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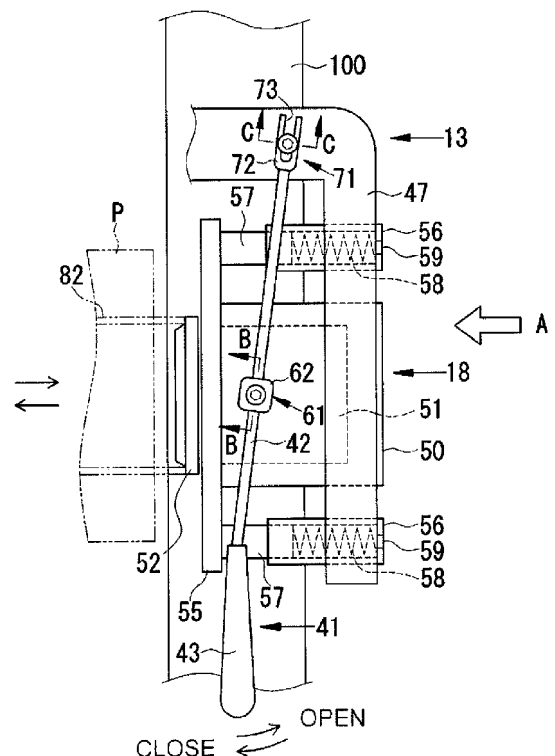
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(54) **Yarn winding device**

(57) A yarn winding device includes a package driving section (18) that directly drives and rotates a package (P), a cradle (13) that supports the package driving section (18) detachably from the package (P), and a lever handle (41) that is coupled to the package driving section (18) by a first supporting member (61) and opens and closes the cradle (13) by coupling and decoupling the package driving section (18) to and from the package (P). The first supporting member (61) allows the lever handle (41) only to pivot, and regulates movement of a pivotal center of the lever handle (41) relative to the package driving section (18).

FIG.2



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a yarn winding device that winds a yarn to form a package.

2. Description of the Related Art

[0002] A yarn winding unit known to the inventor (for example, Japanese Patent Application Laid-open No. 2006-321615) includes a package driving section that directly drives and rotates a package, a cradle that supports the package driving section detachably from the package, and a lever handle that is coupled to the package driving section and that opens and closes the cradle by coupling and decoupling the package driving section to and from the package.

[0003] In the yarn winding unit disclosed in Japanese Patent Application Laid-open No. 2006-321615, the package driving section is supported by the cradle with two parallel slide shafts. When the package or a winding tube is to be mounted, removed, or suchlike, the cradle is opened or closed by manipulating the lever handle to cause the package driving section itself to slide with respect to the cradle. Because the package driving section is supported by the two parallel slide shafts, the package driving section can be prevented from rotating with respect to the cradle.

[0004] A conceivable structure of the lever handle that opens and closes the cradle is shown in FIG. 6. That is, a lever handle 141 is fixed directly to a package driving section 18 with attachment members 90 and 90. A cradle 13 can be opened or closed by manipulating the lever handle 141 in a direction parallel to a sliding direction of the package driving section 18. The package driving section 18, however, is urged in such a manner as to exert a holding force of certain magnitude so that driving and rotating force can be delivered while holding a package P or the like. In such a structure, to open or close the cradle 13, large manipulating force is required for manipulating the lever handle 141 that is fixed directly to the package driving section 18.

[0005] In the yarn winding unit disclosed in Japanese Patent Application Laid-open No. 2006-321615, the cradle is opened or closed against the urging force of the package driving section, and therefore the lever handle has a structure that employs a lever mechanism. More specifically, one end of the lever handle is coupled to the cradle (fulcrum), and a middle portion of the lever handle is connected to the package driving section (point of load). The cradle can thereby be smoothly opened or closed with a small manipulating force.

[0006] As disclosed in Japanese Patent Application Laid-open No. 2006-321615, the package driving section moves with respect to the cradle in a direction parallel to

the two parallel slide shafts when opening and closing the cradle, but the lever handle pivots in an arc form with respect to the package driving section. Consequently, as shown in FIG. 7, if an attachment member 91 (fulcrum) that couples the cradle 13 to the lever handle 141 is fixed, and an attachment member 92 (point of load) that connects the package driving section 18 to the lever handle 141 is fixed, variation in the distance between the fulcrum and the point of load cannot be accommodated. In such a structure, the cradle 13 cannot be opened or closed.

[0007] The structure of the attachment member 91 (fulcrum) of the cradle 13 and the lever handle 141 and the attachment member 92 (point of load) of the package driving section 18 and the lever handle 141 therefore needs to be such that the variation in the distance between the fulcrum and the point of load can be accommodated. The middle portion of the lever handle disclosed in Japanese Patent Application Laid-open No. 2006-321615 is connected to the package driving section via a linkage mechanism.

[0008] In the structure disclosed in Japanese Patent Application Laid-open No. 2006-321615, where the vibration-producing package driving section is connected to the lever handle via the linkage mechanism, the pivotal center of the lever handle is likely to move with respect to the package driving section. This increases play between the package driving section and the lever handle, and the movement of the lever handle cannot be regulated. Consequently, when the vibration from the package driving section is conducted to the lever handle, the vibration of the lever handle cannot be suppressed. If the lever handle greatly vibrates due to the vibration of the package driving section, the attachment member between the package driving section and the lever handle becomes easily worn out, which tends to lead to damage of the lever handle.

[0009] An example of a structure that can accommodate the variation in the distance between the fulcrum and the point of load of the lever handle is shown in FIG. 8. In this structure, the attachment member 91 (fulcrum) between the cradle 13 and the lever handle 141 is fixed, while a slot 93 and a stud (pin) 94, or the like are used as the attachment member 92 (point of load) between the package driving section 18 and the lever handle 141. This structure, however, allows movement of the lever handle 141 in its longitudinal direction at the attachment member 92. The play between the slot 93 and the stud (pin) 94 therefore becomes too large to control the vibration of the lever handle 141. Because the vibration of the package driving section 18 increases the vibration of the lever handle 141, the wearing of the attachment member 91, vibration of a tip portion of the lever handle 141, and the like tend to appear, which tends to lead to the damage of the lever handle 141.

SUMMARY OF THE INVENTION

[0010] It is an object of the present invention to provide

a yarn winding device that can suppress vibration of a lever handle and avoid damage of the lever handle.

[0011] A yarn winding device according to an aspect of the present invention includes a package driving section that directly drives and rotates a package; a cradle that supports the package driving section detachably from the package; a lever handle that is pivotally supported by the cradle and coupled to the package driving section, the package driving section being coupled to and decoupled from the package by pivoting the lever handle with respect to the cradle; and a first supporting member that couples the package driving section and the lever handle to each other, allows the lever handle only to pivot, and regulates movement of a pivotal center of the lever handle relative to the package driving section.

[0012] 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

[0013]

FIG. 1 is a simplified diagram of a yarn winding unit viewed from front, according to an embodiment of the present invention;

FIG. 2 is a plan view of a winding section;

FIG. 3 is a diagram showing the winding section viewed from a direction of an arrow A in FIG. 2; FIGS. 4A and 4B are cross-sectional views of a first supporting member sectioned along a line B-B in FIG. 2;

FIGS. 5A and 5B are cross-sectional views of a second supporting member sectioned along a line C-C in FIG. 2;

FIG. 6 is a diagram of a structure for mounting a lever handle onto a package driving section and a cradle; FIG. 7 is a diagram of another structure for mounting the lever handle onto the package driving section and the cradle; and

FIG. 8 is a diagram of still another structure for mounting the lever handle onto the package driving section and the cradle.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Exemplary embodiments of a yarn winding unit 1 according to the present invention are explained below with reference to FIGS. 1 to 5B.

[0015] The yarn winding unit 1 according to an embodiment, as shown in FIG. 1, forms layers of yarn on a winding tube 82 to form a package P while traversing a yarn Y supplied from a yarn supplying bobbin 81 by a traversing device 3. The yarn Y runs in a direction from the yarn

supplying bobbin 81 to the package P. Although a single yarn winding unit 1 is depicted in FIG. 1, a typical automatic winder includes multiple yarn winding units 1. The yarn winding unit 1 depicted in FIG. 1 forms a cone-shaped package P; the yarn winding unit 1, however, can be configured to form a cheese-shaped package or a package of any other shape.

[0016] In this specification, the winding tube 82 and the package P may be collectively referred to as a winding bobbin B. The winding bobbin B without any yarn wound thereon is the winding tube 82. The winding bobbin B with yarn wound thereon is the package P.

[0017] First, an overview of the yarn winding unit 1 is explained. As shown in FIG. 1, the yarn winding unit 1 includes a winding section (yarn winding device) 2, the traversing device 3, and a yarn supplying section 4.

[0018] The winding section 2 winds the yarn Y into the package P. As shown in FIGS. 1 and 2, the winding section 2 includes a cradle 13, bearings 52 and 53, a package driving section 18, a lever handle 41, a contact roller 14, a winding bobbin rotational speed sensor 32, and a winding bobbin diameter sensor 33. The cradle 13 is freely swingable around a swing shaft 15. The cradle 13 supports the package driving section 18 detachably from the package P. By manipulating the lever handle 41 and opening and closing the cradle 13, the winding bobbin B (package P) can be mounted on and demounted from the cradle 13. The bearings 52 and 53 rotatably hold two ends of the winding bobbin B. when the yarn Y is wound on the winding bobbin B and the diameter of the winding bobbin B thereby increases, the cradle 13 swings. With this arrangement, contact between the periphery of the winding bobbin B and the contact roller 14 can be suitably maintained. As shown in FIG. 3, a dent 101 is formed in a casing 100 that supports the cradle 13 so that the casing 100 is prevented from interfering with the package driving section 18 when the cradle 13 swings.

[0019] The package driving section 18 directly drives and rotates the winding bobbin B (package P). A driving shaft of the package driving section 18 is coupled to the winding bobbin B in such a manner that, when the bearings 52 and 53 of the cradle 13 hold the winding bobbin B, the driving shaft cannot rotate relative to the winding bobbin B (i.e., direct drive system). The package driving section 18 actively drives and rotates the winding bobbin B to wind the yarn Y.

[0020] The winding bobbin rotational speed sensor 32 detects a rotational speed (the number of rotations per unit time) of the winding bobbin B. The winding bobbin diameter sensor 33 detects a diameter of the winding bobbin B. The winding bobbin diameter sensor 33 is a rotary encoder, a resolver, or the like. The winding bobbin diameter sensor 33 detects a swinging angle of the cradle 13 and determines the diameter of the winding bobbin B based on the swinging angle.

[0021] The contact roller 14 is a cylindrical roller that is driven to rotate in contact with the periphery of the winding bobbin B. The contact roller 14 presses the yarn

Y against the surface of the winding bobbin B at a suitable pressure, and also suitably shapes the winding bobbin B (package P). The contact roller 14 can be a cylindrical roller or a cone-shaped roller with one end having a larger diameter and the other end having a smaller diameter. A roller rotation sensor 36 is arranged at one end of the contact roller 14.

[0022] As shown in FIGS. 1 and 2, the traversing device 3 is arranged near the winding bobbin B (package P). The traversing device 3 is driven independently of the winding bobbin B, and traverses the yarn Y that is to be wound on the winding bobbin B. The traversing device 3 includes a traverse guide 17 and a traverse guide driving section 19.

[0023] The traverse guide 17 is a hooking member that hooks the yarn Y and thereby traverses the yarn Y. The traverse guide 17 is arranged at a tip end of a swingable arm member. The traverse guide driving section 19 drives the arm member to reciprocate in a distance of a winding width of the winding bobbin B so that the traverse guide 17 reciprocates. A servomotor is used as a motor of the traverse guide driving section 19 according to the present embodiment; however, a step motor or the like can be used instead. The traverse guide 17 can be shaped into a hooking member or into two rod-like members with their tip ends being open.

[0024] As shown in FIG. 1, the yarn supplying section 4 supplies the yarn Y that is to be wound on the winding bobbin B. The yarn supplying bobbin 81 is set in the yarn supplying section 4. In a yarn running path between the yarn supplying section 4 and the contact roller 14, a tension applying device 20, a yarn joining device 21, and a yarn clearer 22 are arranged in this order from the yarn supplying section 4 side. The tension applying device 20 applies a suitable tension to the yarn Y. A not-shown sensor outputs a signal representing a size of the yarn Y that passes through a detecting section, an analyzer 23 processes the signal output from the sensor, and the yarn clearer 22 detects a yarn defect, such as a slub, based on the result of the processing at the analyzer 23. In addition to a defect in the size of the yarn Y, the yarn clearer 22 can also detect any foreign object included in the yarn Y. A not-shown cutter is arranged in the yarn clearer 22 to cut the yarn Y when a yarn defect is detected (to make a clearer cut) and to discontinue the winding due to a traversing defect (to make an additional cut) even if no yarn defect is detected. The yarn joining device 21 joins an end of a lower yarn on the yarn supplying bobbin 81 side and an end of an upper yarn on the winding bobbin B (package P) side when the yarn Y is cut by the yarn clearer 22 or when yarn supply from the yarn supplying bobbin 81 runs out.

[0025] A suction pipe 24 is arranged below the yarn joining device 21 (on an upstream side in a yarn running direction) to serve as a lower yarn catching and guiding section that catches a yarn end on the yarn supplying bobbin 81 side by suction and guides the caught yarn end to the yarn joining device 21. A suction mouth 27 is

arranged above the yarn joining device 21 (on a downstream side in the yarn running direction) to serve as a yarn end catching section that catches a yarn end on the winding bobbin B side by suction and guides it to the yarn joining device 21. The suction pipe 24 is formed into a pipe and vertically pivots around a shaft 25. The suction pipe 24 has a suction vent 26 on its tip end. The suction mouth 27 is also formed into a pipe, and vertically pivots around a shaft 28. A mouth 29 is arranged at a tip end of the suction mouth 27. A not-shown negative pressure source is connected to the suction pipe 24 and the suction mouth 27 so that suctioning is established in the suction vent 26 and the mouth 29 at the tip ends of the suction pipe 24 and the suction mouth 27, respectively.

[0026] A structure that controls the operation of the yarn winding unit 1 is now explained. According to the present embodiment, as shown in FIG. 1, the package driving section 18 that drives the winding bobbin B and the traverse guide driving section 19 that drives the traverse guide 17 are separately and independently arranged. Driving of the winding bobbin B and the traverse guide 17 is separately and independently controlled. A unit controller 38 is arranged in each yarn winding unit 1 to control the yarn winding unit 1. The unit controller 38 is connected to a winding bobbin driving controller 31 and a traverse controller 34. The winding bobbin driving controller 31 controls the driving and stopping of the package driving section 18, based on a control signal received from the unit controller 38. The traverse controller 34 controls the driving and stopping of the traverse guide driving section 19 based on the control signal received from the unit controller 38.

[0027] The winding bobbin rotational speed sensor 32 transmits a rotational speed signal representing a detected rotational speed of the winding bobbin B to the unit controller 38, the winding bobbin driving controller 31, and the traverse controller 34. The winding bobbin diameter sensor 33 transmits a diameter signal representing a detected diameter of the winding bobbin B to the unit controller 38. The diameter signal is transferred from the unit controller 38 to the winding bobbin driving controller 31 and the traverse controller 34.

[0028] A signal (pulse signal) output from the roller rotation sensor 36, which is arranged at one end of the contact roller 14, is input to a roller rotational speed detecting section 37. The roller rotational speed detecting section 37 detects a rotational speed (the number of rotations per unit time) of the contact roller 14 based on this signal, and outputs a rotational speed signal representing a rotational speed of the contact roller 14 to the unit controller 38.

[0029] The unit controller 38 is connected to the yarn clearer 22, the yarn joining device 21, the suction pipe 24, and the suction mouth 27 that serves as the yarn end catching section. Because the yarn Y needs to be cut off when the winding is suspended due to presence of a yarn defect or due to a traverse defect although no yarn defect is detected, the unit controller 38 controls the yarn cutting

operation of the yarn clearer 22. The unit controller 38 further controls a yarn joining operation of the yarn joining device 21 in which the yarn end on the yarn supplying bobbin 81 side and the yarn end on the winding bobbin B side are joined together when the yarn Y is cut by the yarn clearer 22 or when the yarn supply from the yarn supplying bobbin 81 runs out. The unit controller 38 also controls yarn end catching operations performed by the suction pipe 24 and the suction mouth 27 and a guiding operation of guiding the yarn ends to the yarn joining device 21.

[0030] The unit controller 38 is connected to a main controller 39. The main controller 39 centrally controls the multiple yarn winding units 1 included in the automatic winder. The unit controller 38, the roller rotational speed detecting section 37, the main controller 39, the winding bobbin driving controller 31, and the traverse controller 34 each include a central processing unit (CPU) as a calculating unit, and a read-only memory (ROM), a random-access memory (RAM), and the like as a storing unit. The ROMs store therein a controlling software program that causes hardware such as the CPU to operate as a controlling unit.

[0031] The lever handle 41 and a structure to mount the lever handle 41 are explained below.

[0032] First, the package driving section 18 onto which the lever handle 41 is mounted and a mounting structure for mounting the package driving section 18 onto the cradle 13 are explained. The package driving section 18 and the mounting structure for mounting the package driving section 18 onto the cradle 13 are basically the same as the mounting structure disclosed in Japanese Patent Application Laid-open No. 2006-321615, and therefore the explanation will be briefly made.

[0033] As shown in FIGS. 2 and 3, the package driving section 18 includes a package driving motor 51 arranged inside a housing 50. The bearing 52 is mounted on the driving shaft of the package driving motor 51. A backup flange 55 is attached to the housing 50 on its bearing 52 side.

[0034] The package driving section 18 is coupled to the cradle 13. An inverted U-shaped member 47 is formed in the cradle 13 in such a manner as to straddle the package driving section 18. Two end portions of the inverted U-shaped member 47 are arranged at the two end portions of the package driving section 18 when viewed from the side in a direction substantially parallel to the driving shaft of the package driving section 18. A pair of cylindrical bodies 56 is arranged parallel to a driving shaft line of the package driving motor 51 in the two end portions of the inverted U-shaped member 47. A guiding rod 57 is engaged slidably with each of these two cylindrical bodies 56. One end of each guiding rod 57 is fixed to the backup flange 55. An urging spring 58 is arranged inside each cylindrical body 56. The urging spring 58 urges, via the guiding rod 57, the backup flange 55 and also the entire housing 50 towards the bearing 53 on the other end of the cradle 13 (see FIG. 1), and exerts

holding force to hold the winding bobbin B between the bearings 52 and 53. A stopper (not shown) is arranged in the cradle 13 to regulate the movement of the housing 50 so that the movement of the package driving section 18 is maintained under a certain amount.

[0035] The lever handle 41 is manipulated when opening and closing the cradle 13 by coupling and decoupling the package driving section 18 to and from the winding bobbin B (package P). As shown in FIGS. 2 and 3, the lever handle 41 includes a main shaft portion 42 and a grip portion 43. The main shaft portion 42 is the main body of the lever handle 41. The main shaft portion 42 includes a first shaft member 44 and a second shaft member 45 (see FIGS. 4A and 4B). The first shaft member 44 and the second shaft member 45 are both screwed into, and thereby connected to, an attachment member 62 of a first supporting member 61, which is explained later, to form the main shaft portion 42. The grip portion 43 is a portion that an operator grips to manipulate the lever handle 41 to open or close the cradle 13. The grip portion 43 is attached to one end of the main shaft portion 42.

[0036] The lever handle 41 is arranged across the cradle 13 and the package driving section 18. The lever handle 41 is coupled to the package driving section 18 by the first supporting member 61. The lever handle 41 is coupled to the cradle 13 by a second supporting member 71.

[0037] The first supporting member 61 couples the lever handle 41 to the package driving section 18. The first supporting member 61 allows the lever handle 41 only to pivot, and also regulates the movement of a pivotal center of the lever handle 41 relative to the package driving section 18. As shown in FIG. 4A, the first supporting member 61 includes the attachment member 62, a bolt 64, a collar 65, a bush 66, vibration absorbing members 67, and washers 68. A first fixing portion 54 is formed in the housing 50 of the package driving section 18 to fix the first supporting member 61. The bolt 64 serves as a pivotal shaft that pivotally supports the lever handle 41.

[0038] The attachment member 62 serves as a bearing that supports the bolt 64, which serves as the pivotal shaft, via the collar 65. As mentioned earlier, the attachment member 62 connects the first shaft member 44 and the second shaft member 45 of the lever handle 41 to each other. A hole 63 is formed in the attachment member 62 to insert the bolt 64 or the like.

[0039] The bolt 64, with the collar 65 and the bush 66 attached, is inserted into the hole 63 of the attachment member 62. The bush 66 is a lubricating member that allows the lever handle 41 to smoothly pivot. The collar 65 is a metallic cylindrical member that prevents a direct contact of a screw portion of the bolt 64 with the bush 66. The collar 65 controls tightness of the bolt 64 to allow the lever handle 41 to smoothly pivot.

[0040] The vibration absorbing members 67 are interposed above and below the hole 63 of the attachment member 62, or in other words, between the attachment

member 62 and the bolt 64 and between the attachment member 62 and the first fixing portion 54. The vibration absorbing members 67 are preferably made of an elastic material. According to the present embodiment, the vibration absorbing members 67 are made of urethane rubber. However, the material of the vibration absorbing members 67 is not limited to urethane rubber, and any other material that can absorb vibration can be used. The washers 68 are interposed between the vibration absorbing member 67 and the bolt 64 and between the vibration absorbing member 67 and the first fixing portion 54.

[0041] The first supporting member 61 is mounted on the first fixing portion 54 by screwing the bolt 64 into the first fixing portion 54. The lever handle 41 is mounted on the package driving section 18 by tightening the bolt 64. The lever handle 41 is allowed only to pivot with respect to the package driving section 18. The movement of the pivotal center (bolt 64) of the lever handle 41 is not regulated with respect to the package driving section 18.

[0042] In the above description, a structure employing the bolt 64 has been explained. A stud 69, for example, can be used in place of the bolt 64, as shown in FIG. 4B. Because a cylindrical portion of the stud 69 does not include a screwing portion, the collar 65 can be omitted. In such a case, as shown in FIG. 4B, the bush 66 can be inserted directly into the stud 69, thereby reducing the number of components.

[0043] The second supporting member 71 couples the lever handle 41 to the cradle 13. The second supporting member 71 allows the lever handle 41 to pivot with respect to the cradle 13 and also to move in a longitudinal direction of the lever handle 41. As shown in FIG. 5A, the second supporting member 71 includes a retainer 72, a bolt 74, a collar 75, a flanged bush 76, and washers 78. A second fixing portion 48 is formed in the cradle 13 to fix the second supporting member 71. The bolt 74 serves as a slide shaft that slidably supports the lever handle 41.

[0044] The retainer 72 holds the bolt 74, which serves as the slide shaft, via the collar 75 and the like. A retaining groove 73 is formed in the retainer 72 to hold the bolt 74 and the like.

[0045] The bolt 74 to which the collar 75 and the flanged bush 76 are attached is held by the retaining groove 73 of the retainer 72. The flanged bush 76 is a lubricating member that allows the lever handle 41 to smoothly slide. The collar 75 is a metallic cylindrical member that prevents the screwing portion of the bolt 74 from being in a direct contact with the flanged bush 76. The collar 75 controls tightness of the bolt 74 and allows the lever handle 41 to smoothly slide. The washers 78 are interposed between the flanged bush 76 and the bolt 74 and between the flanged bush 76 and the second fixing portion 48.

[0046] The second supporting member 71 is attached to the second fixing portion 48 by screwing the bolt 74 into the second fixing portion 48. The lever handle 41 is attached to the cradle 13 by tightening the bolt 74. The lever handle 41 is allowed to pivot with respect to the

cradle 13 and also to move in the longitudinal direction of the lever handle 41.

[0047] In the above description, a structure employing the bolt 74 has been explained. However, a stud 79, for example, can be used in place of the bolt 74, as shown in FIG. 5B. Because a cylindrical portion of the stud 79 does not have a screwing portion, the collar 75 can be omitted. In such a case, as shown in FIG. 5B, the stud 79 can be inserted directly into the flanged bush 76, thereby reducing the number of components.

[0048] In the above structure, when mounting the winding bobbin B (winding tube 82) onto the bearings 52 and 53, the operator turns the grip portion 43 of the lever handle 41 in an opening direction, as shown in FIG. 2. The first supporting member 61 allows only pivoting of the lever handle 41, but regulates the movement of the pivotal center of the lever handle 41 with respect to the package driving section 18. The second supporting member 71 allows both pivoting of the lever handle 41 with respect to the cradle 13 and the movement of the lever handle 41 in its longitudinal direction. Consequently, the variation in the distance between the first supporting member 61 (point of load) and the second supporting member 71 (fulcrum) is accommodated, and the pivoting of the lever handle 41 can thereby be smoothly performed.

[0049] When the lever handle 41 is turned in the opening direction, the entire housing 50 is pulled by the lever handle 41. Consequently, the housing 50, the package driving motor 51, and the bearing 52 are moved in a direction away from the bearing 53 on the other side against the force of the urging spring 58. A movement direction of the housing 50, the package driving motor 51, and the bearing 52 is brought into a direction parallel to the shaft direction of the winding bobbin B by guiding of the cylindrical body 56 and the guiding rod 57.

[0050] With the distance between the bearings 52 and 53 increased, the winding bobbin B is placed between the bearings 52 and 53, and then the lever handle 41 is turned in a closing direction shown in FIG. 2 to the original position. The housing 50, the package driving motor 51, and the bearing 52 are thereby moved toward the bearing 53 of the other side, in the direction parallel to the axial line of the winding bobbin B by the force of the urging spring 58 so that the winding bobbin B can be rotatably held at its two ends by the bearings 52 and 53.

[0051] When the manipulation of the lever handle 41 is performed, the guiding rod 57 is slid with respect to the cylindrical body 56. At this time, air comes in and out of the cylindrical body 56. More specifically, when the guiding rod 57 is elongated with respect to the cylindrical body 56, air is sucked into the cylindrical body 56 through clearance between the cylindrical body 56 and the sliding portion of the guiding rod 57. When the guiding rod 57 is contracted with respect to the cylindrical body 56, air comes out of the cylindrical body 56 through the clearance between the cylindrical body 56 and the sliding portion of the guiding rod 57. Because cotton fly and/or fiber

waste, which exist in the air around the yarn winding unit 1, are accumulated in the clearance between the cylindrical body 56 and the sliding portion of the guiding rod 57, slidability between the cylindrical body 56 and the guiding rod 57 tends to gradually reduce.

[0052] For this reason, a vent hole 59 is formed in a bottom portion of the cylindrical body 56 (on the end surface opposite the surface on which the backup flange 55 is arranged), and a sponge filter (not shown) is arranged in the vent hole 59. When the guiding rod 57 is slid with respect to the cylindrical body 56, air comes in and out through the vent hole 59, and therefore the amount of air coming in and out through the clearance of the sliding portion decreases. With the filter arranged in the vent hole 59, the cotton fly and/or the fiber waste are prevented from entering the inside of the cylindrical body 56. Therefore, cotton fly and/or the fiber waste do not accumulate in the clearance of the sliding portion, and excellent slidability can be maintained between the cylindrical body 56 and the guiding rod 57.

[0053] During the operation of the yarn winding unit 1, the package driving motor 51 of the package driving section 18 is driven, and vibration produced by the driving is conducted to the lever handle 41 via the housing 50. The first supporting member 61, however, that is arranged near the vibration-producing package driving section 18 allows the lever handle 41 only to pivot, while the first supporting member 61 regulates the movement of the pivotal center of the lever handle 41 with respect to the package driving section 18. With small play provided between the package driving section 18 and the lever handle 41, the movement of the lever handle 41 can be regulated. The lever handle 41 can therefore be prevented from vibrating even when the vibration is conducted from the package driving section 18.

[0054] The vibration absorbing members 67 are interposed between the housing 50 of the package driving section 18 and the first supporting member 61 that is the attachment member of the lever handle 41. Because the vibration from the package driving section 18 is absorbed by the vibration absorbing members 67, the vibration is not conducted to the lever handle 41.

[0055] The yarn winding unit 1 according to the present embodiment explained above yields the following effects.

[0056] The lever handle 41 that opens and closes the cradle 13 is coupled to the package driving section 18 by the first supporting member 61. The first supporting member 61 allows the lever handle 41 only to pivot, and regulates the movement of the pivotal center of the lever handle 41 with respect to the package driving section 18. Because of this first supporting member 61, the play between the package driving section 18 and the lever handle 41 can be set small, the vibration of the lever handle 41 can be suppressed, and damage of the lever handle 41 can be prevented.

[0057] The lever handle 41 that opens and closes the cradle 13 is coupled to the cradle 13 by the second supporting member 71. The second supporting member 71

allows the lever handle 41 to pivot with respect to the cradle 13 and also to move in the longitudinal direction of the lever handle 41. With this arrangement, the variation in the distance between the fulcrum and the point of load of the leverage in accordance with arc pivoting of the lever handle 41 and parallel movement of the package driving section 18 can be absorbed, and the cradle 13 can be opened and closed smoothly.

[0058] The second supporting member 71 includes the bolt 74 that is the slide shaft and the retainer 72 that holds the bolt 74. Consequently, the structure of the second supporting member 71 can be simplified.

[0059] The first supporting member 61 includes the bolt 64 that is the pivotal shaft that pivotally supports the lever handle 41 and the attachment member 62 that is the bearing that supports the bolt 64. The vibration absorbing members 67 are arranged between the bolt 64 and the attachment member 62. With this arrangement, the vibration of the package driving section 18 can be absorbed, and the vibration of the lever handle 41 can be suppressed.

[0060] Because the vibration absorbing member 67 is an elastic body, the vibration of the package driving section 18 can be effectively absorbed, and the vibration of the lever handle 41 can be suppressed.

[0061] The casing 100 on which the cradle 13 is mounted has the dent 101 to prevent the casing 100 from interfering with the package driving section 18. In the yarn winding unit 1 of the direct drive system that directly drives and rotates the package P, the package driving section 18 tends to interfere with the casing 100 when the winding tube 82 has a small diameter. Because the dent 101 is formed in the casing 100 to prevent the casing 100 from interfering with the package driving section 18, the interference between the package driving section 18 and the casing 100 can be prevented, and the vibration of the casing 100 and the lever handle 41 can be suppressed.

[0062] Various embodiments of the present invention have been explained above; however, various modifications can be made to those embodiments. For example, the structure for controlling the operation of the yarn winding unit 1 is not limited to that explained in the above embodiments. For example, the winding bobbin driving controller 31 and the traverse controller 34 can be arranged in the unit controller 38.

[0063] In the above embodiments, in the traversing device 3, the longitudinal direction of the arm member is parallel to an installation direction of the yarn winding unit 1 (vertical direction). However, the longitudinal direction of the arm member can be perpendicular to an installation surface of the yarn winding unit 1. The traversing device 3 drives and reciprocates the arm member by the traverse guide driving section 19. An endless timing belt can be arranged near the contact roller 14, and the traverse guide 17 can be attached to this timing belt. The timing belt can be driven and reciprocated by, for example, a pulse motor.

[0064] In the above explanation, the manipulation of the cradle 13 is performed by the operator, but can be performed by a doffing carrier cart. When the package P is fully wound at the yarn winding unit 1, the doffing carrier cart performs a doffing operation to remove the fully wound package P from the cradle 13.

[0065] In the above embodiments, the diameter of the winding bobbin B is detected by the winding bobbin diameter sensor 33. However, any other structure in which the diameter of the winding bobbin B can be detected can be employed. For example, the diameter of the winding bobbin B can be calculated by measuring the amount of the yarn Y that is wound on the winding bobbin B.

[0066] According to the present embodiment, an example in which the present invention is applied to the automatic winder has been explained; however, the present invention is applicable to other yarn winding units such as spinning machines.

[0067] The configuration of each component is not limited to the one that is shown in the drawings. For example, steps can be formed in the stud 69 shown in FIG. 4B and the stud 79 shown in FIG. 5B in their longitudinal direction to form a tightening portion.

[0068] A yarn winding device according to an aspect of the present invention includes a package driving section, a cradle, a lever handle, and a first supporting member. The package driving section directly drives and rotates a package. The cradle supports the package driving section detachably from the package. The lever handle is pivotally supported by the cradle and coupled to the package driving section. By pivoting the lever handle with respect to the cradle, the package driving section is coupled to and decoupled from the package. The first supporting member couples the package driving section and the lever handle to each other, allows the lever handle only to pivot, and regulates movement of a pivotal center of the lever handle relative to the package driving section.

[0069] With the first supporting member, play between the package driving section and the lever handle can be set small, and vibration of the lever handle can be suppressed, while damage of the lever handle can be prevented.

[0070] The yarn winding device according to another aspect of the present invention further includes a second supporting member. The second supporting member couples the lever handle to the cradle and allows the lever handle to pivot with respect to the cradle and to move in a longitudinal direction of the lever handle. With this arrangement, both arc pivoting of the lever handle and variation in a distance between a fulcrum and a point of load in accordance with parallel movement of the package driving section can be accommodated, and thereby the cradle can be smoothly opened and closed.

[0071] The second supporting member preferably includes a slide shaft and a retainer that holds the slide shaft. With this arrangement, the structure of the second supporting member can be simplified.

[0072] The first supporting member preferably in-

cludes a pivotal shaft, a bearing, and a vibration absorbing member. The pivotal shaft pivotally supports the lever handle. The bearing supports the pivotal shaft. The vibration absorbing member is arranged between the pivotal shaft and the bearing. With this arrangement, the vibration of the package driving section can be absorbed and the vibration of the lever handle can be suppressed.

[0073] The vibration absorbing member is preferably an elastic body. The vibration absorbing member can effectively absorb the vibration of the package driving section and suppress the vibration of the lever handle.

[0074] The yarn winding device preferably includes a casing. The cradle is mounted on the casing. A dent is formed in the casing to prevent interference with the package driving section. In the yarn winding unit of a direct drive system, which directly drives and rotates the package, the package driving section tends to interfere with the casing if a winding tube has a small diameter. Because the dent is formed in the casing to prevent the interference with the package driving section, the package driving section is prevented from interfering with the casing, and the vibration of the casing and the lever handle can be suppressed.

[0075] 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 scope of the claims.

Claims

1. A yarn winding device comprising:

a package driving section (18) adapted to directly drive and rotate a package (P);

a cradle (13) adapted to support the package driving section (18) detachably from the package (P);

a lever handle (41) that is pivotally supported by the cradle (13) and coupled to the package driving section (18), the package driving section (18) being adapted to be coupled to and decoupled from the package (P) by pivoting the lever handle (41) with respect to the cradle (13); **characterized by**

a first supporting member (61) adapted to couple the package driving section (18) and the lever handle (41) to each other, adapted to allow the lever handle (41) only to pivot, and adapted to regulate movement of a pivotal center of the lever handle (41) relative to the package driving section (18).

2. The yarn winding device according to Claim 1, **characterized by** a second supporting member (71)

adapted to couple the lever handle (41) to the cradle (13) and adapted to allow the lever handle (41) to pivot with respect to the cradle (13) and to move in a longitudinal direction of the lever handle (41).

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3. The yarn winding device according to Claim 2, **characterized in that** the second supporting member (71) includes a slide shaft (74) and a retainer (72) adapted to retain the slide shaft (74).

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4. The yarn winding device according to any one of Claims 1 to 3, **characterized in that** the first supporting member (61) includes a pivotal shaft (64) adapted to pivotally support the lever handle (41), a bearing (62) adapted to support the pivotal shaft (64), and a vibration absorbing member (67) that is arranged between the pivotal shaft (64) and the bearing (62).

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5. The yarn winding device according to Claim 4, **characterized in that** the vibration absorbing member (67) is an elastic body.

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6. The yarn winding device according to any one of Claims 1 to 5, further comprising a casing (100) on which the cradle (13) is mounted, **characterized in that** a dent (101) is formed in the casing (100) and adapted to prevent interference with the package driving section (18).

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FIG.1

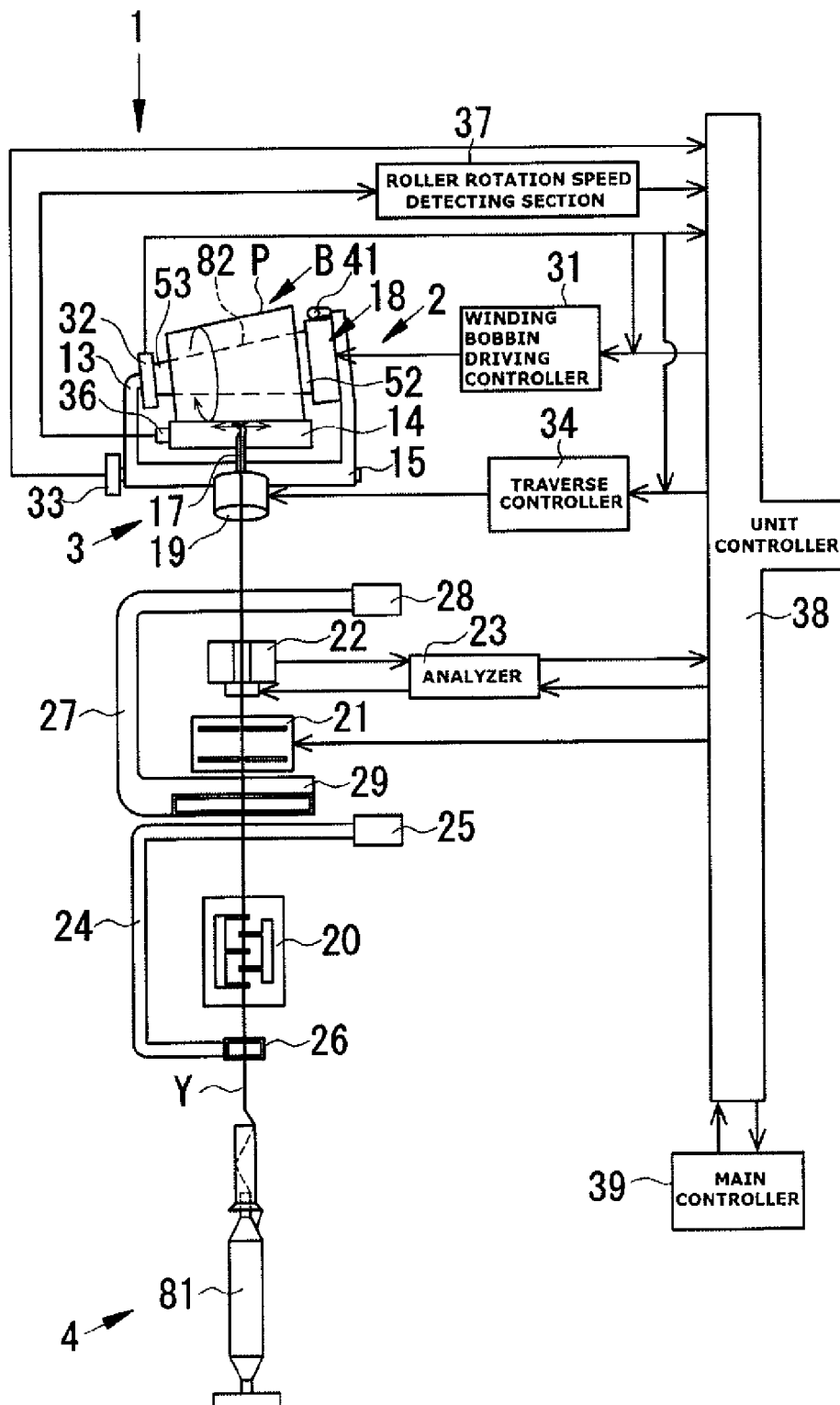


FIG.2

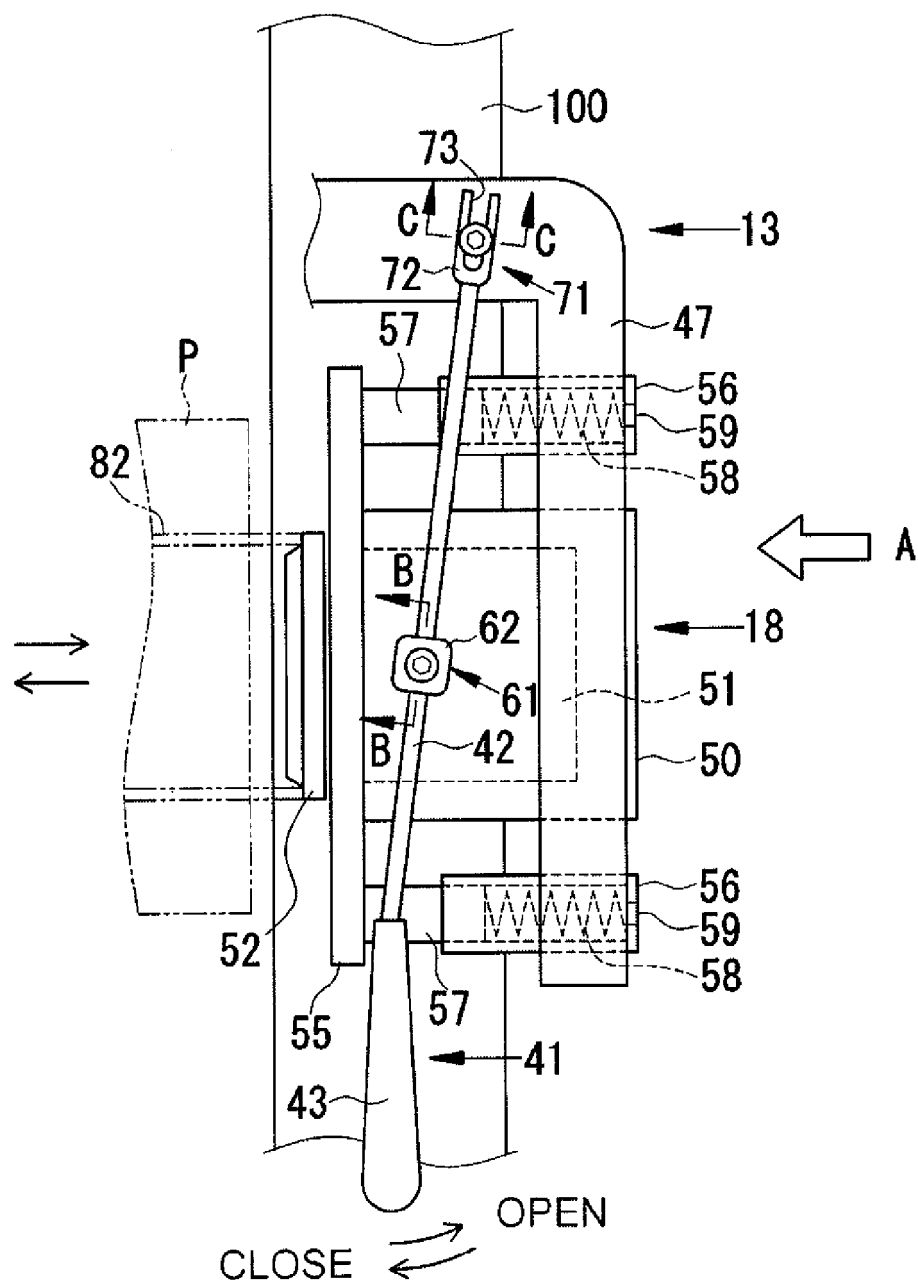


FIG.3

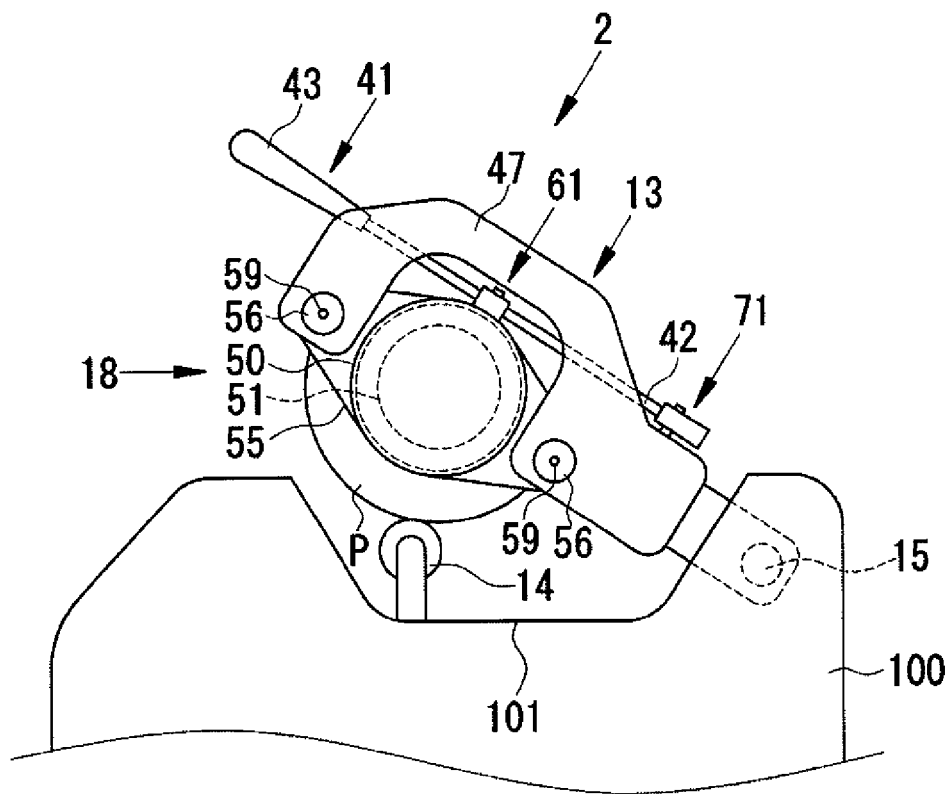


FIG.4A

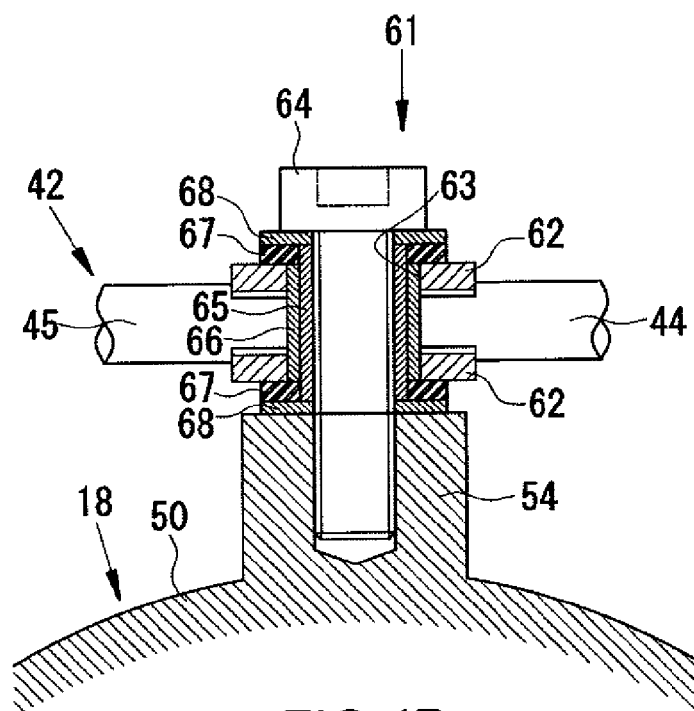


FIG.4B

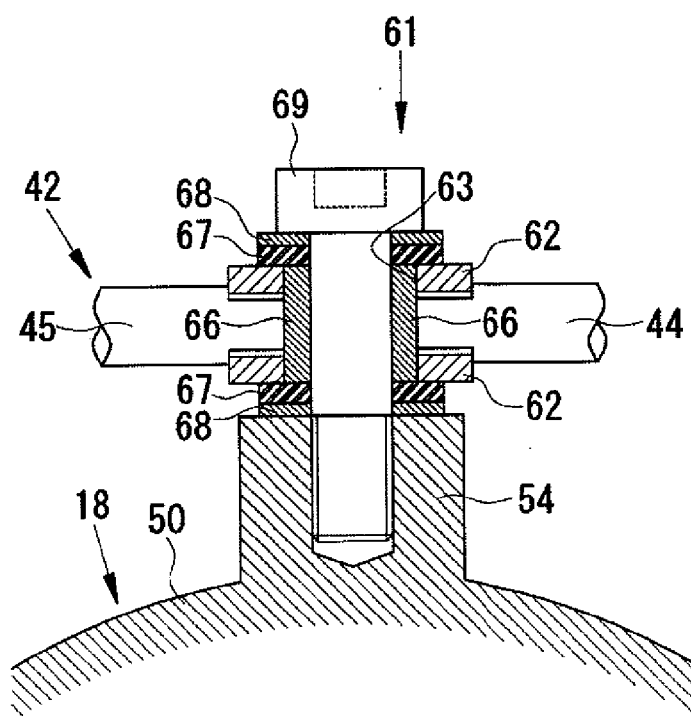


FIG.5A

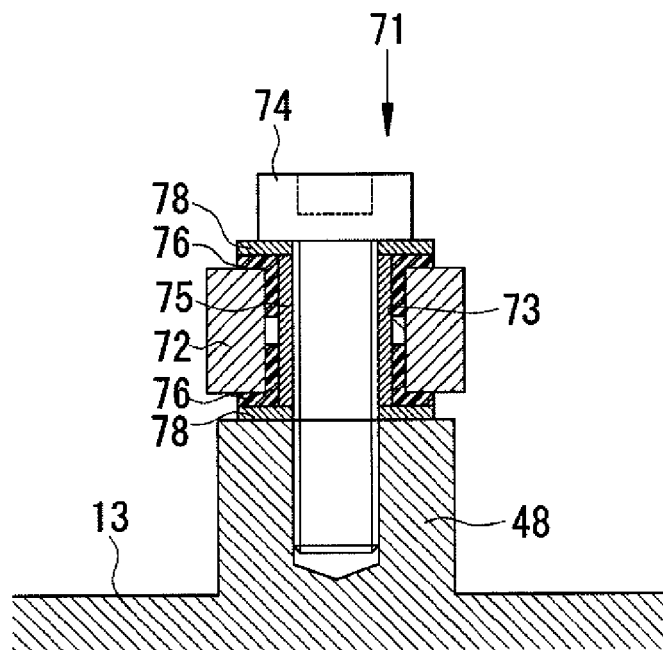


FIG.5B

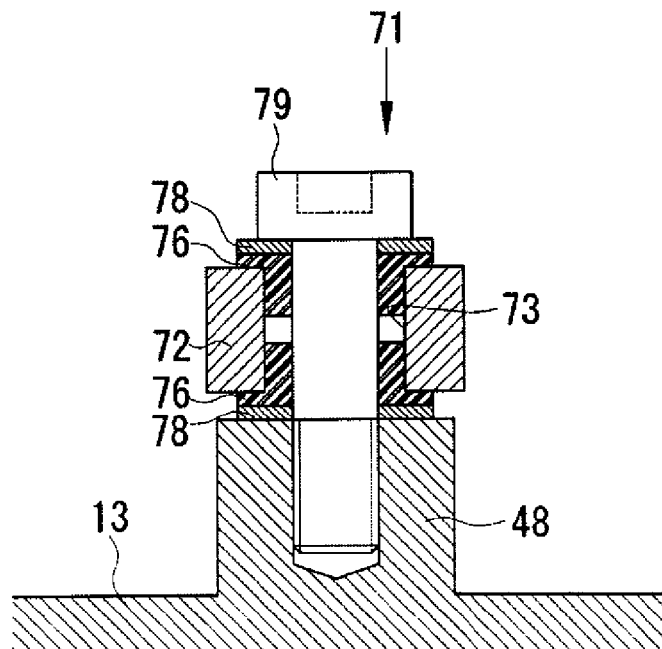


FIG.6

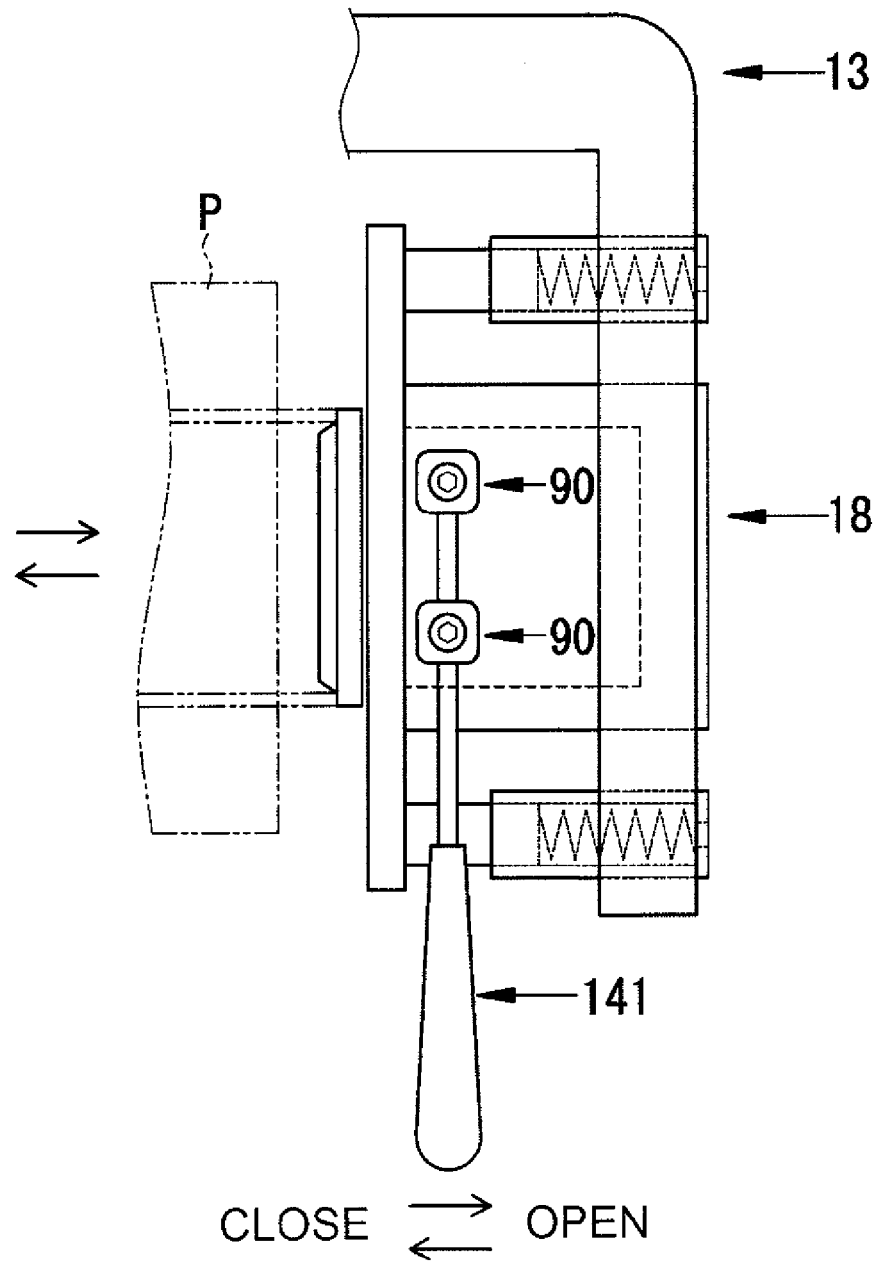


FIG.7

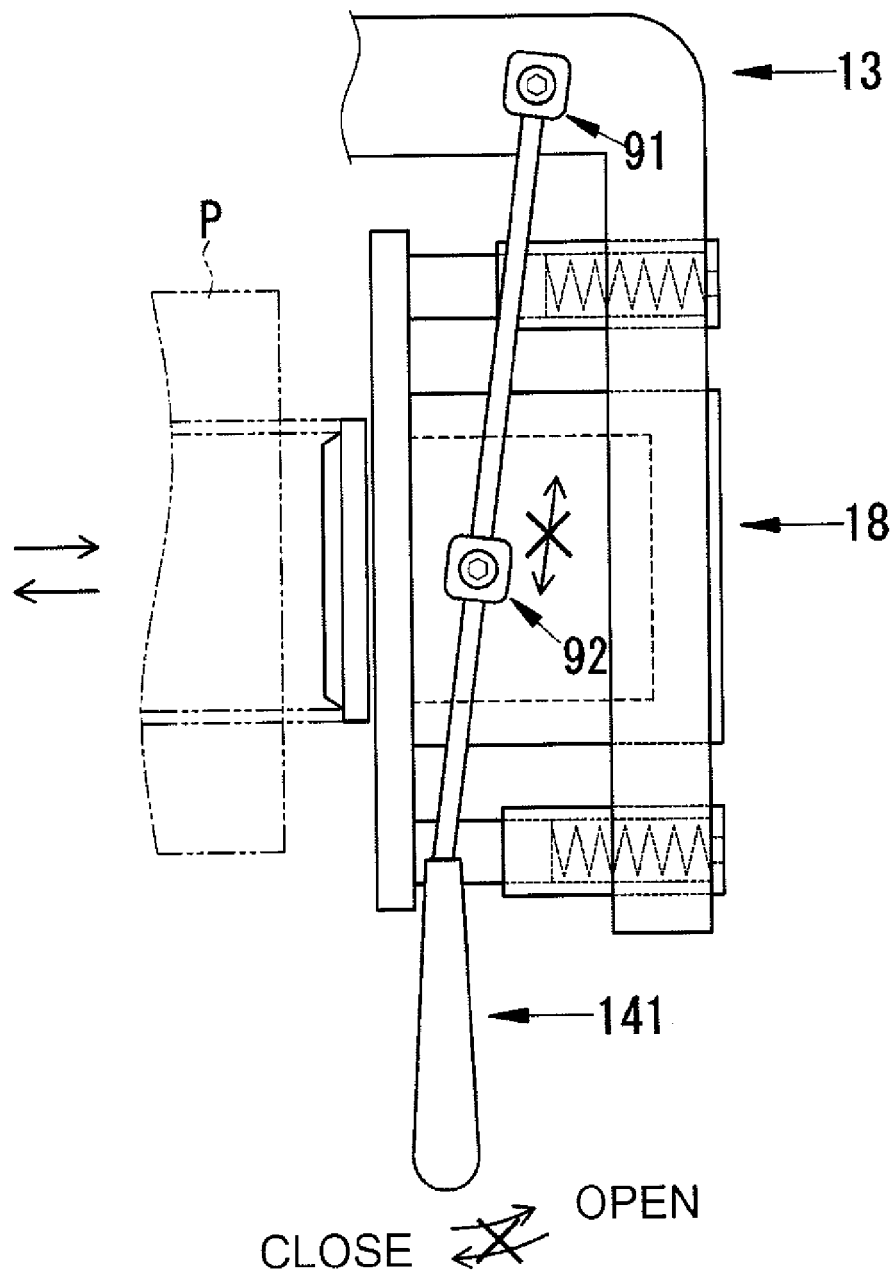
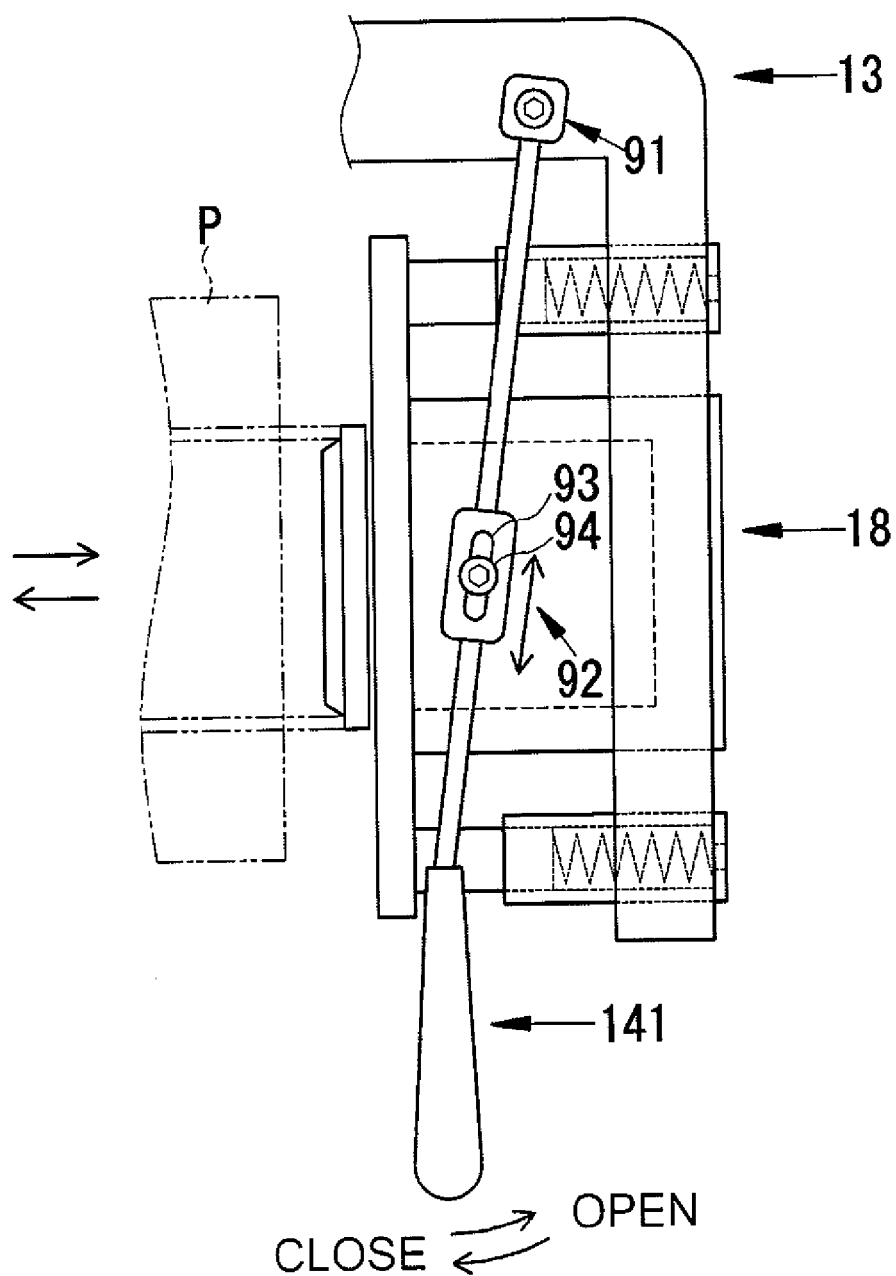


FIG.8



REFERENCES CITED IN THE DESCRIPTION

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- JP 2006321615 A [0002] [0003] [0005] [0006] [0007]
[0008] [0032]