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(54) Method for loosening a spear tube from a container and apparatus therefor

(57) The present invention relates to a method for loosening a spire or spear tube (103) screwed into a neck portion (102) of a container (101) which can automatically loosen the spire or spear tube without interfering a stopper portion with a protruded portion (109) of an opening of the neck portion of the container and without causing galling of the spire tube and an apparatus therefor. To remove the spire tube having the stopper portion by loosening the spire tube thread portion from the thread portion of the opening of the neck portion of the container, the invention comprises a spire tube rotating step in which a rotation transmission engaging portion of a wrench body (43R) of the wrench (43) is engaged with a rotation force receiving portion (111) of the spire tube body to rotate the wrench in a direction to loosen the wrench; a valve push-in step which protrudes a pusher (62) formed on the leading end of the wrench body to push the valve (106) of the spire tube toward the inside of the opening of the neck portion of the container; a valve return step which returns the pushed-in valve to the original state; and a wrench removing step which rotates the wrench in a direction opposite from the loosening direction to remove the wrench from the spire tube.

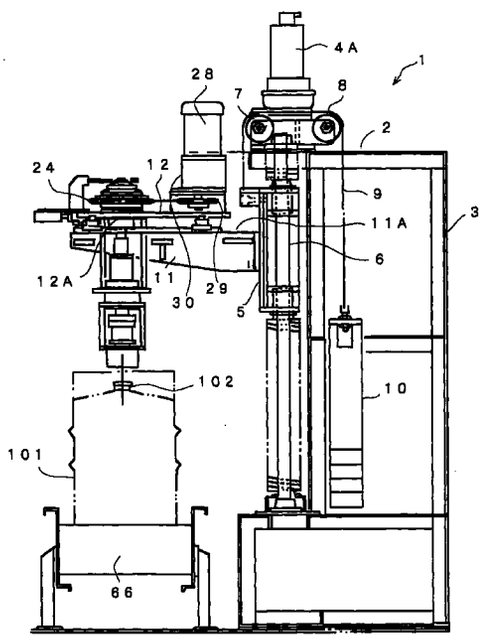

Fig. 2

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Description

Detailed Description of the Invention

Technical Field of the Invention

[0001] The invention relates to a method for removing a spire tube, which is threaded into a neck portion formed at one end of a container, by loosening it and an apparatus thereof.

Description of the Related Art

[0002] For example, a spire tube 103 is conventionally screwed into an opening 102A of a neck portion 102 formed at one end of a beer keg 101, a type of containers used in the field of food as shown in Fig. 11. The spire tube 103, when maintenance is required, is replaced with one having undergone maintenance so to remanufacture the beer keg 101.

[0003] When the spire tube 103 is loosened for replacement, the spire tube 103 might be ejected owing to a pressure of gas remained in the beer keg 101. Therefore, in order to prevent the spire tube 103 from ejecting, there is used the spire tube 103 provided with, for example, an ejection-preventing member, as shown in Fig. 12

[0004] Fig. 12 shows that the spire tube 103 comprises a spire tube body 104, a down tube 105 which is fitted with one end inserted into the spire tube body 104, a retaining disc 105B which is placed on a bottom portion 104E of the spire tube body 104, an annular valve 106 formed of a gas valve disposed on a flange portion 105A of the down tube 105, an inner coil spring 105C mounted in the down tube 105, a beer valve 105D mounted between the inner coil spring 105C and the valve 106, a coil spring 107 which is mounted between the spire tube body 104 and the down tube 105 and also between the retaining disc 105B and the flange portion 105A of the down tube 105, a plate 108 which is disposed between the coil spring 107 and the spire tube body 104 with its one end pierced through the retaining disc 105B and the bottom portion 104E of the spire tube body 104 and a bent ring 108A at the other end held between the flange portion 105A and the coil spring 107, and a stopper portion 109 elastically mounted on the plate 108.

[0005] By configuring as described above, when the spire tube 103 is exchanged, the stopper portion 109, which externally protrudes from an inner diameter 102C of a protruded portion 102B of the neck portion 102 of the beer keg 101, prevents the spire tube 103 from ejecting due to the pressure of gas in the beer keg 101 while it is being loosened.

[0006] The spire tube body 104 is cylindrical, an spire tube thread portion 110 is formed on the upper part of an outer peripheral surface 104A of the spire tube body 104, and a rotation force receiving portion 111 consisting of mutually opposed lug portions 111A, 111A is formed at the top of an inner peripheral surface 104B in the drawing. An annular projection 104C is formed on the inner peripheral surface 104B of the spire tube body 104. And a seal ring 112 is fitted on the outer peripheral surface 104A of the spire tube body 104.

[0007] The coil spring 107 is mounted between the retaining disc 105B and the flange portion 105A of the down tube 105, so that the flange portion 105A of the down tube 105 is pushed upward in the drawing by the coil spring 107.

[0008] The valve 106 is disposed between the flange portion 105A of the down tube 105 and the annular projection 104C of the spire tube body 104, pushed by the coil spring 107 against the annular projection 104C of the spire tube body 104 through the flange portion 105A of the down tube 105, and when pushed down from above in the drawing, made to retract in the axial direction within the spire tube body 104.

[0009] One end of the plate 108 is pushed to be fixed to the flange portion 105A of the down tube 105. The stopper portion 109 is normally protruded externally from the outer peripheral surface 104A of the spire tube body 104 through a hole 104D of the spire tube body 104. When the valve 106 is pushed in to remove the spire tube, the stopper portion 109 is pushed to retract inward from the outer peripheral surface 104A of the spire tube body 104 in communication with the valve 106.

[0010] The spire tube 103 is screwed in the opening 102A of the neck portion 102 by engaging the spire tube thread portion 110 with a thread portion at the top of the opening 102A of the neck portion 102 of the beer keg 101. And the stopper portion 109 of the spire tube 103 is protruded externally from the outer peripheral surface 104A of the spire tube body 104.

[0011] Where the spire tube 103 is to be exchanged for one having undergone maintenance and the spire tube thread portion 110 of the spire tube 103 is loosened to remove from the thread portion of the opening 102A of the neck portion 102 of the beer keg 101, the stopper portion 109 catches the protruded portion 102B of the opening 102A of the neck portion 102 of the beer keg 101 because the spire tube 103 has the stopper portion 109, which is protruded externally from the outer peripheral surface 104A of the spire tube body 104.

[0012] Therefore, the spire tube 103 can be removed from the opening 102A of the neck portion 102 of the beer keg 101 by retracting the stopper portion 109 while pushing the valve 106 by hand and turning the spire tube 103 in a loosening direction while retaining the retracted state.

[0013] But, such a method of loosening the spire tube 103 requires to take the two actions simultaneously with good timing and its workability is poor and troublesome. And it is hard to automate the loosening work of the spire tube 103 because two different actions, one to loosen the spire tube 103 and the other to retract the

stopper portion 109, must be performed in different directions and the thread portion of the spire tube 103 has a problem such as galling.

Summary of the Invention

[0014] The present invention was achieved to solve the problems described above. And it is an object of the invention to provide a method for loosening a spire tube of a container which can automatically loosen the spire tube having a protruded portion to remove it from an opening of a neck portion of the container by rotating the spire tube without interference of the protruded portion with the opening of the neck portion of the container and without having galling on a thread portion of the spire tube and an apparatus therefor.

[0015] It is another object of the invention to provide a method for loosening a spire tube of a container which can shorten an operation time and decrease a force for pulling up the spire tube and an apparatus therefor.

[0016] It is still another object of the invention to provide a method for loosening a spire tube of a container which can readily have a structure to automatically remove the spire tube from the opening of a neck portion of a container by rotating the spire tube even if the spire tube has a protruded portion and can improve workability and an apparatus therefor.

[0017] It is also another object of the invention to provide a method for loosening a spire tube of a container which can cut off the rotation from a rotation drive means by a torque limiter and prevent the spire tube from being damaged even if excess torque is applied to a rotating shaft when the spire tube is deformed conspicuously and an apparatus therefor.

[0018] It is further another object of the invention to provide a method for loosening a spire tube of a container which can detect a change in rotation of a rotating shaft to immediately find that a force to disturb the rotation of the rotating shaft is applied and exchanged for another spire tube to continuously operate an apparatus for loosening a spire tube and the apparatus therefor.

[0019] To achieve the objects described above, a method for loosening a spire tube of a container according to the present invention in that when the spire tube, which comprises a cylindrical spire tube body having a spire tube thread portion formed on its outer peripheral surface and a rotation force receiving portion formed on its inner peripheral surface, a valve disposed to be freely pushed in the spire tube body in its axial liner and a stopper portion which is normally protruded outward from the outer peripheral surface of the spire tube body and retracted inward from the outer peripheral surface of the spire tube body in communication with the valve when the valve is pushed in, and which is mounted with the spire tube thread portion threaded with a thread portion of an opening of a neck portion formed at one end of the container in a state that the stopper portion is protruded outward from the outer peripheral surface of the spire tube body, is removed by loosening the spire tube thread portion from the thread portion of the opening of the neck portion of the container, comprises a spire tube rotating step which loosens the spire tube thread portion of the spire tube by engaging a rotation transmission engaging portion of a wrench, which has a rotation transmitting function and a pushing function by means of a pusher and is mounted on a leading end of a rotating shaft, with the rotation force receiving portion of the spire tube body to rotate the wrench in a loosening direction; a valve push-in step which protrudes the pusher formed on the leading end of the wrench to push the valve of the spire tube into the opening of the neck portion of the container so to retract the stopper portion in communication with the valve toward the inside from the outer peripheral surface of the spire tube body; a valve return step which releases the protrusion of the pusher to return the valve in the pushed-in state into the original state; and a wrench removing step which rotates the wrench in a direction opposite from the loosening direction to remove the wrench from the spire tube.

[0020] And, an apparatus for loosening a spire tube of a container according to the invention in that when the spire tube, which comprises a cylindrical spire tube body having a spire tube thread portion formed on its outer peripheral surface and a rotation force receiving portion formed on its inner peripheral surface, a valve disposed to be freely pushed in the spire tube body in its axial line, and a stopper portion which is normally protruded outward from the outer peripheral surface of the spire tube body and retracted inward from the outer peripheral surface of the spire tube body in communication with the valve when the valve is pushed in, and which is mounted with the spire tube thread portion threaded with a thread portion of an opening of a neck portion formed at one end of the container in a state that the stopper portion is protruded outward from the outer peripheral surface of the spire tube body, is removed by loosening the spire tube thread portion from the thread portion of the opening of the neck portion of the container, comprises a table which is free to lower from a predetermined position; a rotating shaft which is rotatably held by the table; a rotation drive means for transmitting a drive force to the rotating shaft; and a wrench which is mounted to freely protrude at the leading end of the rotating shaft; wherein the wrench includes a wrench body which has the rotation transmission engaging portion for transmitting the rotation to the rotation force receiving portion of the spire tube formed on the outer peripheral surface and a pusher which is mounted on the wrench body so to protrude freely to come in contact with the valve of the spire tube.

Brief Description of the Drawings

[0021]

Fig. 1 is a sectional diagram showing an apparatus for loosening a spire tube of a container according to an embodiment of the invention;
Fig. 2 is a side diagram showing the whole of the apparatus for loosening a spire tube of a container;
Fig. 3 is a plan diagram showing a table of the apparatus for loosening a spire tube of a container;
Fig. 4 is a perspective diagram in part of a wrench body;
Fig. 5 is an explanatory diagram showing a system of steps of a method for loosening a spire tube;
Fig. 6 is an explanatory diagram showing a relation between the spire tube and the wrench where the wrench is lowered in a wrench lowering step;
Fig. 7 is an explanatory diagram showing a relation between the spire tube and the wrench in a spire tube rotating step and a valve push-in step;
Fig. 8 is an explanatory diagram showing a relation between the spire tube and the wrench in a spire tube rotating step and a spire tube pull-up step;
Fig. 9 is an explanatory diagram showing a relation between the spire tube and the wrench in a valve return step;
Fig. 10 is an explanatory diagram showing a relation between the spire tube and the wrench in a wrench removing step;
Fig. 11 is a perspective diagram showing a spire tube and a beer keg; and
Fig. 12 is a sectional diagram showing a state that the spire tube is screwed into a neck portion of a beer keg.

Detailed Description of the Preferred Embodiment

[0022] An embodiment of the invention will be described with reference to the accompanying drawings.

[0023] A method for loosening a spire tube of a container according to embodiments of the invention and an apparatus for loosening a container according to the embodiment of the invention will be described with reference to Fig. 1 through Fig. 10. Description will be made of a beer keg as the container. The beer keg and the spire tube in the embodiment have the same configuration as those described in connection with the related art, and like components are given like reference numerals and their description is omitted.

[0024] Fig. 2 shows a loosening apparatus 1 for a spire tube of a container. This loosening apparatus 1 has an up-and-down device 2.

[0025] In Fig. 2 and Fig. 3, the up-and-down device 2 has a frame 3, a thread shaft 4 erected on the frame 3, a motor 4A mounted on the top end of the thread shaft 4, a vertical plate 5 threaded with the thread shaft 4, rods 6, 6 erected on the frame 3 and disposed on both sides of the thread shaft 4, guides 6A, 6A mounted on the vertical plate 5, pulleys 7, 7, 8, 8 disposed on the top end of the frame 3, chains 9, 9 each one end of which is connected to the vertical plate 5 via the pulleys 7, 7, 8, 8, and a counter weight 10 connected to the other ends of the chains 9, 9. The up-and-down device 2 moves the vertical plate 5 up and down by rotating the thread shaft 4. The guides 6A, 6A mounted on the vertical plate 5 are moved vertically along the rods 6, 6 when the vertical plate 5 is moved up and down.

[0026] Brackets 11 are fixed to the vertical plate 5, and a table 12 is disposed on the brackets 11. X-axis rails 13, 13 are fixed to top surfaces 11A of the brackets 11, and Y-axis rails 14, 14 are fixed to a bottom surface 12A of the table 12. The Y-axis rails 14, 14 are disposed on the X-axis rails 13, 13 to intersect them through four guide members 12B. The table 12 is movable in directions of X and Y axes with respect to the brackets 11 by the four guide members 12B.

[0027] In Fig. 1, a cylindrical member 15 is fixed to the table 12. Bearings 16, 16 are held on an inner peripheral surface 15A of the cylindrical member 15, and a first rotation shaft 17 is supported by the bearings 16, 16.

[0028] A flanged cylindrical member 18 is inserted on one end of the first rotation shaft 17.

[0029] A key 19 is disposed between the inner peripheral surface of the flanged cylindrical member 18 and an outer peripheral surface of one end 17A of the first rotation shaft 17, and a rotation force is transmitted from the flanged cylindrical member 18 to the first rotation shaft 17 through the key 19. A nut 20 is screwed on the top surface of the flanged cylindrical member 18 and a thread portion (not shown) of the one end 17A of the first rotation shaft 17, and the flanged cylindrical member 18 and the first rotation shaft 17 are formed into one body by the nut 20.

[0030] The first rotation shaft 17 is formed an air tunnel 21, and one end of the air tunnel 21 is connected to a switch valve 21A. The switch valve 21A is connected to an air supply source 21B so to selectively communicate with it or open to the atmosphere.

[0031] The other end of the air tunnel 21 is communicated with an elbow 22 which is fixed to an outer peripheral surface 17B of the first rotation shaft 17.

[0032] A first ring 23 is disposed on the top surface of the flange portion 18A of the flanged cylindrical member 18 in the drawing. The first ring 23 is inserted on the flanged cylindrical member 18.

[0033] A first chain sprocket 24 is fixed to the first ring 23 by an unillustrated bolt.

[0034] A thread portion 18B is formed on the outer peripheral surface of the flanged cylindrical member 18, and a collar 25 is screwed on the thread portion 18B. A seat spring 26 and a second ring 27 are placed between the collar 25 and the first ring 23. The first ring 23 is pushed between the second ring 27 and the flange por-

tion 18A of the flanged cylindrical member 18 by the seat spring 26, so that the rotation force of the first ring 23 is transmitted through the first ring 23 → the flanged cylindrical member 18 → the first rotation shaft 17.

[0035] A torque limiter T comprises the flanged cylindrical member 18, the first ring 23, the seat spring 26, and the second ring 27.

[0036] As shown in Fig. 2 and Fig. 3, a motor 28 is fixed on the table 12. A second chain sprocket 29 is disposed on an output shaft (not shown) of the motor 28, and a chain 30 is put around the second chain sprocket 29 to the first chain sprocket 24.

[0037] A rotation drive means K comprises the motor 28, the second chain sprocket 29, the chain 30 and the first chain sprocket 24.

[0038] A rotation number detector 12C is mounted on the table 12 to detect the number of rotations of the first rotation shaft 17. The rotation number detector 12C detects a slit 12E formed on the outer peripheral surface of a disk 12D fixed to the leading end of the first rotation shaft 17.

[0039] A joint 31 formed of a pin is disposed on another end 17C of the first rotation shaft 17. One end of a second rotation shaft 32 is connected to the joint 31.

[0040] The second rotation shaft 32 has a shaft 33 connected to one end of the joint 31, a cylindrical member 34 fixed to the shaft 33 via a lid 37 having an air hole 37A, an elbow 36 connected to the elbow 22 of the first rotation shaft 17 via an air pipe 35 mounted on the cylindrical member 34, a rod holder 38 fixed to the bottom end of the cylindrical member 34 in the drawing, a ball spline 39 disposed in the cylindrical member 34, a piston rod 40 which slides the ball spline 39, has a piston 40A at one end and forms an air chamber 41 between the piston 40A and a top end 39A of the bail spline 39, and a key 42 which is fitted between the cylindrical member 34 and the ball spline 39. The elbow 36 formed on the outer peripheral surface of the cylindrical member 34 and the air chamber 41 are mutually communicated via an air passage 34C formed in a radial direction of the cylindrical member 34.

[0041] A wrench 43 is formed at the leading end of the second rotation shaft 32 so to protrude freely and fixed to the other end of the piston rod 40.

[0042] The wrench 43 comprises a wrench body 43R having a rotation transmitting function and a pusher 62 which is mounted on the wrench body 43R so to be free to protrude and has a pushing function. The pusher 62 is designed to come in contact with the valve 106 of the spire tube 103.

[0043] A compression spring 44 is mounted between the wrench body 43R and the rod holder 38.

[0044] The cylindrical member 34 is supported by an outer cylindrical member 46 via bearings 45, 45.

[0045] The outer cylindrical member 46 has an upper annular flange 46A and a lower annular flange 46B. The upper annular flange 46A is fixed to the table 12 via a plurality of pillars 47. A guide member 49 is fixed to the lower annular flange 46B via a plurality of pillars 48.

[0046] The guide member 49 is cylindrical and has an annular regulating portion 50, which has its axial line aligned with that of the neck portion 102 and its inner diameter corresponded with the outer diameter of the neck portion 102, and a taper portion 51 continuous to the regulating portion 50.

[0047] The regulating portion 50 of the guide member 49 can align the axial line of the neck portion 102 with that of the wrench body 43R to prevent the thread portion from having galling when the spire tube 103 is rotated.

[0048] A holding means, which comprises a plurality of rods 49B configured to reciprocate in a radial direction by an air cylinder 49A, is mounded on the side surface of the guide member 49. The rods 49B are configured to freely hold or release the outer peripheral surface 104A of the spire tube body 104 of the spire tube 103. When they protrude inward, their leading ends hold the outer peripheral surface 104A of the spire tube body 104 of the spire tube 103 to prevent the spire tube 103 from rotating. And a head sensor 49C is mounted on the guide member 49.

[0049] The wrench body 43R has a partition 52 with which the leading end of the piston rod 40 comes in contact and a cylinder portion 53. The cylinder portion 53 is divided into a first operation chamber 54A and a second operation chamber 54B by a piston 54. A stopper 55 in the form of a disk having a diameter smaller than that of the piston 54 is fixed to the top surface of the piston 54 in the drawing.

[0050] An elbow 56 communicated with the first operation chamber 54A is mounted on the outer wall surface of the wrench body 43R and connected to an elbow 58 mounted on an annular flange portion 38A of the rod holder 38 via an air pipe 57. The elbow 58 is communicated with an elbow 59 which is mounted on the side surface of the outer cylindrical member 46 via an air passage 34D which is formed to continue from the annular flange portion 38A, the cylindrical member 34 and the outer cylindrical member 46.

[0051] A cylindrical guide 60 is mounted in the second operation chamber 54B of the wrench body 43R, and a compression spring 61 is mounted between the cylindrical guide 60 and the piston 54. The piston 54 is pushed upward in the drawing by the compression spring 61. The pusher 62 formed of a rod is fixed to the piston 54.

[0052] As shown in Fig. 4, a rotation transmitting engaging portion 63 for transmitting the rotation to a rotation force receiving portion 111 comprising lug portions 111A, 111A (only one is shown) of the spire tube 103 is formed on an outer peripheral surface 43A of the wrench body 43R, and a pull-up engaging portion 64 to be engaged with back sides 111B, 111B of the lug portions 111A, 111A of the spire tube 103 is also formed.

[0053] The rotation transmitting engaging portion 63 comprises vertical nibs 63A, 63A (only one is shown)

which protrude from the outer peripheral surface 43A of the wrench body 43R and extend vertically. The vertical nibs 63A, 63A of the rotation transmitting engaging portion 63 give a rotation force to the rotation force receiving portion 111 comprising the lug portions 111A, 111A of the spire tube 103. The pull-up engaging portion 64 comprises horizontal nibs 64A, 64A. The horizontal nibs 64A, 64A are formed on the same level as a bottom surface 43B of the wrench body 43R and protruded from the outer peripheral surface 43A of the wrench body 43R so to engage with the back side 111B of the lug portion 111A of the spire tube 103, thereby lifting the spire tube 103 upward.

[0054] The rotation transmitting engaging portion 63 and the pull-up engaging portion 64 are configured in the form of letter L when seen from the side of the drawing. The lug portion 111A of the spire tube 103 is engaged with a space 65 formed by the rotation transmitting engaging portion 63 and the pull-up engaging portion 64.

[0055] The wrench 43 is free to contact with or separate from the rod holder 38. When the wrench 43 which is integral with the piston rod 40 is pushed, the wrench 43 is separated from the rod holder 38 to move downward.

[0056] A head comprises the first rotation shaft 17, the second rotation shaft 32, the wrench 43, the outer cylindrical member 46, and the guide member 49.

[0057] Fig. 1 shows a state that air is supplied into the air chamber 41 from the elbow 22 of the first rotation shaft 17, the air pipe 35 and the elbow 36. In this state, the piston 40A of the piston rod 40 is pushed against the lid 37, and the wrench body 43R is shifted upward together with the piston rod 40 which is moved upward. In other words, the compression spring 44 is compressed between the wrench body 43R moved upward and the rod holder 38. The piston rod 40 moves upward against the pushing force of the compression spring 44, and the wrench body 43R is in contact with the rod holder 38.

[0058] When air is released from the air chamber 41 in the state shown in Fig. 1, the piston rod 40 is lowered down by the pushing force of the compression spring 44, which then returns to its original state. Thus, the wrench body 43R is shifted downward.

[0059] As shown in Fig. 2, the beer keg 101 is placed on a top plate conveyor 66 and held by a beer keg clamp (not shown) comprising a pair of L-shaped fingers so to be positioned in X and Y axial directions.

[0060] Actions in this embodiment will be described.

[0061] As shown Fig. 2, the beer keg 101 is carried in by the top plate conveyor 66 and held by a grip (not shown) of a beer keg positioning device so to be positioned in X and Y axial directions.

[0062] The head is lowered (i.e., the table is lowered) to the state as shown in Fig. 1. The pusher 62 is at position (a) as shown in Fig. 1.

[0063] When the head is lowered, the position of the opening 102A of the neck portion 102 of the beer keg 101 is restricted by the guide member 49 which is fixed to the table 12 to accurately determine the position of the axial line of the neck portion 102.

[0064] Subsequently, the spire tube 103 is loosened according to an operation system of a procedure to loosen the spire tube as shown in Fig. 5.

[0065] The operation system of a method for loosening the spire tube will be described in detail. In Fig. 6 through Fig. 10, a solid line shows the spire tube 103, and a phantom line shows a loosening apparatus 1.

[0066] As shown in Fig. 5, the operation system of the spire tube loosening method comprises a wrench lowering step S1, a spire tube rotating step S2, a valve push-in step S3, a spire tube pull-up step S4, a valve return step S5, and a wrench removing step S6.

[0067] In the wrench lowering step S1, the table 12 is lowered by the operation of the up-and-down device 2 to a position lower than an upper stand-by position so not to cause interference when the beer keg 101 is being transferred. Specifically, the head as the whole is lowered, and when the top end of the neck portion 102 of the beer keg 101 is detected by the head sensor 49C as shown in Fig. 1, the head is stopped at a position corresponding to the top end of the neck portion 102.

[0068] Then, the piston rod 40 is shifted downward to lower the wrench 43. The wrench 43 is stopped when it comes in contact with the spire tube 103. Specifically, the wrench 43 is protruded from a position (a) indicated by a solid line to a position (b) indicated by a phantom line. The wrench 43 at the position (b) in Fig. 1 is shown to be at a position (b) in Fig. 6.

[0069] The wrench lowering step S1 is followed by the spire tube rotating step S2. The start of the spire tube rotating step S2 is shown in Fig. 6. It is seen that the stopper portion 109 of the spire tube 103 is protruded externally from the outer peripheral surface 104A of the spire tube body 104.

[0070] In the spire tube rotating step S2, the wrench 43 is rotated in a loosening direction. When the wrench 43 is turned by a predetermined angle, the rotation transmitting engaging portion 63 of the wrench 43 is engaged with the rotation force receiving portion 111 which comprises the lug portions 111A, 111A (only one is shown) of the spire tube 103 as shown in Fig. 4. By rotating the wrench 43, the rotation is transmitted from the rotation transmitting engaging portion 63 to the rotation force receiving portion 111 comprising lug portions 111A, 111A (only one is shown), and the spire tube thread portion 110 of the spire tube 103 is loosened from the opening 102A of the neck portion 102 of the beer keg 101.

[0071] The spire tube rotating step S2 comprises a low-speed loosening step S2A and a high-speed loosening step S2B. In the low-speed loosening step S2A, high torque is transmitted to the wrench 43 to facilitate initial loosening of the thread of the spire tube 103.

[0072] After enabling to loosen the screw of the spire

tube 103 in the low-speed loosening step S2A, the spire tube 103 is loosened faster in the high-speed loosening step S2B.

[0073] The valve push-in step S3 is effected to push in the valve 106 in the second half of the rotating operation of the wrench 43 in the spire tube rotating step S2, and the push-in operation is continued for a very short period of time (e.g., about one second) after completing the rotating operation of the wrench 43.

[0074] As shown in Fig. 7, the pusher 62 is projected by the piston 54 of the wrench 43 in the valve push-in step S3 to push in the valve 106 by the pusher 62. The valve 106 of the spire tube 103 is pushed into the beer keg 101, and the stopper portion 109 is retracted inward from the outer peripheral surface 104A of the spire tube body 104 in communication with the valve 106. Thus, when the spire tube 103 is pulled out upward, the stopper portion 109 of the spire tube 103 is held in a state so not to interfere with the protruded portion 102B of the opening 102A of the neck portion 102 of the beer keg 101. A state after completing the valve push-in step S3 is shown in Fig. 7. The valve push-in step S3 is followed by the spire tube pull-up step S4.

[0075] When the valve 106 is pushed by the pusher 62, even if the compression spring 44 is not strong enough to overcome a reaction force of the coil spring 107, the horizontal nib 64A is engaged with the lug portion 111A of the spire tube 103 as shown in Fig. 7, and the wrench 43 tending to move upward through the valve 106 by the reaction force of the coil spring 107 can be received and fixed by the lug portion 111A of the spire tube 103, enabling to push down the valve 106 by the pusher 62.

[0076] The valve pull-up operation in the spire tube pull-up step S4 and the rotating operation of the wrench 43 in the spire tube rotating step S2 are performed at the same time. The spire tube pull-up step S4 is a step to pull up the spire tube 103 from the neck portion 102 of the beer keg 101 independent of the operation to pull up the spire tube 103 by rotating to loose the spire tube 103.

[0077] In the spire tube pull-up step S4, the pull-up engaging portion 64 formed on the wrench body 43R is in engagement with the back sides 111B of the lug portions 111A, 111A of the spire tube 103 as shown in Fig. 4. And, the wrench 43 is pulled upward by moving the piston rod 40 up, and the spire tube 103 is pulled out of the opening 102A of the neck portion 102 of the beer keg 101 while rotating the wrench 43. A stage after completing the spire tube pull-up step S4 is shown in Fig. 8. After completing the spire tube pull-up step S4, the spire tube rotating step S2 is terminated, and the spire tube 103 is stopped from rotating.

[0078] Subsequently, the valve return step S5 is initiated. In the valve return step S5, when the stopper portion 109 of the spire tube 103 passes by the protruded portion 102B of the opening portion 102A of the neck portion 102 of the beer keg 101, the piston 54 of the wrench body 43R is moved to retract the pusher 62 as shown in Fig. 9. The valve 106 pushed in by the pusher 62 is released to return to the original state. In communication with the valve 106, the stopper portion 109 is projected outward from the outer peripheral surface 104A of the spire tube body 104. And the spire tube 103 is returned to the original state. A state after the completion of the valve return step S5 is shown in Fig. 9.

[0079] After the valve return step S5 comes the wrench removing step S6.

[0080] In the wrench removing step S6, a holding means comprising the rods 49B is protruded inward as shown in Fig. 10, and its leading end holds the outer peripheral surface 104A of the spire tube body 104 of the spire tube 103 to prevent the spire tube 103 from rotating.

[0081] Then, the wrench 43 is rotated in a direction opposite from the loosening direction to remove the wrench 43 from the spire tube 103 before finishing the wrench removing step S6. Subsequently, the head is moved upward to terminate the series of steps. At this time, the spire tube 103 is in a state placed on the opening portion 102A of the neck portion 102 of the beer keg 101.

[0082] As described above, when the spire tube 103 is loosened according to the steps in the operation system for the method to loosen the spire tube shown in Fig. 5, the beer keg 101 is released from being held by the grip (not shown) of the beer keg positioning device, placed on the top plate conveyor 66 and carried out. Finally, the spire tube 103 is removed out of the spire tube loosening apparatus 1 by personnel.

[0083] The embodiment configured as described above provides the following effects.

[0084] First, when the spire tube 103 is rotated to be removed from the opening 102A of the neck portion 102 of the beer keg 101, even if the spire tube 103 has the stopper portion 109, the stopper portion 109 of the spire tube 103 is retracted inward from the outer peripheral surface 104A of the spire tube body 104 by the pusher 62 in communication with the valve 106 so that the stopper portion 109 of the spire tube 103 is not caught by the opening 102A of the neck portion 102, and the rotation transmitting engaging portion 63 of the wrench 43 is engaged with the rotation force receiving portion 111 of the spire tube 103 to transmit the rotation, thereby loosening the spire tube 103. Thus, the spire tube 103 can be removed automatically, and workability can be improved.

[0085] Besides, by utilizing the characteristic that the stopper portion 109 of the spire tube 103 is operated in communication with the valve 106 to move in a radial direction from the outer peripheral surface 104A of the spire tube body 104, two operations in different moving directions, one that the rotation transmitting engaging portion 63 of the wrench 43 is engaged with the rotation force receiving portion 111 of the spire tube 103 to transmit the rotation to loosen the spire tube 103 and

the other that the stopper portion 109 of the spire tube 103 is retracted inward from the outer peripheral surface 104A of the spire tube body 104 by the pusher 62 in communication with the valve 106, can be performed by moving the wrench body 43R and the pusher 62 in the same direction. Thus, the spire tube 103 can be removed automatically by rotating from the opening 102A of the neck portion 102 of the beer keg 101 with ease regardless of the stopper portion 109 formed on the spire tube 103.

[0086] Second, the spire tube thread portion 110 of the spire tube 103 is loosened in the spire tube rotating step S2 and also the valve 106 of the spire tube 103 can be pushed in by the pusher 62 in the valve push-in step S3. Thus, the operation time can be shortened.

[0087] Third, the operation to push in the valve 106 in the valve push-in step S3 is performed in the second half of the operation to rotate the wrench 43 in the spire tube rotating step S2, and the spire tube 103 is mostly pulled out. Therefore, the spire tube thread portion 110 of the spire tube 103 can be prevented from having galling even if the valve 106 is pushed in.

[0088] Fourth, the spire tube pull-up step S4 can pull up the spire tube 103 linearly without rotating it, so that the operation time can be shortened.

[0089] Fifth, when the spire tube 103 is pulled upward, the seal ring 112 might be stack to the opening 102A of the neck portion 102 of the beer keg 101 after a long-term use, making it hard to pull out the spire tube 103 from the opening 102A of the neck portion 102 of the beer keg 101. And, since the spire tube 103 is pulled upward immediately after pushing in the valve 106, the spire tube 103 is also rotated by the rotation of the wrench 43 while the spire tube 103 is being pulled upward. Thus, the seal ring 112 adhered to the opening 102A of the neck portion 102 of the beer keg 101 is peeled and prevented from being caught by the opening 102A of the neck portion 102. Therefore, the operation time can be decreased, and the force to pull up the spire tube 103 can also be decreased.

[0090] Sixth, the pull-up engaging portion 64 which is engaged with the back side 111B of the rotation force receiving portion 111 of the spire tube 103 is formed on the wrench body 43R of the wrench 43. Thus, the wrench 43 can be pulled upward by rotating from the opening 102A of the neck portion 102 of the beer keg 101, and the operation time can be shortened.

[0091] Seventh, when the position of the neck portion 102 of the beer keg 101 is restricted by the guide member 49 to securely align the axial line of the wrench 43 with that of the neck portion 102, thereby loosening the spire tube 103 to remove it, galling between the spire tube thread portion 110 of the spire tube 103 and the thread portion of the opening 102A of the neck portion 102 of the beer keg 101 can be prevented.

[0092] Eighth, when the spire tube 103 is deformed conspicuously and excess torque is applied to the first rotation shaft 17 and the second rotation shaft 32, the rotation from the rotation driving means K is cut off by a torque limiter T to enable the spire tube 103 from being damaged.

[0093] Ninth, when the number of rotations of the first rotation shaft 17 is detected by the rotation detector 12C to find that the first rotation shaft 17 and the second rotation shaft 32 have not reached a predetermined number of rotations, it is judged that there is galling between the spire tube thread portion 110 of the spire tube 103 and the thread portion of the opening 102A of the neck portion 102 of the beer keg 101. Then, the loosening operation is stopped automatically, and alarm is indicated. After that, the spire tube 103 is changed to another spire tube 103 by personnel, and the spire tube loosening apparatus 1 can be operated continuously.

[0094] The embodiment described above has the spire tube pull-up step S4 before the valve return step S5. But, when the valve 106 is pushed by the pusher 62 and the compression spring 44 has a force sufficient to overcome the reaction force of the coil spring 107, the valve 106 can be pushed downward even if the horizontal nibs 64A is not engaged with the lug portion 111A of the spire tube 103 in Fig. 7. And regardless of the spire tube pull-up step S4, the spire tube thread portion 110 of the spire tube 103 can be loosened to raise the spire tube 103 to pull out the spire tube 103.

[0095] Although the embodiment was described in connection with the beer keg as the container, the invention is not limited to the beer keg.

[0096] Besides, the gas valve was referred to as the valve in the embodiment described above, but the invention is not limited to the gas valve.

Claims

1. A method for loosening a spire tube of a container in that when the spire tube, which comprises a cylindrical spire tube body having a spire tube thread portion formed on its outer peripheral surface and a rotation force receiving portion formed on its inner peripheral surface, a valve disposed to be freely pushed in the spire tube body in its axial line, and a stopper portion which is normally protruded outward from the outer peripheral surface of the spire tube body and retracted inward from the outer peripheral surface of the spire tube body in communication with the valve when the valve is pushed in, and which is mounted with the spire tube thread portion threaded with a thread portion of an opening of a neck portion formed at one end of the container in a state that the stopper portion is protruded outward from the outer peripheral surface of the spire tube body, is removed by loosening the spire tube thread portion from the thread portion of the opening of the neck portion of the container, comprising:

   a spire tube rotating step which loosens the

spire tube thread portion of the spire tube by engaging a rotation transmission engaging portion of a wrench, which has a rotation transmitting function and a pushing function by means of a pusher and is mounted on a leading end of a rotating shaft, with the rotation force receiving portion of the spire tube body to rotate the wrench in a loosening direction;

a valve push-in step which protrudes the pusher formed on the leading end of the wrench to push the valve of the spire tube into the opening of the neck portion of the container so to retract the stopper portion in communication with the valve toward the inside from the outer peripheral surface of the spire tube body;

a valve return step which releases the protrusion of the pusher to return the valve in the pushed-in state into the original state; and

a wrench removing step which rotates the wrench in a direction opposite from the loosening direction to remove the wrench from the spire tube.

2. The method for loosening a spire tube of a container according to claim 1, wherein the operation for pushing in the valve in the valve push-in step is performed in the second half of the operation to rotate the wrench in the spire tube rotating step.

3. The method for loosening a spire tube of a container according to claim 2, wherein the valve push-in operation is continuously performed after terminating the wrench rotating operation.

4. The method for loosening a spire tube of a container according to any one of claims 1 through 3, wherein the valve return step is preceded by a spire tube pull-up step in that a pull-up engaging portion formed on the wrench is engaged with the back of the rotation force receiving portion of the spire tube to pull up the spire tube from the neck portion of the container independent of the operation to pull up the spire tube by rotating the spire tube.

5. The method for loosening a spire tube of a container according to any one of claims 1 through 4, wherein the wrench rotating operation in the spire tube rotating step and the pull-up operation in the spire tube pull-up step are performed simultaneously.

6. An apparatus for loosening a spire tube of a container in that when the spire tube, which comprises a cylindrical spire tube body having a spire tube thread portion formed on its outer peripheral surface and a rotation force receiving portion formed on its inner peripheral surface, a valve disposed to be freely pushed in the spire tube body in its axial line, and a stopper portion which is normally protruded outward from the outer peripheral surface of the spire tube body and retracted inward from the outer peripheral surface of the spire tube body in communication with the valve when the valve is pushed in, and which is mounted with the spire tube thread portion threaded with a thread portion of an opening of a neck portion formed at one end of the container in a state that the stopper portion is protruded outward from the outer peripheral surface of the spire tube body, is removed by loosening the spire tube thread portion from the thread portion of the opening of the neck portion of the container, comprising:

a table which is free to lower from a predetermined position;

a rotating shaft which is rotatably held by the table;

a rotation drive means for transmitting a drive force to the rotating shaft; and

a wrench which is mounted to freely protrude at the leading end of the rotating shaft; wherein

the wrench includes a wrench body which has the rotation transmission engaging portion for transmitting the rotation to the rotation force receiving portion of the spire tube formed on the outer peripheral surface and a pusher which is mounted on the wrench body so to protrude freely to come in contact with the valve of the spire tube.

7. The apparatus for loosening a spire tube of a container according to claim 6, wherein the wrench body has a pull-up engaging portion to be engaged with the back side of the rotation force receiving portion of the spire tube.

8. The apparatus for loosening a spire tube of a container according to claim 6 or 7, wherein the table is configured to be freely movable in X and Y axial directions and fixed a guide member which has a regulating portion with its axial line aligned with that of the neck portion of the container and its inner diameter equivalent to the outer diameter of the neck portion.

9. The apparatus for loosening a spire tube of a container according to any one of claims 6 through 8, wherein a torque limiter is mounted between the rotating shaft and the rotation drive means.

10. The apparatus for loosening a spire tube of a container according to claim 9, wherein the table is provided with a rotation number detecting device for detecting the rotation of the rotating shaft.

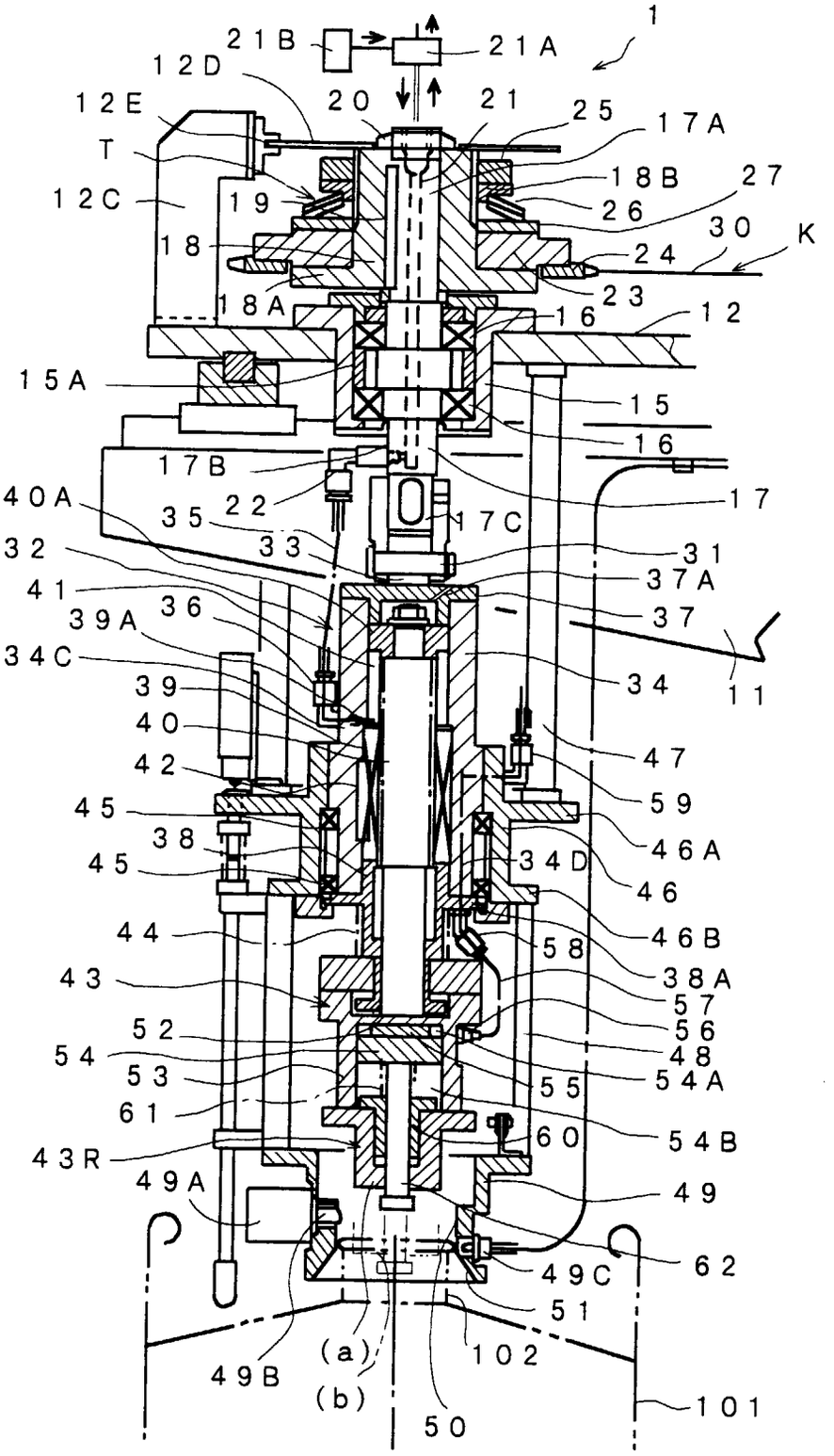
1
21B
21A
12D
20
21
25
17A
12E
T
18B
27
12C
19
26
30
K
18
24
18A
23
16
12
15A
15
16
17B
17
40A
35
22
17C
32
33
31
37A
41
36
37
39A
34C
34
11
39
40
47
42
59
45
38
46A
45
34D
46
44
46B
58
43
38A
57
52
56
54
48
53
55
54A
61
60
54B
43R
49A
49
49C
62
51
49B
(a)
102
(b)
50
101

Fig. 1

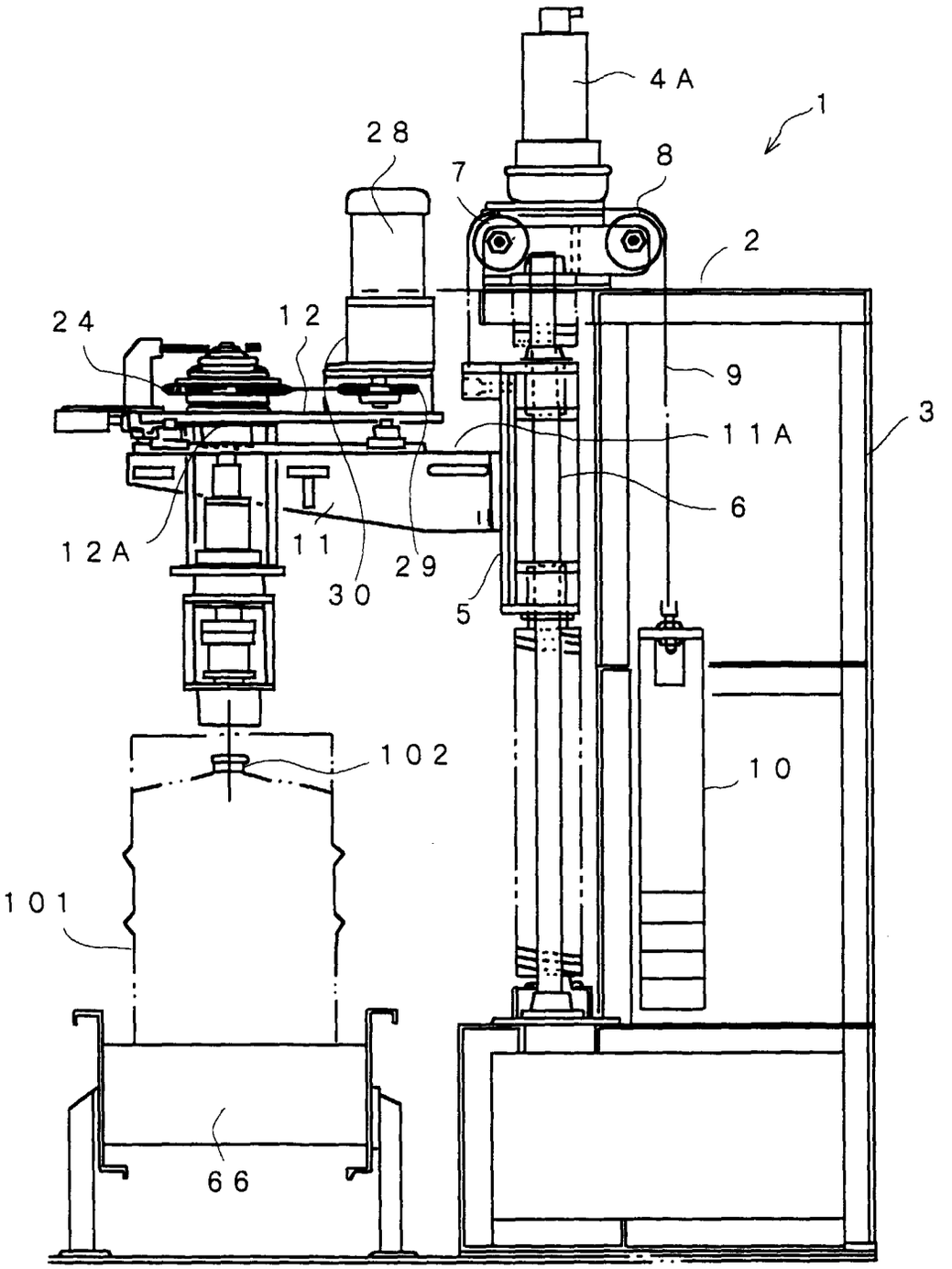

Fig. 2

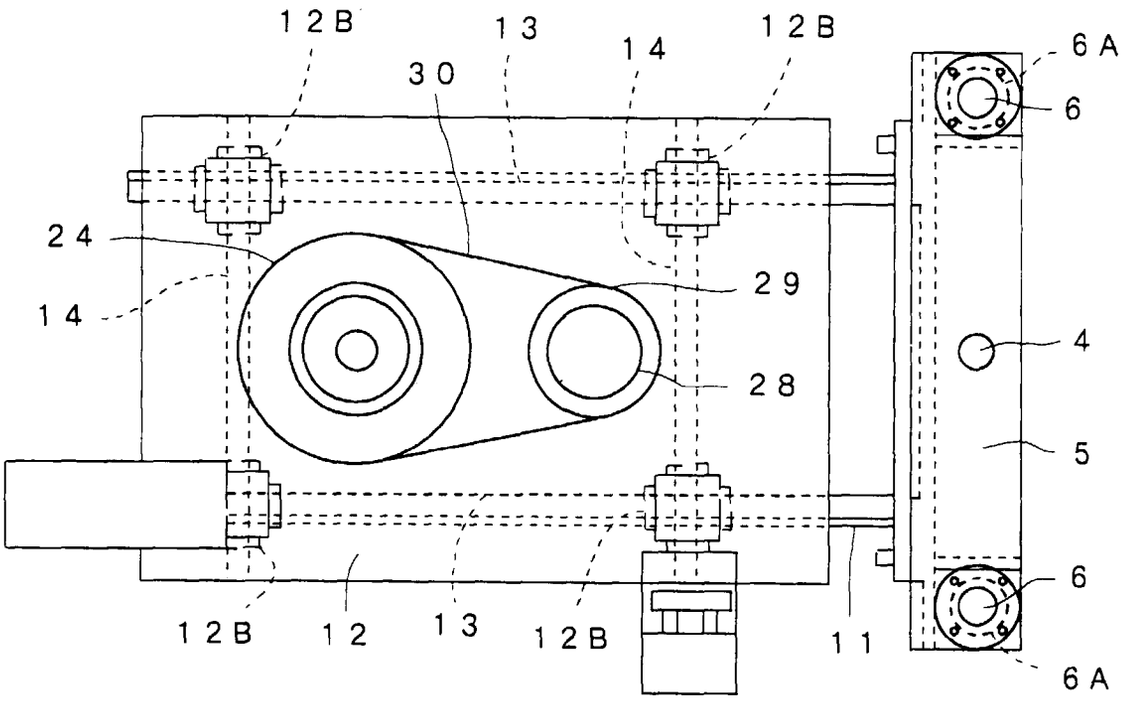

Fig. 3

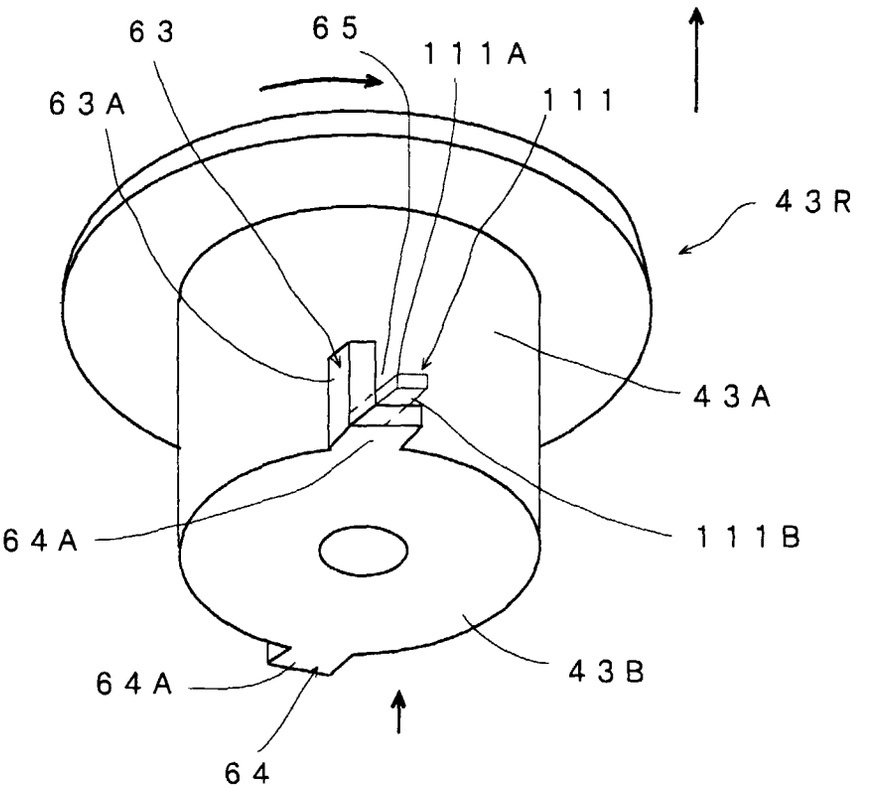

Fig. 4

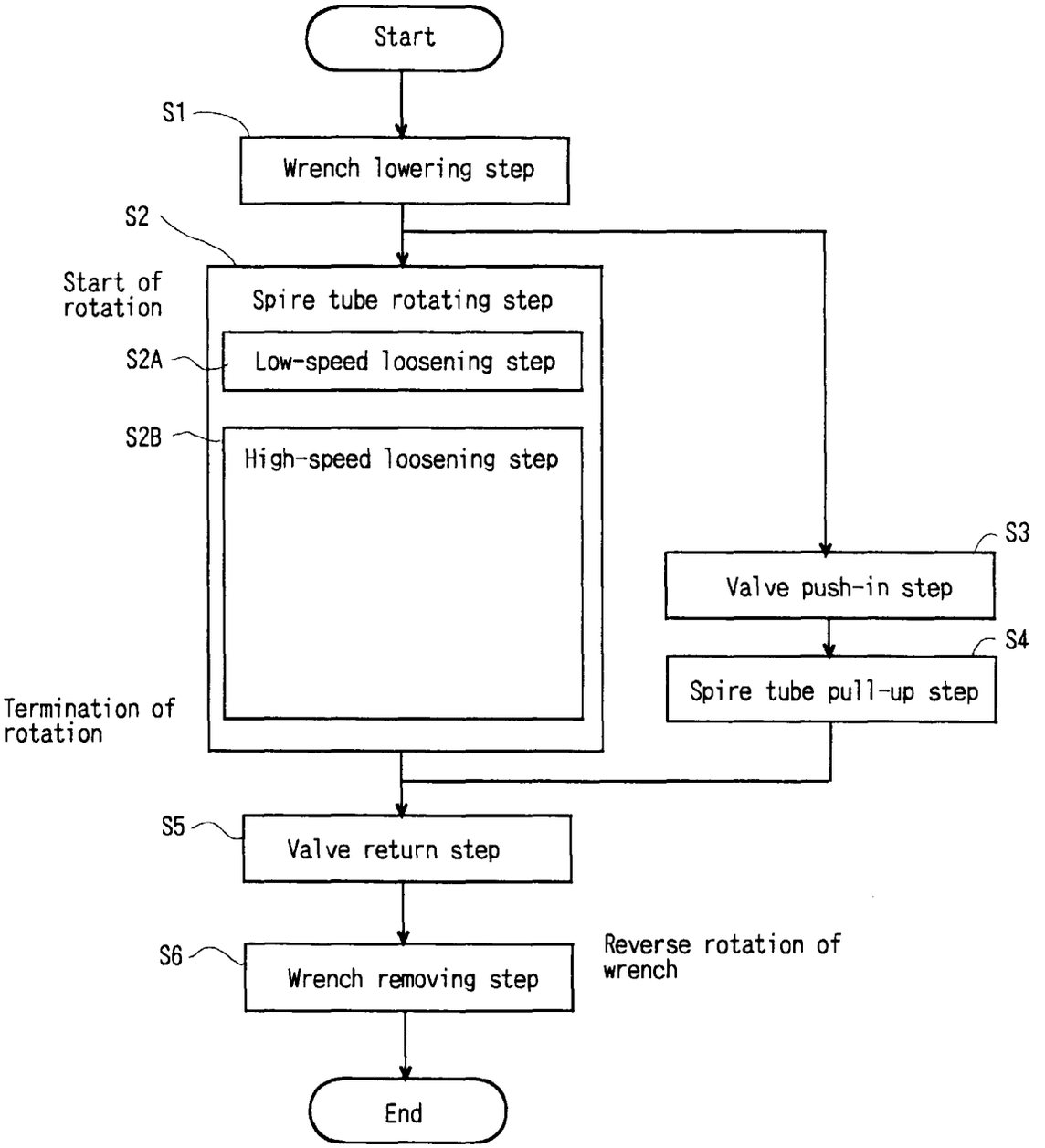
Start
S1
Wrench lowering step
S2
Start of rotation
Spire tube rotating step
S2A
Low-speed loosening step
S2B
High-speed loosening step
Termination of rotation
S3
Valve push-in step
S4
Spire tube pull-up step
S5
Valve return step
S6
Wrench removing step
Reverse rotation of wrench
End

Fig. 5

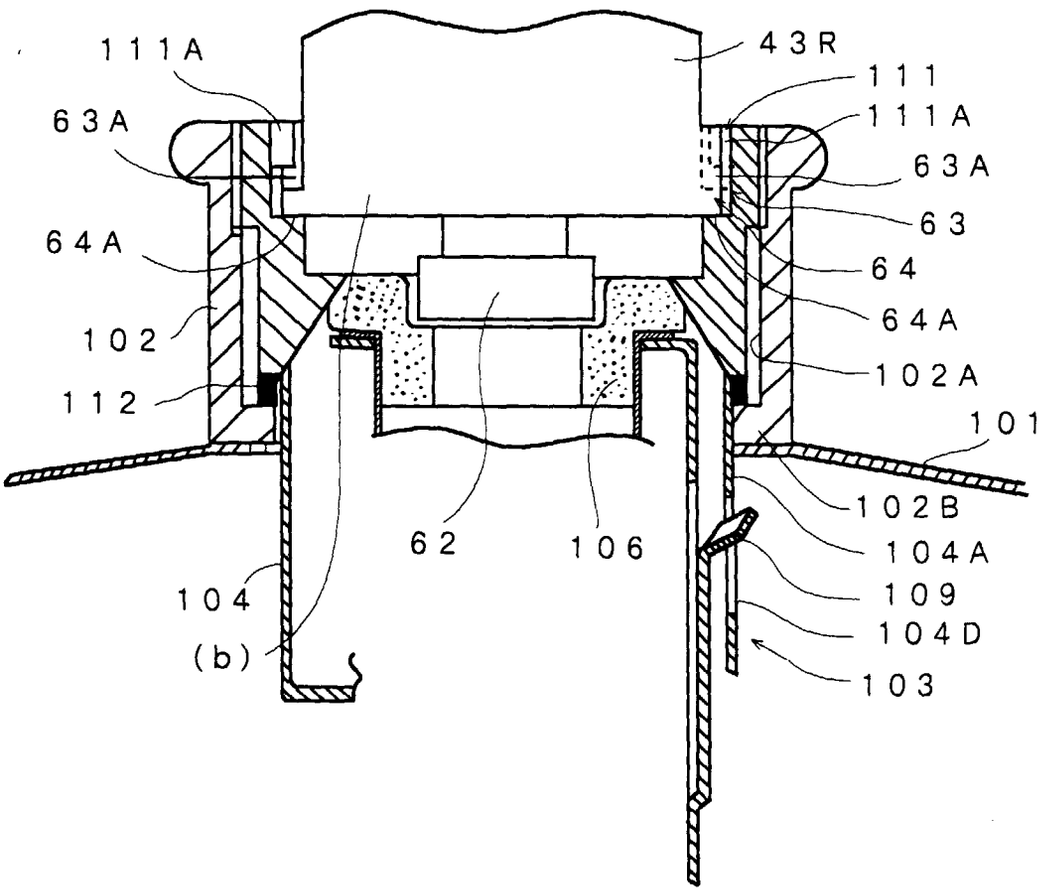
111A
63A
64A
102
112
43R
111
111A
63A
63
64
64A
102A
101
102B
104A
109
104D
103
62
106
104
(b)

Fig. 6

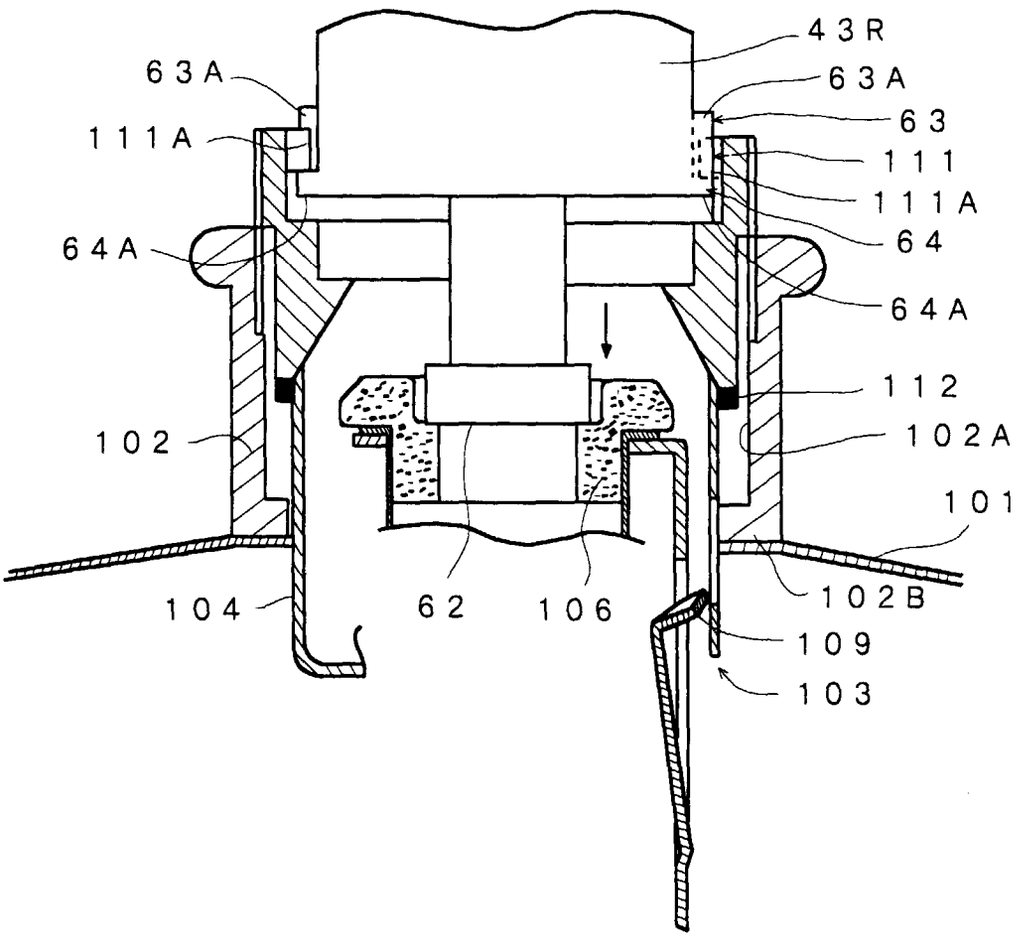
43R
63A
63A
63
111
111A
64
64A
64A
112
102A
101
102B
109
103
102
104
62
106

Fig. 7

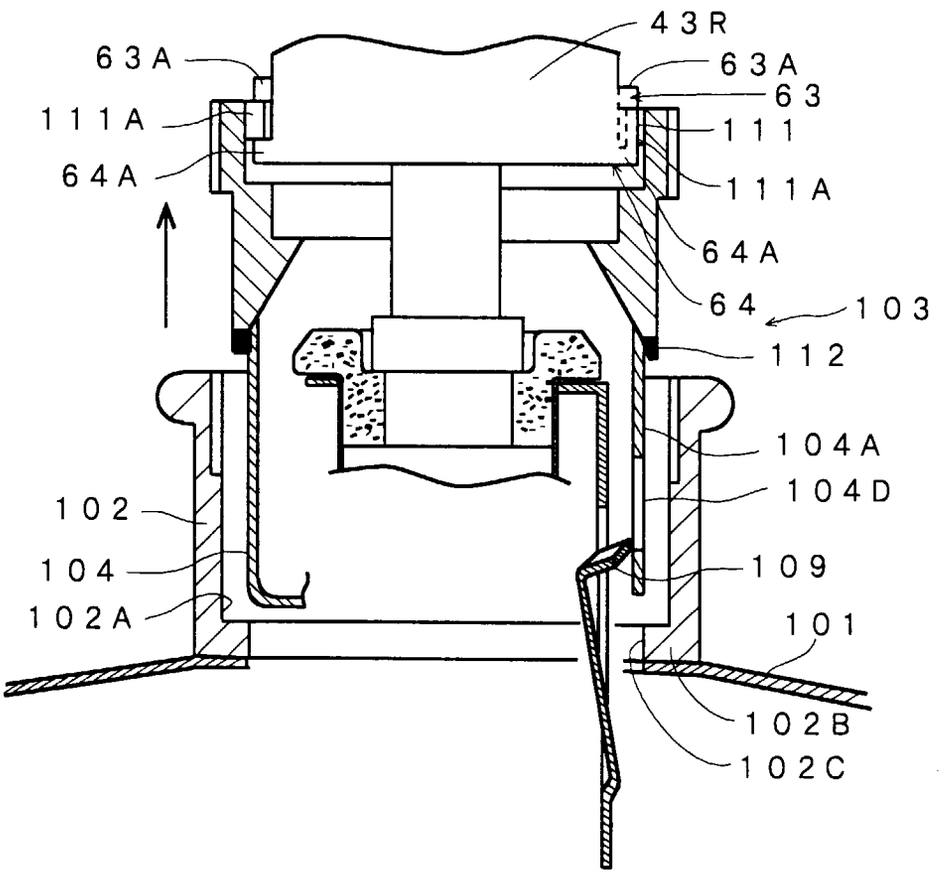
43R
63A
63A
63
111A
111
64A
111A
64A
64
103
112
104A
104D
102
104
109
102A
101
102B
102C

Fig. 8

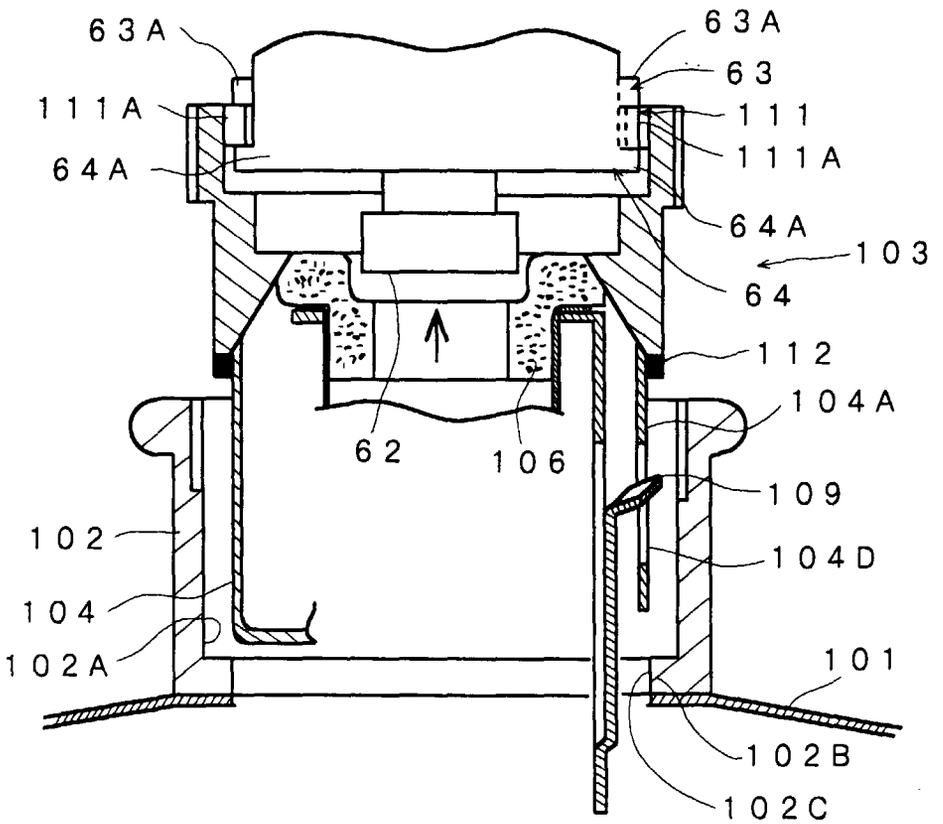
63A
63A
63
111A
111
64A
111A
64A
103
64
112
104A
62
106
109
102
104D
104
102A
101
102B
102C

Fig. 9

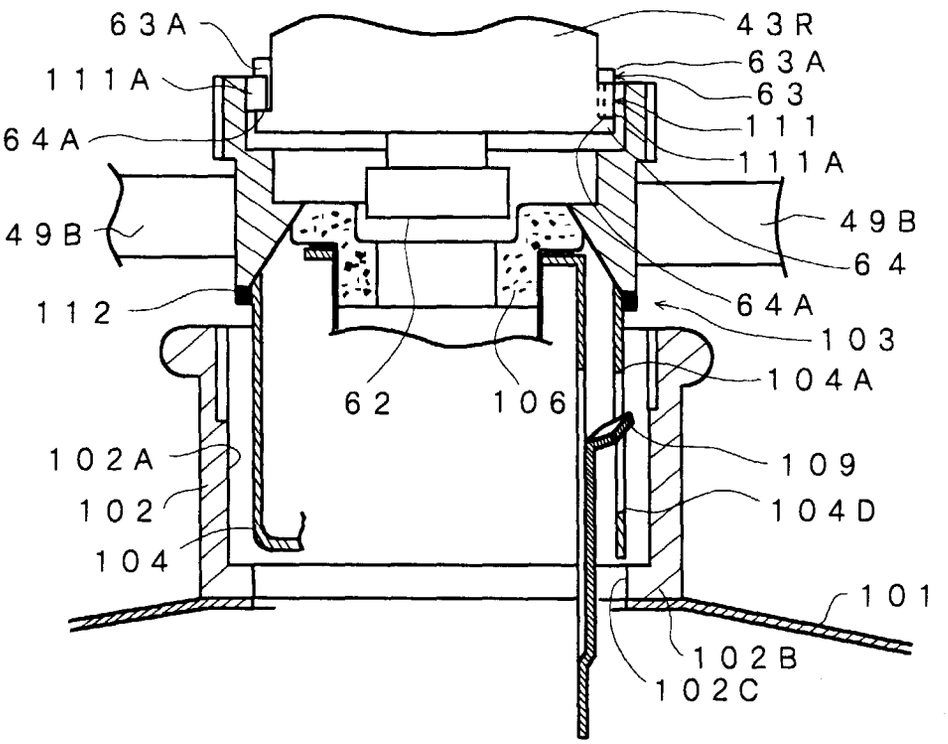
63A
111A
64A
49B
112
102A
102
104
62
106
43R
63A
63
111
111A
49B
64
64A
103
104A
109
104D
101
102B
102C

Fig. 10

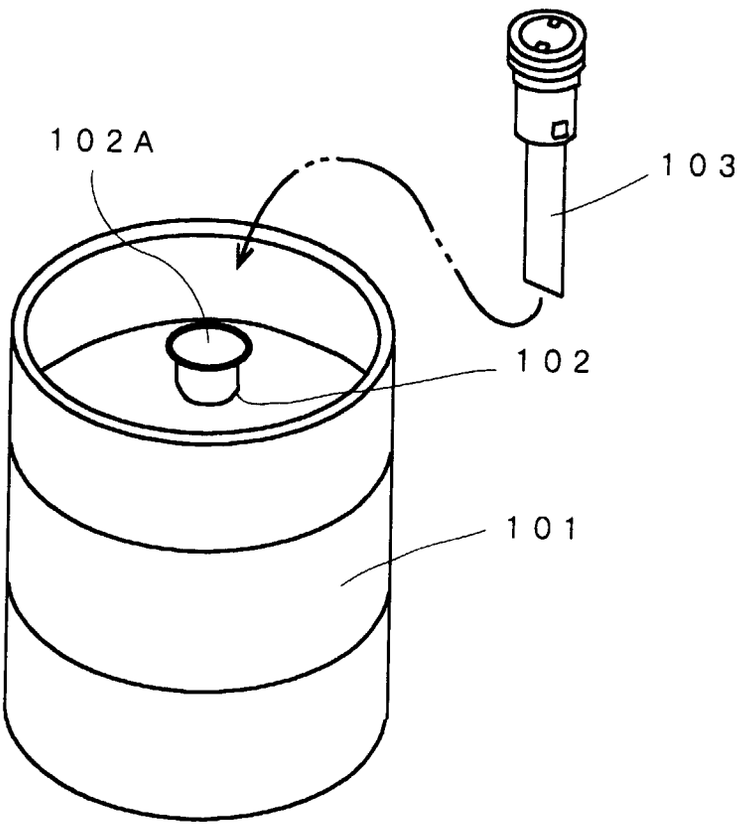

Fig. 11

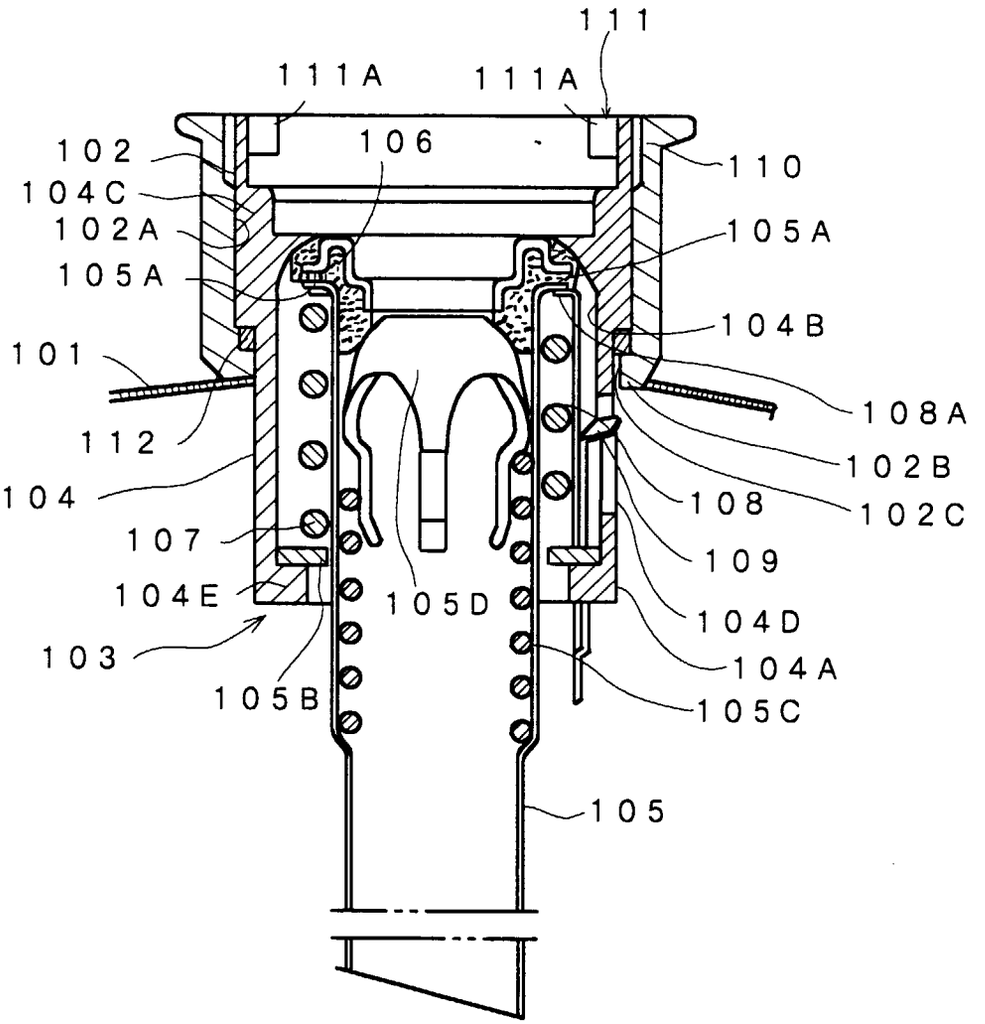
111
111A
111A
102
106
110
104C
102A
105A
105A
104B
101
108A
112
102B
104
108
102C
107
109
104E
105D
104D
103
104A
105B
105C
105

Fig. 12

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 10 0724

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 645 342 A (UNIVERSAL EQUIP CO) 29 March 1995 * column 4, line 33 - line 43; figure 7 *	1,3,4	B67B7/42 B67D1/08
X	WO 91 02694 A (MICRO MATIC AS) 7 March 1991 * page 13, line 1 - line 15; figures 10,11 *	1,4	
X	EP 0 623 550 A (ODL SRL) 9 November 1994 * column 4, line 11 - line 21; figures 1,2 *	1,4	
X	US 3 180 344 A (HARGREAVES G.) 27 April 1965 * column 4, line 12 - column 5, line 33; figure 4 *	6	
A	GB 2 202 216 A (GKN SANKEY LTD) 21 September 1988 * page 11, paragraph 2; figures 1,2 *	1,6	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B67B
B67D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 April 1999	Martínez Navarro, A.

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 10 0724

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16-04-1999

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