

[0100] As a driving section that drives the cylindrical body 52, driving sources such as a stepping motor can be used instead of the air cylinder 54 in the above embodiment. The use of the stepping motor is preferable from an aspect that a moving distance and moving speed of the cylindrical body 52 can be easily controlled. In addition, even when the cylindrical body 52 collides with the bobbin 9 that is stuck in the bobbin space 94, the stepping motor causes a loss of synchronization. This is advantageous because the stepping motor and the device can be protected from damage.

[0101] Application of the bunch removing section 72 having the structure shown in FIGS. 6 to 8 is not limited to the bobbin picking-up section 23 of a vertical transport conveyor type but also to a bobbin picking-up section of a parts-feeder type.

[0102] The structure of the present invention can be applied to an automatic winder of a what-is-called link type having a structure in which a chute is arranged between the spinning machine and the automatic winder as disclosed in Japanese Patent Application Laid-open No. S62-74886.

[0103] According to an aspect of the present invention, a bobbin delivering device having the following configuration is presented. That is, the bobbin delivering device includes a supplying section, a bunch removing section, and a mounting section. The supplying section supplies one bobbin at a time to the bunch removing section. The bunch removing section performs a removing process on a bunch winding of the bobbin supplied by the supplying section. The mounting section mounts onto a transporting tray the bobbin on which the bunch removing section has performed the removing process to remove the bunch winding.

[0104] With this arrangement, because the bunch removing section is arranged in the bobbin delivering device, no bunch removing mechanism is required in a subsequent process. In addition, yarn dragging, which is a yarn coming loose and off from the bunch winding or the seed yarn of a bobbin that is being transported on the transporting tray, can be prevented.

[0105] In the bobbin delivering device, it is preferable that the bunch removing section performs the removing process onto a bottom bunch of the bobbin.

[0106] With this arrangement, the bottom bunch formed by winding the yarn end around the bobbin tube is subjected to the removing process, and therefore the yarn dragging that tends to occur when the bottom bunch is unwound can be prevented.

[0107] It is preferable that the bobbin delivering device

has the following configuration. That is, the bunch removing section includes a suction opening member, an opening/shutting mechanism, and a cutting mechanism. The suction opening member has a suction opening, is connected to a negative pressure source, and generates a suction airflow in the suction opening. The opening/shutting mechanism opens and shuts the suction opening of the suction opening member. The cutting mechanism cuts a yarn that forms the bottom bunch that is suctioned away from the bobbin into the suction opening.

[0108] With this arrangement, the bottom bunch of the bobbin is suctioned through the suction opening, and also the yarn that forms the bottom bunch is cut off and removed by the cutting mechanism. Especially because suctioning is performed to remove the bottom bunch from the bobbin before the bobbin is mounted onto the transporting tray, the structure can be significantly simplified in comparison with a conventional structure of removing the bottom bunch while rotating the bobbin.

[0109] It is preferable that the bobbin delivering device has the following configuration. That is, the opening/shutting mechanism is a shutter member that is formed of a plate member and arranged inside the suction opening member. Moreover, the cutting mechanism is arranged on a peripheral portion of the plate member and cuts the yarn off.

[0110] With this arrangement, the suction opening can be opened and shut with a simple structure. Moreover, the opening and shutting of the suction opening can be easily performed together with the cutting of the yarn.

[0111] In the bobbin delivering device, it is preferable that the bunch removing section includes a driving section that drives and moves the suction opening member forward and backward with respect to the bobbin that is at a processing position.

[0112] With this arrangement, because the suction opening is movable, a strong suction airflow can be sent to the bottom bunch, with the supported end of the bobbin inserted into the suction opening and capped with the cylindrical body. The bottom bunch can be thereby suctioned and removed. Consequently, the removal of the bottom bunch can be reliably realized.

[0113] It is preferable that the bobbin delivering device has the following configuration. That is, the bobbin delivering device further includes a holding mechanism and an air nozzle. The holding mechanism holds an unwinding end of the bobbin that is at the processing position. The air nozzle is arranged inside the suction opening member and sends jetting air toward a downstream side of the suction airflow.

[0114] With this arrangement, the bottom bunch can be reliably unwound by the jetting air from the air jetting nozzles. In addition, because the clamping mechanism holds the bobbin during the removal of the bottom bunch, the removal of the bottom bunch can be smoothly performed with the bobbin maintained in a stable state (preventing the bobbin itself from being suctioned and stuck at the suction opening).

[0115] In the bobbin delivering device, it is preferable that the supplying section is a bobbin separating device that receives a plurality of bobbins and separates the bobbins one by one.

[0116] With this arrangement, the introduced multiple bobbins are separated and the bottom bunches are removed from these bobbins, and then the bobbins are mounted onto the transporting trays. This can simplify the operations at the subsequent processes. Moreover, the yarn is prevented from tangling with the transporting tray because the yarn dragging does not occur.

[0117] It is preferable that the bobbin delivering device has the following configuration. That is, the bobbin separating device includes a bobbin introducing section and a bobbin picking-up section. The bobbins are introduced into the bobbin introducing section. The bobbin picking-up section picks a bobbin from a pile of the bobbins that are introduced into the bobbin introducing section. Moreover, the bobbin picking-up section separates the bobbins while transporting the bobbins upwardly in a direction substantially perpendicular to an installation surface of the bobbin introducing section.

[0118] With this arrangement, the bobbins are separated while being transported upwardly in a substantially vertical direction in the bobbin picking-up section. An area required for installation of the device that separates the bobbins can be thereby reduced.

[0119] It is preferable that the bobbin delivering device has the following configuration. That is, the bobbin delivering device further includes an upward path and a downward path. The upward path transports the bobbins upwardly. The downward path transports the bobbins downwardly. The bobbin picking-up section is arranged on the upward path. The bunch removing section and the mounting section are arranged on the downward path.

[0120] With this arrangement, a rational layout can be realized, in which the bobbins are separated while being transported upwardly, and the bobbins are subjected to the bunch removal and the mounting on the transporting trays while being transported downwardly. Along the downward path, the bunch removing section and the tray mounting section are arranged in the vertical direction, the former upon the latter, and therefore the entire installation area can be significantly reduced.

[0121] It is preferable that the bobbin delivering device further includes an orientation unifying and supplying section that, along the downward path, detects an orientation of the bobbin, unifies the orientation into a predetermined orientation, and then supplies the bobbin to the bunch removing section.

[0122] With this arrangement, the bobbin orientation unifying section detects the orientation of each bobbin, and supplies the bobbin that is brought into the predetermined orientation to the bunch removing section. This simplifies the removing process at the bunch removing section. More specifically, the bobbin is always supplied with its bottom bunch facing a side on which the mechanism that performs the removing process of the bottom

bunch is arranged, and therefore the orientation of the bobbin does not need to be adjusted at the bunch removing section.

[0123] According to another aspect of the present invention, a winding system having the following configuration is presented. That is, the winding system includes the bobbin delivering device, a winding device, and a bobbin preparing device. The winding device winds a yarn from the bobbin to produce a package. The bobbin preparing device transports the transporting tray onto which the bobbin is supplied by the supplying section to the winding device, and brings the bobbin into a condition ready for the winding device to process the bobbin. Moreover, the bobbin preparing device includes a bobbin supplying path along which the transporting tray onto which the bobbin is supplied is transported from the bobbin delivering device to the winding device. A yarn end guiding-out device that unwinds from a surface of the bobbin a yarn end of a winding end side of the bobbin that has been wound and inserts the yarn end into a winding tube of the bobbin is arranged on the bobbin supplying path.

[0124] With this arrangement, because the bunch removing section is arranged on a bobbin delivering device side, no bottom bunch removing section is required in the bobbin preparing device. This can realize downsizing of the device.

[0125] In the winding system, it is possible that the bobbin preparing device includes a second bunch removing section that performs a removing process onto the bottom bunch of the bobbin.

[0126] With this arrangement, the bunch removing process is performed twice, at the bunch removing section of the bobbin delivering device and at the second bunch removing section. The bottom bunch of the bobbin therefore can be reliably removed.

[0127] Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching of the claims.

Claims

1. A bobbin delivering device(12) characterized by:

- a supplying section(24) that supplies bobbins (9) one by one;
- a bunch removing section(72) that performs a removing process on a bunch winding (9a) of the bobbin (9) supplied by the supplying section (24); and
- a mounting section(73) that mounts onto a transporting tray (21) the bobbin (9) on which the bunch removing section (72) has performed the removing process to remove the bunch winding

- (9a).
2. The bobbin delivering device(12) according to Claim 1, **characterized in that** the bunch removing section (72) performs the removing process onto a bottom bunch (9a) of the bobbin (9).
 3. The bobbin delivering device(12) according to Claim 2, **characterized in that** the bunch removing section (72) includes
 - a suction opening member(52) that has a suction opening, which is connected to a negative pressure source, and generates a suction airflow in the suction opening;
 - an opening/shutting mechanism(84) that opens and shuts the suction opening of the suction opening member(52); and
 - a cutting mechanism that cuts a yarn (9b) that forms the bottom bunch (9a) that is suctioned away from the bobbin (9) into the suction opening.
 4. The bobbin delivering device(12) according to Claim 3, **characterized in that**
 - the opening/shutting mechanism(84) is a shutter member that is formed of a plate member and arranged inside the suction opening member(52), and the cutting mechanism is arranged on a peripheral portion of the plate member and cuts the yarn (9b) off.
 5. The bobbin delivering device(12) according to Claim 4, **characterized in that** the bunch removing section (72) includes a driving section(54) that drives and moves the suction opening member(52) forward and backward with respect to the bobbin (9), the bottom bunch (9a) of which is to be subjected to the removing process.
 6. The bobbin delivering device(12) according to Claim 5, **characterized by**:
 - a holding mechanism(93) that holds an unwind- ing end (9p) of the bobbin (9), the bottom bunch (9a) of which is to be subjected to the removing process; and
 - an air nozzle(55) that is arranged inside the suc- tion opening member(52) and sends jetting air toward a downstream side of the suction airflow.
 7. The bobbin delivering device(12) according to any one of Claims 1 to 6, **characterized in that** the sup- plying section(24) is a bobbin separating device that receives a plurality of bobbins (9) and separates the bobbins (9) one by one.
 8. The bobbin delivering device(12) according to Claim 7, **characterized in that**
 - the bobbin separating device includes a bobbin in- troducing section(22) into which the bobbins (9) are introduced, and a bobbin picking-up section(23) that picks a bobbin (9) from a pile of the bobbins (9) that are introduced into the bobbin introducing section (22), and
 - the bobbin picking-up section(23) separates the bob- bins (9) while transporting the bobbins (9) upwardly in a direction substantially perpendicular to an instal- lation surface of the bobbin introducing section(22).
 9. The bobbin delivering device(12) according to Claim 8, **characterized by** an upward path along which the bobbins (9) are transported upwardly, and a downward path along which the bobbins (9) are transported downwardly, wherein
 - the bobbin picking-up section(23) is arranged on the upward path, and
 - the bunch removing section(72) and the mounting section(73) are arranged on the downward path.
 10. The bobbin delivering device(12) according to Claim 9, **characterized by** an orientation unifying and sup- plying section(24) that, along the downward path, detects an orientation of the bobbin (9), unifies the orientation into a predetermined orientation, and then supplies the bobbin (9) to the bunch removing section(72).
 11. A winding system (10) comprising:
 - the bobbin delivering device(12) according to any one of Claims 1 to 10;
 - a winding device that winds a yarn from the bob- bin (9) to produce a package; and
 - a bobbin preparing device(17) that transports the transporting tray (21), onto which the bobbin (9) is supplied by the supplying section(24), to the winding device, and brings the bobbin into a condition ready for the winding device to proc- ess the bobbin, **characterized in that**
 - the bobbin preparing device(17) includes a bob- bin supplying path along which the transporting tray (21), onto which the bobbin (9) is supplied, is transported from the bobbin delivering device (12) to the winding device, and a yarn end guid- ing-out device (18) that unwinds from a surface of the bobbin (9) a yarn end of a winding end side (9p) of the bobbin (9) that has been wound and inserts the yarn end into a winding tube (9t) of the bobbin (9) is arranged on the bobbin sup- plying path (20).
 12. The winding system according to Claim 11, **charac- terized in that** the bobbin preparing device(17) in- cludes a second bunch removing section(74) that performs a removing process onto the bottom bunch (9a) of the bobbin (9).

FIG.1

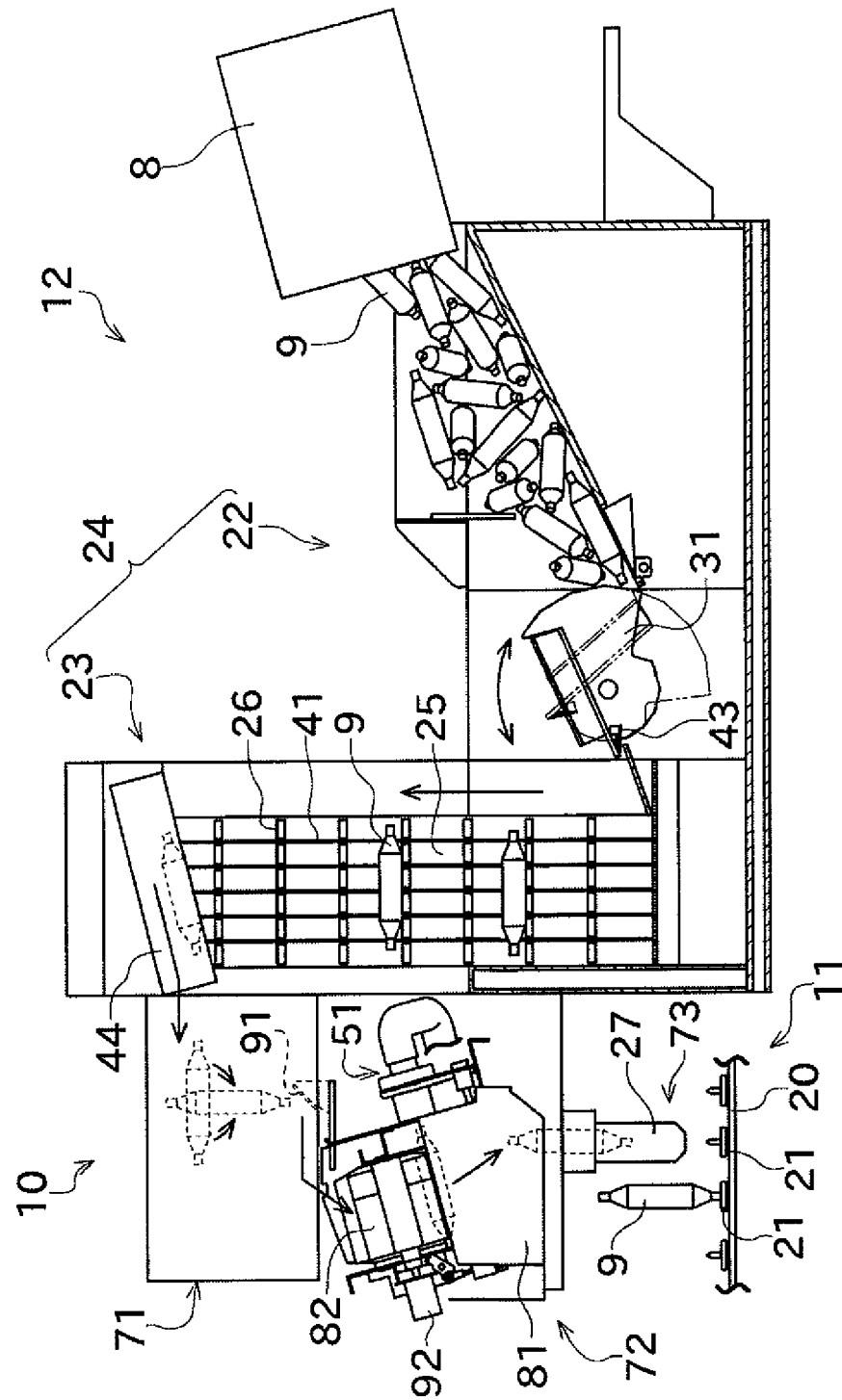


FIG.2

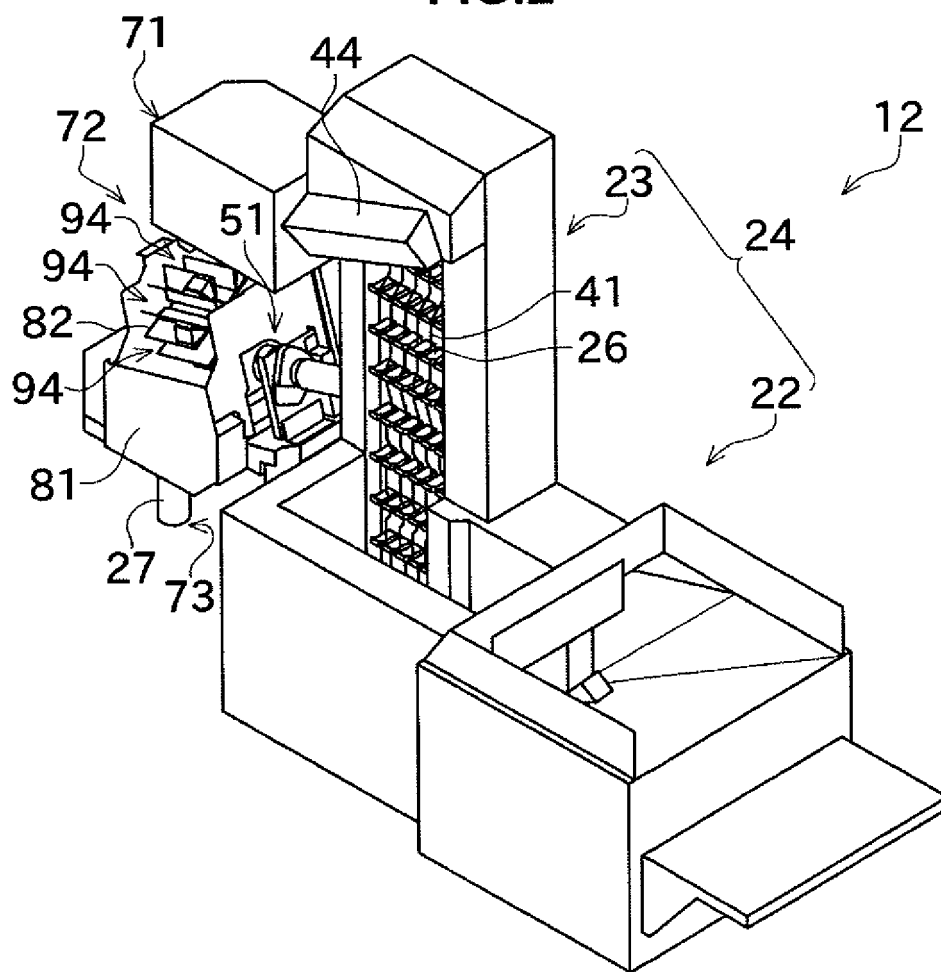


FIG.3

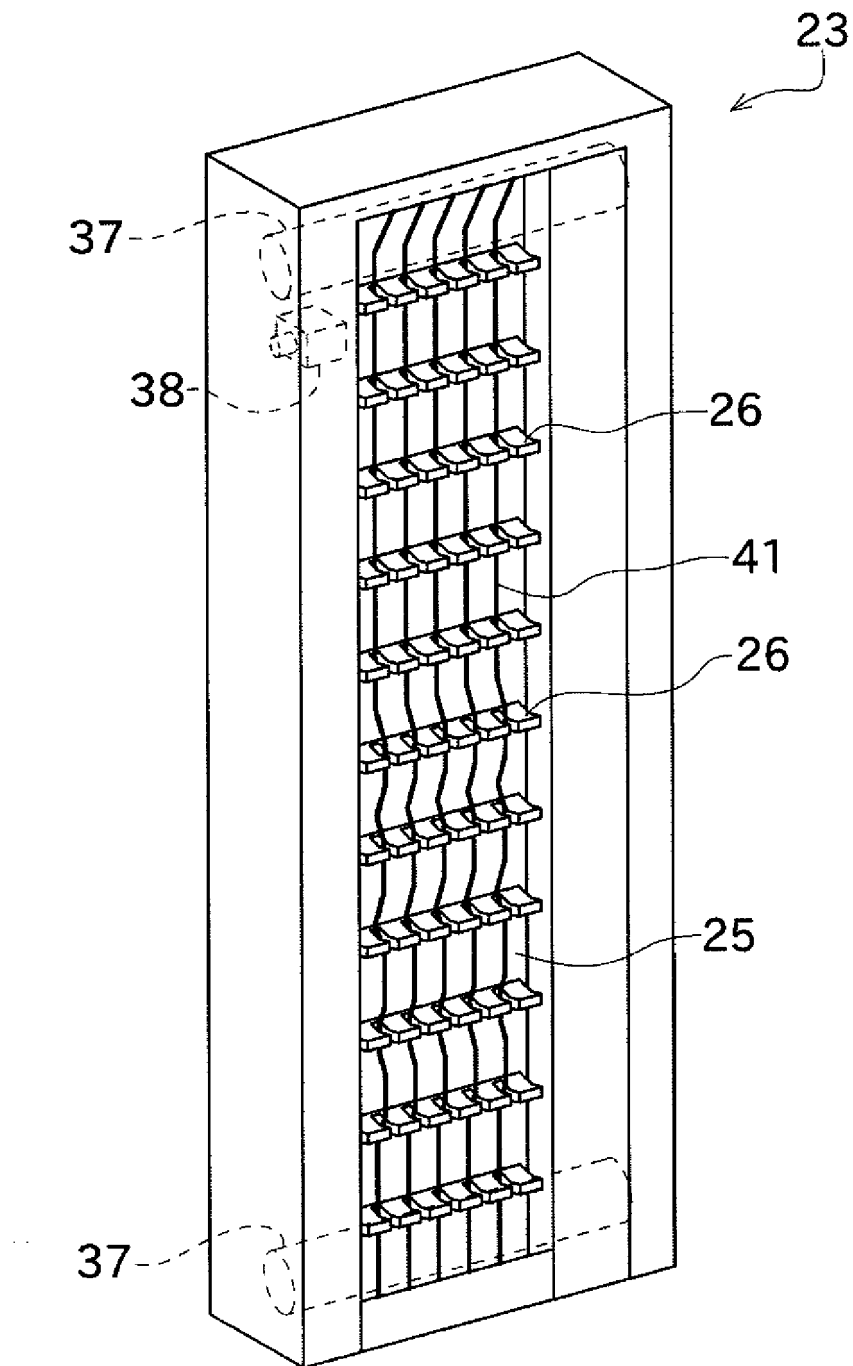


FIG.4

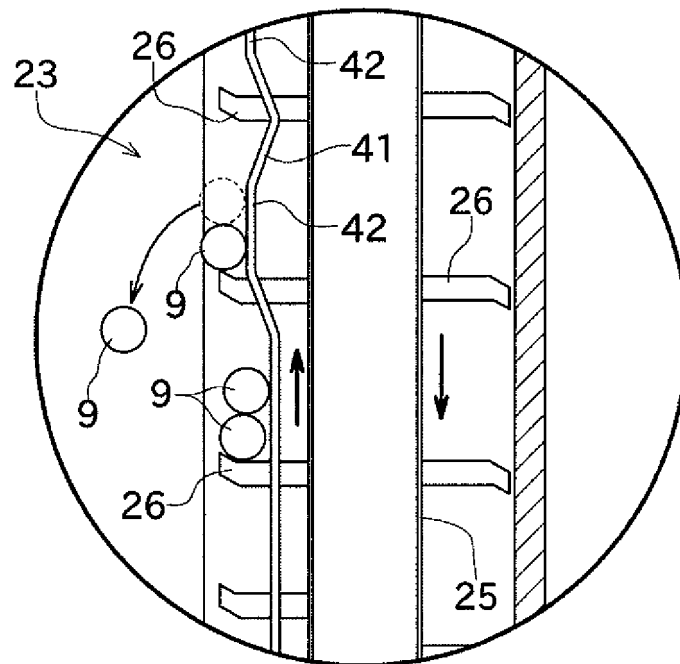


FIG.5

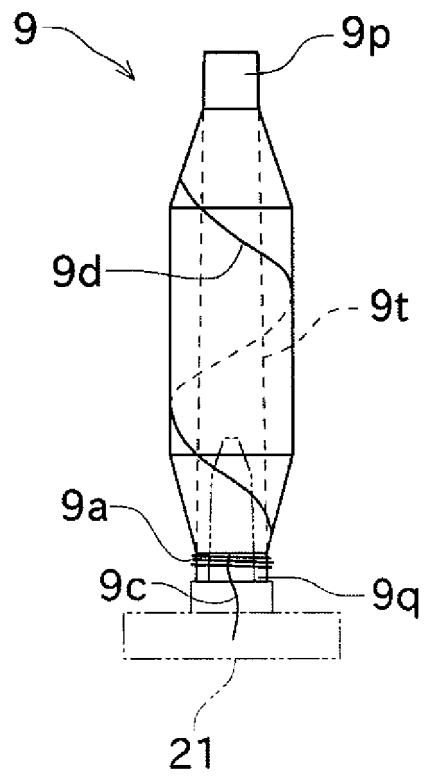


FIG.6

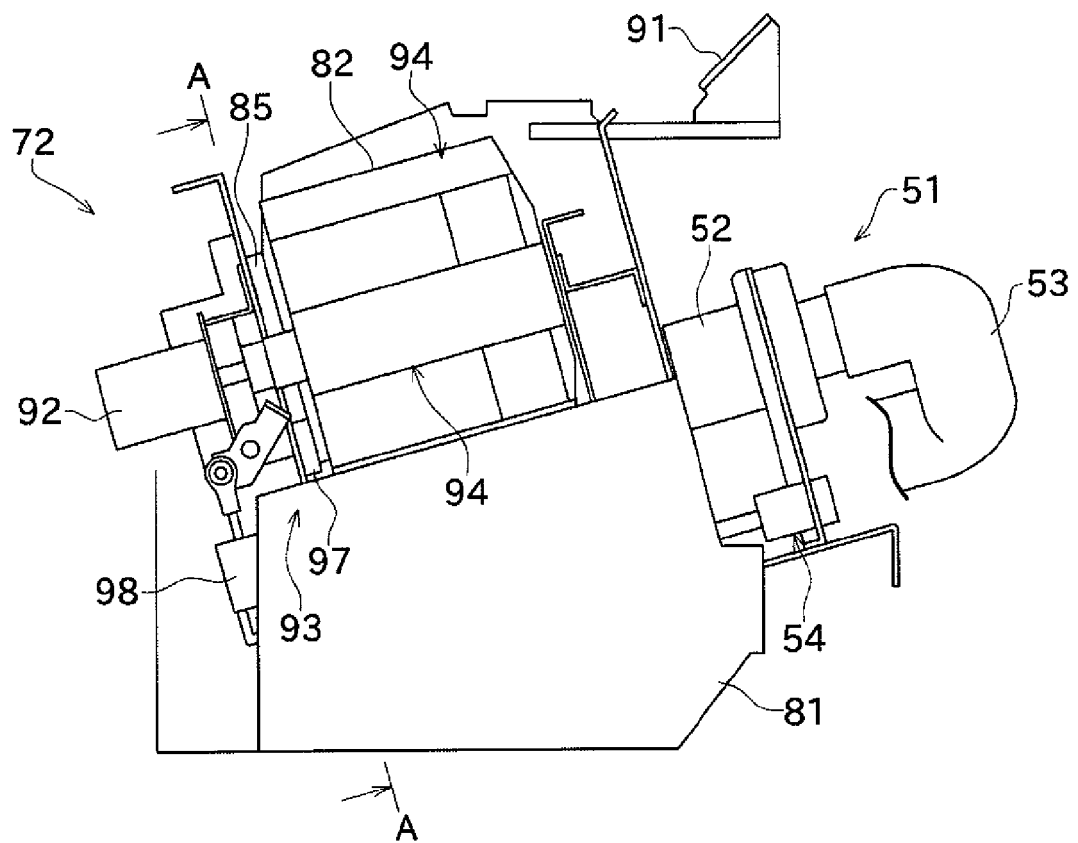


FIG.7

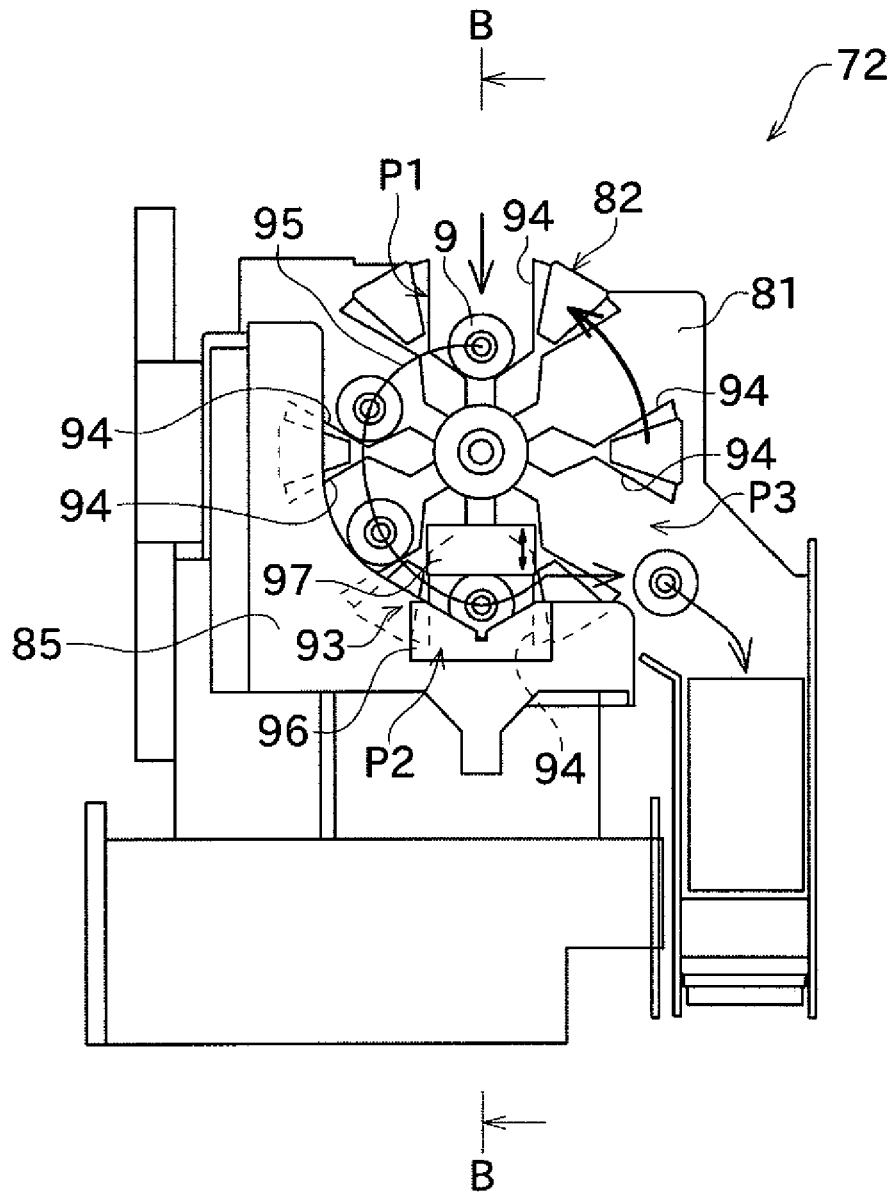


FIG.8

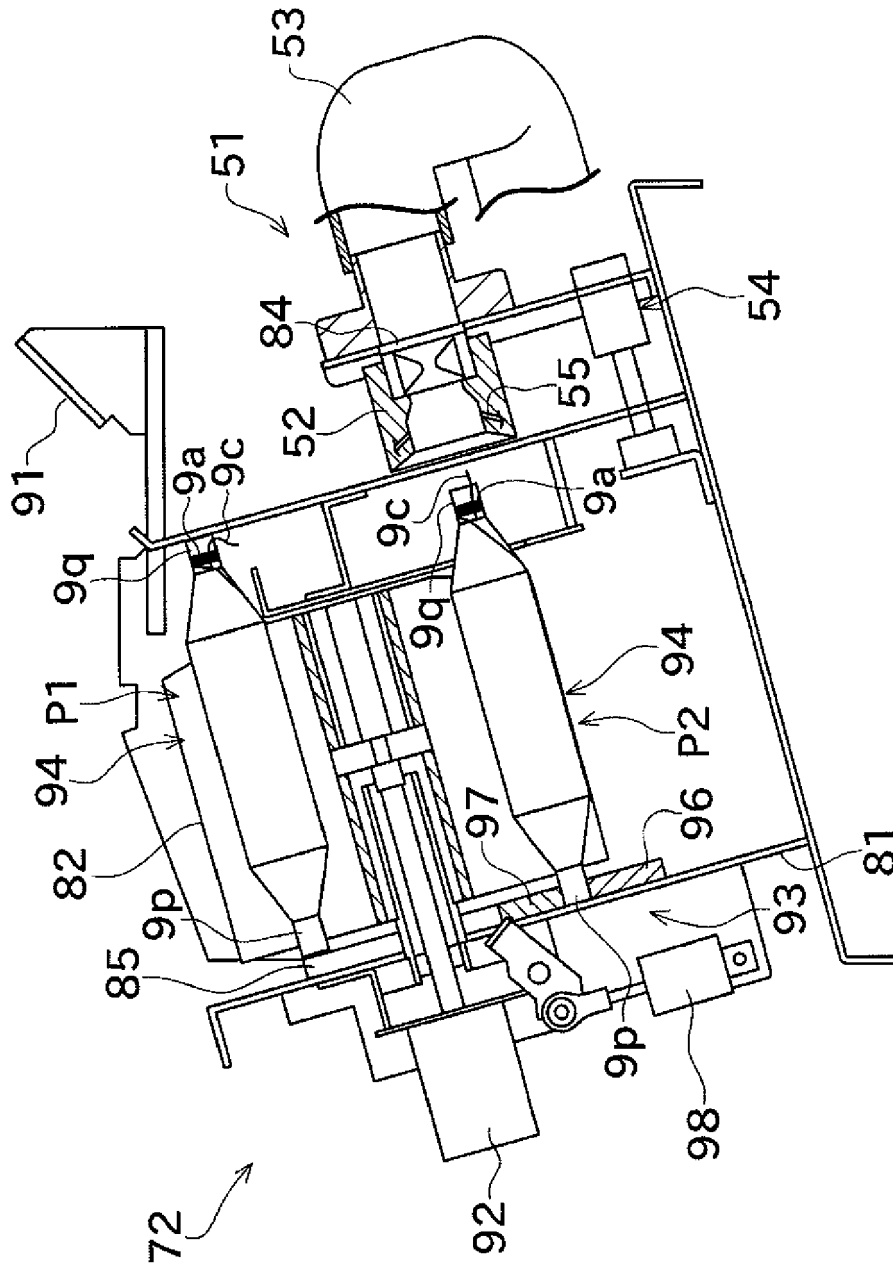


FIG.9

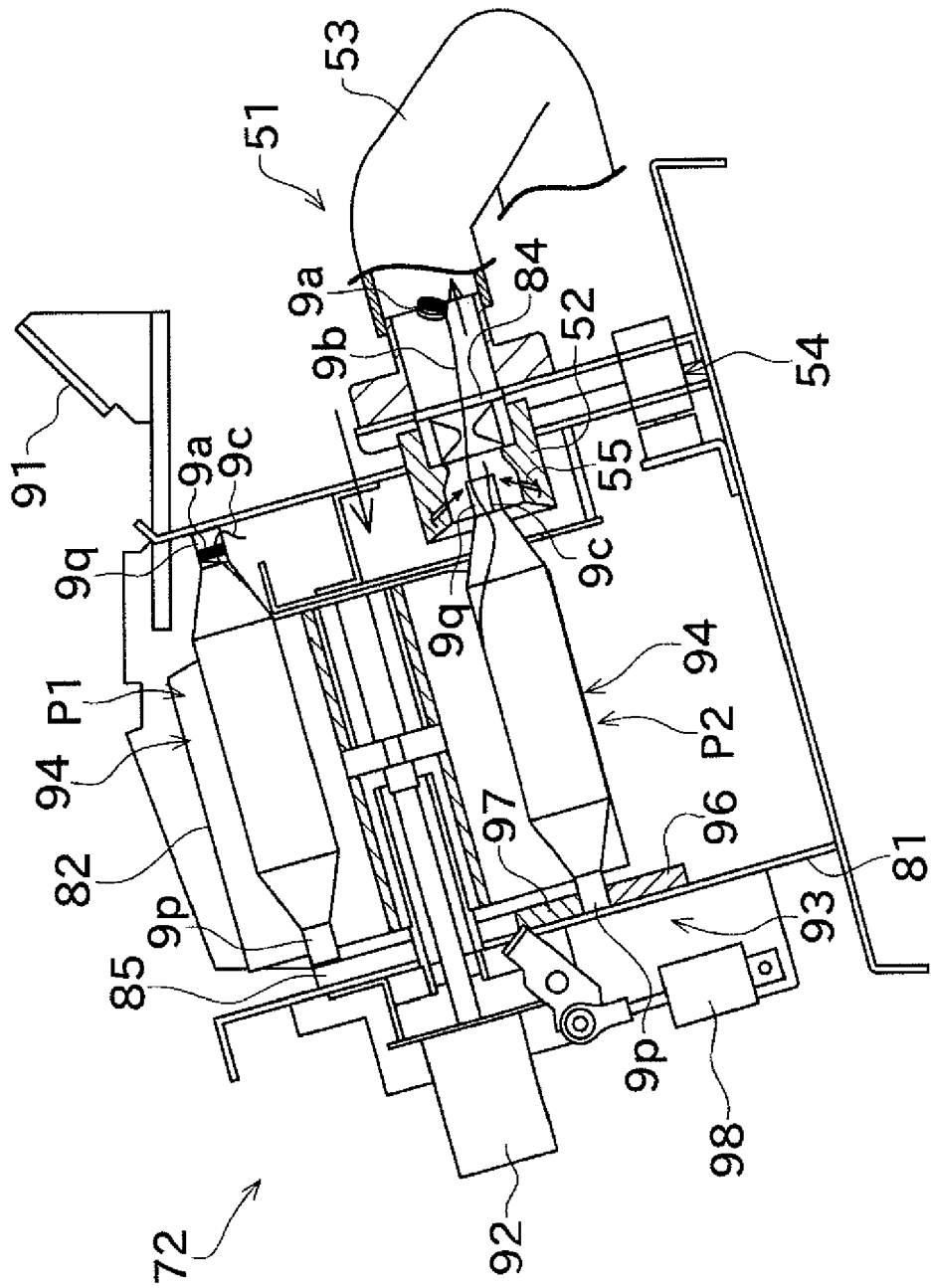


FIG.10

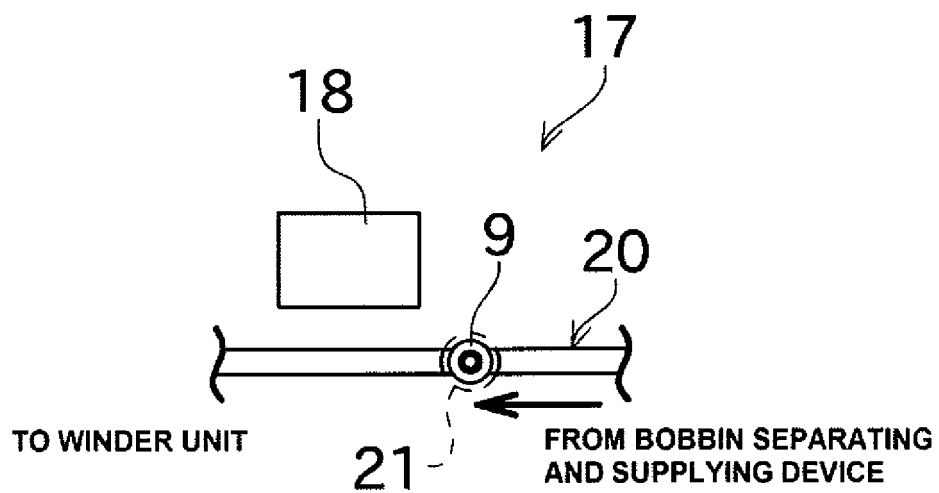
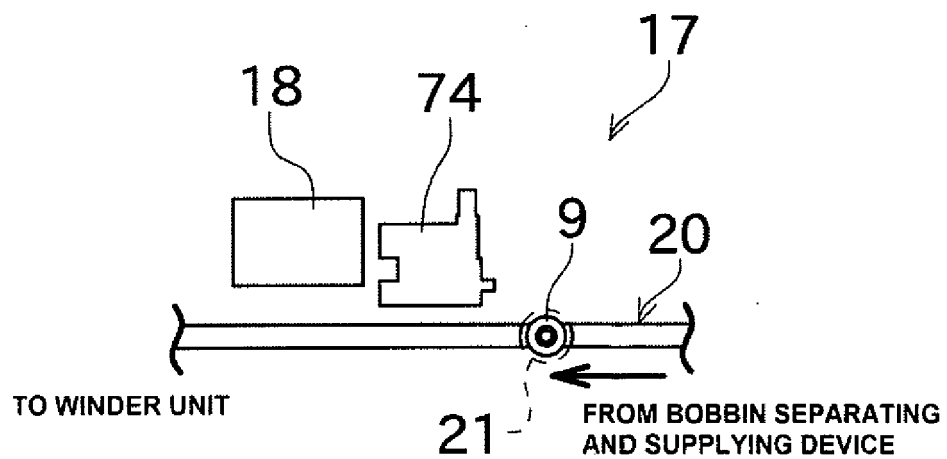


FIG.11



REFERENCES CITED IN THE DESCRIPTION

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