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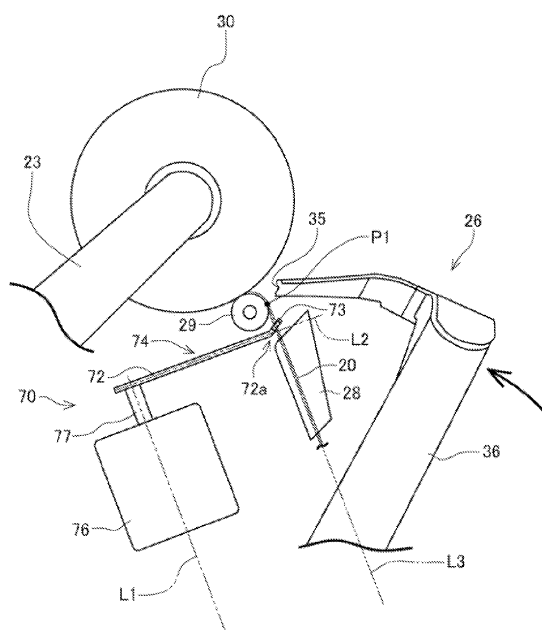
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(54) **Yarn winding device**

(57) An automatic winder includes a cradle (23) that rotatably supports a winding bobbin, a contact roller (29) that rotates while making contact with a package (30), a traverse arm (74), and a traverse driving motor (76) that rotationally drives the traverse arm (74). A yarn guide section (73) is arranged at a tip end of the traverse arm (74) in order to guide yarn, and the yarn guide section (73) traverses the yarn. The yarn guide section (73) includes a terminal section and an opened section. The terminal section regulates the yarn on the tip end of the yarn guide section (73). The opened section is formed facing towards a base end of the traverse arm (74) so as to guide the yarn to the terminal section. When viewed from an axial direction of the contact roller (29), a rotational axis line (L1) of the traverse arm (74) and a yarn path line (L3), which is formed by extending a yarn path near the yarn guide section (73) at a traverse end, intersect while forming an acute angle or are parallel to one another.

FIG. 3



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding machine that winds yarn around a winding tube while traversing the yarn.

2. Description of the Related Art

[0002] Conventionally, there is known a yarn winding machine including a yarn traverse device that traverses yarn. For example, Japanese Unexamined Patent Publication No. 2006-298499 or Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2002-518276 disclose a yarn traverse device including a yarn guide that guides the yarn while engaging the yarn, a traverse arm on which the yarn guide is attached to a tip end thereof, and a driving device that reciprocates the traverse arm. The driving device reciprocates (swings) the traverse arm, which allows the yarn to be wound into a package while being traversed by the yarn guide.

[0003] There is also known a yarn winding machine including a yarn joining device and a yarn guiding member for guiding the yarn to the yarn joining device. The yarn joining device connects a yarn end from a yarn supplying bobbin and a yarn end from a package when the yarn is cut due to detection of a yarn defect or when the yarn breaks while being unwound.

[0004] In the configuration of Japanese Unexamined Patent Publication No. 2006-298499, because a yarn guide is located downward (upstream in a yarn path) when approaching close to a traverse end, the yarn is pulled in a downward direction of the yarn winding machine (a direction opposite to a winding direction of the package). In this case, a yarn path is bent at traverse ends and near the traverse ends to increase a winding tension. Therefore, hardness of the package may be increased, and stitching may be generated, to degrade package quality.

[0005] On the other hand, the configuration of Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2002-518276 has a finger shape in which a tip end of a guide slit (yarn guide section) is opened. Therefore, when a pointer (traverse arm) is reciprocated in an arc shape, the yarn may be released from the guide slit at turns of the pointer. The yarn may be disengaged from the guide slit not only at turns of the pointer but also due to a vibration generated during the traverse operation of the yarn.

[0006] Moreover, in the configuration of Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2002-518276, the yarn is easily disengaged from the opened tip end in catching the yarn at the beginning of the winding. Therefore, the traverse

operation may not be promptly started. In order to guide the yarn to the guide slit, it is necessary to move the pointer to a specific position with respect to the guide plate. Thus, in the configuration of Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2002-518276, because the traverse operation cannot be promptly started, there is a demand for improvement from the viewpoint of productivity of the yarn winding machine.

SUMMARY OF THE INVENTION

[0007] An object of the present invention is to provide a yarn winding machine in which quality degradation can be prevented in end portions of a package while yarn can quickly be guided to a yarn guide section. This object is achieved by a yarn winding machine according to claim 1 and claim 9.

[0008] According to a first aspect of the present invention, a yarn winding machine includes a winding tube supporting section, a contact roller, a traverse arm, and a traverse driving section. The winding tube supporting section is adapted to rotatably support a winding tube around which the yarn is wound to form the package. The contact roller rotates while making contact with the winding tube or the package. The traverse arm traverses the yarn. A yarn guide section for guiding the yarn is arranged at a tip end of the traverse arm. The traverse driving section is adapted to rotationally drive the traverse arm. The yarn guide section includes a regulating section that regulates the yarn at a tip end of the yarn guide section and a guide opening that is formed facing towards a base end of the traverse arm so as to guide the yarn to the regulating section. When viewed from an axial direction of the contact roller, a rotational axis line of the traverse arm and a yarn path line, which is formed by extending a yarn path near the yarn guide section at a traverse end, intersect while forming an acute angle or are parallel to one another.

[0009] Therefore, an angle formed by the rotational axis line of the traverse arm and the yarn path line is small or the rotational axis line and the yarn path line are parallel to one another. Accordingly, even if the traverse arm swings to the traverse end, the yarn guide section hardly moves in the direction along the yarn path. Particularly, at the traverse end, the yarn bending caused by the yarn guide section can be reduced to prevent the degradation of the package quality. Since the regulating section is formed in the yarn guide section, the yarn can be prevented from being disengaged from the yarn guide section even if the yarn is pulled by a vibration or an inertial force during the traverse. Moreover, since the yarn is easily guided to the yarn guide section at the beginning of the traverse operation of the traverse arm, the traverse of the yarn can promptly be started by the traverse arm and productivity of the yarn winding machine can be improved.

[0010] In the above yarn winding machine, a slope

adapted to guide the yarn to the guide opening is preferably formed in the yarn guide section. Therefore, the yarn is reliably and quickly guided to the yarn guide section, and the productivity of the yarn winding machine can be improved.

[0011] In the above yarn winding machine, the rotational axis line and the yarn path line are preferably substantially parallel to one another. Therefore, bending of the yarn at the traverse ends caused by the yarn guide section can be suppressed to minimum level, and a high-quality package can be formed.

[0012] In the above yarn winding machine, when viewed from the axial direction of the contact roller, a position of the yarn guide section at the traverse ends is located more downstream in the yarn path than an intersecting point formed by a perpendicular line, which is drawn from a base end portion of the traverse arm to the yarn path line, and the yarn path line. Therefore, the yarn guide section is brought close to a contact line of the package and the contact roller by setting the traverse arm to an appropriate length, and a free length and a print length can be shortened. As a result, a behavior of the yarn wound into the package can be stabilized to improve the package quality. As used herein, the "free length" means a distance between the yarn guide section and a point where the yarn makes contact with a surface of the contact roller. That is, the yarn corresponding to the free length is not regulated by the contact roller or the like. When the free length is lengthened, the behavior of the yarn traversed at high speed by the yarn guide section becomes unstable and is hardly wound into a satisfactory package. The yarn that is wound into the package while being traversed by the yarn guide section is wound after being once brought into contact with (printed on) the contact roller. The "print length" means a length of a portion in which the yarn wound into the package is in contact with the contact roller.

[0013] In the above yarn winding machine, provided that a perpendicular surface is a surface near the yarn supplying section that is perpendicular to a straight line drawn in a direction in which the yarn is unwound from the yarn supplying section, the traverse arm is supported by the traverse driving section such that a longitudinal direction of the traverse arm is parallel to the perpendicular surface. Therefore, when the layout of the present invention (the angle formed by the rotational axis line of the traverse arm and the yarn path line is small or the rotational axis line and the yarn path line are parallel to one another) is adopted, and when the traverse arm is perpendicular to the rotational axis line, a layout can be implemented in which the yarn from the yarn supplying section to the package is not bent so much.

[0014] In the above yarn winding machine, provided that a perpendicular surface is a surface near the yarn supplying section that is perpendicular to a straight line drawn in a direction in which the yarn is unwound from the yarn supplying section, the traverse arm is supported by the traverse driving section such that the yarn guide

section is located farther away from the perpendicular surface than the base end portion of the traverse arm. Accordingly, when a yarn traveling pathway from the yarn supplying section to the package is formed in a substantially straight line, the traverse arm is arranged such that the yarn guide section comes close to the contact line of the package and the contact roller. As a result, the free length and the print length can be shortened. Accordingly, the behavior of the yarn wound into the package can be stabilized, and the package quality can be improved.

[0015] In the above yarn winding machine, the traverse arm preferably has a bent portion that is bent in a direction towards the contact roller. Therefore, by setting the traverse arm located on the tip end side than the bent portion to an appropriate length, the yarn guide section is brought close to the contact line of the package and the contact roller. Accordingly, the free length and the print length can be shortened. As a result, the behavior of the yarn wound into the package can be stabilized, and the package quality can be improved.

[0016] The above yarn winding machine preferably includes a rotational driving section adapted to directly drive and rotate the winding tube. Accordingly, a diameter of the contact roller can be reduced compared with the configuration in which the package is driven. Therefore, since the free length and the print length are shortened, the behavior of the wound yarn can be stabilized and the package quality can be improved.

[0017] The above yarn winding machine includes the yarn supplying section, a yarn joining device, and a yarn guiding member. The yarn supplying section is adapted to supply the yarn wound into the package. The yarn joining device connects a yarn end from the package and a yarn end from the yarn supplying section. The yarn guiding member is adapted to catch the yarn end from the package and can guide the yarn end by the suction opening portion. The traverse arm is supported by the traverse driving section such that at a position where the suction opening portion sucks and catches the yarn end from the package, the yarn guide section is located more upstream in the yarn path than the suction opening portion.

[0018] Therefore, the yarn guide section and the yarn guiding member can reliably be prevented from being damaged due to the contact between the traverse arm and the yarn guiding member. When sucking the yarn end of the yarn from the package by the suction opening portion due to yarn breakage or the like, the yarn guiding member sucks, catches, and guides the yarn end from the package. At this time, it is not necessary to move the traverse arm to a special retreat position, so that the suspended winding operation of the yarn can quickly be resumed.

[0019] According to a second aspect of the present invention, a yarn winding machine includes a yarn supplying section, a winding tube supporting section, a contact roller, a traverse arm, and a traverse fulcrum. The yarn supplying section supplies yarn to be wound into a

package. The winding tube supporting section rotatably supports a winding tube around which the yarn is wound to form the package. The contact roller rotates while making contact with the winding tube or the package. The traverse arm traverses the yarn. A yarn guide section for guiding the yarn is arranged at a tip end of the traverse arm. The traverse fulcrum is a traverse fulcrum of the yarn that is wound into the package. The yarn guide section includes a regulating section that regulates the yarn at a tip end of the yarn guide section, and a guide opening that is formed facing towards a base end of the traverse arm so as to guide the yarn to the regulating section. When viewed from an axial direction of the contact roller, at least at an edge of the package, a line along a longitudinal direction of the traverse arm is substantially perpendicular to a straight line that connects a most upstream position of the yarn on the contact roller and the traverse fulcrum.

[0020] Accordingly, even at a traverse stroke end of the traverse arm, the yarn wound into the package can be prevented from being greatly bent by the yarn guide section. Therefore, the yarn can be wound into the package with little damage while being prevented from being disengaged from the yarn guide section.

[0021] The above yarn winding machine further includes a traverse driving section. The traverse driving section supports a rotational shaft of the traverse arm and rotationally drives the traverse arm. The traverse arm is supported by the traverse driving section such that the yarn guide section is located in proximity of a position where the yarn first contacts with the contact roller. Therefore, the free length and the print length are shortened, and the behavior of the yarn wound into the package can be stabilized. As a result, the package quality can be improved while preventing stitching and/or a wrinkle from being generated.

[0022] In the above yarn winding machine, the traverse arm preferably includes a bent portion that is bent in a direction towards the contact roller. Therefore, the free length and the print length are further shortened, and the behavior of the yarn wound into the package can further be stabilized. As a result, the package quality can be improved while preventing stitching and/or wrinkle from being generated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

FIG. 1 is a schematic diagram of an automatic winder according to an embodiment of the present invention;
 FIG. 2 is a schematic diagram and a block diagram illustrating a schematic configuration of a winder unit;
 FIG. 3 is an enlarged side view in proximity of a traverse device;
 FIG. 4 is a front view describing a shape of a yarn guide section;

FIG. 5 is an enlarged side view in proximity of a traverse device according to a first modification; and
 FIG. 6 is an enlarged side view in proximity of a traverse device according to a second modification.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0024] An embodiment of the present invention will be described below. First, an entire configuration of an automatic winder (yarn winding machine) 1 according to the present embodiment will be described with reference to FIG. 1. Herein, "upstream" and "downstream" respectively mean upstream and downstream in a traveling direction of yarn during winding.

[0025] As illustrated in FIG. 1, the automatic winder (yarn winding machine) 1 mainly includes a plurality of winder units 10 arranged in a line, an automatic doffing device 60, and a machine setting device 90.

[0026] Each of the winder units 10 winds yarn 20 unwound from a yarn supplying bobbin 21 while traversing the yarn 20, thereby forming a package 30.

[0027] When the package 30 is fully wound in each winder unit 10, the automatic doffing device 60 travels to a position of the respective winder unit 10, and the automatic doffing device 60 supplies an empty bobbin while collecting the fully wound package 30.

[0028] The machine setting device 90 mainly includes a setting section 91 and a display section 92. An operator inputs a predetermined setting value or selects an appropriate control method, which allows the setting section 91 to perform a setting to each winder unit 10. The display section 92 can display a yarn winding status of each winder unit 10 and contents of a generated trouble.

[0029] Next, a configuration of the winder unit 10 will specifically be described with reference to FIG. 2. As illustrated in FIG. 2, the winder unit 10 mainly includes a winding unit main body 16 and a unit control section 50.

[0030] For example, the unit control section 50 includes a Central Processing Unit (CPU), a Random Access Memory (RAM), a Read Only Memory (ROM), an Input-and-Output (I/O) port, and a communication port. A program for controlling various components in the winding unit main body 16 is recorded in the ROM. Various components (described in detail later) of the winding unit main body 16 and the machine setting device 90 are connected to the I/O port and the communication port such that communication of control information can be conducted. Therefore, the unit control section 50 can control an operation of various components of the winding unit main body 16.

[0031] In the winding unit main body 16, a yarn unwinding assisting device 12, a tension applying device 13, a splicer device (yarn joining device) 14, and a clearer 15 are arranged along a yarn traveling pathway between the yarn supplying bobbin 21 and a contact roller 29 in this order from the yarn supplying bobbin 21 side.

[0032] A yarn supplying section 11 is provided in a low-

er portion of the winding unit main body 16 in order to supply the yarn 20 to the winding bobbin 22. The yarn supplying section 11 retains the yarn supplying bobbin 21, which has been transported by a bobbin transportation system (not illustrated), at a predetermined position.

[0033] The yarn unwinding assisting device 12 includes a regulating member 40 which covers a core tube of the yarn supplying bobbin 21. The yarn unwinding assisting device 12 lowers the regulating member 40 in conjunction with unwinding of the yarn 20 from the yarn supplying bobbin 21, thereby assisting the unwinding of the yarn 20 from the yarn supplying bobbin 21. The regulating member 40 makes contact with a balloon of the yarn 20 formed at an upper portion of the yarn supplying bobbin 21 by a rotation and a centrifugal force of the yarn 20 unwound from the yarn supplying bobbin 21, thereby controlling the balloon to an appropriate size. Accordingly, the yarn unwinding assisting device 12 assists the unwinding of the yarn 20. A sensor (not illustrated) is provided near the regulating member 40 in order to detect a chase portion of the yarn supplying bobbin 21. When the sensor detects the lowering of the chase portion, the regulating member 40 is lowered with, for example, an air cylinder (not illustrated) according to the lowering of the chase portion.

[0034] The tension applying device 13 applies a predetermined tension to the traveling yarn 20. For example, a gate type tension applying device in which movable combs are arranged with respect to fixed combs can be used as the tension applying device 13. The movable combs can be swung by a rotary solenoid such that the movable combs are engaged or released with respect to the fixed combs. In place of the gate type tension applying device, for example, a disc type tension applying device may be used as the tension applying device 13.

[0035] The splicer device 14 connects lower yarn from the yarn supplying bobbin 21 and upper yarn from the package 30 when the yarn is cut due to detection of a yarn defect by the clearer 15, or when the yarn is broken during the unwinding of the yarn 20 from the yarn supplying bobbin 21. As the yarn joining device that connects the upper yarn and the lower yarn, a mechanical type yarn joining device or a yarn joining device that uses fluid such as compressed air can be used.

[0036] The clearer 15 includes a clearer head 49 and an analyzer 52. The clearer head 49 includes a sensor (not illustrated) in order to detect a thickness of the yarn 20. The analyzer 52 processes a yarn thickness signal from the sensor. The clearer 15 is configured to monitor the yarn thickness signal from the sensor to detect a yarn defect such as slub. A cutter 39 is provided near the clearer head 49, and the cutter 39 immediately cuts the yarn 20 when the clearer 15 detects the yarn defect.

[0037] A lower yarn catching member 25 is arranged below the splicer device 14. The lower yarn catching member 25 catches a yarn end from the yarn supplying bobbin 21 to guide the yarn end to the splicer device 14. An upper yarn catching member (yarn guiding member)

26 is arranged above the splicer device 14. The upper yarn catching member 26 catches a yarn end from the package 30 to guide the yarn end to the splicer device 14. The lower yarn catching member 25 includes a lower yarn pipe arm 33 and a lower yarn suction opening 32 formed at a tip end of the lower yarn pipe arm 33. The upper yarn catching member 26 includes an upper yarn pipe arm (suction arm) 36 and an upper yarn suction opening (suction opening portion) 35 formed at a tip end of the upper yarn pipe arm 36.

[0038] The lower yarn pipe arm 33 and the upper yarn pipe arm 36 are configured capable of swinging around shafts 34 and 37, respectively. An appropriate negative pressure source is connected to each of the lower yarn pipe arm 33 and the upper yarn pipe arm 36. Suction flows are generated in the lower yarn suction opening 32 and the upper yarn suction opening 35 to suck and catch the yarn ends of the upper yarn and lower yarn.

[0039] The winding unit main body 16 includes a cradle (winding tube supporting section) 23 and the contact roller 29. The cradle 23 detachably supports a winding bobbin (winding tube) 22. The contact roller 29 can rotate while making contact with a peripheral surface of the winding bobbin 22 or a peripheral surface of the package 30. In the winding unit main body 16, an arm type traverse device 70 is provided near the cradle 23 in order to traverse the yarn 20. The winding unit main body 16 winds the yarn 20 into the package 30 while traversing the yarn 20 by the traverse device 70. A guide plate 28 is provided slightly upstream of a traverse position to guide the upstream yarn 20 to the traverse position. A ceramic traverse fulcrum (traverse fulcrum) 27 is provided further upstream of the guide plate 28. The traverse device 70 traverses the yarn 20 in a direction indicated by an arrow of FIG. 2 with the traverse fulcrum 27 as a fulcrum.

[0040] The cradle 23 can swing around a swing shaft 48. An increase in a yarn layer diameter associated with the winding of the yarn 20 around the winding bobbin 22 is absorbed by the swinging of the cradle 23.

[0041] A package driving motor (rotational driving section) 41 is attached to the cradle 23. The package driving motor 41 rotationally drives the winding bobbin 22 to wind the yarn 20 into the package 30. A motor shaft of the package driving motor 41 is coupled so as to not be rotatable relative to the winding bobbin 22 when the winding bobbin 22 is supported by the cradle 23 (so-called a direct drive system). A package driving control section 42 controls an operation of the package driving motor 41. The package driving control section 42 receives an operation signal from the unit control section 50 to control operation and stopping of the package driving motor 41.

[0042] An angle sensor (package diameter acquiring section) 44 is attached to the swing shaft 48 in order to detect an angle (swing angle) of the cradle 23. For example, the angle sensor 44 includes a rotary encoder. The angle sensor 44 transmits an angle signal corresponding to an angle of the cradle 23 to the unit control

section 50. The angle of the cradle 23 changes as the diameter of the package 30 increases. Accordingly, by detecting the swing angle of the cradle 23 by the angle sensor 44, the package diameter (yarn layer diameter) of the package 30 can be detected. In place of the angle sensor 44, an appropriate configuration in which a Hall IC or an absolute encoder is used can be adapted as the method for detecting the package diameter as long as the configuration can detect the package diameter.

[0043] In the automatic winder 1, the yarn 20 unwound from the yarn supplying bobbin 21 travels substantially upward, and the yarn 20 is wound into the package 30. Accordingly, in the present embodiment, a surface (perpendicular surface) that is perpendicular to a straight line drawn in a direction in which the yarn 20 is drawn from the yarn supplying section 11 and that is near the yarn supplying section 11 is substantially parallel (or parallel) to an installation surface on which the automatic winder 1 is installed.

[0044] A configuration of the traverse device 70 and a layout of a configuration near the traverse device 70 will be described with reference to FIG. 3. In the present embodiment, the contact roller 29 is arranged such that an axial direction of the contact roller 29 is oriented towards a lateral direction of the winding unit main body 16. Therefore, FIG. 3 is a side view when the traverse device 70 is viewed from the axial direction of the contact roller 29.

[0045] As illustrated in FIG. 3, the traverse device 70 includes a traverse driving motor (traverse driving device) 76, an output shaft 77, and a traverse arm 74.

[0046] The traverse driving motor 76 drives the traverse arm 74. For example, the traverse driving motor 76 is a servo motor. As illustrated in FIG. 2, a traverse control section 78 controls operation of the traverse driving motor 76. Alternatively, other motors such as a step motor and a voice coil motor may be used as the traverse driving motor 76.

[0047] The traverse control section 78 is formed by hardware such as a dedicated micro processor. The traverse control section 78 receives a signal from the unit control section 50 to control operation and stopping of the traverse driving motor 76.

[0048] Power of the traverse driving motor 76 is transmitted to a base end portion of the traverse arm 74 through the output shaft 77 illustrated in FIG. 3. A rotor of the traverse driving motor 76 rotates in both directions to reciprocate the traverse arm 74 in a width direction of the package 30 (direction perpendicular to the page of FIG. 3 (horizontal direction of FIG. 2)). In FIG. 3, the traverse arm 74 is located at a traverse end portion.

[0049] A yarn guide section 73, to be described later, is formed at a tip end of the traverse arm 74. The traverse arm 74 can retain (guide) the yarn 20 by the yarn guide section 73. The yarn guide section 73 reciprocates while retaining the yarn 20, thereby traversing the yarn 20.

[0050] The bending of the yarn path generated in traversing the yarn 20 will be described below.

[0051] In FIG. 3 that is a side view of the traverse device

70, a reference numeral L1 denotes a rotational axis line of the traverse driving motor 76 (a rotational axis line of the traverse arm 74), and a reference numeral L2 denotes a virtual line straightly drawn from the base end portion of the traverse arm 74 to a longitudinal direction in a side surface of the traverse arm 74 (a center line in a side face of the traverse arm 74). Accompanying the reciprocation of the traverse arm 74, the yarn guide section 73 reciprocates while drawing an arc locus in a virtual plane perpendicular to the rotational axis line L1 of the traverse arm 74 (hereinafter the virtual plane is referred to as "swing plane"). In the present embodiment, the traverse arm 74 is arranged substantially perpendicular to the rotational axis line L1. Therefore, the virtual line L2 is perpendicular to the rotational axis line L1. Accordingly, it can be said that the traverse arm 74 reciprocates in the swing plane.

[0052] A yarn path line L3 is a straight line indicating the yarn path near the tip end of the traverse arm 74 (the yarn path from an edge of the guide plate 28 to the contact roller 29). In the present embodiment, the yarn path line L3 is parallel to the rotational axis line L1 of the traverse arm 74. In other words, the yarn path line L3 is perpendicular to the swing plane (and the virtual line L2).

[0053] Alternatively, other than the above description, the yarn path line L3 may be expressed as "a straight line that connects a point P1 and the traverse fulcrum 27, provided that the point P1 is a position located most upstream in the yarn 20 making contact with the contact roller 29". The point P1 may also be expressed as "a point indicating a position where the yarn 20 guided by the yarn guide section 73 first contacts with the contact roller 29".

[0054] Accordingly, the yarn guide section 73 reciprocates so as to draw the arc locus about the rotational axis line L1, thereby traversing the yarn 20. At this time, a force is applied to the yarn 20 only in a direction parallel to the swing plane. That is, the bending of the yarn path can be reduced because a force that pulls or relaxes the yarn 20 in the direction of the yarn path line L3 (direction along the yarn path) is not applied during the traverse. Particularly, in the present embodiment, the bending of the yarn path at the traverse ends can be minimized because the traverse arm 74 is arranged such that a yarn guide point of the yarn guide section 73 is located on the yarn path line L3 at the traverse ends. If the rotational axis line L1 is not parallel to the yarn path line L3, a force in a direction along the yarn path line L3 is also applied to the yarn 20 during the traverse in addition to the force in the direction within the swing plane. Therefore, the bending of the yarn path is increased than that of the present embodiment. In this case, a winding tension of the yarn 20 wound into the package 30 may be increased, hardness of the package 30 may be increased particularly in the end portions of the package, or stitching may be generated. As a result, the package quality is degraded.

[0055] As illustrated in FIG. 3, the traverse arm 74 in-

cludes a bent portion 72a that is bent in a direction towards the contact roller 29. Although the bent portion 72a is steeply bent (folded), the bent portion 72a may also be smoothly bent (curved).

[0056] With this configuration, the yarn guide section 73 is brought close to a contact line of the package 30 and the contact roller 29, so that the free length (a length of the yarn 20 from the traverse arm 74 to a position where the yarn 20 contacts with the contact roller 29) and the print length (a length of the yarn 20 that is in contact with the contact roller 29) can be shortened. Therefore, the behavior of the wound yarn 20 can be stabilized, and the quality of the package 30 can be improved.

[0057] It is particularly desirable that the traverse arm 74 including the bent portion 72a is used when the winder unit 10 winds the conical package 30. The reason will be described below. The peripheral speed of the cylindrical (columnar) contact roller 29 greatly differs from the peripheral speed of the conical winding bobbin 22 (package 30) from the beginning of the winding of the package 30 until yarn layer becomes thick. As a result, the winding tension is increased on the large diameter side while the winding tension is decreased on the small diameter side with respect to a central portion in the winding width direction of the package 30. Therefore, stitching or wrinkle is easily generated in the end portions of the package 30, and a defective package may be formed. On the other hand, in the present embodiment, the traverse arm 74 including the bent portion 72a traverses the yarn 20. Therefore, the bending of the yarn 20 can be reduced while the free length and the print length of the yarn 20 are shortened at the package ends (traverse ends), and the formation of the defective package as described above can be prevented.

[0058] A positional relationship between the upper yarn catching member 26 and the traverse arm 74 in catching the yarn end will be described below. FIG. 3 illustrates the position of the upper yarn catching member 26 in catching the yarn end.

[0059] As illustrated in FIG. 3, in the present embodiment, a tip end portion (yarn guide section 73) of the traverse arm 74 is arranged near the contact roller 29 (below and in front of the contact roller 29). This is for shortening the free length and the print length. By shortening the free length and the print length, the behavior of the yarn 20 is stabilized during the winding, thereby improving the quality of the package 30.

[0060] The traverse arm 74 is provided such that the yarn guide section 73 is arranged on the yarn path line L3 and such that an arm section 72 is arranged at a position where the arm section 72 is retreated from the yarn path line L3. Specifically, the yarn guide section 73 is provided on the front side of the winder unit 10, and the arm section 72 is provided on the back side of the winder unit 10. Therefore, the traverse arm 74 during the traverse and the upper yarn catching member 26 during the catching of the yarn end do not interfere with one another. As a result, collision of the traverse arm 74 with

the upper yarn catching member 26 can reliably be prevented. Therefore, the upper yarn catching member 26 can be swung to the vicinity of the package 30 immediately after the yarn breakage or the yarn cut, so that the yarn joining operation can quickly be performed to promptly resume the winding operation of the package 30.

[0061] The yarn guide section 73 of the traverse arm 74 will be described below with reference to FIG. 4. The traverse arm 74 includes the yarn guide section 73 arranged on the tip end and the arm section 72 arranged at the base end.

[0062] The yarn guide section 73 made of ceramics and aluminum or the like is formed in a hook shape, and the yarn guide section 73 is connected to the tip end of the arm section 72. As illustrated in FIG. 4, the yarn guide section 73 is formed in a shape curved onto one side. A long and thin yarn hooking groove 71 is formed on an inner circumferential side of the yarn guide section 73 in order to hook the yarn 20. The yarn hooking groove 71 is formed along the longitudinal direction of the traverse arm 74 so as to be extended straight onto the tip end while an opened section (guide opening) 71b is formed in a side portion on one side of the yarn guide section 73. A terminal section (regulating section) 71a of the yarn hooking groove 71 is closed (the tip end of the traverse arm 74 is not opened). The end portion on the opened side (the opened section 71b) of the yarn hooking groove 71 is located closer to the base end of the traverse arm 74 than the terminated end portion (the terminal section 71a).

[0063] The yarn guide section 73 traverses the yarn 20 while guiding the yarn 20, and when the yarn 20 is wound into the package 30, the yarn 20 is located in the yarn hooking groove 71. An inner wall surface of the yarn hooking groove 71 pushes the yarn 20 accompanying the reciprocation of the yarn guide section 73, whereby the yarn 20 is traversed with respect to the package 30. In the present embodiment, the opened section 71b of the yarn hooking groove 71 is oriented not towards the tip end of the traverse arm 74 but towards the base end. Therefore, the yarn 20 is not disengaged from the yarn guide section 73 even if a force towards the tip end of the traverse arm 74 is applied to the yarn 20.

[0064] Two slopes 73a and 73b are formed on a side portion of the yarn guide section 73. The slope 73a is obliquely extended towards the opened section 71b of the yarn hooking groove 71 from the curved tip end portion of the yarn guide section 73. The slope 73b is obliquely extended towards the vicinity of the opened section 71b from the base end portion of the yarn guide section 73 (portion connected to the arm section 72). Accordingly, under the state in which the yarn 20 has been disengaged from the traverse arm 74 at the beginning of the winding of the package 30 and immediately after the yarn joining operation, by swinging the traverse arm 74 to the side (the left of FIG. 4) where the slopes 73a and 73b are formed, the yarn 20 makes contact with the

slopes 73a and 73b and the yarn 20 can be guided into the yarn hooking groove 71 from the opened section 71b by guide action of the slopes 73a and 73b.

[0065] As described above, the automatic winder 1 of the present embodiment includes the cradle 23, the contact roller 29, the traverse arm 74, and the traverse driving motor 76. The cradle 23 rotatably supports the winding bobbin 22 around which the yarn 20 is wound in order to form the package 30. The contact roller 29 rotates while making contact with the winding bobbin 22 or the package 30. The traverse arm 74 traverses the yarn 20. The yarn guide section 73 is arranged on the tip end of the traverse arm 74 in order to guide the yarn 20. The traverse driving motor 76 rotationally drives the traverse arm 74. The yarn guide section 73 includes the terminal section 71a and the opened section 71b. The terminal section 71a regulates the yarn 20 on the tip end of the yarn guide section 73. The opened section 71b is opened to the base end of the traverse arm 74 so as to guide the yarn 20 to the terminal section 71a. When viewed from the axial direction of the contact roller 29, the rotational axis line L1 of the traverse arm 74 is parallel to the yarn path line L3 indicating the yarn path near the yarn guide section 73 at the traverse end.

[0066] Since the rotational axis line L1 and the yarn path line L3 are parallel to one another, the yarn guide section 73 hardly moves in the direction along the yarn path line L3 even if the traverse arm 74 swings to the end portion. Therefore, the bending of the yarn 20 can be suppressed to the minimum level to prevent the degradation of the quality of the package 30. Moreover, the yarn hooking groove 71 of the yarn guide section 73 is configured such that the yarn 20 enters the yarn guide section 73 from the base end of the traverse arm 74. Therefore, even if the yarn 20 is pulled by the vibration and the inertia force during the traverse, the yarn 20 can be prevented from being disengaged from the yarn guide section 73. Since the yarn 20 is easily guided to the yarn guide section 73, the suspended yarn winding operation can quickly be resumed to improve the productivity of the automatic winder 1.

[0067] In the automatic winder 1 of the present embodiment, the slopes 73a and 73b are formed in the yarn guide section 73 in order to guide the yarn 20 to the opened section 71b of the yarn hooking groove 71. Accordingly, the yarn 20 can be smoothly guided to the yarn hooking groove 71 at the start of the winding and after the yarn joining, and the productivity of the automatic winder 1 can be improved.

[0068] In the automatic winder 1 of the present embodiment, the traverse driving motor 76 (output shaft 77) supports the traverse arm 74 such that the yarn guide section 73 is located farther away from the installation surface (perpendicular surface) than the base end. Therefore, the traverse arm 74 is arranged such that the yarn guide section 73 is located close to the contact line of the package 30 and the contact roller 29, and the free length and the print length can be shortened.

[0069] In the automatic winder 1 of the present embodiment, the traverse arm 74 includes the bent portion 72a that is bent in the direction towards the contact roller 29. Therefore, the free length and the print length can be shortened. As a result, the behavior of the yarn 20 wound into the package 30 can be stabilized, and the quality of the package 30 can be improved.

[0070] The automatic winder 1 of the present embodiment includes the package driving motor 41 that directly rotates the winding bobbin 22. Accordingly, the diameter of the contact roller 29 can be reduced compared with the configuration in which the package 30 is driven. Therefore, since the free length and the print length can be shortened, the behavior of the wound yarn 20 can be stabilized and the quality of the package 30 can be improved.

[0071] The automatic winder 1 of the present embodiment includes the yarn supplying section 11, the splicer device 14, and the upper yarn catching member 26. The yarn supplying section 11 supplies the yarn 20 wound into the package 30. The splicer device 14 connects the yarn end from the package 30 and the yarn end from the yarn supplying section 11. The upper yarn catching member 26 can catch the yarn end from the package 30 by the upper yarn suction opening 35 to guide the yarn end to the splicer device 14. The traverse arm 74 is supported by the traverse driving motor 76 (output shaft 77) such that at a position where the upper yarn suction opening 35 sucks and catches the yarn end from the package, the yarn guide section 73 is located more upstream in the yarn path than the upper yarn suction opening 35.

[0072] Therefore, the yarn guide section 73 and the upper yarn suction opening 35 can be reliably prevented from making contact with one another and being broken. Additionally, it is not necessary to move the traverse arm 74 to the special retreat position when the upper yarn catching member 26 catches the yarn end. Therefore, for example, after the upper yarn catching member 26 catches the yarn end from the package 30, and the splicer device 14 performs an appropriate process, the winding operation of the yarn 20 can quickly be resumed. In case of the winder unit 10 of the present embodiment in which the yarn 20 is wound into the package 30 while being traversed by the traverse arm 74, since the traverse driving motor 76 swings the traverse arm 74, the width of the winding package 30 can freely be changed. Accordingly, in the winder unit 10 of the present embodiment, the package 30 can be formed while the yarn 20 is traversed to the position close to the end portions of the winding bobbin 22. Further, in the winder unit 10 of the present embodiment, the package 30 can also be formed while the yarn 20 is traversed within a narrow width in a region near the central portion in the axial direction of the winding bobbin 22. In a conventional yarn winding machine, when the winding width of the package is narrow, if the traverse arm (yarn guide section) is retreated to the position where the yarn guiding member does not interfere with the traverse arm when the yarn guiding member

catches the yarn end from the package, a distance in which the yarn guide section is retreated becomes longer than that of the case in which the yarn 20 is wound into the package whose winding width is located close to the winding bobbin ends. As a result, efficiency of the winder unit is reduced during the yarn guiding operation of the yarn guiding member. On the other hand, in the present embodiment, even if the winding width of the package 30 is narrow, the upper yarn catching member 26 can efficiently perform the yarn end catching operation.

[0073] The automatic winder 1 of the present embodiment includes the traverse fulcrum 27. The traverse fulcrum 27 is a fulcrum of the traverse of the yarn 20 wound into the package 30. When viewed from the axial direction of the contact roller 29, at least in the end portion of the package 30, it is assumed that the yarn path line L3 is the line connecting the traverse fulcrum 27 and the point P1 indicating the most upstream position of the yarn 20 on the contact roller 29, and the virtual line L2 is the line indicating the line along the longitudinal direction of the traverse arm 74. In this case, the yarn path line L3 and the virtual line L2 form a substantially right angle.

[0074] Accordingly, the large bending of the yarn 20 wound into the package 30, which is caused by the yarn guide section 73, can be reduced even at the traverse stroke ends of the traverse arm 74. As a result, the yarn 20 having little damage can be wound into the package 30 while preventing the yarn 20 from being disengaged from the yarn guide section 73.

[0075] In the automatic winder 1 of the present embodiment, the traverse arm 74 is supported by the traverse driving motor 76 with the output shaft 77 interposed therebetween such that the yarn guide section 73 is located in proximity of a position where the yarn 20 first contacts with the contact roller 29. Therefore, the free length and the print length can be shortened. As a result, because the behavior of the yarn 20 wound into the package 30 can be stabilized, the quality of the package 30 can be improved while preventing the generation of stitching or wrinkle.

[0076] A first modification of the above embodiment will be described below with reference to FIG. 5. Hereinafter, in the description of the modifications, same reference numeral is denoted to the member identical or similar to that of the above embodiment, and the description thereof is not given.

[0077] In the layout of the above embodiment, the rotational axis line L1 of the traverse arm 74 is parallel to the yarn path line L3. In a layout of the first modification, a rotational axis line L1a and a yarn path line L3a intersect at an angle θ when the yarn path line L3a is extended towards the direction away from the package 30. In this modification, a virtual line L2a that is a line drawn from the base end portion of the traverse arm 74 to the yarn guide section 73 forms not right angle but substantially right angle with the yarn path line L3a. As used herein, "substantially right angle" means an angle in a relatively wide range including not only an angle extremely close

to right angle but also an angle formed by the virtual line L2a and the yarn path line L3a of FIG. 5.

[0078] In the automatic winder 1 of the first modification, when viewed from the side (when viewed from the axial direction of the contact roller 29), an intersecting point P2 of the virtual line L2a and the yarn path line L3a (in other words, the position of the yarn guide section 73) is located more downstream in the yarn path than an intersecting point P3 of the yarn path line L3a and a perpendicular line L4a drawn from the base end portion of the traverse arm 74 to the yarn path line L3a.

[0079] Accordingly, since the yarn guide section 73 is brought close to the contact line of the package 30 and the contact roller 29 by setting the traverse arm 74 to an appropriate length, the free length and the print length can be shortened. Therefore, the behavior of the yarn 20 wound into the package 30 can be stabilized, and the quality of the package 30 can be improved.

[0080] In the first modification, the angle θ is an acute angle, and the bending of the yarn path at the traverse ends can be reduced as the angle θ decreases (as the relationship between the rotational axis line L1a and the yarn path line L3a comes close to parallelism).

[0081] A second modification of the present embodiment will be described below with reference to FIG. 6. In the above embodiment and the first modification, the virtual line L2 of the traverse arm 74 is inclined with respect to the installation surface of the winder unit 10. On the other hand, in the second modification, the traverse arm 74 is arranged such that a virtual line L2b of the traverse arm 74 is parallel to the installation surface of the winder unit 10. Alternatively, the traverse arm 74 may be arranged such that the virtual line L2b of the traverse arm 74 is substantially parallel to the installation surface of the winder unit 10.

[0082] In the above embodiment and the first modification, the yarn 20 is bent by the guide plate 28. On the other hand, the second modification implements the layout in which the yarn 20 from the yarn supplying section 11 to the traverse arm 74 is not bent so much.

[0083] When compared with the yarn guide section 73 of the above embodiment, the yarn guide section 73 of the second modification is arranged away from the contact line of the package 30 and the contact roller 29. Therefore, the layout of the above embodiment is preferably used from the viewpoint of shortening the free length and the print length.

[0084] The preferred embodiment and the modifications of the present invention have been described above. For example, the above configurations can be changed as follows.

[0085] The winder unit 10 can form packages having various shapes such as conical shape and tapered shape in addition to the cheese shaped package.

[0086] The shape of the yarn guide section 73 is not limited to shape of the above embodiment. For example, a yarn hooking groove with a long hole in which a distance from the opened section 71b to the terminal section 71a

is lengthened may be formed. In this case, the yarn can effectively be prevented from being disengaged during the traverse.

[0087] In the layout of the above embodiment, the rotational axis line L1 of the traverse arm 74 is parallel to the yarn path line L3. Alternatively, the rotational axis line L1 of the traverse arm 74 may substantially be parallel to the yarn path line L3.

[0088] In the above embodiment and the modifications, each of the winding unit main bodies 16 respectively includes the splicer device 14 and the upper yarn catching member 26. Alternatively, a yarn splicing cart or the like may be provided, and when the yarn joining is required, the yarn splicing cart may move to the corresponding winding unit main body 16 to perform the yarn joining. However, the effect of the present invention that the traverse arm 74 does not collide with the upper yarn catching member 26 even if the yarn joining operation is immediately started can be better exerted in the configuration of the above embodiment in which the yarn joining operation can be started without waiting the arrival of the yarn splicing cart.

[0089] In the above embodiment and the modifications, the package driving control section 42 and the traverse control section 78 are provided independently of the unit control section 50. Alternatively, the unit control section 50 may include at least one of the package driving control section 42 and the traverse control section 78.

[0090] In the above embodiment and the modifications, the contact roller 29 is formed in the cylindrical shape (columnar shape). However, the shape of the contact roller 29 is not limited to such a shape. For example, when the yarn 20 is wound into the conical package, the contact roller 29 may be formed in the conical shape similarly to the winding bobbin 22. Specifically, a diameter ratio of a large diameter side to a small diameter side of the contact roller may be 1.1 or more and less than 1.8. In the general winding bobbin 22 used to wind the yarn 20 into the conical package 30, the diameter ratio of the large diameter side to the small diameter side is 1.6 or 1.8. In the automatic winder 1 having the configuration in which the yarn 20 is printed on the contact roller 29 and then wound into the conical package 30, the difference in peripheral speed is generated between the package 30 and the contact roller 29, which sometimes causes the yarn 20 to slip on the contact roller 29. Therefore, by setting the diameter ratio of the large diameter side to the small diameter side in the contact roller 29, as compared to the configuration in which the contact roller 29 is formed in the cylindrical shape, the difference in peripheral speed generated between the contact roller 29 and the package 30 is reduced, and the slip of the yarn 20 printed on the contact roller 29 can be reduced. Accordingly, stitching that is likely to be generated in winding the yarn 20 into the conical package 30 can be prevented on the large diameter side, and high-quality package 30 can be formed.

[0091] In the above embodiment and the modifica-

tions, the package driving motor 41 drives the package 30. Instead, the contact roller 29 may be driven by an appropriate driving device, and the package 30 may be driven by the contact roller 29.

[0092] In the above embodiment and the modifications, the bobbin transportation system supplies the yarn supplying bobbin 21 to the yarn supplying section 11. Alternatively, a magazine type supplying system provided in the winding unit main body 16 may supply the yarn supplying bobbin 21 to the yarn supplying section 11.

[0093] The above embodiment and the modifications are not limited to the automatic winder, and the present invention can widely be applied to a yarn winding machine such as a rewinding machine and a fine spinning machine (e.g., an air spinning machine and an open-end spinning machine). The present invention can also be applied to an automatic winder including a yarn accumulating device.

Claims

1. A yarn winding machine comprising:

- a winding tube supporting section (23) adapted to rotatably support a winding tube around which the yarn is wound to form a package;
 - a contact roller (29) that rotates while making contact with the winding tube or the package;
 - a traverse arm (74) arranged to traverse the yarn, the traverse arm (74) having a yarn guide section (73) for guiding the yarn, the yarn guide section (73) being arranged at a tip end of the traverse arm (74); and
 - a traverse driving section (76) adapted to rotationally drive the traverse arm (74);
- wherein the yarn guide section (73) includes:

- a regulating section (71a) provided at a tip end of the yarn guide section (73) to regulate the yarn,
 - a guide opening (71b) formed facing towards a base end of the traverse arm (74) so as to guide the yarn to the regulating section (71a), and
 - a slope (73a) adapted to guide the yarn to the guide opening (71b),
- wherein when viewed from an axial direction of the contact roller (29), a rotational axis line (L1) of the traverse arm (74) and a yarn path line (L3), which is formed by extending a yarn path near the yarn guide section (73) at a traverse end, intersect while forming an acute angle or are parallel to one another.

2. The yarn winding machine according to claim 1, wherein the rotational axis line (L1) and the yarn path

line (L3) are substantially parallel.

3. The yarn winding machine according to claim 1, wherein when viewed from the axial direction of the contact roller (29), a position of the yarn guide section (73) at the traverse end is located more downstream in the yarn path than an intersecting point (P2) formed by a perpendicular line (L2), which is drawn from a base end portion of the traverse arm (74) to the yarn path line (L3), and the yarn path line (L3). 5
4. The yarn winding machine according to claim 1, further comprising a yarn supplying section (11) adapted to supply yarn to be wound into the package; wherein provided that a perpendicular surface is a surface near the yarn supplying section (11) that is perpendicular to a straight line drawn in a direction in which the yarn is unwound from the yarn supplying section (11), the traverse arm (74) is supported by the traverse driving section (76) such that a longitudinal direction of the traverse arm (74) is parallel to the perpendicular surface. 15
5. The yarn winding machine according to claim 1, further comprising a yarn supplying section (11) adapted to supply yarn to be wound into the package; wherein provided that a perpendicular surface is a surface near the yarn supplying section (11) that is perpendicular to a straight line drawn in a direction in which the yarn is unwound from the yarn supplying section (11), the traverse arm (74) is supported by the traverse driving section (76) such that the yarn guide section (73) is located farther away from the perpendicular surface than a base end portion of the traverse arm (74). 20
6. The yarn winding machine according to any one of claim 1 through claim 5, wherein the traverse arm (74) has a bent portion (72a) that is bent in a direction towards the contact roller (29). 25
7. The yarn winding machine according to any one of claim 1 through claim 6, further comprising a rotational driving section (41) adapted to directly drive and rotate the winding tube. 30
8. The yarn winding machine according to any one of claim 1 through claim 5, further comprising: 35
 - a yarn supplying section (11) adapted to supply yarn to be wound into the package;
 - a yarn joining device (14) that connects a yarn end from the package and a yarn end from the yarn supplying section (11); and
 - a yarn guiding member (26) adapted to catch the yarn end from the package and guide such

yarn end,

wherein the traverse arm (74) is supported by the traverse driving section (76) such that at a position where the suction opening portion (35) sucks and catches the yarn end from the package, the yarn guide section (73) is located more upstream in the yarn path than the suction opening portion (35).

9. A yarn winding machine comprising: 10

- a yarn supplying section (11) adapted to supply yarn to be wound into a package;
- a winding tube supporting section (23) adapted to rotatably support a winding tube around which the yarn is wound to form the package;
- a contact roller (29) that rotates while making contact with the winding tube or the package;
- a traverse arm (74) arranged to traverse the yarn, the traverse arm (74) having a yarn guide section (73) for guiding the yarn, the yarn guide section (73) being arranged at a tip end of the traverse arm (74); and
- a traverse fulcrum (27) of the yarn to be wound into the package,

wherein the yarn guide section (73) includes:

- a regulating section (71a) provided at a tip end of the yarn guide section (73) to regulate the yarn,
- a guide opening (71b) formed facing towards a base end of the traverse arm (74) so as to guide the yarn to the regulating section (71a), and
- a slope (73a) adapted to guide the yarn to the guide opening (71b),

wherein when viewed from an axial direction of the contact roller (29), at least at an edge of the package, a line (L2) along a longitudinal direction of the traverse arm (74) is substantially perpendicular to a straight line (L3) that connects a most upstream position of the yarn on the contact roller (29) and the traverse fulcrum (27). 35

10. The yarn winding machine according to claim 9, further comprising a traverse driving section (76) adapted to support a rotational shaft (77) of the traverse arm (72) and rotationally drive the traverse arm (74); the traverse arm (72) being supported by the traverse driving section (76) such that the traverse guide section (73) is located in proximity of a position where the yarn first contacts with the contact roller (29). 40
11. The yarn winding machine according to claim 9 or claim 10, wherein the traverse arm (72) has a bent portion (72a) that is bent in a direction towards the 45

contact roller (29).

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FIG. 1

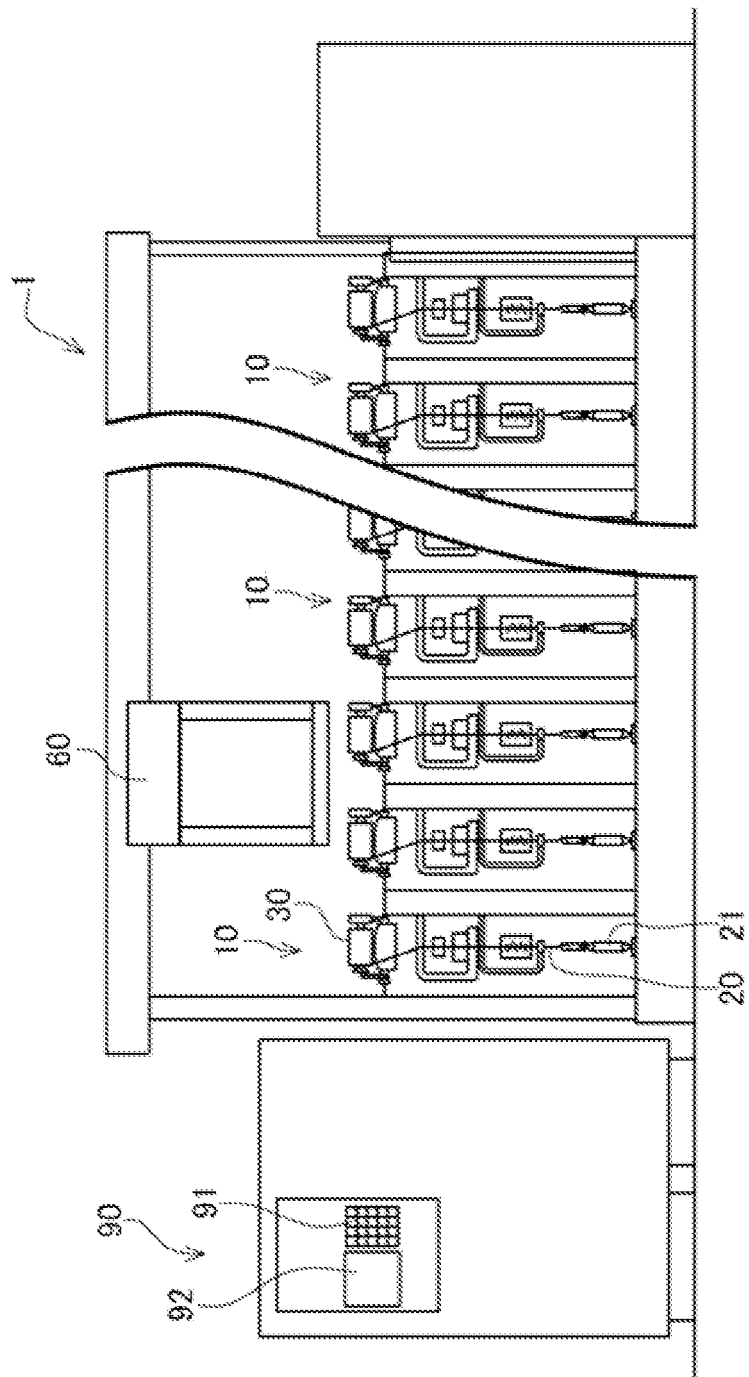


FIG. 2

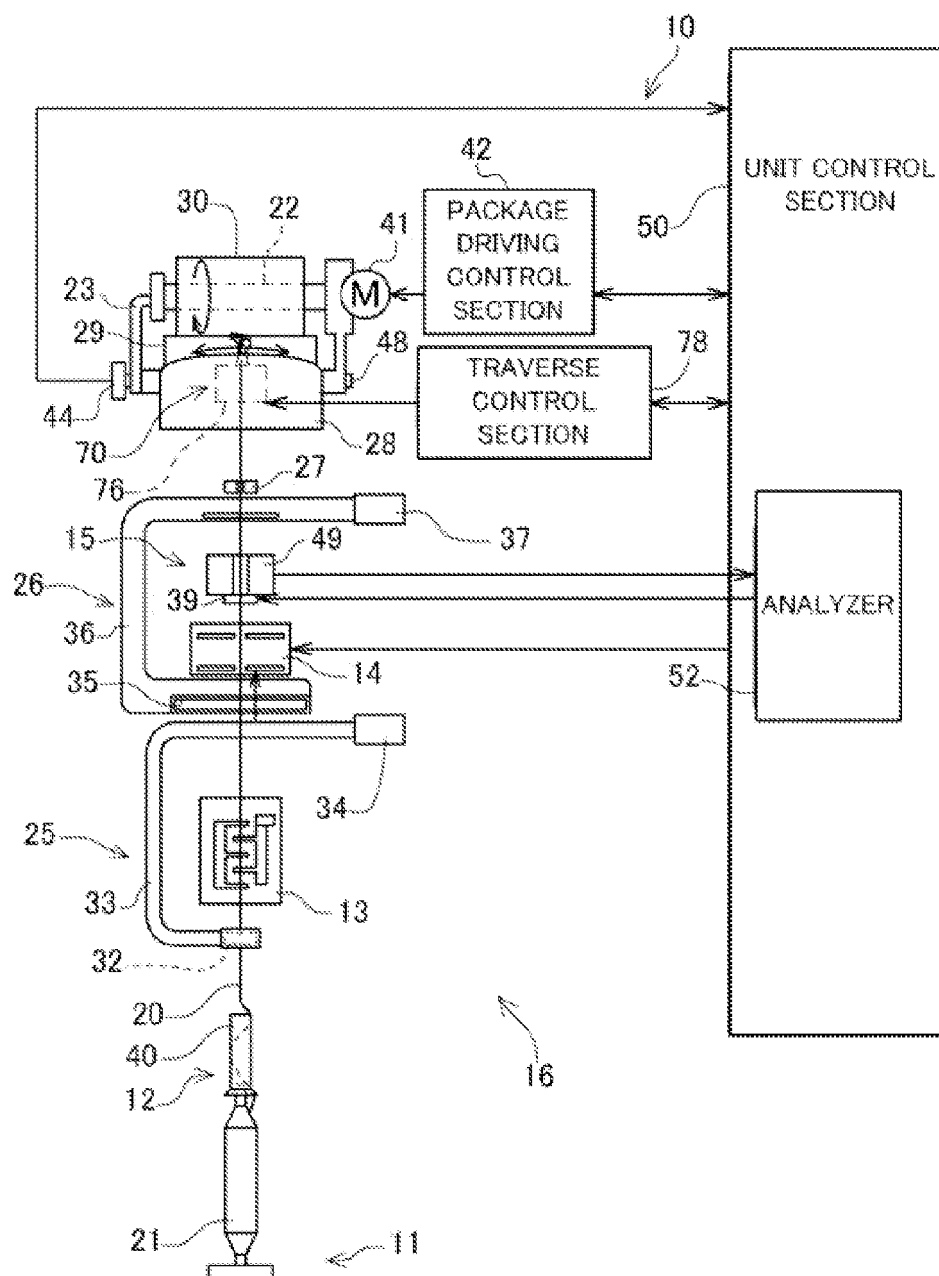


FIG. 3

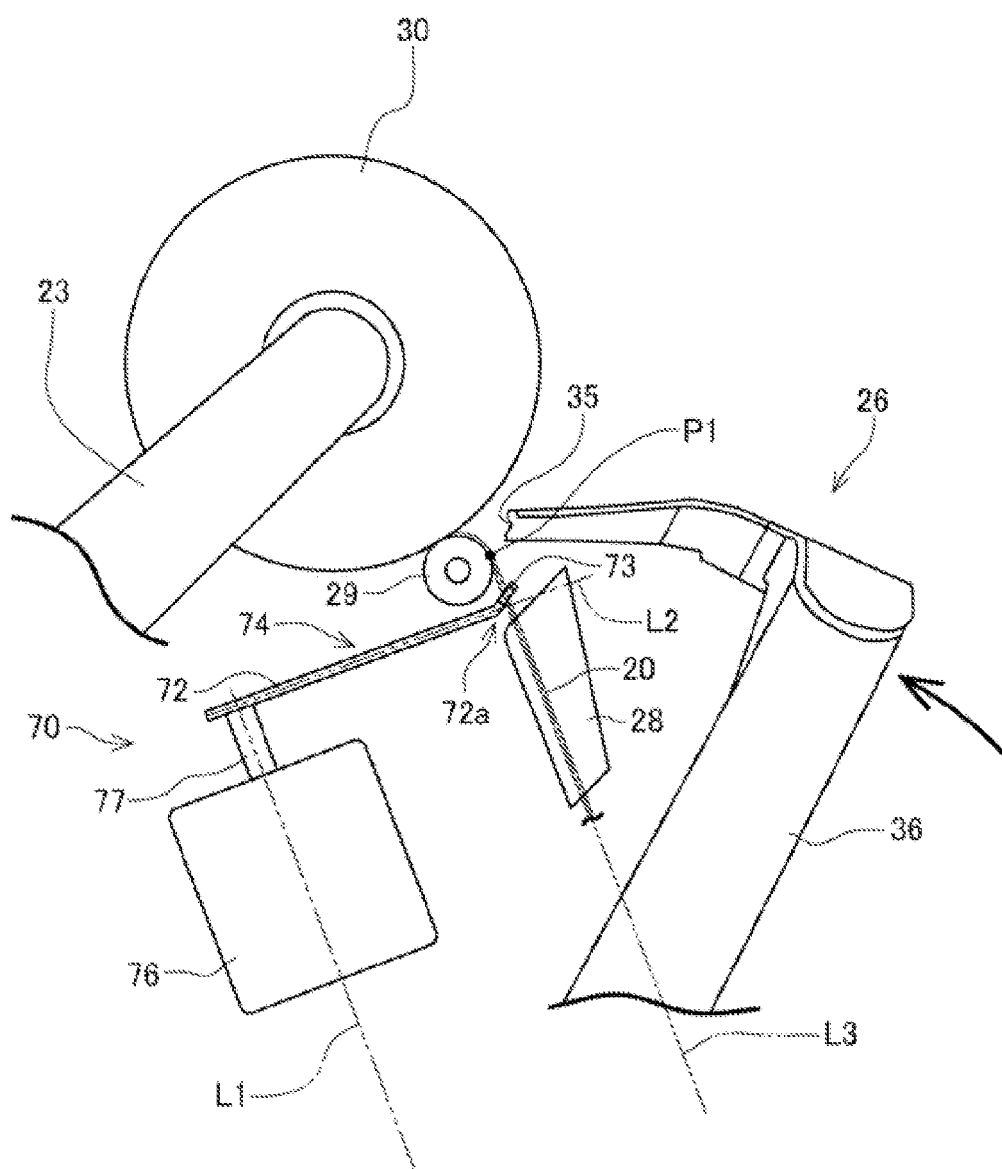


FIG. 4

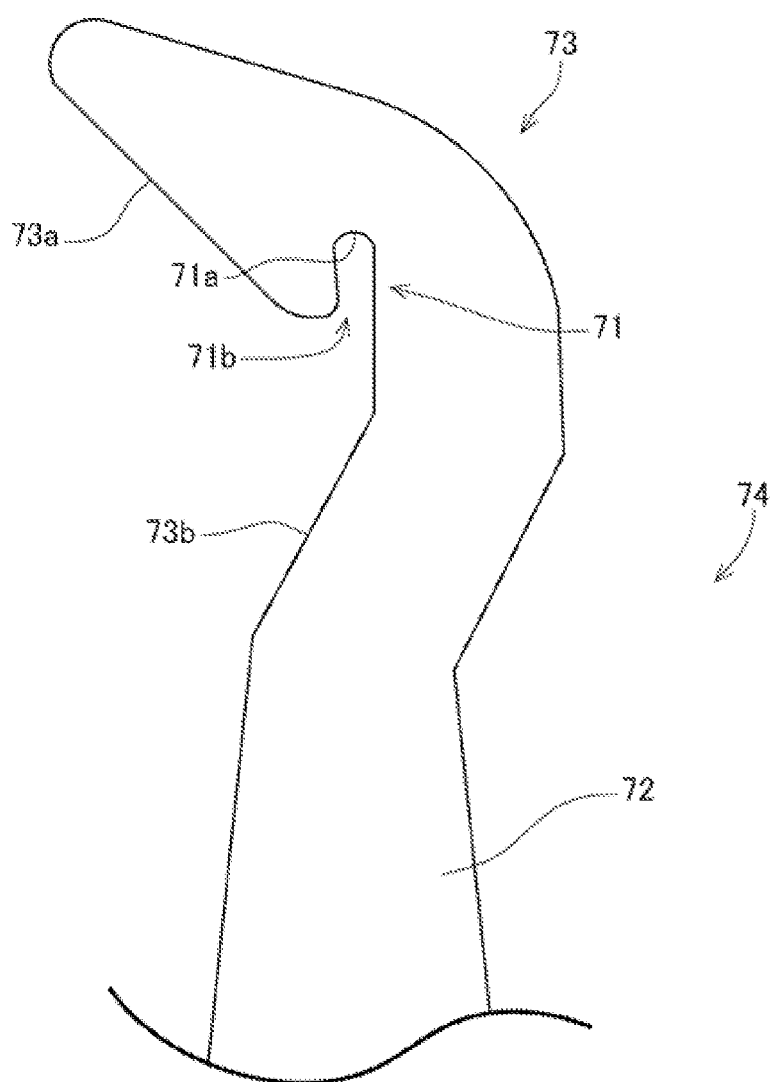


FIG. 5

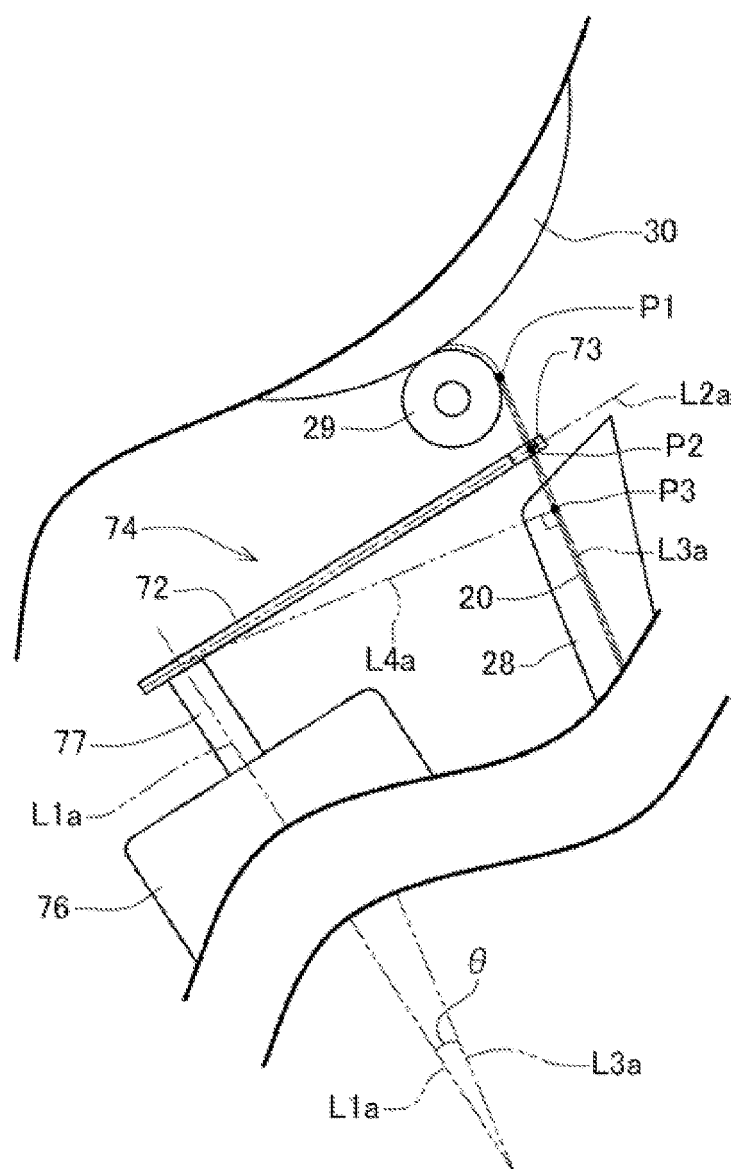
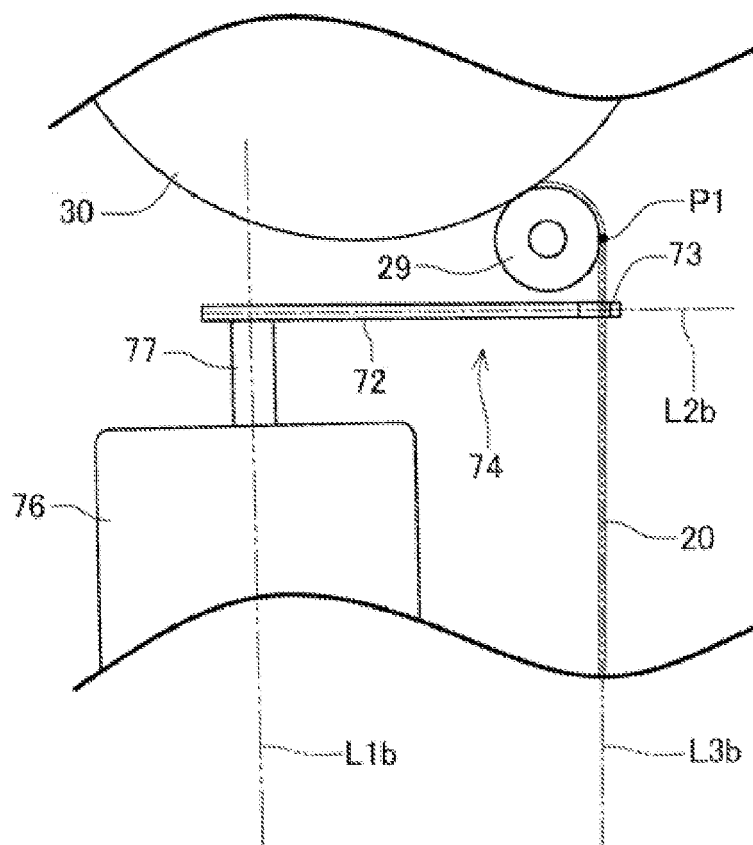


FIG. 6



REFERENCES CITED IN THE DESCRIPTION

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