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(54) **ROTARY DYEING DEVICE AND AUTOMATIC DYEING DEVICE**

ROTIERENDE FÄRBEVORRICHTUNG UND AUTOMATISCHE FÄRBEVORRICHTUNG

DISPOSITIF DE TEINTURE ROTATIF ET DISPOSITIF DE TEINTURE AUTOMATIQUE

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Description

Technical Field

[0001] The present invention relates to a rotary dyeing device and an automatic dyeing device.

Background Art

[0002] A conventionally known pot-type dyeing machine dyes fabric in such a manner that the fabric is placed in a pot that stores a dyeing solution, and the pot is rotated. For example, PTL 1 discloses a dyeing machine, as shown in Fig. 12, comprising a plurality of units 210, each unit comprising a dyeing container 200 in which a material to be dyed and a dyeing solution are placed, and a rotating shaft 202 rotating the dyeing container 200, with each unit transmitting torque to the rotating shaft 202 via a driving pulley 204 fixed to the rotating shaft 202. In each unit 210, the opening of the dyeing container 200 is closed with an upper lid 206, which is mounted in the rotating shaft 202 via a mounting member 208. The rotation of the rotating shaft 202 rotates the dyeing container 200, and the fabric can be thereby dyed.

Citation List

Patent Literature

[0003]

PTL 1: Japanese Unexamined Patent Publication No. 2002-309476

PRIOR ART

[0004] Document CH 530 823 A discloses an apparatus for the treatment of textiles by liquids, for instance in order to dye the textile.

Summary of Invention

Technical Problem

[0005] The above prior-art dyeing machine requires operations of mounting the dyeing container 200 in the rotating shaft 202 via the mounting member 208 after the fabric and dyeing solution are placed in the dyeing container 200, and after dyeing, removing the dyeing container 200 from the mounting member 208, opening the upper lid 206, and taking out the fabric. Performing these operations on each of the plurality of units 210 is burdensome and requires a long time.

[0006] Accordingly, an object of the present invention is to provide a rotary dyeing device and an automatic dyeing device that can quickly and efficiently carry out various types of dyeing.

Solution to Problem

[0007] The above object of the present invention can be achieved by a rotary dyeing device that dyes a material to be dyed by rotating a container in which the material and a dyeing solution are placed, the device comprising a rotating table on which the container having an opening at the top thereof is rotatably mounted, a pressing means for pressing a lid against the container from above to thereby rotatably seal the container, a tilting means for tilting the sealed container, and a rotation drive means for rotating the container in a tilted state.

[0008] In a preferred embodiment of the present invention, the pressing means comprises a pressing body to be brought into contact with the lid, and a fixing shaft extending from the pressing body and penetrating through the lid, with the fixing shaft rotatably supporting the lid.

[0009] In a more preferred embodiment of the present invention, the fixing shaft comprises a hollow portion, to which a pressure release pipe is connected to thereby communicate the inside and outside of the container, and the pressure release pipe extends upward in the container when the container is tilted.

[0010] In an even more preferred embodiment of the present invention, the lid is provided with a plate via a spacer on a surface to be brought into contact with the container, and the pressure release pipe is disposed in a gap portion formed between the lid and the plate.

[0011] In a still more preferred embodiment of the present invention, the rotary dyeing device further comprises a heating means for heating the tilted container, and a cooling means for spraying cooling water on the surface of the tilted container.

[0012] In a still more preferred embodiment of the present invention, the heating means comprises a far-infrared heater arranged along the tilted container, and a reflector covering the far-infrared heater so that far-infrared rays are emitted to the container.

[0013] In a still more preferred embodiment of the present invention, the rotating table, pressing means, and tilting means are provided in plural numbers corresponding to a plurality of the containers, and the rotation drive means comprises a drive belt to be brought into contact with the outer circumferential edge of the rotating table upon tilting of the container and is capable of transmitting driving force to the plurality of containers via the drive belt.

[0014] In a still more preferred embodiment of the present invention, the outer surface of the container is surface-treated so as to have an absorption wavelength of 2 to 20 μm.

[0015] In a still more preferred embodiment of the present invention, the inner surface of the container is provided with one or more elongated convex portions extending in a longitudinal direction.

[0016] In a still more preferred embodiment of the present invention, the inner surface of the container is

formed into an irregular surface in which convex portions and concave portions alternate consecutively in a circumferential direction.

[0017] The aforementioned object of the present invention can also be achieved by an automatic dyeing device comprising a plurality of rotary dyeing devices having the above structure, and a container-carrying means that holds and carries the container in a receiving station to any of the rotary dyeing devices, and that holds and carries the container in which dyeing of the material is completed from the rotary dyeing device to a discharge station.

[0018] In a preferred embodiment of the present invention, the container-carrying means inserts the container horizontally between the rotating table, which is in a horizontal position, and the lid.

[0019] In an even more preferred embodiment of the present invention, the container-carrying means comprises a chuck member for holding the container, a triaxial driving means for driving the chuck member along three mutually perpendicular axial directions, and a chuck opening/closing means for opening and closing the chuck member.

[0020] In a still more preferred embodiment of the present invention, the receiving station comprises a weight-detecting means for detecting the weight of the container.

[0021] In a still more preferred embodiment of the present invention, the automatic dyeing device further comprises an intermediate station for temporary placement of the container in which dyeing of the material is not yet completed, after being carried by the container-carrying means, and the intermediate station comprises an adding means for adding a dyeing assistant to the container.

Advantageous Effect of Invention

[0022] The rotary dyeing device and automatic dyeing device of the present invention can quickly and efficiently carry out various types of dyeing.

Brief Description of Drawings

[0023]

Figure 1 is a perspective view showing the entire structure of an automatic dyeing device according to one embodiment of the present invention.

Figure 2 is a perspective view of rotary dyeing devices of the automatic dyeing device shown in Fig 1 viewed from the direction of arrow A.

Figure 3 is a cross-sectional view of the rotary dyeing devices shown in Fig. 2 taken along the line B-B.

Figure 4 is a cross-sectional view of the rotary dyeing device shown in Fig. 2 taken along the line C-C.

Figure 5 is a side view of the rotary dyeing device shown in Fig. 4 before the container is tilted.

Figure 6 is an enlarged view of the main part of the rotary dyeing device shown in Fig. 4.

Figure 7 is a perspective view of a container carrier of the automatic dyeing device shown in Fig. 1 viewed from the direction of arrow A.

Figure 8 shows enlarged perspective views of a chuck member of the container carrier shown in Fig. 7; (a) shows a closed state, and (b) shows an open state.

Figure 9 is a perspective view of the chuck member shown in Fig. 8 viewed from below.

Figure 10 is a perspective view of the main part of a rotary dyeing device according to another embodiment.

Figure 11 is a perspective view showing the appearance of the container.

Figure 12 is a cross-sectional view showing a part of a prior-art dyeing machine.

Description of Embodiments

[0024] The embodiments of the present invention are described below with reference to the accompanying drawings. Figure 1 is a perspective view showing the entire structure of an automatic dyeing device according to one embodiment of the present invention. Figure 2 is a perspective view of one unit of rotary dyeing devices shown in Fig. 1 viewed from the direction of arrow A. Figures 3 and 4 respectively show a B-B cross-sectional view and C-C cross-sectional view of Fig 2.

[0025] As shown in Fig. 1, the automatic dyeing device 100 comprises a plurality of rotary dyeing devices 1 that dye materials to be dyed by individually rotating containers in which the materials and dyeing solutions are placed, and comprises a container carrier 50 that carries the container to each rotary dyeing device 1. In this embodiment, the rotary dyeing devices 1 are arranged in a matrix form in such a manner that three rotary dyeing devices arranged in the horizontal direction (X-direction) form one unit, and four units are arranged in a multilevel configuration in the vertical direction (Z-direction).

[0026] As shown in Fig. 11, the container 2 is in a cylindrical shape with a bottom and an opening 2A at the top thereof, and internally has an accommodation space 2B for accommodating materials to be dyed, such as socks and underwear. In order for the container 2 to well absorb far-infrared rays emitted from a heater 8 (described later), the outer surface of the container 2 is surface-treated so as to have an absorption wavelength of 2 to 20 μm. For example, in this embodiment, the outer surface of the container 2 is coated with a matte black paint, etc. (blackening treatment). Because the ability to absorb far-infrared rays is imparted to the container 2 in this manner, when the heater 8 emits far-infrared rays to heat the container 2, the container 2 can absorb far-infrared rays well, and the heat-receiving efficiency of the container 2 can be enhanced. The color of the outer surface of the container 2 is not necessarily limited to black,

and various colors can be used as long as they have sufficient far-infrared ray absorption efficiency. Moreover, the outer surface of the container 2 preferably has a matte, satin-finished rough surface, whereas a mirror-finished surface is not preferable because it reflects far-infrared rays.

[0027] The inner surface of the container 2 is provided with a plurality of longitudinally elongated convex portions 2C (three convex portions in this embodiment) extending in the height direction of the container 2 and arranged at equiangular positions. As will be described in detail later, when a material to be dyed is dyed by rotating the container 2 lying on its side in which the material and a dyeing solution are placed, the convex portions 2C churn the material in the container 2 while stirring to thereby sufficiently mix the material with the dyeing solution. Consequently, the dyeing solution can be uniformly applied to the material without unevenness, and the resulting dyed material has excellent quality. In this embodiment, a plurality of convex portions 2C are provided in the inner surface of the container 2 at equal intervals; however, the convex portions are not necessarily provided at equal intervals. The number of convex portions 2C may be one. Alternatively, the inner surface of the container 2 may be formed into an irregular surface in which a plurality of convex portions and a plurality of concave portions alternate consecutively in a circumferential direction. The convex portion 2C is positioned at a predetermined distance from the upper edge of the container 2 so that, when a lid 27 is fitted in the container 2, a plate 27a (described later) on the back side of the lid 27 does not come into contact with the convex portion 2C in the container 2.

[0028] Each of the rotary dyeing devices 1 is configured to be capable of holding a container 2 and has a rotating table 10, a pressing unit 20, and a tilting unit 30, as shown in Figs. 2 to 4. Figure 2 shows the containers 2 that are tilted almost horizontally (in Y-direction of Fig. 1).

[0029] The rotating table 10 has a disk-like shape and is rotatably supported by a mounting frame 4 via a bearing unit 6.

[0030] The pressing unit 20 comprises a pressing cylinder 21 (e.g., an air cylinder) attached to the mounting frame 4, a transmission shaft 23, one end of which is connected to the tip of a rod 21a of the pressing cylinder 21 via a connecting plate 22, and a plate-like pressing body 24 attached to the other end of the transmission shaft 23. The pressing cylinder 21 and transmission shaft 23 are arranged approximately parallel to the rotational axis of the rotating table 10. The pressing body 24 is disposed opposing the rotating table 10. As shown in Fig. 4, a fixing shaft 25 is fixed to the pressing body 24.

[0031] The fixing shaft 25 has a hollow portion 25a formed along the axis of the fixing shaft 25 and penetrates through the pressing body 24 so that the axis of the fixing shaft 25 conforms to the rotational axis of the rotating table 10. One end of the hollow portion 25a facing the rotating table 10 is connected to a pressure release pipe 26, and the other end of the hollow portion 25a communicates with the outside via a communication port 25b. The pressure release pipe 26 is arranged to extend upwardly when the container 2 is tilted, as shown in Fig. 4. Moreover, a thermocouple 29 is inserted from the other end of the hollow portion 25a. The thermocouple 29 has a temperature sensing portion 29a arranged to extend downwardly via one end of the hollow portion 25a. The portion of the fixing shaft 25 where the thermocouple 29 is inserted is sealed in a fluid-tight manner to prevent leakage of the dyeing solution from the container 2. The pressure release pipe 26 and thermocouple 29 are covered with the plate 27a (described later) provided in the lid 27.

[0032] The pressing unit 20 comprises the lid 27 for tightly sealing the opening of the container 2. The lid 27 has a bearing unit 28 fixed in the center of the surface. The fixing shaft 25 of the pressing body 24 is inserted into an opening formed in the center of the lid 27 via the bearing unit 28 and rotatably supports the lid 27. The bearing unit 28 is composed of an annular case 28a and a rolling bearing 28b housed in the case 28a. The pressing body 24 is brought into contact with the case 28a of the bearing unit 28 to press the lid 27, so that the lid 27 is closely attached to the circumferential edge of the container 2. As shown in the enlarged view of Fig. 6, a washer 201 is provided between the pressing body 24 and the bearing 28b. The lid 27 is pressed by a pressing force applied to the pressing body 24 in the direction indicated by the arrow, via the washer 201, bearing 28b, and case 28a. An annular packing 202 is fitted onto one end of the fixing shaft 25, and the fixing shaft 25 and lid 27 are sealed in a fluid-tight manner by the packing 202.

[0033] As shown in Figs. 3 to 5, the back side of the lid 27 is provided with the plate 27a having a diameter smaller than that of the lid 27 via a spacer 27b, and a gap portion 27c is accordingly formed between the lid 27 and the plate 27a. The pressure release pipe 26 and thermocouple 29 are disposed in the gap portion 27c so that a material C to be dyed is prevented from being caught on the pressure release pipe 26 or thermocouple 29 during dyeing. The outside diameter of the plate 27a is slightly smaller than the inside diameter of the container 2. This allows the communication between the interior space of the container 2 and the gap portion 27c. Consequently, the dyeing solution enters into the gap portion 27c during dyeing and is thus brought into contact with the thermocouple 29, and the interior space of the container 2 communicates with the outside of the container 2 via the pressure release pipe 26.

[0034] The pressing unit 20 may be configured to seal the container 2 with the lid 27 and rotatably hold the container 2 and lid 27. For example, the configuration of the pressing unit 20 may be such that a U-shaped frame rotatably supports the rotating table 10 in one of the opposing faces of the frame and supports the pressing body 24 in the other face via a driving cylinder so that the press-

ing body 24 is movable forward and backward. The container 2, lid 27, and other parts to be in contact with the dyeing solution are preferably made of corrosion-resistant materials, such as stainless steel.

[0035] The tilting unit 30 comprises a tilting cylinder 32 (e.g., an air cylinder) attached to a supporting frame 31, and the tip of a rod 32a of the tilting cylinder 32 is fixed to the mounting frame 4. The mounting frame 4 is supported by a rotating shaft 33 so as to be rotatable relative to the supporting frame 31. When the rod of the tilting cylinder 32 is moved forward and backward, the mounting frame 4 rotates to change the posture of the container 2 between the standing state shown in Fig. 5 and the tilted state shown in Fig. 4.

[0036] Moreover, the rotary dyeing device 1 comprises a rotation drive unit 40 that rotates the container 2 mounted on the rotating table 10. The rotation drive unit 40 includes a driving pulley 41 and a driven pulley 42 attached to the supporting frame 31, and an endless drive belt 43 wound around the driving pulley 41 and driven pulley 42. The supporting frame 31 is provided with a tension roller 44, which imparts tension to the drive belt 43. The driving pulley 41 is connected to the rotating shaft of a drive motor 45 and rotationally drives the drive belt 43 in one direction. The driven pulley 42 has a groove 42a formed along the outer surface thereof. The drive belt 43 is arranged so that the bottom side of the belt is brought into contact with the outer circumferential edge of the rotating table 10 in the groove 42a of the driven pulley 42 when each container 2 is tilted, and the drive belt 43 rotationally drives the rotating table 10 by friction. In this embodiment, the containers 2 in the three rotary dyeing devices 1 are rotated by one rotation drive unit 40, thereby achieving downsizing of the structure; however, the rotation drive unit 40 may be provided in each rotary dyeing device 1.

[0037] Furthermore, the rotary dyeing device 1 comprises heaters 8 (e.g., far-infrared heaters) arranged in both right and left sides of the rotating table 10 so as to extend along the axis of the tilted container 2. To efficiently heat the container 2, each of the heaters 8 is covered with a reflector 8a and is attached to the supporting frame 31 via a stay (not shown).

[0038] The heaters 8 may be various heaters, such as infrared heaters and IH (electromagnetic induction heating) heaters, other than far-infrared heaters. When infrared heaters, IH (electromagnetic induction heating) heaters, etc., are used as the heaters 8, it is preferable for improving the heat-receiving efficiency of the container 2 to select a suitable material of the container 2 depending on each heater, or to apply surface treatment to the outer surface of the container 2.

[0039] Additionally, the rotary dyeing device 1 comprises a cooling water nozzle 9 for supplying cooling water to the side surface of the tilted container 2, as shown only in Fig. 4. The cooling water nozzle 9 is fixed to the supporting frame 31 at a position so close as not to interfere with the container 2 so that cooling water can be supplied from a cooling water tank (not shown) to the side surface of the container 2 by the action of a pump and an electromagnetic valve disposed in the flow path. The tip of the cooling water nozzle 9 is provided with two cooling water spray ports 9a and 9a for spraying cooling water obliquely downward from both sides across the axis of the cooling water nozzle 9. Thereby, cooling water can be supplied broadly along the axis of the container 2. In this embodiment, the cooling water nozzle 9 is disposed above the container 2 so as to spray cooling water to the side surface of the container 2 from the upside of the container 2, as shown in Fig. 4; however, the present invention is not limited to this embodiment. For example, the cooling water nozzle 9 may be disposed below the container 2 so as to spray cooling water to the side surface of the container 2 from the downside of the container 2. In addition, water is used as a cooling medium in this embodiment, but can be replaced with liquid or gas having cooling capacity.

[0040] The container carrier 50 comprises, as shown in Figs. 1 and 7, a supporting frame 60 including a plurality of vertical columns 61 and a plurality of horizontal beams 62, a horizontally moving body 70 supported by the supporting frame 60 so as to be movable in the horizontal direction (X-direction), a lifting body 80 provided in the horizontally moving body 70 so as to be movable up and down in the vertical direction (Z-direction), and a chuck member 90 provided in the lifting body 80 so as to be movable forward and backward in the anteroposterior direction (Y-direction). In the supporting frame 60, a pair of guide rails 63 and 63 extending in the horizontal direction (X-direction) is mounted on the horizontal beams 62 connected to the lower ends of the vertical columns 61.

[0041] The horizontally moving body 70 is configured such that an upper block 72 and a lower block 71 are connected to each other via a pair of guide rods 73 and 73 extending in the vertical direction (Z-direction). Both lower sides of the lower block 71 are engaged with the pair of guide rails 63 and 63.

[0042] As shown in the enlarged view of Fig. 8 (a), the lifting body 80 is configured such that a pair of brackets 81 and 81 disposed on both right and left sides (X-direction) is connected to each other via a pair of stays 82a and 82a disposed on the upper and lower sides (Z-direction) and a pair of connecting plates 82b and 82b disposed on the front and back sides (Y-direction). The opposing inner sides of the pair of brackets 81 and 81 are provided with guide members 83 and 83 for guiding the chuck member 90. The outer sides of the brackets 81 and 81 are provided with insertion blocks 84 and 84 into which the guide rods 73 and 73 are inserted.

[0043] In the chuck member 90, as also shown in Fig. 8 (a), a pair of plate-like base members 91 and 91 is disposed on the upper and lower sides, and two rotating shafts 92 and 92 are rotatably mounted on both sides of the base members 91. The rotating shafts 92 and 92 are connected to the ends of holding pawls 93 and 93, respectively. The holding pawls 93 and 93 rotate together

with the rotation of the rotating shafts 92 and 92, so that holding pawls 93 and 93 are opened or closed. The rotating shafts 92 and 92 are each connected to one end of plate-like lever members 94 and 94. In the other ends of the lever members 94 and 94, projections 94a and 94a (see Fig. 8 (b)) rotatably mounted in the lever members 94 and 94 are engaged with grooves 95a and 95a formed in a block-shaped coupler 95. The grooves 95a and 95a extend along the longitudinal direction of the lever members 94 and 94. When the chuck member 90 is opened or closed, the projections 94a and 94a are movable along the grooves 95a and 95a.

[0044] Moreover, the container carrier 50 comprises, as shown in Fig. 7, a horizontal drive unit 52 for driving the horizontally moving body 70 in the X-direction, a vertical drive unit 54 for driving the lifting body 80 in the Z-direction, and a back-and-forth drive unit 56 for driving the chuck member 90 in the Y-direction, and further comprises a chuck opening/closing unit (not shown) for opening and closing the chuck member 90.

[0045] The horizontal drive unit 52 has a pair of timing pulleys 52a and 52b disposed at the same height. The pair of timing pulleys 52a and 52b is mounted in each of the upper and lower horizontal beams 62 of the supporting frame 60. An endless timing belt 52c is suspended between each pair of timing pulleys 52a and 52b along the horizontal direction (X-direction). The upper block 72 and lower block 71 of the horizontally moving body 70 are fixed to the upper and lower timing belts 52c and 52c, respectively. The timing pulleys 52a and 52a arranged on the upper and lower sides are connected to each other by a connecting shaft 52d so that they are integrally rotated. Another timing belt 52 g is wound and suspended between the upper timing pulley. 52a and a timing pulley 52f provided in the output shaft of a servomotor 52e. Because of this structure of the horizontal drive unit 52, the upper and lower timing belts 52c and 52c are driven in synchronization by the action of the servomotor 52e, thereby moving the horizontally moving body 70 along the pair of guide rails 63 and 63 in the X-direction.

[0046] The vertical drive unit 54 has a pair of timing pulleys 54a and 54b disposed respectively in the upper block 72 and lower block 71 of the horizontally moving body 70. The pair of timing pulleys 54a and 54b is disposed in both sides of the horizontally moving body 70 along the horizontal direction (X-direction). An endless timing belt 54c is suspended between each pair of timing pulleys 54a and 54b along the vertical direction (Z-direction). The brackets 81 and 81 on both sides of the lifting body 80 are fixed to the right and left timing belts 54c and 54c, respectively (see Fig. 8). The upper timing pulleys 54a and 54a are connected to each other by a connecting shaft 54d so that they are integrally rotated. Another timing belt 54g is wound and suspended between one timing pulley 54a and a timing pulley 54f provided in the output shaft of a servomotor 54e. Because of this structure of the vertical drive unit 54, the right and left timing belts 54c and 54c are driven in synchronization by the action of the servomotor 54e, thereby moving the lifting body 80 along the pair of guide rods 73 and 73 in the Z-direction.

[0047] The back-and-forth drive unit 56 is composed of a rodless cylinder fixed between the pair of connecting plates 82b and 82b disposed in front and behind between the pair of brackets 81 and 81, as shown in Fig. 9, which is viewed from obliquely downward. The back-and-forth drive unit 56 accommodates a piston and a magnet (not shown) therein. Compressed air is selectively introduced from air induction ports of both ends of the back-and-forth drive unit 56 to thereby move the piston and magnet forward and backward (Y-direction). Then, the magnet sticks to another magnet provided in the back side of the chuck member 90 to work with the chuck member 90. Because of this structure, the back-and-forth drive unit 56 can drive the chuck member 90 in the back-and-forth direction.

[0048] The chuck opening/closing unit is composed of an air cylinder, which is omitted in Figs. 8 and 9. The rod of the air cylinder is coupled with the coupler 95 to thereby move the coupler 95 forward and backward (Y-direction). The chuck opening/closing unit moves the chuck member 90 from the state shown in Fig. 8 (a) forward in the back-and-forth direction (Y-direction), as shown in Fig. 8 (b), and further drives the coupler 95 forward to thereby open the holding pawls 93 and 93, so that the container 2 held by the chuck member 90 is placed on the rotary dyeing device 1. In addition, after the completion of dyeing in the rotary dyeing device 1, the container 2 on the rotary dyeing device 1 can be held again by performing this operation in reverse order.

[0049] As described above, the horizontal drive unit 52, vertical drive unit 54, and back-and-forth drive unit 56 function as a triaxial driving means for driving the chuck member 90 along the three mutually perpendicular axial directions (x-, y-, and z-axes). The behaviors of the horizontal drive unit 52, vertical drive unit 54, and back-and-forth drive unit 56 are controlled by a control unit (not shown), together with the chuck opening/closing unit and the rotary dyeing device 1.

[0050] Moreover, the automatic dyeing device 100 comprises, as shown in Fig. 1, a receiving station S1, an intermediate station S2, and a discharge station S3 in an area that allows the container carrier 50 to carry the containers 2. The receiving station S1 and intermediate station S2 are respectively provided with weight scales 51a and 51b, which are arranged adjacent in the vertical direction and on which the carried containers 2 are placed. The containers 2 in which materials to be dyed and dyeing solutions are placed are sequentially conveyed by a receiving conveyor (not shown) to the receiving station S1 from a pretreatment device, such as a color kitchen (not shown). The weight scales 51a and 51b are intended to detect the entire weight of the container 2 containing the material and dyeing solution, and to output a signal depending on the detected weight. For example, piezoelectric elements, strain gauge weight sensors, capaci-

tance type weight sensors, etc., can be used.

[0051] Additionally, the automatic dyeing device 100 further comprises an addition unit for adding dyeing assistants, such as salt cake and soda ash. A supply nozzle 53 of the addition unit is disposed above the intermediate station S2 so that dyeing assistants are added from the upper opening of the container 2.

[0052] The discharge station S3 is equipped with a discharge conveyor 51c (e.g., a belt conveyor). The container 2 placed on the discharge conveyor 51c is carried to a post-treatment device (not shown) that performs neutralization or washing.

[0053] The following describes the behavior of the automatic dyeing device 100 having the above structure. A material to be dyed, such as cotton or chemical fiber (e.g., nylon, polyester (cation-dyeable polyester), and acrylic), is placed in each container 2, in which a dyeing solution and dyeing assistants suitable for the material are poured in advance. The container 2 thus containing the material and dyeing solution is placed on the receiving conveyor (not shown) with the top of the container open. After the containers 2 are sequentially carried in the vicinity of the receiving station S1, each container is placed on the weight scale 51a of the receiving station S1 by a pusher (not shown), etc. When a detection signal of the weight scale 51a is input, the control unit determines whether the amount of dyeing solution, etc., contained is appropriate in comparison with a predetermined weight value. When the amount is deemed to be inappropriate, an alarm or the like is output, and the operation is suspended. When the amount is deemed to be appropriate, the control unit activates the horizontal drive unit 52 and vertical drive unit 54 to move the chuck member 90 to the receiving station S1. Then, the chuck member 90 holds the container 2 by the action of the back-and-forth drive unit 56. One rotary dyeing device 1 is selected from those in a halted state, and the container is carried to the selected rotary dyeing device 1.

[0054] The movement rates of the horizontally moving body 70 and lifting body 80 by the action of the horizontal drive unit 52 and vertical drive unit 54 can be individually set on the basis of coordinates in the X-Z plane of the receiving station S1 and coordinates in the X-Z plane of the rotary dyeing device 1, which is the destination. The horizontally moving body 70 and lifting body 80 are simultaneously activated to thereby move thechuck member 90 linearly to the rotary dyeing device 1.

[0055] When the rotary dyeing device 1 is in the not-used state, the space between the rotating table 10, which is in a horizontal state, and the lid 27 is previously expanded by the action of the pressing unit 20 and tilting unit 30. After carrying the container 2 to the rotary dyeing device 1, the chuck member 90 inserts the container 2 between the rotating table 10 and lid 27 by the action of the back-and-forth drive unit 56. The tips of the holding pawls 93 and 93 are expanded by the action of the chuck opening/closing unit to thereby place the container 2 on the rotating table 10.

[0056] When a sensor, etc., detects the placement of the container 2 on the rotating table 10, the rotary dyeing device 1 activates the pressing unit 20 to press the lid 27 against the container 2 from above. Accordingly, the container 2 is sealed with the lid 27, and the container 2 and lid 27 are rotatably held between the rotating table 10 and the pressing body 24. Thereafter, the tilting unit 30 is activated to tilt the container 2, as shown in Fig. 4. In this embodiment, the container 2 is tilted so that the axis of the container is approximately horizontal; however, the container 2 may be tilted obliquely upward or obliquely downward. When the container 2 is in the tilted state, the pressure release pipe 26 extends upward in the container 2, and the open end of the pressure release pipe 26 is exposed above the liquid level of the dyeing solution so that the interior space of the container 2 communicates with the outside of the container 2. On the other hand, the thermocouple 29 extends downward in the container 2 to measure the temperature of the dyeing solution.

[0057] When the container 2 is in the tilted state, the inside of the container 2 is heated by the heaters 8, while the outer circumferential edge of the rotating table 10 is brought into contact with the drive belt 43 to initiate rotation of the rotating table 10. Thus, the drive unit 40 can automatically rotate each container 2 by the drive belt 43 in conjunction with the tilting of the container 2 and can individually rotate the plurality of rotating tables 10.

[0058] Thus, the container 2 rotates together with the lid 27, and the contained material C is dyed with the dyeing solution L, as illustrated by dashed lines in Fig. 4. The amount of dyeing solution L stored is generally determined so that the liquid level is positioned slightly below the axis of the container 2 in the tilted state. The pressure release pipe 26 always faces upward during rotation of the container 2 and releases the internal pressure increase following the increase in the internal temperature of the container 2.

[0059] The temperature of the dyeing solution can be controlled in accordance with a predetermined temperature control pattern by controlling the output of the heating unit based on the measurement of the thermocouple 29. Since this embodiment comprises, other than the heaters 8, the cooling unit for spraying cooling water on the outer surface of the container 2, when the temperature of the dyeing solution is required to be decreased during dyeing, the temperature can be rapidly changed to a preset temperature. Therefore, dyeing can be performed in accordance with a desired temperature control pattern by using a known control method, such as PID control. For example, the temperature can be slowly decreased by controlling the output of the heaters 8, whereas the temperature can be rapidly decreased by controlling the output of the heaters 8 while supplying cooling water from the cooling water nozzle 9. Although the flow rate of cooling water is constant in this embodiment, the flow rate can be controlled depending on the target temperature.

[0060] After dyeing of the material is completed after

a predetermined time has passed, the tilting unit 30 is activated again to return the container 2 to the standing position shown in Fig. 5. Subsequently, the pressing unit 20 is activated to lift the lid 27, releasing the sealing of the container 2. In response to this operation, the control unit moves the chuck member 90 to the rotary dyeing device 1 by the action of the horizontal drive unit 52 and vertical drive unit 54. The chuck member 90 holds the container 2 again by the action of the back-and-forth drive unit 56 and chuck opening/closing unit, and is then moved to the discharge station S3. In the discharge station S3, the container 2 is placed on the discharge conveyor 51c and transferred to a post-treatment device that performs neutralization, washing, etc. When a sensor, etc., detects the removal of the container 2, the rotary dyeing device 1 outputs a signal indicating that it is in a not-used state to the control unit, and the rotary dyeing device 1 enters a state that allows the rotary dyeing device 1 to receive another container 2.

[0061] According to the rotary dyeing device 1 of this embodiment, the container 2 containing a material to be dyed and a dyeing solution can be automatically sealed, tilted, rotated, and opened by placing the container 2 on the rotating table 10, and dyeing can be efficiently and quickly carried out in sequentially transferred containers 2. Therefore, the rotary dyeing device 1 can be particularly suitably used as a dyeing device for multi-type, small-lot dyeing.

[0062] Further, according to the automatic dyeing device 100 of this embodiment, the container-carrying means 50 inserts each container 2 horizontally between the rotating table 10 and lid 27 of each of the plurality of rotary dyeing devices 1 for dyeing materials to be dyed. Because of this structure, each rotary dyeing device 1 can quickly start dyeing, the material in the container 2 received therein.

[0063] Additionally, since dyeing can be performed while changing dyeing conditions as desired, such as the type of dyeing solution, dyeing temperature, and dyeing time, for every rotary dyeing device 1, the automatic dyeing device 100 can flexibly deal with multi-type, small-lot dyeing. Furthermore, even when the dyeing time varies in each rotary dyeing device 1, immediately after dyeing is completed in any rotary dyeing device 1, the container 2 is replaced by another container 2, and the sequent dyeing can be started, regardless of the order of supplying the containers 2 to the rotary dyeing devices 1. Hence, the production lead time can be shortened.

[0064] Moreover, even when a number of rotary dyeing devices 1 are disposed, the structure of this embodiment, in which the chuck member 90 is triaxially driven by the horizontal drive unit 52, vertical drive unit 54, and back-and-forth drive unit 56, allows quick and easy delivery of the containers 2 to each rotary dyeing device 1.

[0065] In the explanation of the above embodiment, the container 2 carried into the receiving station S1 is conveyed by the container carrier 50 to any of the rotary dyeing devices 1. After dyeing of the material in the container, the container is conveyed again by the container carrier 50 to the discharge station S3. However, for example, when a material made of cellulose fibers, such as cotton or cupra, is dyed to a deep color, the container may be carried to the intermediate station S2 by the container carrier 50 for temporary placement after the material is dyed in the rotary dyeing device 1. In the intermediate station S2, soda ash, etc., can be added from the supply nozzle 53 of the addition unit disposed above the container 2. When the weight scale 51b detects the addition of a predetermined amount, the control unit conveys the container 2 again to the rotary dyeing device 1 in a halted state. After the dyeing process is continued for a predetermined time, the container carrier 50 conveys the container 2 to the discharge station S3. Thus, the automatic dyeing device 100 of this embodiment ensures prompt response when the addition of dyeing assistants is required during dyeing of the material.

[0066] In the above embodiment, three rotary dyeing devices 1 form one unit, and a plurality of the units (four units in this embodiment) are arranged in a multilevel configuration in the vertical direction, so that the plurality of rotary dyeing devices 1 are arranged in a matrix form, and the container 2 is conveyed to each rotary dyeing device 1 by the container carrier 50 movable in the X- and Z-directions; however, the arrangement of the rotary dyeing devices 1 is not necessarily limited to this embodiment, and the rotary dyeing devices can be arranged in various forms. Further, for example, the container 2 may be held by a robot hand, etc., and conveyed to each rotary dyeing device 1.

[0067] In the above embodiment, the hollow portion 25a is formed inside the fixing shaft 25 of the rotary dyeing device 1, and the interior space of the container 2 communicates with the outside of the container 2 via the pressure release pipe 26 connected to one end of the hollow portion 25a and the communication port 25b provided in the other end of the hollow portion 25a. Thereby, the internal pressure increase following the increase in the internal temperature of the container 2 due to heating during dyeing is released, and the pressure of the interior space of the container 2 is maintained at near-atmospheric pressure. However, the container 2 may be configured as a pressure container. More specifically, without providing the pressure release pipe 26 and communication port 25b in the fixing shaft 25, the container 2 is sealed with the lid 27, and the degree of sealing between the container 2 and lid 27 is increased. Accordingly, dyeing of the material can be carried out at temperatures as high as 100°C or more, associated with heating during dyeing.

[0068] Additionally, the rotary dyeing device 1 may be configured to dye a material to be dyed in a container whose opening is sealed with a lid in advance. For example, as shown in Fig. 10, a rotary dyeing device 110 comprises a plurality of rotatable supporting rollers 111 that support a container 2 whose opening is closed with a lid 2a so that the axis of the container is horizontal, a

driving roller 112 supported above the container 2 so as to be movable up and down and rotated by a motor (not shown), and a pair of stoppers 113 and 114 respectively in contact with the top surface and bottom surface of the container 2 to rotatably hold the container 2, wherein the stopper 113 in contact with the top surface of the container 2 can move forward and backward along the axis of the container 2. By a container carrier (not shown), the rotary dyeing device 110 conveys the container 2 in which a material C to be dyed and a dyeing solution L are placed and which is sealed in advance with a lid 2a. When the container is placed on the supporting rollers 111, the placement is detected by a sensor (not shown), and the stopper 113 is moved forward to hold the container 2 between the stoppers 113 and 114. Simultaneously, the driving roller 112 is lowered and brought into contact with the body of the container 2 to transmit rotational driving force. Consequently, the container 2 is rotated sealed with the lid 2a, thereby dyeing the material C.

[0069] In this embodiment, the rotary dyeing device 1 is used to dye a material to be dyed; however, the rotary dyeing device 1 having the above-described structure can also be used to, for example, perform after-treatment (e.g., neutralization, washing, fixing, and softening) on the material after dyeing. More specifically, the material after dyeing (processed material) and various treatment solutions (e.g., neutralizing solutions, cleaning solutions, fix-treatment solutions including dye-fixing agents, and soft-treatment solutions including softeners) are placed in the container 2, and the container 2 is rotated to thereby treat the processed material with various treatment solutions.

Reference Signs List

[0070]

1. Rotary dyeing device
2. Container
2C. Rib
8. Far-infrared heater
8a. Reflector
9. Cooling water nozzle
10. Rotating table
20. Pressing unit
24. Pressing body
25. Fixing shaft
25a. Hollow portion
26. Pressure release pipe
27. Lid
30. Tilting unit
40. Drive unit
43. Drive belt
50. Container carrier
51a and 51b. Weight scales
52. Horizontal drive unit
53. Supply nozzle
54. Vertical drive unit
56. Back-and-forth drive unit
60. Supporting frame
70. Horizontally moving body
80. Lifting body
90. Chuck member
100. Automatic dyeing device

Claims

1. A rotary dyeing device (1) that dyes a material to be dyed by rotating a container (2) in which the material and a dyeing solution are placed, the device comprising:

a rotating table(10) on which the container (2) having an opening at the top thereof is rotatably mounted;
a pressing means (20) for pressing a lid (27) against the container (2) from above to thereby rotatably seal the container (2);
a tilting means (30) for tilting the sealed container (2); and
a rotation drive means (40) for rotating the container (2) in a tilted state.

2. The rotary dyeing device (1) according to claim 1, wherein the pressing means (20) comprises a pressing body (24) to be brought into contact with the lid (27), and a fixing shaft (25) extending from the pressing body (24) and penetrating through the lid(27); and
the fixing shaft (25) rotatably supports the lid (27).

3. The rotary dyeing device (1) according to claim 2, wherein the fixing shaft (25) comprises a hollow portion (25a) to which a pressure release pipe (26) is connected to thereby communicate the inside and outside of the container (2); and
the pressure release pipe (26) extends upward in the container (2) when the container (2) is tilted.

4. The rotary dyeing device (1) according to claim 3, wherein the lid (27) is provided with a plate via a spacer on a surface to be brought into contact with the container (2), and the pressure release pipe (26) is disposed in a gap portion formed between the lid (27) and the plate.

5. The rotary dyeing device (1) according to any one of claims 1 to 4, further comprising a heating means (8) for heating the tilted container (2), and a cooling means (9) for spraying cooling water on the surface of the tilted container (2).

6. The rotary dyeing device (1) according to claim 5, wherein the heating means comprises a far-infrared heater (8) arranged along the tilted container (2), and

a reflector (8a) covering the far-infrared heater (8) so that far-infrared rays are emitted to the container (2).

7. The rotary dyeing device (1) according to any one of claims 1 to 6, wherein the outer surface of the container (2) is surface-treated so as to have an absorption wavelength of 2 to 20 μm.

8. The rotary dyeing device (1) according to any one of claims 1 to 7, wherein the inner surface of the container (2) is provided with one or more elongated convex portions extending in a longitudinal direction.

9. The rotary dyeing device (1) according to any one of claims 1 to 7, wherein the inner surface of the container (2) is formed into an irregular surface in which convex portions and concave portions alternate consecutively in a circumferential direction.

10. A system comprising a plurality of rotary dyeing devices (1) that dye a material to be dyed by rotating a container (2) in which the material and a dyeing solution are placed, each of the rotary dyeing devices (1) comprising:

a rotating table (10) on which the container (2) having an opening at the top thereof is rotatably mounted;
a pressing means (20) for pressing a lid (27) against the container (2) from above to thereby rotatably seal the container (2); and
a tilting means (30) for tilting the sealed container (2); and
the system comprising a rotation drive means (40) for rotating the plurality of containers (2) in a tilted state, wherein
the rotation drive means (40) comprises a drive belt (43) to be brought into contact with the outer circumferential edge of the rotating table (10) upon tilting of the container (2), and is capable of transmitting driving force to the plurality of containers (2) via the drive belt (43).

11. An automatic dyeing device (100) comprising:

claims a plurality of the rotary dyeing devices (1) according to any one of claims 1 to 9; and
a container-carrying means (50) that holds and carries the container (2) in a receiving station to any of the rotary dyeing devices (1), and that holds and carries the container (2) in which dyeing of the material is completed from the rotary dyeing device to a discharge station.

12. The automatic dyeing device (100) according to claim 11, wherein the container-carrying means (50) inserts the container horizontally between the rotating table (10), which is in a horizontal position, and the lid (27).

13. The automatic dyeing device (100) according to claim 11 or 12,
wherein the container-carrying means (50) comprises a chuck member (90) for holding the container (2), a triaxial driving means for driving the chuck member (90) along three mutually perpendicular axial directions, and a chuck opening/closing means for opening and closing the chuck member (90).

14. The automatic dyeing device (100) according to any one of claims 11 to 13, wherein the receiving station comprises a weight-detecting means (51a/b) for detecting the weight of the container (2).

15. The automatic dyeing device (100) according to any one of claims 11 to 14, further comprising an intermediate station for temporary placement of the container (2) in which dyeing of the material is not yet completed, after being carried by the container-carrying means (50);
the intermediate station comprising an adding means for adding a dyeing assistant to the container (2).

Patentansprüche

1. Rotierende Färbevorrichtung (1), die ein zu färbendes Material durch Rotieren eines Behälters (2), in dem das Material und eine Färbelösung angeordnet sind, färbt, wobei die Vorrichtung umfasst:

einen Drehtisch (10), auf dem der Behälter (2) mit einer Öffnung auf seiner Oberseite drehbar montiert ist;
ein Druckmittel (20), um einen Deckel (27) von oben gegen den Behälter (2) zu drücken, um dadurch den Behälter (2) drehbar zu verschließen;
ein Kippmittel (30) zum Kippen des verschlossenen Behälters (2); und
ein Rotationsantriebsmittel (40) zum Rotieren des Behälters (2) in einem gekippten Zustand.

2. Rotierende Färbevorrichtung (1) nach Anspruch 1, wobei das Druckmittel (20) einen Druckkörper (24), der in Kontakt mit dem Deckel (27) gebracht werden soll, und einen Befestigungsschaft (25), der sich von dem Druckkörper (24) erstreckt und den Deckel (27) durchdringt, umfasst; und
wobei der Befestigungsschaft (25) den Deckel (27) drehbar hält.

3. Rotierende Färbevorrichtung (1) nach Anspruch 2, wobei der Befestigungsschaft (25) einen hohlen Ab-

schnitt (25a) umfasst, mit dem eine Druckentlastungsleitung (26) verbunden ist, um dadurch das Innere und Äußere des Behälters (2) in Verbindung zu bringen; und
wobei die Druckentlastungsleitung (26) sich in dem Behälter (2) nach oben erstreckt, wenn der Behälter (2) gekippt wird.

4. Rotierende Färbevorrichtung (1) nach Anspruch 3, wobei der Deckel (27) über ein Distanzstück auf einer Fläche, die mit dem Behälter (2) in Kontakt gebracht werden soll, mit einer Platte versehen ist, und wobei die Druckentlastungsleitung (26) in einem Spaltabschnitt, der zwischen dem Deckel (27) und der Platte ausgebildet ist, angeordnet ist.

5. Rotierende Färbevorrichtung (1) nach einem der Ansprüche 1 bis 4, die ferner ein Heizmittel (8) zum Heizen des gekippten Behälters (2) und ein Kühlmittel (9) zum Sprühen von Kühlwasser auf die Oberfläche des gekippten Behälters (2) umfasst.

6. Rotierende Färbevorrichtung (1) nach Anspruch 5, wobei das Heizmittel eine Ferne-Infrarotheizung (8), die entlang des gekippten Behälters (2) angeordnet ist, und einen Reflektor (8a) umfasst, der die Ferne-Infrarotheizung (8) bedeckt, so dass Strahlen im fernen Infrarot zu dem Behälter (2) emittiert werden.

7. Rotierende Färbevorrichtung (1) nach einem der Ansprüche 1 bis 6, wobei die Außenfläche des Behälters (2) oberflächenbehandelt ist, so dass sie eine Absorptionswellenlänge von 2 bis 20 μm hat.

8. Rotierende Färbevorrichtung (1) nach einem der Ansprüche 1 bis 7, wobei die Innenfläche des Behälters (2) mit einem oder mehreren verlängerten konvexen Abschnitten versehen ist, die sich in einer Längsrichtung erstrecken.

9. Rotierende Färbevorrichtung (1) nach einem der Ansprüche 1 bis 7, wobei die Innenfläche des Behälters (2) zu einer unregelmäßigen Fläche ausgebildet ist, in der konvexe Abschnitte und konkave Abschnitte sich in einer Umfangsrichtung fortlaufend abwechseln.

10. System, das eine Vielzahl rotierender Färbevorrichtungen (1) umfasst, die ein zu färbendes Material durch Rotieren eines Behälters (2), in dem das Material und eine Färbelösung angeordnet sind, färbt, wobei jede der rotierenden Vorrichtungen (1) umfasst:

einen Drehtisch (10), auf dem der Behälter (2) mit einer Öffnung auf seiner Oberseite drehbar montiert ist;
ein Druckmittel (20), um einen Deckel (27) von oben gegen den Behälter (2) zu drücken, um dadurch den Behälter (2) drehbar zu verschließen;
ein Kippmittel (30) zum Kippen des verschlossenen Behälters (2); und
wobei das System ein Rotationsantriebsmittel (40) zum Rotieren der Vielzahl von Behältern (2) in einem gekippten Zustand umfasst, wobei das Rotationsantriebsmittel (40) einen Antriebsriemen (43) umfasst, der nach dem Kippen des Behälters (2) in Kontakt mit dem Außenumfangsrand des Drehtisches (10) gebracht werden soll und fähig ist, die Antriebskraft über den Antriebsriemen (43) auf die Vielzahl von Behältern (2) zu übertragen.

11. Automatische Färbevorrichtung (100), die umfasst:

eine Vielzahl der rotierenden Färbevorrichtungen (1) nach einem der Ansprüche 1 bis 9; und ein Behältertransportmittel (50), das den Behälter (2) in einer Aufnahmestation hält und zu jeder der rotierenden Färbevorrichtungen (1) transportiert und das den Behälter (2), in dem das Färben des Materials abgeschlossen ist, von der rotierenden Färbevorrichtung zu einer Abgabestation transportiert.

12. Automatische Färbevorrichtung (100) nach Anspruch 11, wobei das Behältertransportmittel (50) den Behälter horizontal zwischen dem Drehtisch (10), der in einer horizontalen Postition ist, und dem Deckel (27) einsetzt.

13. Automatische Färbevorrichtung (100) nach Anspruch 11 oder 12, wobei das Behältertransportmittel (50) ein Futterelement (90) zum Halten des Behälters (2), ein dreiachsiges Antriebsmittel zum Antreiben des Futterelements (90) entlang drei wechselseitig senkrechter Axialrichtungen und ein Futteröffnungs-/Schließmittel zum Öffnen und Schließen des Futterelements (90) umfasst.

14. Automatische Färbevorrichtung (100) nach einem der Ansprüche 11 bis 13, wobei die Aufnahmestation ein Gewichtserfassungsmittel (51a/b) zum Erfassen des Gewichts des Behälters (2) umfasst.

15. Automatische Färbevorrichtung (100) nach einem der Ansprüche 11 bis 14, die ferner eine Zwischenstation für das vorübergehende Anordnen des Behälters (2), in dem das Färben des Materials noch nicht abgeschlossen ist, umfasst, nachdem er von dem Behältertransportmittel (50) transportiert wurde;
wobei die Zwischenstation eine Hinzufügemittel zum Hinzufügen von Färbehilfsmittel in den Behälter (2) umfasst.

Revendications

1. Dispositif de teinture rotatif (1) qui teint un matériau à teindre par rotation d'une cuve (2) dans laquelle sont placés le matériau et une solution de teinture, le dispositif comprenant :

   une table rotative (10) sur laquelle est montée de façon rotative la cuve (2), qui comporte une ouverture dans sa partie supérieure ;
   un moyen de compression (20) pour comprimer un couvercle (27) contre la cuve (2) depuis le dessus afin de sceller ainsi la cuve (2) en rotation ;
   un moyen de basculement (30) pour basculer la cuve scellée (2) ; et
   un moyen d'entraînement de rotation (40) pour faire tourner la cuve (2) à l'état basculé.

2. Dispositif de teinture rotatif (1) selon la revendication 1, dans lequel le moyen de compression (20) comprend un corps de compression (24) à mettre en contact avec le couvercle (27) et un axe de fixation (25) qui s'étend depuis le corps de compression (24) et traverse le couvercle (27) ; et
   l'axe de fixation (25) supporte le couvercle (27) de manière rotative.

3. Dispositif de teinture rotatif (1) selon la revendication 2, dans lequel l'axe de fixation (25) comprend une partie creuse (25a) à laquelle une conduite de libération de pression (26) est connectée pour mettre ainsi en communication l'intérieur et l'extérieur de la cuve (2) ; et
   la conduite de libération de pression (26) s'étend vers le haut dans la cuve (2) lorsque la cuve (2) est basculée.

4. Dispositif de teinture rotatif (1) selon la revendication 3, dans lequel le couvercle (27) est pourvu d'une plaque via une entretoise sur une surface à mettre en contact avec la cuve (2), et la conduite de libération de pression (26) est agencée dans un intervalle formé entre le couvercle (27) et la plaque.

5. Dispositif de teinture rotatif (1) selon l'une quelconque des revendications 1 à 4, comprenant en outre un moyen de chauffage (8) pour chauffer la cuve basculée (2), et un moyen de refroidissement (9) pour pulvériser de l'eau de refroidissement sur la surface de la cuve basculée (2).

6. Dispositif de teinture rotatif (1) selon la revendication 5, dans lequel le moyen de chauffage comprend un chauffage à infrarouge lointain (8) agencé le long de la cuve basculée (2), et un réflecteur (8a) qui recouvre le chauffage à infrarouge lointain (8) de telle sorte que des rayons en infrarouge lointain sont émis vers la cuve (2).

7. Dispositif de teinture rotatif (1) selon l'une quelconque des revendications 1 à 6, dans lequel la surface externe de la cuve (2) comporte un traitement de surface de manière à présenter une longueur d'onde d'absorption de 2 μm à 20 μm.

8. Dispositif de teinture rotatif (1) selon l'une quelconque des revendications 1 à 7, dans lequel la surface interne de la cuve (2) est pourvue d'une ou plusieurs parties convexes allongées qui s'étendent en direction longitudinale.

9. Dispositif de teinture rotatif (1) selon l'une quelconque des revendications 1 à 7, dans lequel la surface interne de la cuve (2) est conformée comme une surface irrégulière sur laquelle des parties convexes et concaves alternent consécutivement en direction circonférentielle.

10. Système comprenant une pluralité de dispositifs de teinture rotatifs (1) qui teignent un matériau à teindre par rotation d'une cuve (2) dans laquelle sont placés le matériau et une solution de teinture, chacun des dispositifs de teinture rotatifs (1) comprenant :

    une table rotative (10) sur laquelle est montée de façon rotative la cuve (2), qui comporte une ouverture dans sa partie supérieure ;
    un moyen de compression (20) pour comprimer un couvercle (27) contre la cuve (2) depuis le dessus afin de sceller ainsi la cuve (2) en rotation ; et
    un moyen de basculement (30) pour basculer la cuve scellée (2) ; et
    le système comprenant un moyen d'entraînement de rotation (40) pour faire tourner la pluralité de cuves (2) à l'état basculé, dans lequel le moyen d'entraînement de rotation (40) comprend une courroie d'entraînement (43) à mettre en contact avec le bord circonférentiel externe de la table rotative (10) lors du basculement de la cuve (2), et est capable de transmettre une force d'entraînement à la pluralité de cuves (2) via la courroie d'entraînement (43).

11. Dispositif de teinture automatique (100), comprenant :

    une pluralité de dispositifs de teinture rotatifs (1) selon l'une quelconque des revendications 1 à 9 ; et
    un moyen de support de cuve (50) qui soutient et supporte la cuve (2) dans une station de réception de l'un quelconque des dispositifs de teinture rotatifs (1), et qui soutient et supporte la cuve (2) dans laquelle la teinture du matériau

est achevée depuis le dispositif de teinture rotatif jusqu'à une station de déchargement.

12. Dispositif de teinture automatique (100) selon la revendication 11, dans lequel le moyen de support de cuve (50) insère la cuve horizontalement entre la table rotative (10), qui se trouve en position horizontale, et le couvercle (27).

13. Dispositif de teinture automatique (100) selon la revendication 11 ou 12, dans lequel le moyen de support de cuve (50) comprend un élément de mandrin (90) pour maintenir la cuve (2), un moyen d'entraînement triaxial pour entraîner l'élément de mandrin (90) selon trois directions axiales perpendiculaires entre elles, et un moyen d'ouverture/fermeture de mandrin pour ouvrir et fermer l'élément de mandrin (90).

14. Dispositif de teinture automatique (100) selon l'une quelconque des revendications 11 à 13, dans lequel la station de réception comprend un moyen de détection de poids (51a/b) pour détecter le poids de la cuve (2).

15. Dispositif de teinture automatique (100) selon l'une quelconque des revendications 11 à 14, comprenant en outre une station intermédiaire pour y placer temporairement la cuve (2) dans laquelle la teinture du matériau n'est pas encore achevée, après avoir été portée par le moyen de support de cuve (50) ;
la station intermédiaire comprenant un moyen d'ajout pour ajouter un assistant de teinture dans la cuve (2).

DRAWINGS

Fig. 1

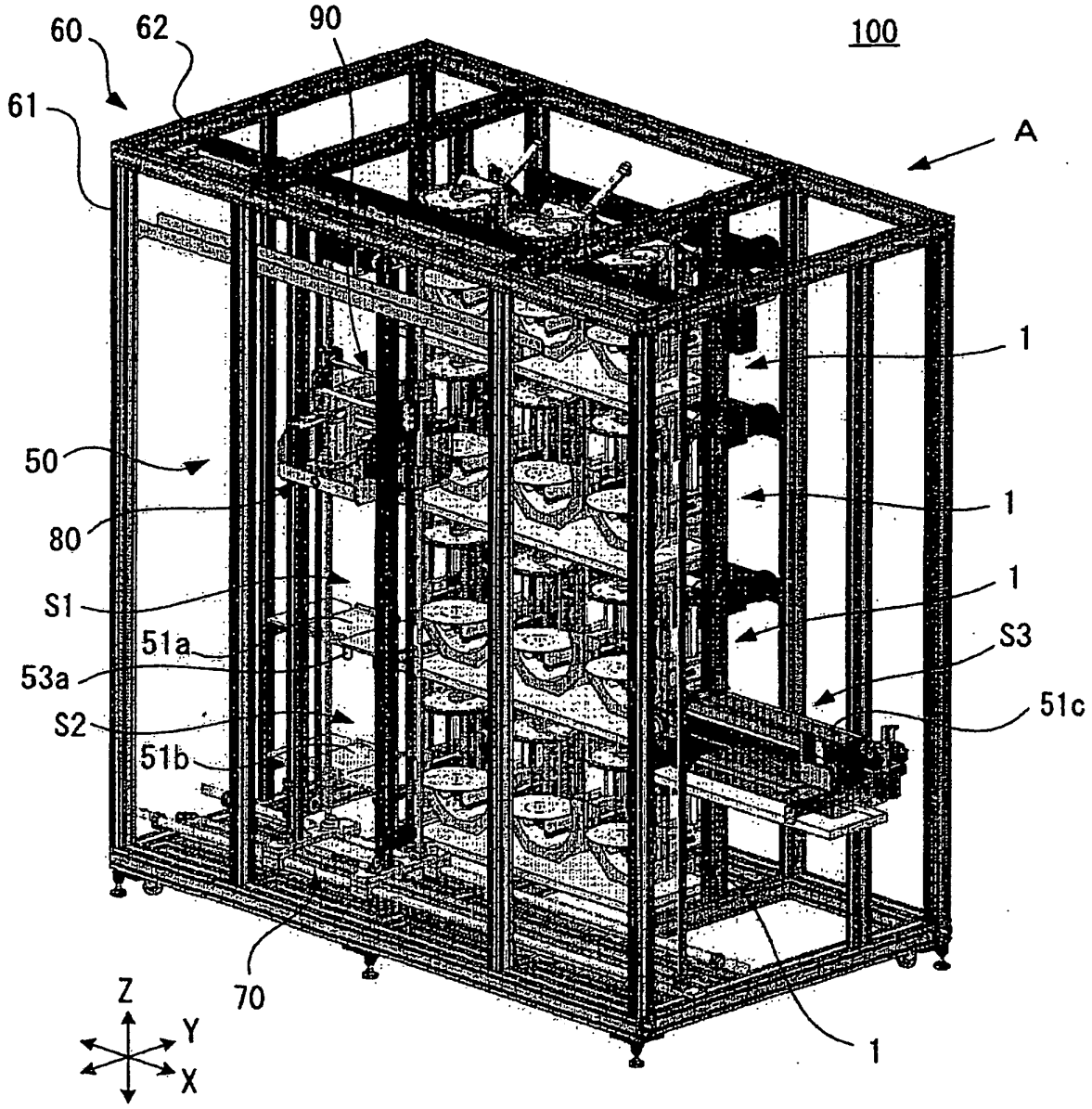
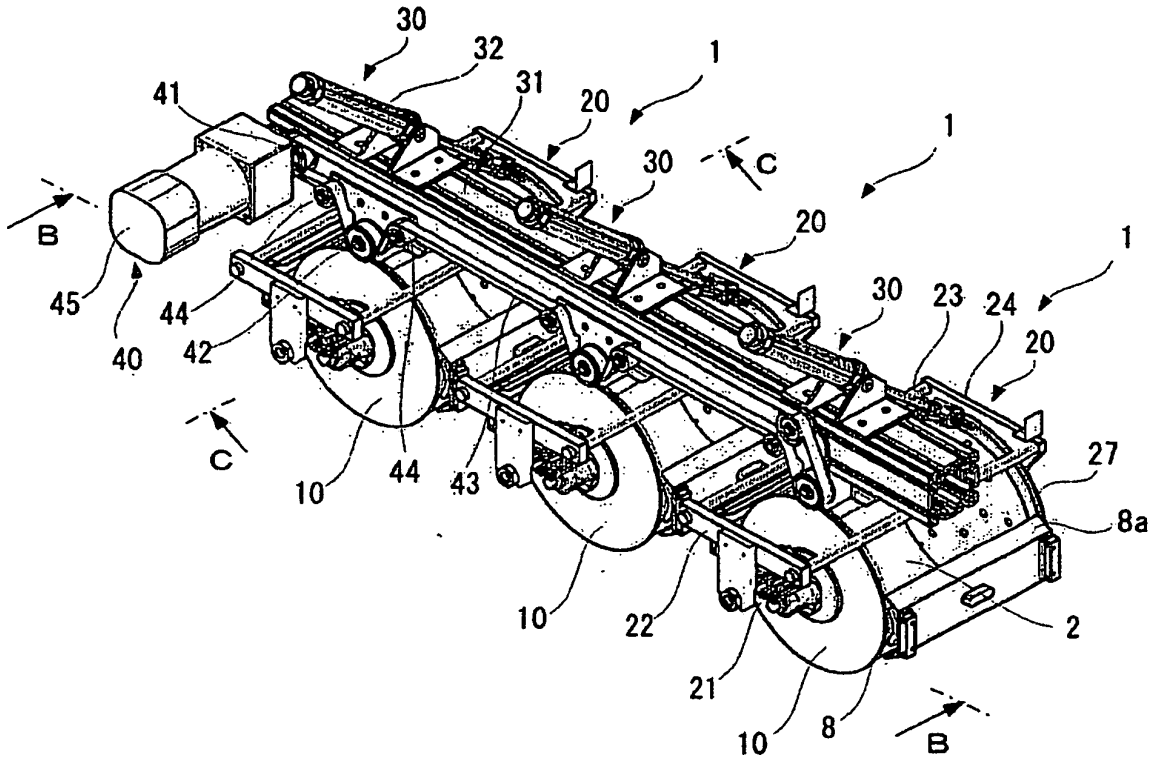


Fig. 2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8a
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22
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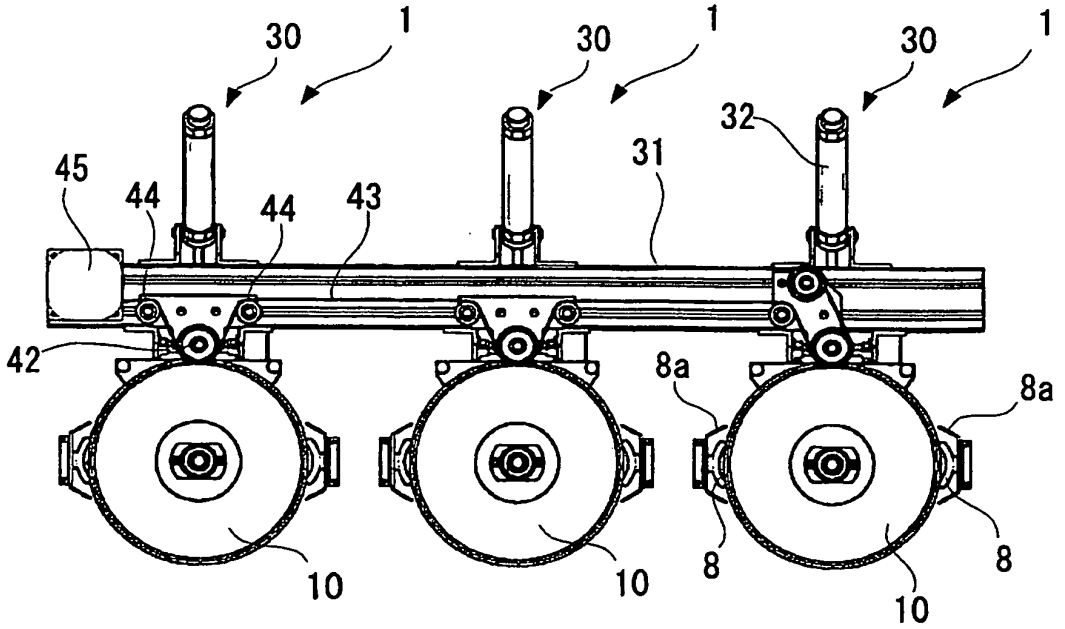
21
10
8
B

Fig. 3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31
42
8a
8a
10
10
8
8
10

Fig. 4

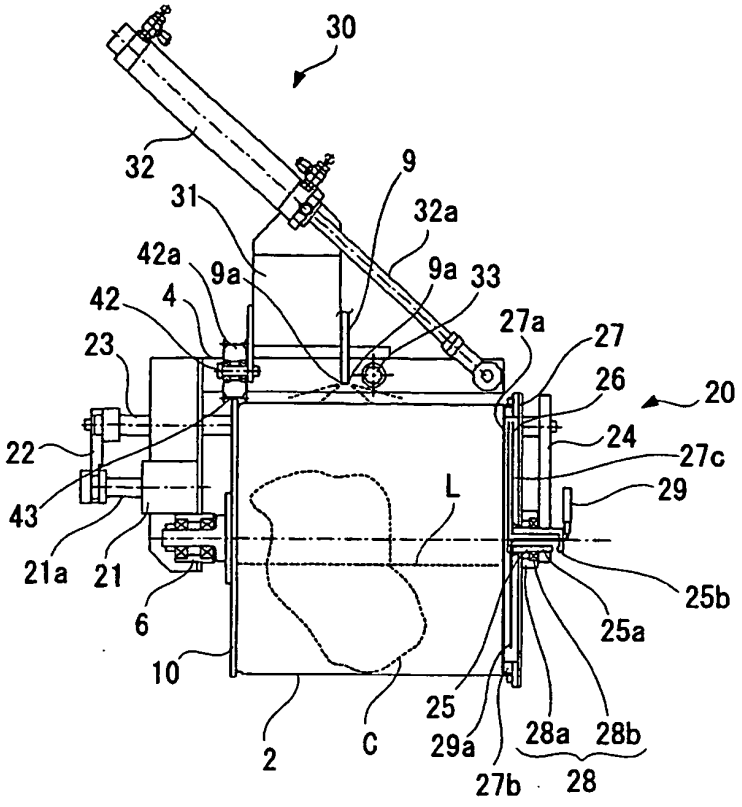

30
32
9
31
32a
42a
9a
9a
33
42
4
27a
27
23
26
20
24
22
27c
29
L
43
21a
21
25b
6
25a
10
25
2
C
29a
28a
28b
27b
28

Fig. 5

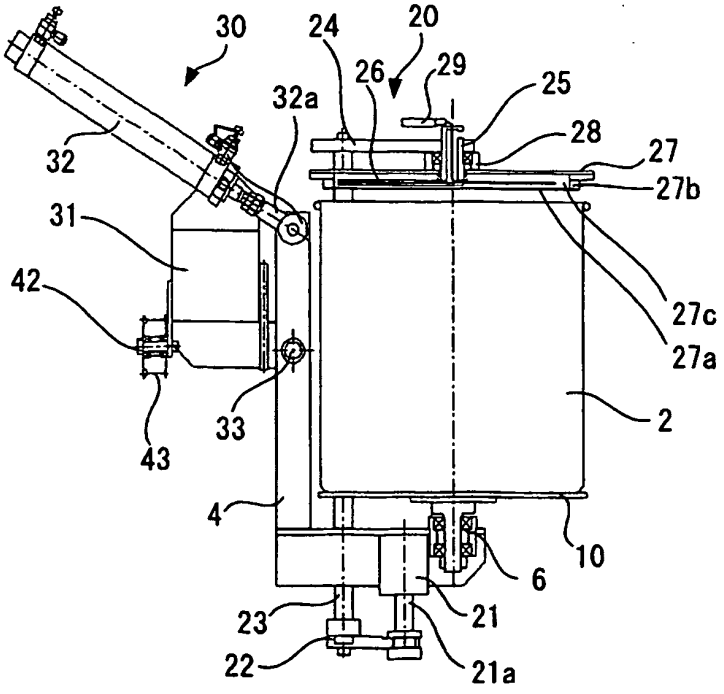

30
24
20
26
29
25
32a
28
27
32
27b
31
27c
42
27a
33
2
43
4
10
6
23
21
22
21a

Fig. 6

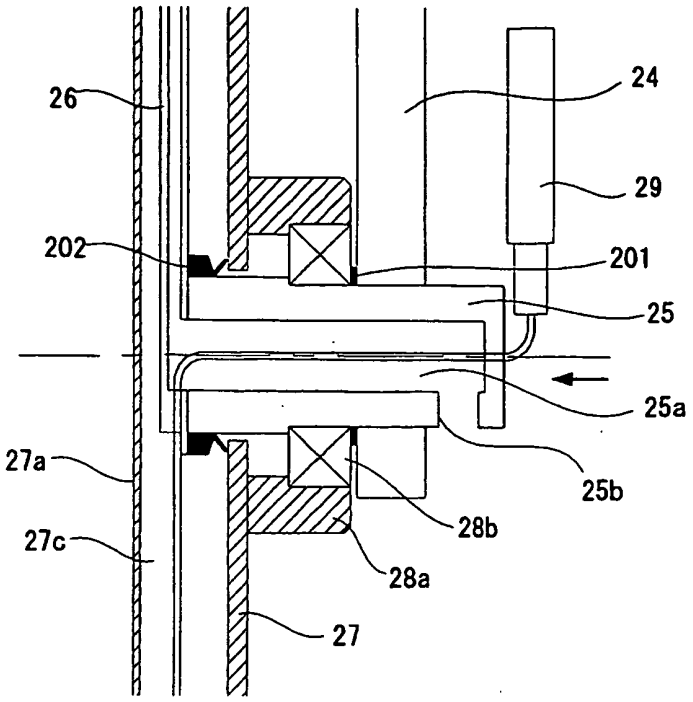

26
24
29
202
201
25
25a
27a
25b
28b
27c
28a
27

Fig. 7

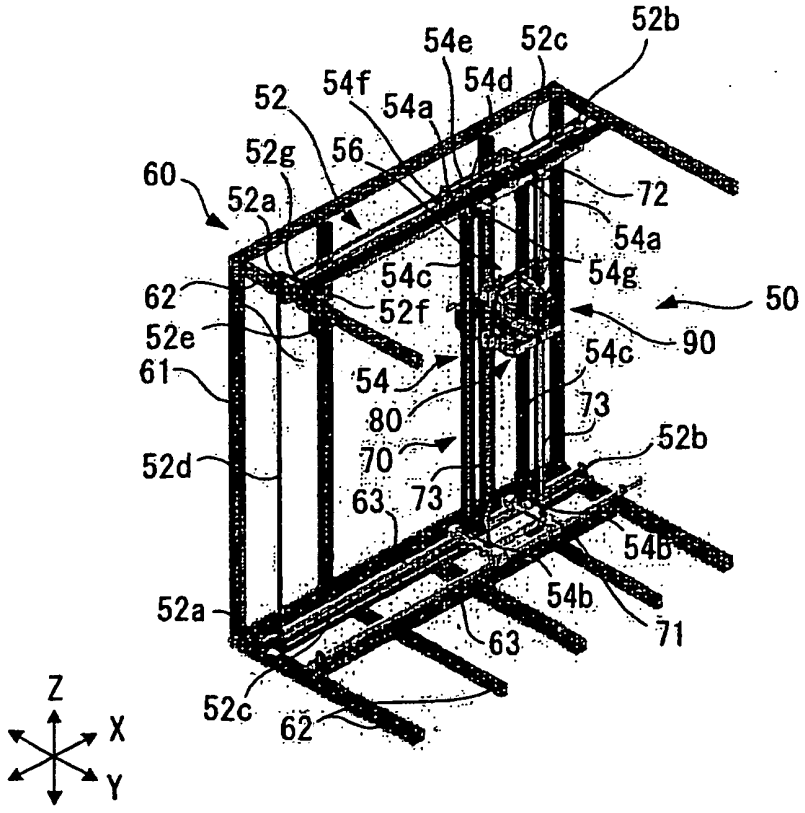
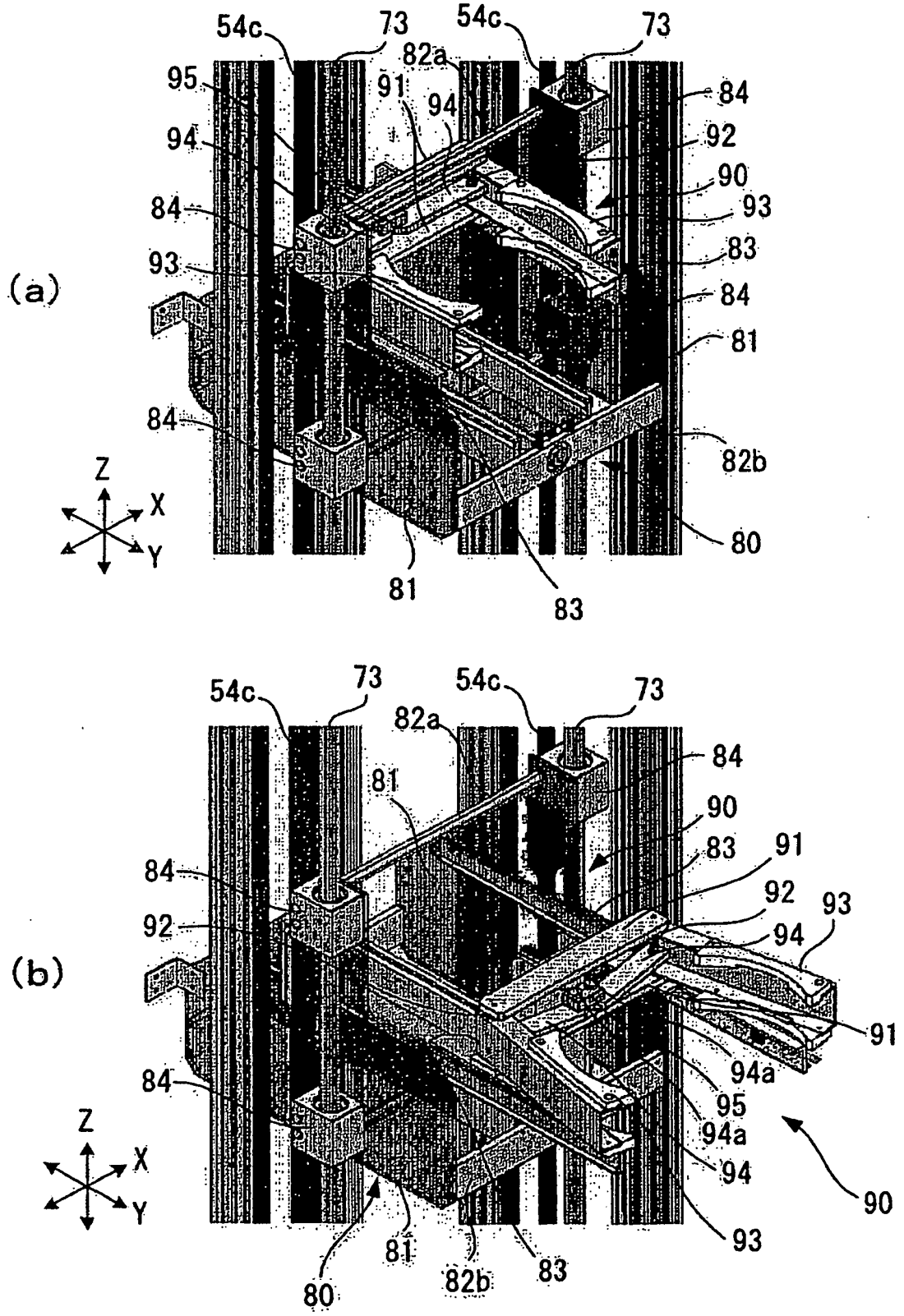

52b
54e
52c
54f
54d
52
54a
52g
56
60
52a
72
54a
54c
54g
50
62
52f
52e
90
54c
61
54
80
73
52b
52d
70
63
73
54b
54b
52a
71
63
52c
62
Z
X
Y

Fig. 8


(a)
54c
73
54c
73
82a
95
91
94
84
94
92
90
84
93
93
83
84
93
84
81
84
82b
Z
X
Y
80
81
83
(b)
54c
73
54c
73
82a
84
81
90
83
91
84
92
92
93
94
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94a
84
95
94a
94
90
Z
X
Y
93
81
80
82b
83

Fig. 9

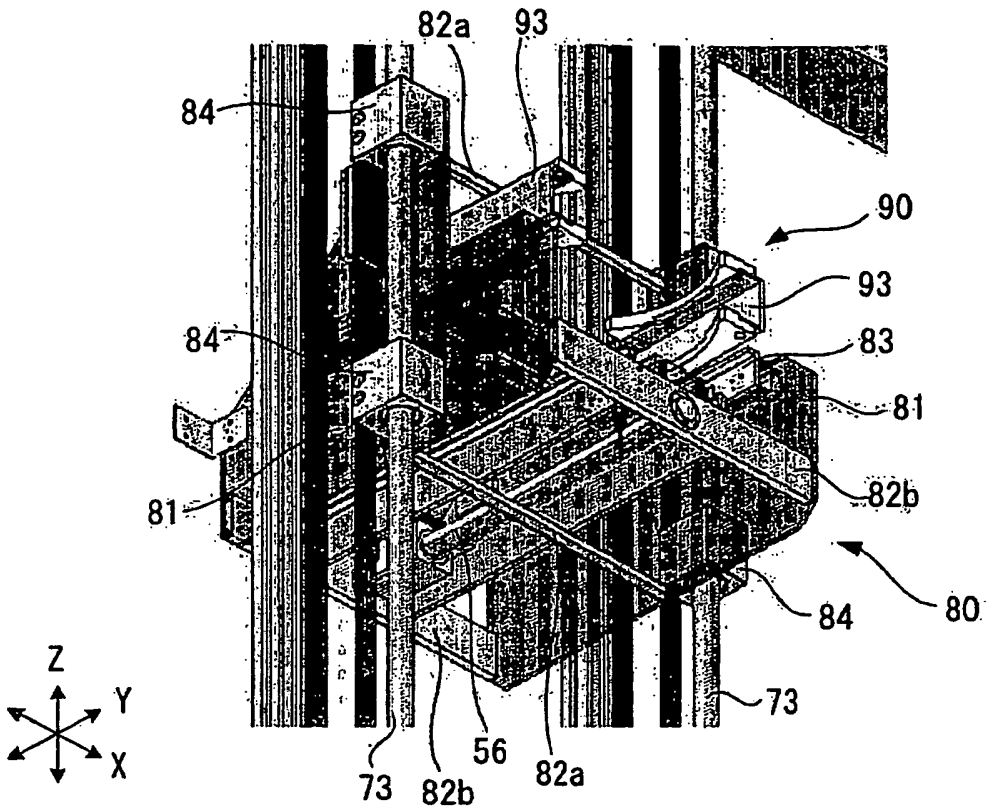

82a
93
84
90
93
84
83
81
81
82b
84
80
Z
Y
X
73
56
82a
73
82b

Fig. 10

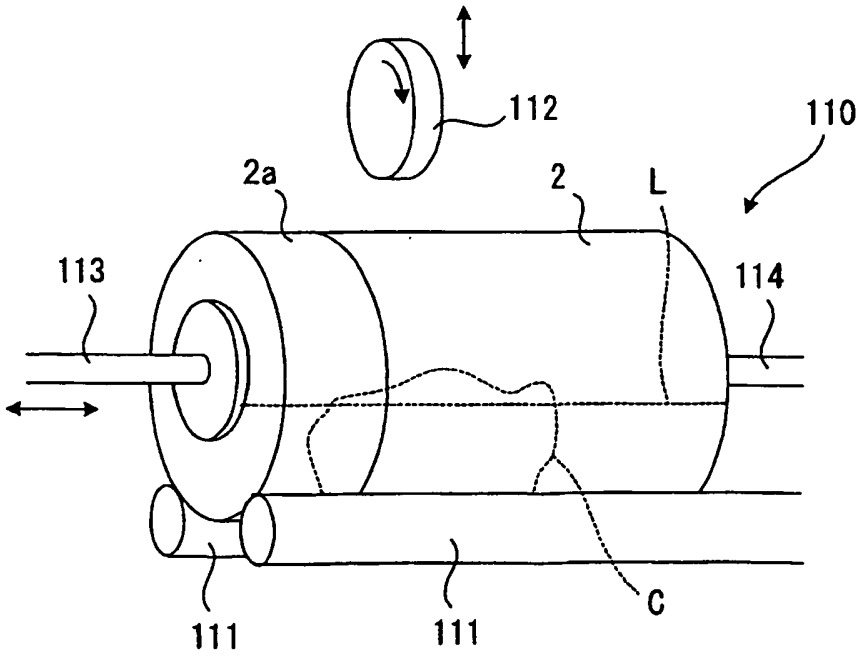

112
110
2a
2
L
113
114
111
111
C

Fig. 11

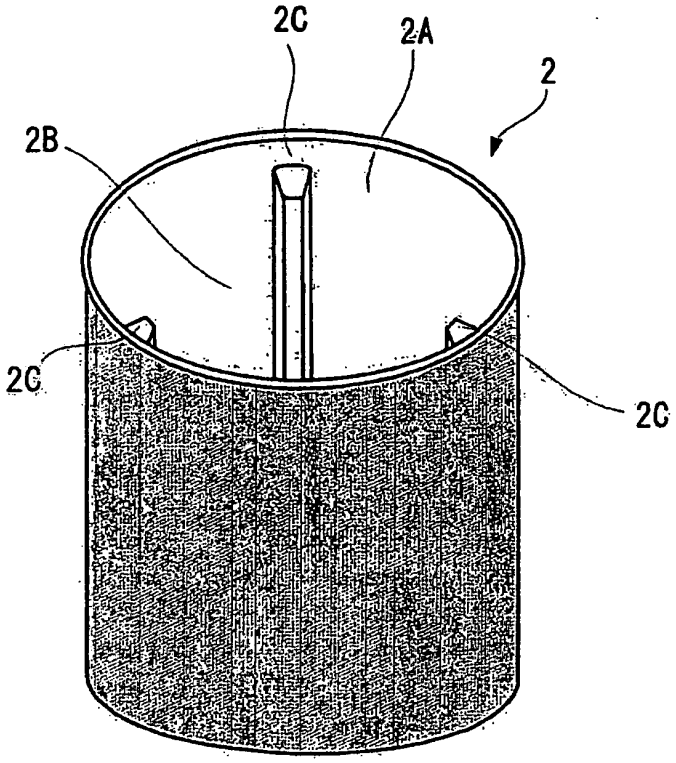
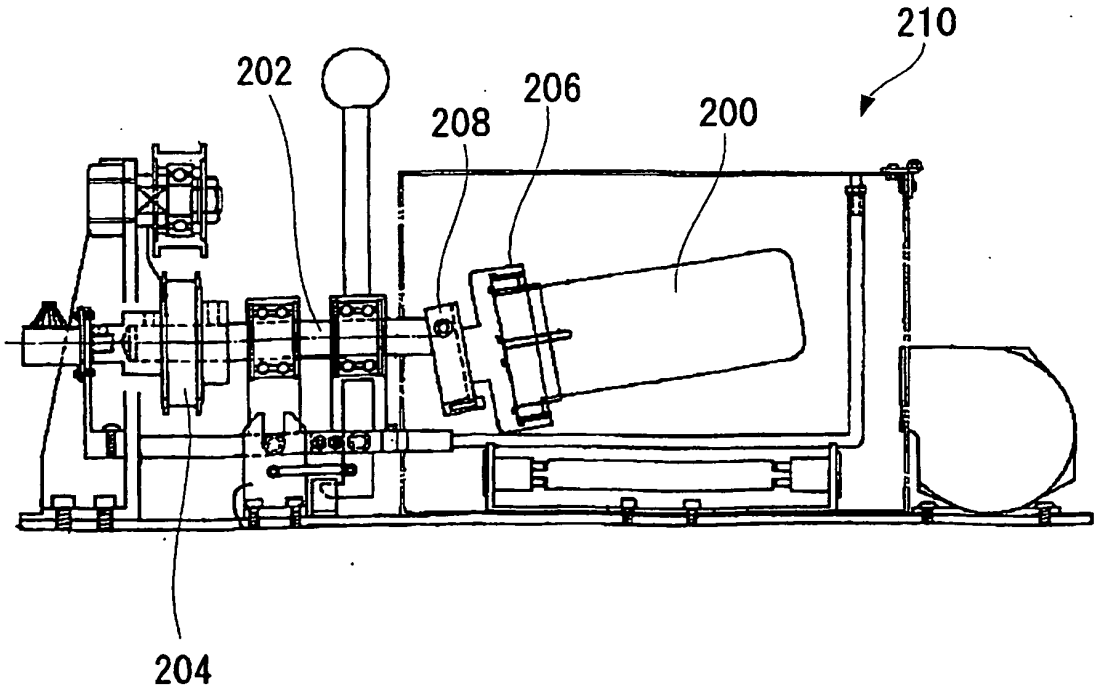


Fig. 12



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2002309476 A **[0003]**
- CH 530823 A **[0004]**