(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 101 539 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.12.2022 Bulletin 2022/50

(21) Application number: **21191460.1**

(22) Date of filing: **16.08.2021**

(51) International Patent Classification (IPC):
B01L 9/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B01L 9/00; B01L 9/50; B01L 2200/021; B01L 2300/041; B01L 2300/042

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **09.06.2021 JP 2021096959**

(71) Applicant: **SHIMADZU CORPORATION**
Kyoto-shi, Kyoto 604-8511 (JP)

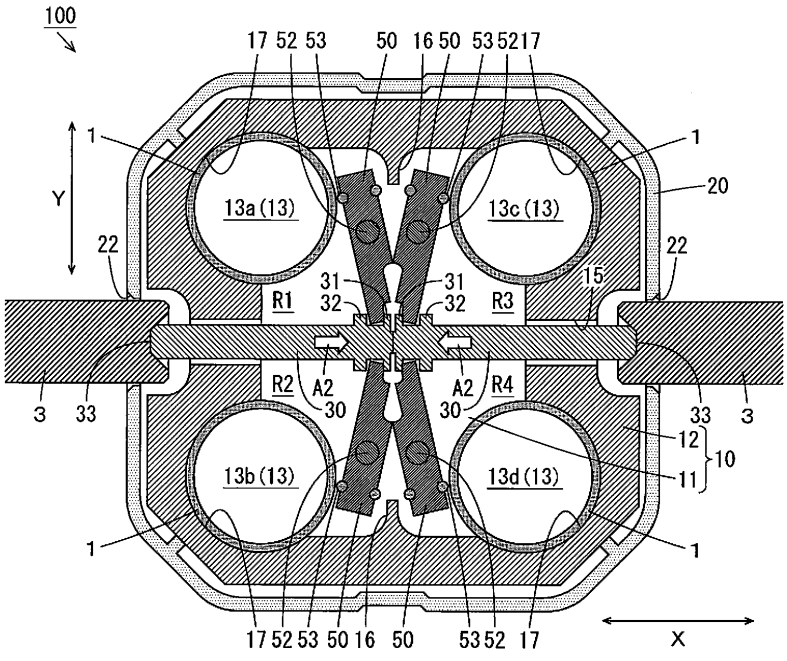
(72) Inventors:
- **YAMAZAKI, Tomoyuki**
  Kyoto, 604-8511 (JP)
- **MATSUMOTO, Kenta**
  Kyoto, 604-8511 (JP)

(74) Representative: **Müller-Boré & Partner**
Patentanwälte PartG mbB
Friedenheimer Brücke 21
80639 München (DE)

(54) CONTAINER HOLDING RACK AND PRE-PROCESSING DEVICE

(57) A container holding rack 100 is used in a pre-processing device and holds a plurality of containers 1. A cap of each container 1 held by the container holding rack 100 is attached or detached by an attachment-detachment device of the pre-processing device. The container holding rack 100 includes a plurality of container storages and a clamping member. The plurality of container storages store the plurality of containers 1. The clamping member can clamp the plurality of containers 1 to restrict rotation of the plurality of containers 1 stored in the plurality of container storages.

FIG. 6



EP 4 101 539 A1

Description

BACKGROUND

Technical Field

[0001] The present invention relates to a container holding rack and a pre-processing device.

Description of Related Art

[0002] Pre-processing may be performed on a sample using a container such as a centrifuge tube before an analysis of a sample is performed in an analysis device. For example, in the pre-processing, a sample to be analyzed is injected into a container having a cap, and a predetermined solvent or agent is added to the stored sample. Further, a content in the container is stirred, etc. Thereafter, the content is extracted from the container and injected into a predetermined vial. The content including the sample after the pre-processing is supplied from the vial to the analysis device, whereby a desired analysis is performed in regard to the sample.

[0003] In the pre-processing, the cap is opened or closed before and after the content is injected into the container, or before and after the content is extracted from the container. Such repetitive manual work of opening or closing the cap is cumbersome. As such, a cap open/close device that automatically opens or closes the cap of the container is used. For example, in a cap open/close device described in JP 3-226484 A, a sample container is held by a pair of grippers of a grip open-close driver, and a cap is held by a robot hand. In this state, the grip open-close driver is rotated, so that the cap is opened or closed.

SUMMARY

[0004] With the cap open/close device described in JP 3-226484 A, caps are opened or closed one by one. Therefore, in a case where the number of containers is large, it requires a long period of time to open or close the caps, and throughput is reduced.

[0005] An object of the present invention is to provide a container holding rack that can easily attach caps to or detach the caps from a plurality of containers and a pre-processing device.

[0006] One aspect of the present invention relates to a container holding rack which is used in a pre-processing device and holds a plurality of containers, and in which a cap of each container is attached or detached by an attachment-detachment device of the pre-processing device, and includes a plurality of container storages that store the plurality of containers, respectively, and a clamping member that is capable of clamping the plurality of containers to restrict rotation of the plurality of containers respectively stored in the plurality of container storages.

[0007] Another aspect of the present invention relates to a pre-processing device that includes the above-mentioned container holding rack, and the attachment-detachment device that attaches or detaches caps of a plurality of containers held by the container holding rack, wherein the attachment-detachment device attaches or detaches the cap of each container held by the container holding rack when the clamping member clamps the plurality of containers.

[0008] Other features, elements, characteristics, and advantages of the present disclosure will become more apparent from the following description of preferred embodiments of the present disclosure with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWING

[0009]

Fig. 1 is a perspective view showing the appearance of a container holding rack according to a first embodiment;
Fig. 2 is a plan view of a main body of the container holding rack of Fig. 1;
Fig. 3 is a cross sectional view showing the configuration of the inside of the container holding rack;
Fig. 4 is an enlarged cross sectional view for explaining the configuration of a swinging member in one region;
Fig. 5 is a cross sectional view for explaining the behavior of the container holding rack;
Fig. 6 is a cross sectional view for explaining the behavior of the container holding rack;
Fig. 7 is a cross sectional view showing the configuration of the inside of a container holding rack according to a first modified example;
Fig. 8 is a cross sectional view showing the configuration of the inside of a container holding rack according to a second modified example;
Fig. 9 is a cross sectional view showing the configuration of the inside of a container holding rack according to a third modified example;
Fig. 10 is a perspective view showing the appearance of a container holding rack according to a second embodiment of the present invention;
Fig. 11 is a plan view showing a main body of the container holding rack of Fig. 10;
Fig. 12 is a plan view showing the configuration of the inside of the container holding rack;
Fig. 13 is a cross sectional view for explaining the behavior of the container holding rack;
Fig. 14 is a cross sectional view for explaining the behavior of the container holding rack;
Fig. 15 is a plan view showing the configuration of the inside of a container holding rack according to a first modified example;
Fig. 16 is a plan view showing the configuration of the inside of a container holding rack according to a

second modified example;
Fig. 17 is a block diagram showing one example of an analysis system;
Fig. 18 is a cross sectional view showing the configuration of the inside of a container holding rack according to another embodiment; and
Fig. 19 is a cross sectional view showing the configuration of the inside of a container holding rack according to another embodiment.

DETAILED DESCRIPTION

[1] First Embodiment

(1) Configuration of Container Holding Rack

[0010] A container holding rack according to embodiments of the present invention will be described below in detail with reference to the drawings. Fig. 1 is a perspective view showing the appearance of a container holding rack according to a first embodiment. As shown in Fig. 1, the container holding rack 100 can hold a plurality (four in the present example) of containers 1 using a main body, described below. Each container 1 is a centrifuge tube that is used in pre-processing for an analysis of a sample, for example, and has a cylindrical outer peripheral surface. Further, a screw-type cap 2 is attachable to or detachable from an upper portion of each container 1.

[0011] Fig. 2 is a plan view showing the main body of the container holding rack 100 of Fig. 1. As shown in Fig. 2, the main body 10 is formed of metal such as aluminum and includes a bottom member 11 and a peripheral wall member 12. The bottom member 11 is substantially square. The peripheral wall member 12 is provided to project upwardly from the edge of the bottom member 11. Circular concave portions 13 are respectively formed in four corners of the upper surface of the bottom member 11. The diameter of each concave portion 13 is slightly larger than the outer diameter of a container 1 of Fig. 1.

[0012] In the following description, in a case where the four concave portions 13 are to be differentiated from one another, the four concave portions 13 are respectively referred to as concave portions 13a to 13d. Within a horizontal plane, the direction in which a pair of sides of the bottom member 11 opposite to each other extends is referred to as an X direction, and the direction that is orthogonal to the X direction is referred to as a Y direction. Further, the straight line in parallel with the X direction and passing through the center of the bottom member 11 is referred to as a virtual line Lx, and the straight line in parallel with the Y direction and passing through the center of the bottom member 11 is referred to as a virtual line Ly.

[0013] Further, a region, which includes the concave portion 13a and is sectioned by the virtual lines Lx, Ly, of the bottom member 11 is referred to as a region R1. A region, which includes the concave portion 13b and is sectioned by the virtual lines Lx, Ly, of the bottom member 11 is referred to as a region R2. A region, which includes the concave portion 13c and is sectioned by the virtual lines Lx, Ly, of the bottom member 11 is referred to as a region R3. A region, which includes the concave portion 13d and is sectioned by the virtual lines Lx, Ly, of the bottom member 11 is referred to as a region R4.

[0014] The region R2 has the configuration symmetrical with that of the region R1 with respect to the virtual line Lx. The region R3 has the configuration symmetrical with the region R1 with respect to the virtual line Ly. The region R4 has the configuration symmetrical with the region R2 with respect to the virtual line Ly. In each of the regions R1 to R4 of the bottom member 11, an opening 14 is formed to be adjacent to a concave portion 13 in the X direction.

[0015] A through hole 15 extending in the X direction is formed in each of a portion, between the concave portions 13a, 13b, of the peripheral wall member 12, and a portion, between the concave portions 13c, 13d, of the peripheral wall member 12. Further, a projection 16 projecting in the Y direction is formed in each of a portion, between the concave portions 13a, 13c, of the inner peripheral surface of the peripheral wall member 12, and a portion, between the concave portions 13b, 13d, of the inner peripheral surface of the peripheral wall member 12.

[0016] Fig. 3 is a cross sectional view showing the configuration of the inside of the container holding rack 100. As shown in Fig. 3, the container holding rack 100 includes a cover member 20, two mobile members 30, a biasing body 40 and four swinging members 50 in addition to the main body 10. The cover member 20 is formed of a resin material having a substantially cuboid shape, for example, and covers the main body 10. Four through holes 21 (see Fig. 1) that respectively correspond to the four concave portions 13 of the main body 10 and are circular are formed in the upper surface of the cover member 20. Further, a through hole 22 corresponding to a through hole 15 of the main body 10 is formed in each of the two side surfaces facing each other of the cover member 20.

[0017] The two mobile members 30 are formed of a material similar to that of the main body 10, for example. The two mobile members 30 has a bar shape extending in the X direction and are respectively inserted into two through holes 15 of the peripheral wall member 12 of the main body 10 to be slidable in the X direction. At the tip of each mobile member 30, flange-shape wide portions 31, 32 are formed at a predetermined interval. The base portion of each mobile member 30 is a pressure portion 33 that can be pressed by a drive member, described below. The biasing body 40 is a spring member, for example. The biasing body 40 is provided to connect the tips of the two mobile members 30 to each other, and biases the two mobile members 30 such that the two mobile members 30 move away from each other.

[0018] The four swinging members 50 are formed of a

material similar to that of the main body 10, for example, and are respectively provided in the four regions R1 to R4 of the bottom member 11 of the main body 10. A swinging member 50 in the region R1 will be described below. A swinging member 50 in the region R2 has the configuration similar to that of the swinging member 50 in the region R1 except for being symmetrical with the swinging member 50 in the region R1 with respect to the virtual line Lx. A swinging member 50 in the region R3 has the configuration similar to that of the swinging member 50 in the region R1 except for being symmetrical with the swinging member 50 in the region R1 with respect to the virtual line Ly. A swinging member 50 in the region R4 has the configuration similar to that of the swinging member 50 in the region R2 except for being symmetrical with the swinging member 50 in the region R2 with respect to the virtual line Ly.

[0019] Fig. 4 is an enlarged cross sectional view for explaining the configuration of the swinging member 50 in the one region R1. As shown in Fig. 4, the swinging member 50 is a plate-shape member extending in one direction. A through hole 51 extending in an up-and-down direction is formed in the swinging member 50. A pin member 52 is attached to an opening 14 (see Fig. 2) in the region R1 of the bottom member 11 through the through hole 51 of the swinging member 50. Thus, the swinging member 50 is attached to the region R1 of the bottom member 11 to be swingable within the horizontal plane about the pin member 52. The center of the pin member 52 within the horizontal plane is referred to as a swing axis P1.

[0020] One end of the swinging member 50 is located between wide portions 31, 32 of the mobile member 30, and can abut against the wide portion 31 or 32. A portion, that can abut against the wide portion 32, of the swinging member 50 is referred to as an exertion portion P2. The other end of the swinging member 50 can abut against the outer peripheral surface of the container 1 of Fig. 1. A portion, that can abut against the container 1, of the swinging member 50 is referred to as an abutment portion P3. In the present example, the distance L1 between the swing axis P1 and the exertion portion P2 is larger than the distance L2 between the swing axis P1 and the abutment portion P3. Further, in the present example, an elastic member 53 is provided at the swinging member 50 as the abutment portion P3. The elastic member 53 is an annular rubber member, for example, and is wound around the swinging member 50.

(2) Behavior of Container Holding Rack

[0021] Figs. 5 and 6 are cross sectional views for explaining the behavior of the container holding rack 100. As shown in Figs. 5 and 6, a container 1 is fitted into each concave portion 13 of the bottom member 11 of the main body 10 through a through hole 21 (see Fig. 1) of the cover member 20. Thus, the four containers 1 are held by the main body 10. The outer peripheral surface of a container 1 fitted into each concave portion 13 abuts against the inner peripheral surface of the peripheral wall member 12 of the main body 10. A portion, which abuts against each container 1, of the inner peripheral surface of the peripheral wall member 12 is referred to as a wall portion 17.

[0022] Further, a drive member 3 can be inserted into each through hole 22 of the cover member 20. Two drive members 3 have a bar shape and respectively correspond to the two mobile members 30. Each drive member 3 is connected to an actuator (not shown) such as an air cylinder or a stepping motor and presses a corresponding pressure portion 33 of a corresponding mobile member 30 by driving in the X direction. A state in which each mobile member 30 is not pressed is referred to as a normal state, and a state in which each mobile member 30 is pressed is referred to as a pressure state.

[0023] In the normal state, a force directed outwardly is applied to each mobile member 30 by biasing of the biasing body 40 as indicated by the outlined arrows A1 in Fig. 5. In this case, one end of the swinging member 50 in the region R1 and one end of the swinging member 50 in the region R2 abut against a wide portion 31 of one mobile member 30. One end of the swinging member 50 in the region R3 and one end of the swinging member 50 in the region R4 abut against a wide portion 31 of the other mobile member 30. Thus, each swinging member 50 swings within the horizontal plane about a pin member 52 such that one end moves outwardly and the other end moves inwardly.

[0024] In this state, the other ends of the swinging members 50 in the regions R1, R3 abut against one projection 16 of the peripheral wall member 12 of the main body 10. The other ends of the swinging members 50 in the regions R2, R4 abut against the other projection 16 of the peripheral wall member 12 of the main body 10. At this time, each swinging member 50 is substantially in parallel with the Y direction, and an elastic member 53 wound around each swinging member 50 does not abut against a container 1. Therefore, a container 1 can be pulled out of each concave portion 13 of the main body 10, or a container 1 can be fitted into each concave portion 13 of the main body 10.

[0025] In the pressure state, a pressure portion 33 of each mobile member 30 is pressed by a corresponding drive member 3 against biasing of the biasing body 40, whereby a force directed inwardly is applied to each mobile member 30 as indicated by the outlined arrows A2 in Fig. 6. In this case, one end of the swinging member 50 in the region R1 and one end of the swinging member 50 in the region R2 abut against the wide portion 32 of the one mobile member 30. One end of the swinging member 50 in the region R3 and one end of the swinging member 50 in the region R4 abut against the wide portion 32 of the other mobile member 30. Thus, each swinging member 50 swings within the horizontal plane about the pin member 52 such that one end moves inwardly and the other end moves outwardly.

[0026] In this state, an elastic member 53 wound around each swinging member 50 abuts against the outer peripheral surface of a container 1 fitted into a concave portion 13 corresponding to the swinging member 50. Therefore, each container 1 is held not to be rotatable by abutting against a corresponding wall portion 17 of the peripheral wall member 12 of the main body 10 and a corresponding elastic member 53. Therefore, it is possible to respectively attach the caps 2 to or detach the caps 2 from the upper portions of the containers 1 by respectively rotating the plurality of caps 2 of Fig. 1 in the upper portions of the plurality of containers 1.

(3) Effects

[0027] In the container holding rack 100 according to the present embodiment, the concave portions 13 are respectively formed in the four corners of the one surface of the bottom member 11. In a plan view as viewed toward the one surface of the bottom member 11, the two mobile members 30 are movable in the X direction along the virtual line Lx. In the plan view, a swing axis P1 is arranged in each of the regions R1, R2 that are opposite to each other with respect to the virtual line Lx, and a swing axis P1 is arranged in each of the regions R3, R4 opposite to each other with respect to the virtual line Lx. In each of the regions R1 to R4, a swinging member 50 is swingable about a swing axis P1.

[0028] In the pressure state in which a pressure portion 33 of each mobile member 30 is pressed, the two mobile members 30 move toward each other. Thus, each swinging member 50 abuts against a container 1 fitted into a corresponding concave portion 13. In the normal state where the pressure portion 33 of each mobile member 30 is not pressed, the two mobile members 30 are moved away from each other by the biasing body 40. Thus, each swinging member 50 is spaced apart from a container 1 fitted into a corresponding concave portion 13.

[0029] With this configuration, it is possible to cause each swinging member 50 to be spaced apart from a container 1 fitted into a corresponding concave portion 13 by putting each mobile member 30 in the normal state. Thus, a container 1 can be pulled out from each concave portion 13, or a container 1 can be fitted into each concave portion 13.

[0030] On the other hand, it is possible to cause each swinging member 50 to abut against a container 1 fitted into a corresponding concave portion 13 by putting each mobile member 30 in the pressure state. In this case, a container 1 fitted into each concave portion 13 is held by a corresponding swinging member 50 and a corresponding wall portion 17 of the peripheral wall member 12. Therefore, rotation of each container 1 is restricted. Thus, the caps 2 can be easily attached to or detached from the plurality of containers 1.

[0031] Each swinging member 50 includes an exertion portion p2 on which a force of a corresponding mobile member 30 is to be exerted and an abutment portion P3 that can abut against a container 1 fitted into a corresponding concave portion 13. The distance L1 between an exertion portion P2 and a swing axis P1 is larger than the distance L2 between an abutment portion P3 and the swing axis P1. In this case, each swinging member 50 can firmly abut against a container 1 fitted into a corresponding concave portion 13. Further, in the present example, an elastic member 53 is provided as an abutment portion P3. Thus, rotation of a container 1 is restricted more easily.

[0032] Further, in the plan view, the one mobile member 30 is provided to be movable in the X direction between the concave portions 13a, 13b, and the other mobile member 30 is provided to be movable in the X direction between the concave portions 13c, 13d. In this case, the size of the container holding rack 100 can be reduced in the X direction. Further, because the center axes of the two mobile members 30 extend in a common straight line, the two mobile members 30 can be pressed with an easier operation.

[0033] Further, in the plan view, the regions R1, R3 are located opposite to each other with respect to the virtual line Ly, and the regions R2, R4 are located opposite to each other with respect to the virtual line Ly. Similarly, the swinging member 50 in the region R1 and the swinging member 50 in the region R3 are located opposite to each other with respect to the virtual line Ly, and the swinging member 50 in the region R2 and the swinging member 50 in the region R4 are located opposite to each other with respect to the virtual line Ly. The two mobile members 30 are also located opposite to each other with respect to the virtual line Ly. In this case, each swinging member 50 can uniformly abut against a container 1 fitted into a corresponding concave portion 13. Thus, the caps 2 can be easily attached to or detached from the plurality of containers 1.

(4) Modified Examples

[0034] While each mobile member 30 has a pressure portion 33 at its base portion and exerts a force on two corresponding swinging members 50 by being pressed in the present embodiment, the embodiment is not limited to this. Fig. 7 is a cross sectional view showing the configuration of the inside of a container holding rack 100 according to a first modified example. As shown in Fig. 7, each mobile member 30 may exert a force on two corresponding swinging members 50 by being pulled. In the first modified example, a state in which each mobile member 30 is not being pulled is a normal state. Further, a biasing body 40 biases two mobile members 30 such that the two mobile members 30 move toward each other.

[0035] While swinging members 50 in regions R1, R3 are arranged between concave portions 13a, 13c, and swinging members 50 in regions R2, R4 are arranged between concave portions 13b, 13d in the present embodiment, the embodiment is not limited to this. Fig. 8 is a cross sectional view showing the configuration of the

inside of a container holding rack 100 according to a second modified example. As shown in Fig. 8, swinging members 50 in regions R1, R3 may be arranged outwardly of concave portions 13a, 13c, and swinging members 50 in regions R2, R4 may be arranged outwardly of concave portions 13b, 13d.

[0036] In the second modified example, one mobile member 30 is not provided between the concave portions 13a, 13b in a plan view, and the other mobile member 30 is not provided between the concave portions 13c, 13d in the plan view. Further, wall portions 17 in the regions R1, R3 are located between a swinging member 50 in the region R1 and a swinging member 50 in the region R3, and wall portions 17 in the regions R2, R4 are located between a swinging member 50 in the region R2 and a swinging member 50 in the region R4.

[0037] While the container holding rack 100 is configured to be capable of holding four containers 1 in the present embodiment, the embodiment is not limited to this. Fig. 9 is a cross sectional view showing the configuration of the inside of a container holding rack 100 according to a third modified example. As shown in Fig. 9, in a bottom member 11 of a main body 10, concave portions 13a, 13b may be formed but concave portions 13c, 13d do not have to be formed. In this case, the container holding rack 100 is configured to be capable of holding two containers 1. In the third modified example, the container holding rack 100 does not have a region R3 or R4, and does not include a mobile member 30 or a swinging member 50 corresponding to a region R3 or R4.

[2] Second Embodiment

(1) Configuration of Container Holding Rack

[0038] A container holding rack according a second embodiment of the present invention will be described below in detail with reference to the drawings. Fig. 10 is a perspective view showing the appearance of the container holding rack according to a second embodiment. As shown in Fig. 10, the container holding rack 100 includes a main body 110 and a cover member 120. The container holding rack 100 can hold a plurality (four in the present example) of containers 1 using the main body 110. Each container 1 is a centrifuge tube that is used in pre-processing for an analysis of a sample, for example, and has a circular outer peripheral surface. Further, a screw-type cap 2 is attachable to or detachable from an upper portion of each container 1.

[0039] The cover member 120 is formed of a resin material having a substantially cuboid shape, for example, and is attached to the main body 110 to cover an upper portion of the main body 110. In the upper surface of the cover member 120, four through holes 121 that are located in upper portions of four concave portions 114 of the main body 110, described below, and have a circular shape of the same size as the concave portions 114 are formed. A container 1 held by the main body 110 is inserted into each through hole 121.

[0040] Fig. 11 is a plan view showing the main body 110 of the container holding rack 100 of Fig. 10. As shown in Fig. 11, the main body 110 is formed of a resin material, for example, and includes a bottom member 111, a peripheral wall member 112 and a center wall member 113. The bottom member 111 is substantially square. The peripheral wall member 112 is provided to project upwardly from the edge of the bottom member 111.

[0041] The center wall member 113 is provided to project upwardly from the center portion of the bottom member 111. Between the peripheral wall member 112 and the center wall member 113, circular concave portions 114 are respectively formed in four corners of the upper surface of the bottom member 111. Each concave portion 114 is an example of a container storage. The diameter of each concave portion 114 is slightly larger than the outer diameter of a pressing member 130, described below.

[0042] In the following description, in a case where the four concave portions 114 are to be differentiated from one another, the four concave portions 114 are respectively referred to as concave portions 114a to 114d. Within a horizontal plane, the direction in which a pair of sides of the bottom member 111 opposite to each other extends is referred to as an X direction, and the direction that is orthogonal to the X direction is referred to as a Y direction. Further, the straight line in parallel with the X direction and passing through the center of the bottom member 111 is referred to as a virtual line Mx, and the straight line in parallel with the Y direction and passing through the center of the bottom member 111 is referred to as a virtual line My.

[0043] Further, a region, which includes the concave portion 114a and is sectioned by the virtual lines Mx, My, of the bottom member 111 is referred to as a region S1. A region, which includes the concave portion 114b and is sectioned by the virtual lines Mx, My, of the bottom member 111 is referred to as a region S2. A region, which includes the concave portion 114c and is sectioned by the virtual lines Mx, My, of the bottom member 111 is referred to as a region S3. A region, which includes the concave portion 114d and is sectioned by the virtual lines Mx, My, of the bottom member 111 is referred to as a region S4. The regions S2, S4 respectively have the configuration symmetrical with the regions S1, S3 with respect to the virtual line Mx. The regions S1, S2 are respectively opposite to the regions S3, S4 with the virtual line My located therebetween.

[0044] One end portion of the center wall member 113 in the Y direction is located between the concave portion 114aand the concave portion 114c. The other end portion of the center wall member 113 in the Y direction is located between the concave portion 114b and the concave portion 114d. In the upper surfaces of the one end portion and the other end portion of the center wall member 113, screw holes 101 extending in the up-and-down direction are respectively formed. Two screw members 102 (see

Fig. 10) are respectively screwed in the two screw holes 101 of the center wall member 113 via the cover member 120. Thus, the cover member 120 is attached to the upper portion of the main body 110.

[0045] Fig. 12 is a plan view showing the configuration of the inside of the container holding rack 100. As shown in Fig. 12, the container holding rack 100 includes a plurality of (four in the present example) of pressing members 130, a latch member 140 and a belt member 150 in addition to the main body 110 and the cover member 120. The plurality of pressing members 130 correspond to the plurality of concave portions 114, respectively.

[0046] Each pressing member 130 is formed of silicon rubber, for example, and has a cylindrical shape. Each pressing member 130 may be formed of another rubber material or formed of a material having relatively high flexibility and a relatively high coefficient of static friction. The inner diameter of each pressing member 130 is slightly larger than the outer diameter of a container 1 of Fig. 10. Each pressing member 130 is arranged to be able to come into contact with the outer peripheral surface of a container 1 and to come into contact with the inside of a corresponding concave portion 114.

[0047] The latch member 140 is attached to the side surface or the like in the Y direction of the center wall member 113, is a draw latch, for example, and includes a fixed end 141, a free end 142 and a turning shaft 143. The fixed end 141 is attached to the side surface in the Y direction of the center wall member 113, for example. The free end 142 is provided to be turnable about the turning shaft 143. The turning shaft 143 is connected to the fixed end 141 and constitutes one member in combination with the free end 142. The latch member 140 can be switched between an open state in which the free end 142 turns freely with respect to the fixed end 141 and a close state in which the free end 142 is engaged with the fixed end 141. The open state and the close state are examples of first and second states, respectively. In Fig. 12, the latch member 140 in the open state is shown.

[0048] The belt member 150 is formed of stainless, for example, and has an elongated shape. The belt member 150 may be formed of another metallic material or may be formed of another material having relatively high rigidity. The belt member 150 is arranged to surround the plurality of pressing members 130. One end portion 151 of the belt member 150 is connected to the fixed end 141 of the latch member 140. The other end portion 152 of the belt member 150 is connected to the free end 142 of the latch member 140. The end portions 151, 152 are examples of first and second end portions, respectively.

[0049] In the present example, an annular member 144 that is turnable with respect to the free end 142 is provided at the free end 142. The end portion 152 of the belt member 150 is inserted into the annular member 144 and is fixed to another portion of the belt member 150 by a screw member 103 while being folded. The method of fixing the end portion 152 of the belt member 150 is not limited to the above-mentioned method. The end portion 152 of the belt member 150 may be directly fixed to the free end 142 of the latch member 140, for example.

[0050] Further, while the end portion 151 of the belt member 150 is directly connected to the fixed end 141 of the latch member 140 in the present example, the embodiment is not limited to this. The end portion 151 of the belt member 150 may be fixed to the side surface of the center wall member 113, for example. In this case, the end portion 151 of the belt member 150 and the fixed end 141 of the latch member 140 are indirectly connected to each other via the center wall member 113.

(2) Behavior of Container Holding Rack

[0051] Figs. 13 and 14 are cross sectional views for explaining the behavior of the container holding rack 100. As shown in Fig. 13, a user puts the latch member 140 in the open state. Next, the user fits a container 1 into each concave portion 114 in the upper surface of the bottom member 111 of the main body 110 through each through hole 121 (see Fig. 10) of the cover member 120. In this case, each pressing member 130 comes into contact with a container 1 while surrounding the corresponding container 1. Thus, the four containers 1 are held by the main body 110.

[0052] Thereafter, the user puts the latch member 140 in the close state as indicated by the arrow A in Fig. 14. In this case, the end portion 151 and the end portion 152 of the belt member 150 are closer to each other than a case where the latch member 140 is in the open state. Therefore, as indicated by the arrows B in Fig. 14, the belt member 150 presses the plurality of pressing members 130 inwardly from outside with a larger pressure than a case where the latch member 140 is in the open state. Therefore, the belt member 150 presses a corresponding container 1 against the inner peripheral surface of each concave portion 114 via each pressing member 130.

[0053] In this state, rotation of each container 1 is restricted by a corresponding pressing member 130. As a result, in the upper portions of the plurality of containers 1, the containers 1 are not rotated when the plurality of caps 2 of Fig. 10 are respectively rotated, and a cap 2 in an upper portion of each container 1 can be attached or detached.

[0054] With this configuration, because restriction of rotation of each container 1 can be realized only by the container holding rack 100, it is not necessary to provide an actuator for applying force to press each container 1 to the container holding rack 100. Therefore, a positioning mechanism of the container holding rack 100 in the attachment-detachment device of the caps 2 does not conflict with a positioning mechanism of the container holding rack 100 in the actuator. Thus, the caps 2 can be more easily attached or detached.

(3) Effects

[0055] In the container holding rack 100 according to the present embodiment, when the latch member 140 is in the open state, a corresponding container 1 is fitted into each concave portion 114 in the upper surface of the bottom member 111. In this case, each container 1 is stably held while being surrounded by a corresponding pressing member 130 and being opposite to the belt member 150 in a corresponding concave portion 114.

[0056] Further, after each container 1 is fitted into a corresponding concave portion 114, the latch member 140 is put in the close state. In this case, each container 1 is firmly pressed with a larger pressure than a case where the latch member 140 is in the open state by the belt member 150 and the inner peripheral surface of a corresponding concave portion 114 via a corresponding pressing member 130. Thus, rotation of the plurality of containers 1 is restricted. As a result, the caps 2 can be easily attached to or detached from the plurality of containers 1.

(4) Modified Examples

[0057] While each pressing member 130 is arranged to surround a corresponding container 1 in the present embodiment, the embodiment is not limited to this. Fig. 15 is a plan view showing the configuration of the inside of a container holding rack 100 according to a first modified example. As shown in Fig. 15, in the first modified example, each pressing member 130 has not a cylindrical shape but a curved plate shape. Each pressing member 130 is opposite to a corresponding container 1 and is arranged to be able to come into contact with the container 1.

[0058] In the first modified example, when a latch member 140 is in the close state, each container 1 is firmly pressed with a larger pressure than a case where the latch member is in the open state by a belt member 150 and the inner peripheral surface of a corresponding concave portion 114 via a corresponding pressing member 130. In this case, because rotation of a plurality of containers 1 is restricted, caps 2 can be easily attached to or detached from the plurality of containers 1.

[0059] Fig. 16 is a plan view showing the configuration of the inside of a container holding rack 100 according to a second modified example. As shown in Fig. 16, in the second modified example, not a plurality of pressing members 130 but one pressing member 130 is provided. The pressing member 130 has a strip shape and is attached to the inner peripheral surface of a belt member 150 to be able to come into contact with a plurality of containers 1.

[0060] In the second modified example, when a latch member 140 is in the close state, each container is firmly pressed with a larger pressure than a case where the latch member 140 is in the open state by the belt member 150 and the inner peripheral surface of a corresponding concave portion 114 via the common pressing member 130. In this case, because rotation of the plurality of containers 1 is restricted, caps 2 can be easily attached to or detached from the plurality of containers 1.

[3] Third Embodiment

[0061] A pre-processing device according to a third embodiment of the present invention will be described below in detail with reference to the drawings. Fig. 17 is a block diagram showing one example of an analysis system. As shown in Fig. 17, the analysis system 500 includes a pre-processing device 200 and an analysis device 300. The pre-processing device 200 includes a container holding rack 100, a sample storage 210, an adder 220, a shaker 230, a separator 240, an injector 250 and a discarder 260.

[0062] The container holding rack 100 holding the four containers 1 for pre-processing is introduced into the sample storage 210. While being the container holding rack 100 of Fig. 10 according to the second embodiment in the example of Fig. 17, the container holding rack 100 may be the container holding rack 100 of Fig. 1 according to the first embodiment. A vial rack 310 holding a plurality of vials 311 for an analysis is introduced into the injector 250.

[0063] In a case where the container holding rack 100 according to the first embodiment is used, in each of the sample storage 210, the adder 220 and the injector 250, a drive member 3 (see Fig. 5) and an actuator for pressing a pressure portion 33 of a mobile member 30 of the container holding rack 100 are provided. Further, in each of the sample storage 210, the adder 220 and the injector 250, an attachment-detachment device 270 for attaching caps 2 to or detaching the caps 2 from the plurality of containers 1 by rotating the caps 2 of the plurality of containers 1 in the container holding rack 100 is provided.

[0064] After detaching a cap 2 from each container 1 in the introduced container holding rack 100, the sample storage 210 stores a sample to be analyzed in each container 1 and attaches the cap 2 to each container 1. A sample to be analyzed includes food, for example. Thereafter, the sample storage 210 carries the container holding rack 100 into the shaker 230 and carries the container holding rack 100 that has been carried in from the shaker 230 into the adder 220.

[0065] After detaching a cap 2 from each container 1 in the container holding rack 100 that has been carried in from the sample storage 210, the adder 220 adds a predetermined solvent, an internal standard reagent, etc. to each container 1 and attaches the cap 2 to each container 1. Thereafter, the adder 220 carries the container holding rack 100 into the shaker 230 and carries the container holding rack 100 that has been carried in from the shaker 230 into the separator 240.

[0066] After stirring the content in each container 1 by shaking the container 1 in the container holding rack 100 that has been carried in from the sample storage 210,

the shaker 230 carries the container holding rack 100 into the sample storage 210. Further, after stirring the content in the container 1 by shaking each container 1 in the container holding rack 100 that has been carried in from the adder 220, the shaker 230 carries the container holding rack 100 into the adder 220. The separator 240 separates the content in a container 1 into components by applying a centrifugal force to each container 1 in the container holding rack 100 that has been carried in from the adder 220. Thereafter, the separator 240 carries the container holding rack 100 into the injector 250.

[0067] After detaching a cap 2 from each container 1 in the container holding rack 100 that has been carried in from the separator 240, the injector 250 extracts part of the content from each container 1 and injects the extracted content into each vial 311 in the vial rack 310. Thus, the content including a sample after the pre-processing is stored in each vial 311. Thereafter, the injector 250 attaches a cap 2 to each container 1 in the container holding rack 100 and carries the container holding rack 100 into the discarder 260. Further, the injector 250 carries the vial rack 310 into the analysis device 300. The discarder 260 discards the content in each container 1 in the container holding rack 100 that has been carried in from the injector 250.

[0068] The analysis device 300 performs a predetermined analysis in regard to the content in each vial 311 in the vial rack 310 that has been carried in from the pre-processing device 200. An analysis includes determining quantity of pesticide residue in food, which is a sample, for example. The analysis device 300 may be a liquid chromatograph mass spectrometer (LC/MS), a gas chromatograph mass spectrometer (GC/MS) or another analysis device, for example.

[0069] In the pre-processing device 200, it is possible to attach the caps 2 to or detach the caps 2 from the plurality of containers 1 simultaneously and automatically by using the container holding rack 100. Thus, throughput can be improved. Further, it can save human labor.

[4] Other Embodiments

[0070]

(1) While the container holding rack 100 includes a wall portion 17 that can abut against each container 1 in the first embodiment, the embodiment is not limited to this. As long as each swinging member 50 can press a container 1 to restrict rotation of the corresponding container 1, a container holding rack 100 does not have to include a wall portion 17 that can abut against each container 1.

(2) While an elastic member 53 is provided at each swinging member 50 as an abutment portion P3 in the first embodiment, the embodiment is not limited to this. As long as each swinging member 50 can press a container 1 to restrict rotation of the corresponding container 1, an elastic member 53 does not have to be provided at each swinging member 50.

(3) While the distance L1 between a swing axis P1 and an exertion portion P2 of each mobile member 30 is larger than the distance L2 between the swing axis P1 and an abutment portion P3 of the mobile member 30 in the first embodiment, the embodiment is not limited to this. As long as each swinging member 50 can press a container 1 to restrict rotation of the corresponding container 1, the distance L1 between a swing axis P1 and an exertion portion P2 of each mobile member 30 is equal to or less than the distance L2 between the swing axis P1 and an abutment portion P3.

(4) While the container holding rack 100 includes the biasing body 40 in the first embodiment, the embodiment is not limited to this. As long as a container 1 can be pulled out of each concave portion 13 of the bottom member 11, or a container 1 can be fitted into each concave portion 13 of the bottom member 11 in the normal state, a container holding rack 100 does not have to include a biasing body 40.

(5) While the container holding rack 100 has the symmetrical configuration with respect to the virtual line Ly in the first embodiment, the embodiment is not limited to this. As long as each swinging member 50 can press a container 1 to restrict rotation of the corresponding container 1, a container holding rack 100 does not have to have the symmetrical configuration with respect to a virtual line Ly. For example, a center axis of one mobile member 30 and a center axis of the other mobile member 30 do not have to be on a common straight line.

(6) While the belt member 150 is provided to press the plurality of containers 1 inwardly from outside in the second embodiment, the embodiment is not limited to this. Figs. 18 and Fig. 19 are cross sectional views showing the configuration of the inside of a container holding rack 100 according to another embodiment. As shown in Fig. 18 and Fig. 19, in the present embodiment, a belt member 150 is provided to extend along the side surface of a center wall member 113 to be opposite to a plurality of pressing members 130. As shown in Fig. 18, a user puts a latch member 140 in the open state and fits a container 1 to each concave portion 114 in the upper surface of a bottom member 111 of a main body 110. Thereafter, as indicated by the arrow C in Fig. 19, the user puts the latch member 140 in the close state. In this case, the force directed toward the center of the circular shape of a corresponding concave portion 114 is applied to a portion of the belt member 150 extending along the circular inner peripheral surface of each concave portion 114. Therefore, as indicated by the arrows D in Fig. 19, the belt member 150 presses a plurality of pressing members 130 outwardly from inside with a larger pressure than a case where the latch member 140 is in the open state. Therefore, the belt member 150 presses a corre-

sponding container 1 against the inner peripheral surface of a peripheral wall member 112 via each pressing member 130.

Also in this state, rotation of each container 1 is restricted by a corresponding pressing member 130. Therefore, in upper portions of a plurality of containers 1, the plurality of caps 2 of Fig. 10 are respectively rotated, so that a cap 2 can be attached to or detached from an upper portion of each container 1.

Also in the container holding rack 100 of Fig. 19, similarly to the first modified example, a plurality of pressing members 130 having a curved plate shape may be provided instead of a plurality of pressing members 130 having a cylindrical shape. Alternatively, similarly to the second modified example, a common strip shaped pressing member 130 may be provided instead of a plurality of pressing members 130 having a cylindrical shape.

(7) While the container holding rack 100 includes the pressing members 130 in the second embodiment, the present embodiment is not limited to this. In a case where each container 1 can be sufficiently firmly pressed when a latch member 140 is in the close state, a container holding rack 100 does not have to include a pressing member 130. The same applies to the first or second modified example. With the configuration, when the latch member 140 is in the close state, each container 1 is directly pressed by a belt member 150.

(8) While the plurality of concave portions 114 are formed in the upper surface of the bottom member 111 in the second embodiment, the embodiment is not limited to this. The concave portions 114 do not have to be formed in the upper surface of the bottom member 111. Further, in a case where a plurality of containers 1 can be stably arranged, the main body 110 does not have to include the bottom member 111 as long as including a container storage.

(9) While the container holding rack 100 is configured to hold the four containers 1 in the second embodiment, the embodiment is not limited to this. A container holding rack 100 may be configured to hold two or three containers 1 or may be configured to hold five or more containers 1.

[5] Correspondences between Constituent Elements in Claims and Parts in Preferred Embodiments

[0071] In the above-mentioned embodiment, the swinging member 50 or the belt member 150 is an example of a clamping member. The concave portions 13a to 13d are examples of first to fourth concave portions, respectively, and the regions R1 to R4 are examples of first to fourth regions, respectively. The virtual line Lx is an example of a first virtual line, a second virtual line and a common straight line, the virtual line Ly is an example of a third virtual line, and the mobile member 30 is an example of first and second mobile members.

[0072] The containers 1 in the regions R1 to R4 are examples of first to fourth containers, respectively, the swing axes P1 in the regions R1 to R4 are examples of first to fourth axes, respectively, the swinging members 50 in the regions R1 to R4 are examples of first to fourth swinging members, respectively. The wall portions 17 in the regions R1, R2 are examples of first and second wall portions, respectively, and the abutment portions P3 in the regions R1, R2 are examples of first and second abutment portions, respectively. The exertion portions P2 in the regions R1, R2 are examples of first and second exertion portions, respectively, and the elastic members 53 in the regions R1, R2 are examples of first and second elastic members, respectively.

[6] Aspects

[0073] It is understood by those skilled in the art that the plurality of above-mentioned illustrative embodiments are specific examples of the below-mentioned aspects.

[0074] (Item 1) A container holding rack according to one aspect may be used in a pre-processing device and may hold a plurality of containers, and in which a cap of each container may be attached or detached by an attachment-detachment device of the pre-processing device, and may include a plurality of container storages that store the plurality of containers, respectively, and a clamping member that is capable of clamping the plurality of containers to restrict rotation of the plurality of containers respectively stored in the plurality of container storages.

[0075] In the container holding rack, the clamping member clamps the plurality of containers stored in the plurality of container storages, whereby rotation of the plurality of containers is restricted. Thus, the caps can be easily attached to or detached from the plurality of containers.

[0076] (Item 2) The container holding rack according to item 1, wherein the plurality of containers may include first and second containers, the container holding rack may include a bottom member having one surface in which first and second concave portions, into which the first and second containers are respectively fitted, are formed as the plurality of container storages, a first mobile member configured to be movable in first and second directions that are opposite to each other along a first virtual line passing between the first concave portion and the second concave portion in a plan view as viewed toward the one surface of the bottom member, a first swinging member that is swingable about a first axis in association with movement of the first mobile member as the clamping member, and a second swinging member that is swingable about a second axis in association with movement of the first mobile member as the clamping member, the first and second axes may be arranged in first and second regions opposite to each other with respect to the first virtual line in the plan view, and the

first and second swinging members may be configured to respectively abut against the first and second containers fitted into the first and second concave portions due to movement of the first mobile member in the first direction, and may be configured to be respectively spaced apart from the first and second containers fitted into the first and second concave portions due to movement of the first mobile member in the second direction.

[0077] In this container holding rack, the first and second containers are fitted into the first and second concave portions formed in the one surface of the bottom member, respectively. In the plan view as viewed toward the one surface of the bottom member, the first mobile member is movable in the first and second directions opposite to each other along the first virtual line passing between the first and second concave portions. In the plan view, the first and second axes are respectively arranged in the first and second regions that are opposite to each other with respect to the first virtual line. The first and second swinging members are swingable about the first and second axes, respectively.

[0078] The first and second swinging members respectively abut against the first and second containers fitted into the first and second concave portions due to movement of the first mobile member in the first direction. Further, the first and second swinging members are respectively spaced apart from the first and second containers fitted into the first and second concave portions due to movement of the first mobile member in the second direction.

[0079] With this configuration, it is possible to cause the first and second swinging members to be spaced apart from the first and second containers fitted into the first and second concave portions by moving the first mobile member in the second direction. Thus, the first and second containers can be pulled out from the first and second concave portions, or the first and second containers can be fitted into the first and second concave portions, respectively.

[0080] On the other hand, it is possible to cause the first and second swinging members to abut against the first and second containers fitted into the first and second concave portions by moving the first mobile member in the first direction. In this case, rotation of the first and second containers is restricted. Thus, the caps can be attached to or detached from the first and second containers easily.

[0081] (Item 3) The container holding rack according to item 2 may further include a first wall portion provided at a position opposite to the first swinging member with the first concave portion held between the first wall portion and the first swinging member in the plan view, and a second wall portion provided at a position opposite to the second swinging member with the second concave portion held between the second wall portion and the second swinging member, wherein the first wall portion may be configured to abut against the first container when the first swinging member abuts against the first container fitted into the first concave portion, and the second wall portion may be configured to abut against the second container when the second swinging member abuts against the second container fitted into the second concave portion.

[0082] With this configuration, in a case where the first mobile member is moved in the first direction, the first container fitted into the first concave portion is held between the first swinging member and the first wall portion, and the second container fitted into the second concave portion is held between the second swinging member and the second wall portion. Thus, rotation of the first and second containers is restricted more easily. As a result, the caps can be attached to or detached from the first and second containers more easily.

[0083] (Item 4) The container holding rack according to item 2 or 3, wherein the first swinging member may include a first abutment portion that is abuttable against the first container fitted into the first concave portion and a first exertion portion on which a force of the first mobile member is exerted, a distance between the first exertion portion and the first axis may be larger than a distance between the first abutment portion and the first axis, the second swinging member may include a second abutment portion that is abuttable against the second container fitted into the second concave portion and a second exertion portion on which a force of the first mobile member is exerted, and a distance between the second exertion portion and the second axis may be larger than a distance between the second abutment portion and the second axis.

[0084] In this case, the first and second swinging members can abut against the first and second containers fitted into the first and second concave portions respectively, firmly and easily. Thus, rotation of the first and second containers is restricted more easily. As a result, the caps can be attached to or detached from the first and second containers more easily.

[0085] (Item 5) The container holding rack according to any one of items 2 to 4, wherein a first elastic member may be provided at a portion that is abuttable against the first container in the first swinging member, and a second elastic member may be provided at a portion that is abuttable against the second container in the second swinging member.

[0086] In this case, rotation of the first and second containers is restricted more easily by respective abutment of the first and second elastic members. Thus, the caps are attachable to or detachable from the first and second containers more easily.

[0087] (Item 6) The container holding rack according to any one of items 2 to 5, may further include a biasing body that is attached to the first mobile member to bias the first mobile member in the second direction.

[0088] In this case, the first mobile member can be moved in the second direction. Thus, the first and second containers can be pulled out from the first and second concave portions more easily. Further, the first and sec-

ond containers can be fitted into the first and second concave portions respectively and more easily.

[0089] (Item 7) The container holding rack according to any one of items 2 to 6, wherein the first mobile member may include a pressure portion that is pressable in the first direction.

[0090] In this case, the first mobile portion can be moved in the first direction. Thus, the caps can be attached to or detached from the first and second containers easily.

[0091] (Item 8) The container holding rack according to any one of items 2 to 7, wherein the first mobile member may be provided to be movable between the first concave portion and the second concave portion in the plan view.

[0092] In this case, the size of the container holding rack can be reduced in the first or second direction.

[0093] (Item 9) The container holding rack according to any one of items 2 to 8, wherein the plurality of containers may further include third and fourth containers, third and fourth concave portions into which the third and fourth containers are respectively fitted may further be formed as the plurality of container storages in the one surface of the bottom member, the container holding rack may further include a second mobile member that is configured to be movable in third and fourth directions opposite to each other along a second virtual line passing between the third concave portion and the fourth concave portion in the plan view, a third swinging member that is swingable about a third axis in association with movement of the second mobile member as the clamping member, and a fourth swinging member that is swingable about a fourth axis in association with movement of the second mobile member as the clamping member, the third and fourth axes may be arranged in third and fourth regions that are opposite to each other with respect to the second virtual line in the plan view, the third and fourth swinging members may be configured to respectively abut against the third and fourth containers fitted into the third and fourth concave portions due to movement of the second mobile member in the third direction, and may be respectively spaced apart from the third and fourth containers fitted into the third and fourth concave portions due to movement of the second mobile member in the fourth direction.

[0094] With this configuration, the first and second mobile members are moved in the second and fourth directions, respectively, whereby the first to fourth swinging members can be spaced apart from the first to fourth containers fitted into the first to fourth concave portions, respectively. Thus, the first to fourth containers can be pulled out from the first to fourth concave portions, or the first to fourth containers can be fitted into the first to fourth concave portions, respectively.

[0095] On the other hand, the first and second mobile members are moved in the first and third directions, respectively, whereby the first to fourth swinging members can abut against the first to fourth containers fitted into the first to fourth concave portions, respectively. In this case, rotation of the first to fourth containers is restricted. Thus, the caps can be attached to or detached from the first to fourth containers easily.

[0096] (Item 10) The container holding rack according to item 9, wherein the first virtual line and the second virtual line may extend on a common straight line.

[0097] In this case, the first and second mobile members can be moved by an easier operation.

[0098] (Item 11)The container holding rack according to item 10, wherein the first region and the third regions may be located opposite to each other with respect to a third virtual line that intersects with the common straight line in the plan view, the second region and the fourth region may be located opposite to each other with respect to the third virtual line, the first swinging member and the third swinging member may be located opposite to each other with respect to the third virtual line, the second swinging member and the fourth swinging member may be located opposite to each other with respect to the third virtual line, and the first mobile member and the second mobile member may be located opposite to each other with respect to the third virtual line.

[0099] In this case, the first to fourth swinging members can abut against the first to fourth containers fitted into the first to fourth concave portions respectively and more uniformly. Thus, the caps can be attached to or detached from the first to fourth containers more easily.

[0100] (Item 12) The container holding rack according to item 1 may include a latch member provided to be switchable between a first state and a second state, and a belt member that is arranged to extend along side surfaces of the plurality of container storages, and when the latch member is in the second state, presses the plurality of containers as the clamping member with a larger pressure than a case where the latch member is in the first state.

[0101] With this configuration, the latch member is put in the first state, so that the plurality of containers can be held by the container holding rack to be opposite to the belt member. Further, the latch member is put in the second state with the plurality of containers held by the container holding rack, whereby the plurality of containers can be pressed by the belt member with a larger pressure than a case where the latch member is in the first state. Thus, rotation of the plurality of containers is restricted. As a result, the caps can be easily attached to or detached from the plurality of containers.

[0102] (Item 13) The container holding rack according to item 12, wherein the belt member may have a first end portion and a second end portion, and when the latch member is in the second state, may be connected to the latch member such that the first end portion and the second end portion are closer to each other than a case where the latch member is in the first state.

[0103] In this case, with a simple configuration, the pressure applied to the plurality of containers in a case where the latch member is in the second state can be larger than the pressure applied to the plurality of con-

tainers in a case where the latch member is in the first state.

[0104] (Item 14) The container holding rack according to item 13, wherein the latch member may have a fixed end and a free end movable with respect to the fixed end, and the first end portion and the second end portion of the belt member may be respectively connected to the fixed end and the free end of the latch member.

[0105] In this case, with a simple connection relationship, when the latch member is in the second state, the first end portion and the second end portion the belt member can be closer to each other than a case where the latch member is in the first state.

[0106] (Item 15) The container holding rack according to any one of items 12 to 14 may further include a pressing member that is provided in the container storage to be able to come into contact with the plurality of containers, wherein the belt member may press the plurality of containers via the pressing member.

[0107] In this case, the plurality of containers are more firmly pressed via the pressing member. Thus, when the latch member is in the second state, rotation of the plurality of containers are more reliably restricted. As a result, the caps can be more easily attached to or detached from the plurality of containers.

[0108] (Item 16) The plurality of container holding rack according to item 15, wherein a plurality of the pressing members may be provided to correspond to the plurality of containers, respectively, and each of the plurality of the pressing members may be arranged to be able to come into contact with a corresponding container.

[0109] In this case, each container is more firmly pressed by a corresponding pressing member. Thus, when the latch member is in the second state, rotation of the plurality of containers is more reliably restricted. As a result, the caps can be more easily attached to or detached from the plurality of containers.

[0110] (Item 17) The container holding rack according to item 16, wherein each of the plurality of pressing members may be arranged to surround a corresponding container.

[0111] In this case, each container is more firmly pressed by a corresponding pressing member. Thus, when the latch member is in the second state, rotation of the plurality of containers is more reliably restricted. As a result, the caps can be more easily attached to or detached from the plurality of containers.

[0112] (Item 18) The container holding rack according to any one of items 12 to 17 may further include a bottom member having one surface in which the plurality of container storages are formed as a plurality of concave portions into which the plurality of containers are respectively fitted.

[0113] In this case, each container can be stably held in a corresponding concave portion.

[0114] (Item 19) The container holding rack according to item 18, wherein the belt member, when the latch member is in the second state, may press each of the plurality of containers against an inner peripheral surface of a corresponding concave portion with a larger pressure than a case where the latch member is in the first state.

[0115] In this case, each container is more firmly pressed by the belt member and the inner peripheral surface of the corresponding concave portion. Thus, when the latch member is in the second state, rotation of the plurality of containers is more firmly restricted. As a result, the caps can be more easily attached to or detached from the plurality of containers.

[0116] (Item 20) A pre-processing device according to another aspect may include the container holding rack according to any one of items 1 to 19, and the attachment-detachment device that attaches or detaches caps of a plurality of containers held by the container holding rack, wherein the attachment-detachment device may attach or detach the cap of each container held by the container holding rack when the clamping member clamps the plurality of containers.

[0117] In this case, the caps can be easily attached to or detached from the plurality of containers.

[0118] While preferred embodiments of the present disclosure have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without departing the scope and spirit of the present disclosure. The scope of the present disclosure, therefore, is to be determined solely by the following claims.

Claims

1. A container holding rack which is used in a pre-processing device and holds a plurality of containers, and in which a cap of each container is attached or detached by an attachment-detachment device of the pre-processing device, comprising:

   a plurality of container storages that store the plurality of containers, respectively; and
   a clamping member that is capable of clamping the plurality of containers to restrict rotation of the plurality of containers respectively stored in the plurality of container storages.

2. The container holding rack according to claim 1, wherein

   the plurality of containers include first and second containers,
   the container holding rack includes
   a bottom member having one surface in which first and second concave portions, into which the first and second containers are respectively fitted, are formed as the plurality of container storages,
   a first mobile member configured to be movable in first and second directions that are opposite

to each other along a first virtual line passing between the first concave portion and the second concave portion in a plan view as viewed toward the one surface of the bottom member,
a first swinging member that is swingable about a first axis in association with movement of the first mobile member as the clamping member, and
a second swinging member that is swingable about a second axis in association with movement of the first mobile member as the clamping member,
the first and second axes are arranged in first and second regions opposite to each other with respect to the first virtual line in the plan view, and
the first and second swinging members are configured to respectively abut against the first and second containers fitted into the first and second concave portions due to movement of the first mobile member in the first direction, and are configured to be respectively spaced apart from the first and second containers fitted into the first and second concave portions due to movement of the first mobile member in the second direction.

3. The container holding rack according to claim 2, further comprising:

a first wall portion provided at a position opposite to the first swinging member with the first concave portion held between the first wall portion and the first swinging member in the plan view; and
a second wall portion provided at a position opposite to the second swinging member with the second concave portion held between the second wall portion and the second swinging member, wherein
the first wall portion is configured to abut against the first container when the first swinging member abuts against the first container fitted into the first concave portion, and
the second wall portion is configured to abut against the second container when the second swinging member abuts against the second container fitted into the second concave portion.

4. The container holding rack according to claim 2 or 3, wherein

the first swinging member includes a first abutment portion that is abuttable against the first container fitted into the first concave portion and a first exertion portion on which a force of the first mobile member is exerted,
a distance between the first exertion portion and the first axis is larger than a distance between the first abutment portion and the first axis,
the second swinging member includes a second abutment portion that is abuttable against the second container fitted into the second concave portion and a second exertion portion on which a force of the first mobile member is exerted,
a distance between the second exertion portion and the second axis is larger than a distance between the second abutment portion and the second axis,
a first elastic member is provided at a portion that is abuttable against the first container in the first swinging member, and
a second elastic member is provided at a portion that is abuttable against the second container in the second swinging member.

5. The container holding rack according to any one of claims 2 to 4, further comprising a biasing body attached to the first mobile member to bias the first mobile member in the second direction.

6. The container holding rack according to any one of claims 2 to 5, wherein the first mobile member includes a pressure portion that is pressable in the first direction.

7. The container holding rack according to any one of claims 2 to 6, wherein the first mobile member is provided to be movable between the first concave portion and the second concave portion in the plan view.

8. The container holding rack according to claim 1, comprising:

a latch member provided to be switchable between a first state and a second state; and
a belt member that is arranged to extend along side surfaces of the plurality of container storages, and when the latch member is in the second state, presses the plurality of containers as the clamping member with a larger pressure than a case where the latch member is in the first state.

9. The container holding rack according to claim 8, wherein
the belt member has a first end portion and a second end portion, and when the latch member is in the second state, is connected to the latch member such that the first end portion and the second end portion are closer to each other than a case where the latch member is in the first state.

10. The container holding rack according to claim 9, wherein

the latch member has a fixed end and a free end movable with respect to the fixed end, and
the first end portion and the second end portion of the belt member are respectively connected to the fixed end and the free end of the latch member.

11. The container holding rack according to any one of claims 8 to 10, further comprising a pressing member that is provided in the container storage to be able to come into contact with the plurality of containers, wherein
the belt member presses the plurality of containers via the pressing member.

12. The plurality of container holding rack according to claim 11, wherein

a plurality of the pressing members are provided to correspond to the plurality of containers, respectively, and
each of the plurality of the pressing members is arranged to be able to come into contact with a corresponding container.

13. The container holding rack according to claim 12, wherein
each of the plurality of pressing members is arranged to surround a corresponding container.

14. The container holding rack according to any one of claims 8 to 13, further comprising a bottom member having one surface in which the plurality of container storages are formed as a plurality of concave portions into which the plurality of containers are respectively fitted.

15. The container holding rack according to claim 14, wherein
the belt member, when the latch member is in the second state, presses each of the plurality of containers against an inner peripheral surface of a corresponding concave portion with a larger pressure than a case where the latch member is in the first state.

16. A pre-processing device comprising:

the container holding rack according to any one of claims 1 to 15; and
the attachment-detachment device that attaches or detaches caps of a plurality of containers held by the container holding rack, wherein
the attachment-detachment device attaches or detaches the cap of each container held by the container holding rack when the clamping member clamps the plurality of containers.

FIG. 1

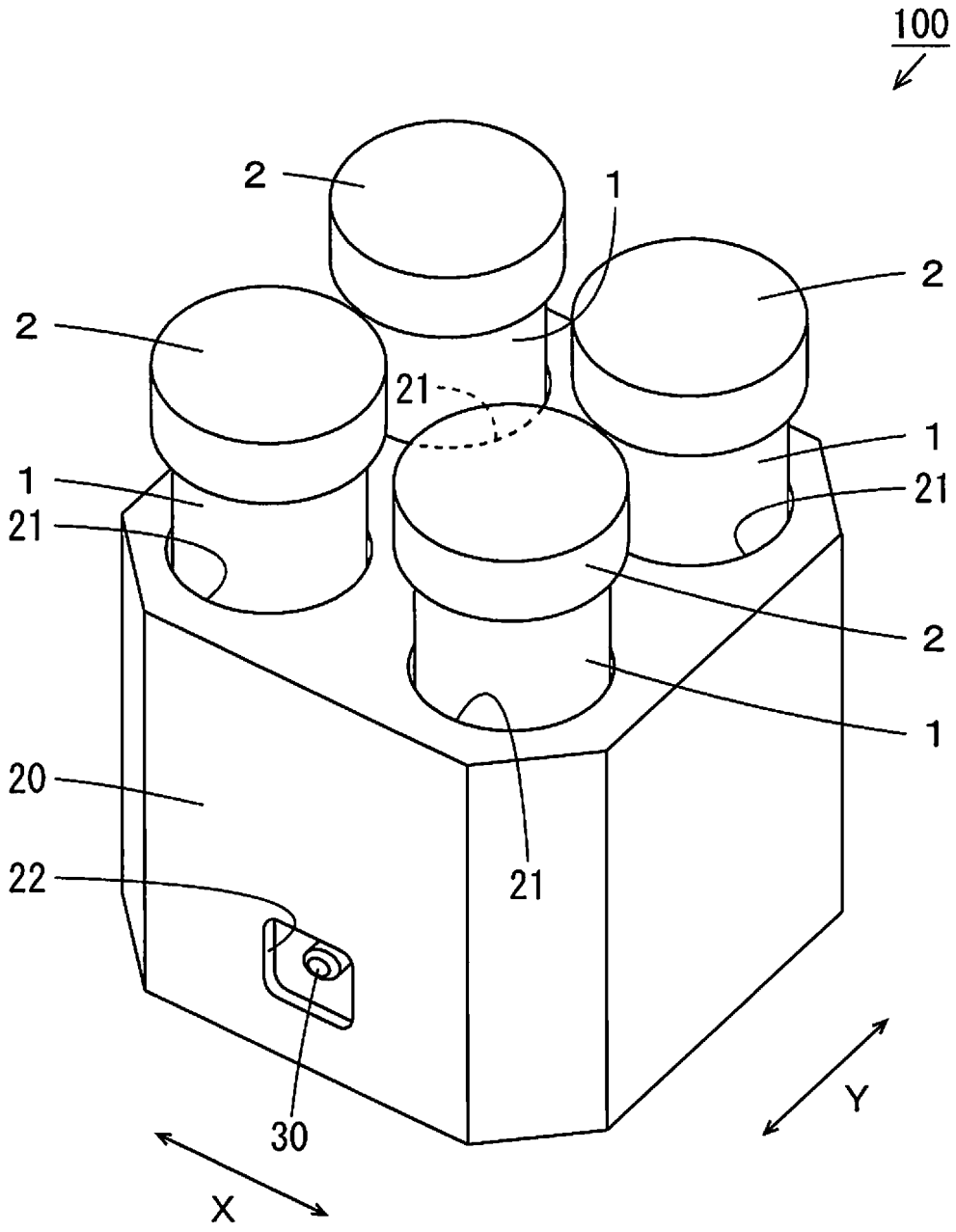


FIG. 2

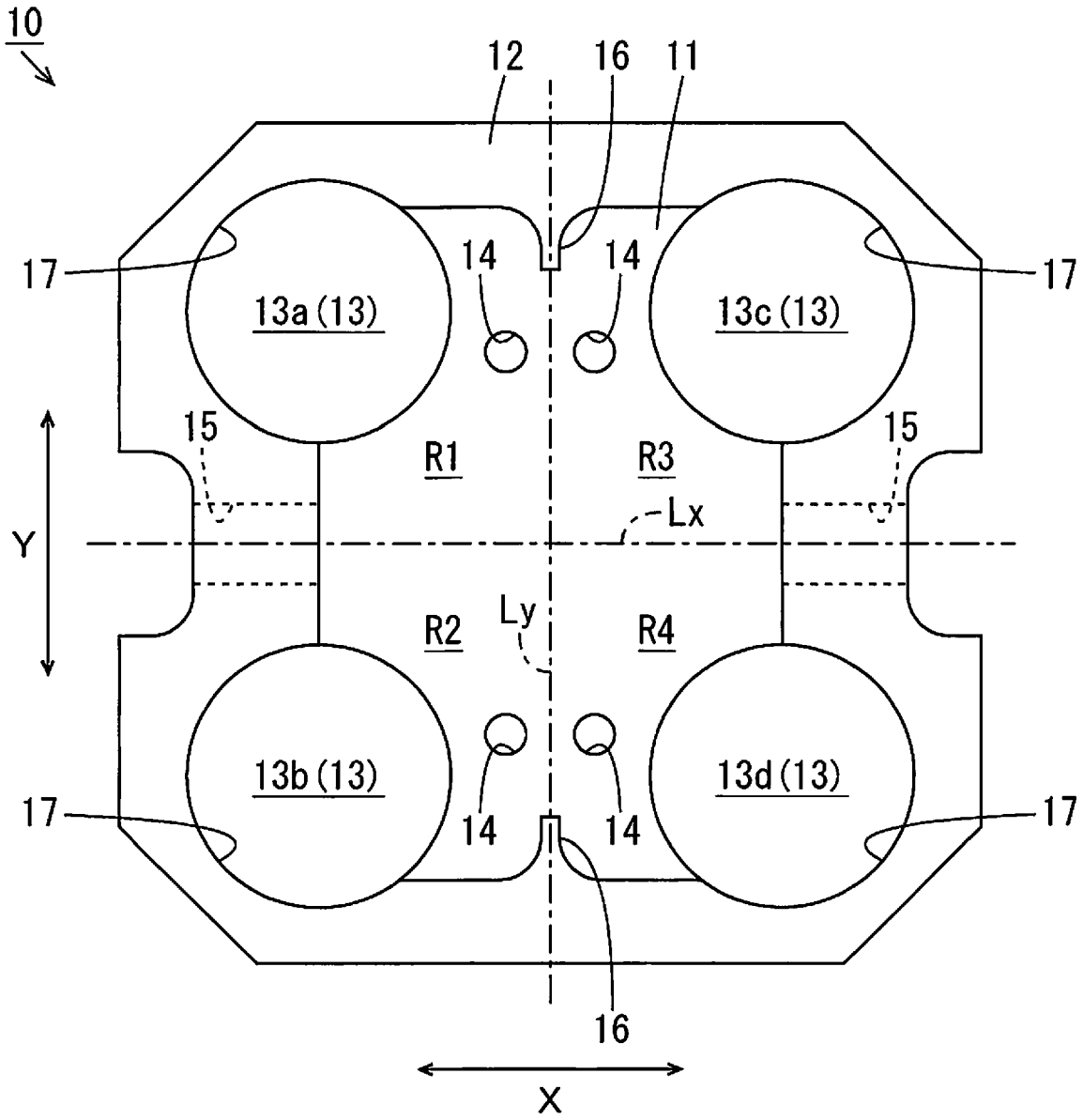
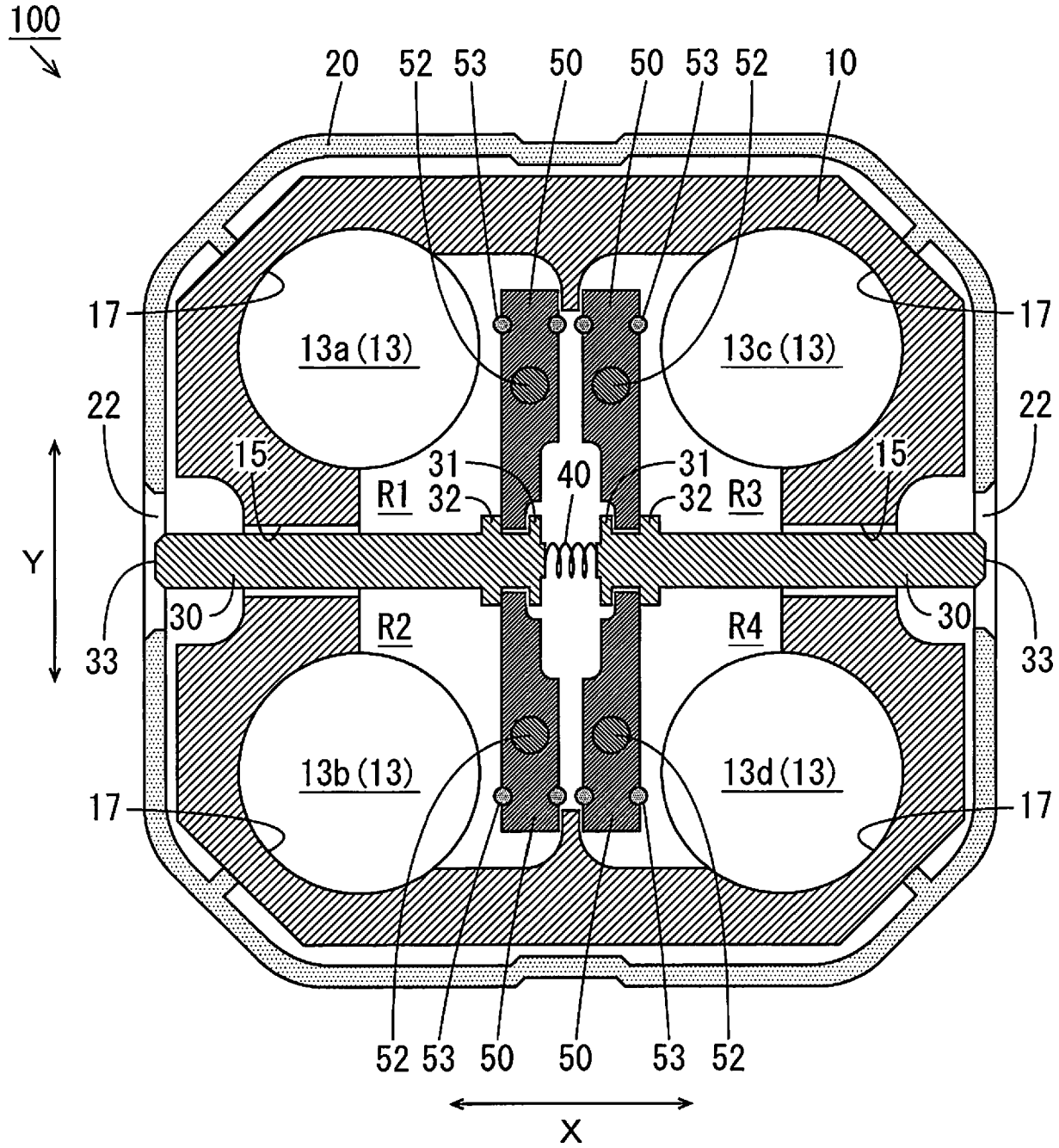

10
12
16
11
17
14
14
17
13a (13)
13c (13)
15
15
R1
R3
Lx
Y
Ly
R2
R4
13b (13)
13d (13)
17
14
14
17
16
X

FIG. 3


100
20
52
53
50
50
53
52
10
17
17
13a (13)
13c (13)
22
22
15
31
40
31
15
R1
32
32
R3
Y
30
30
33
33
R2
R4
13b (13)
13d (13)
17
17
52
53
50
50
53
52
X

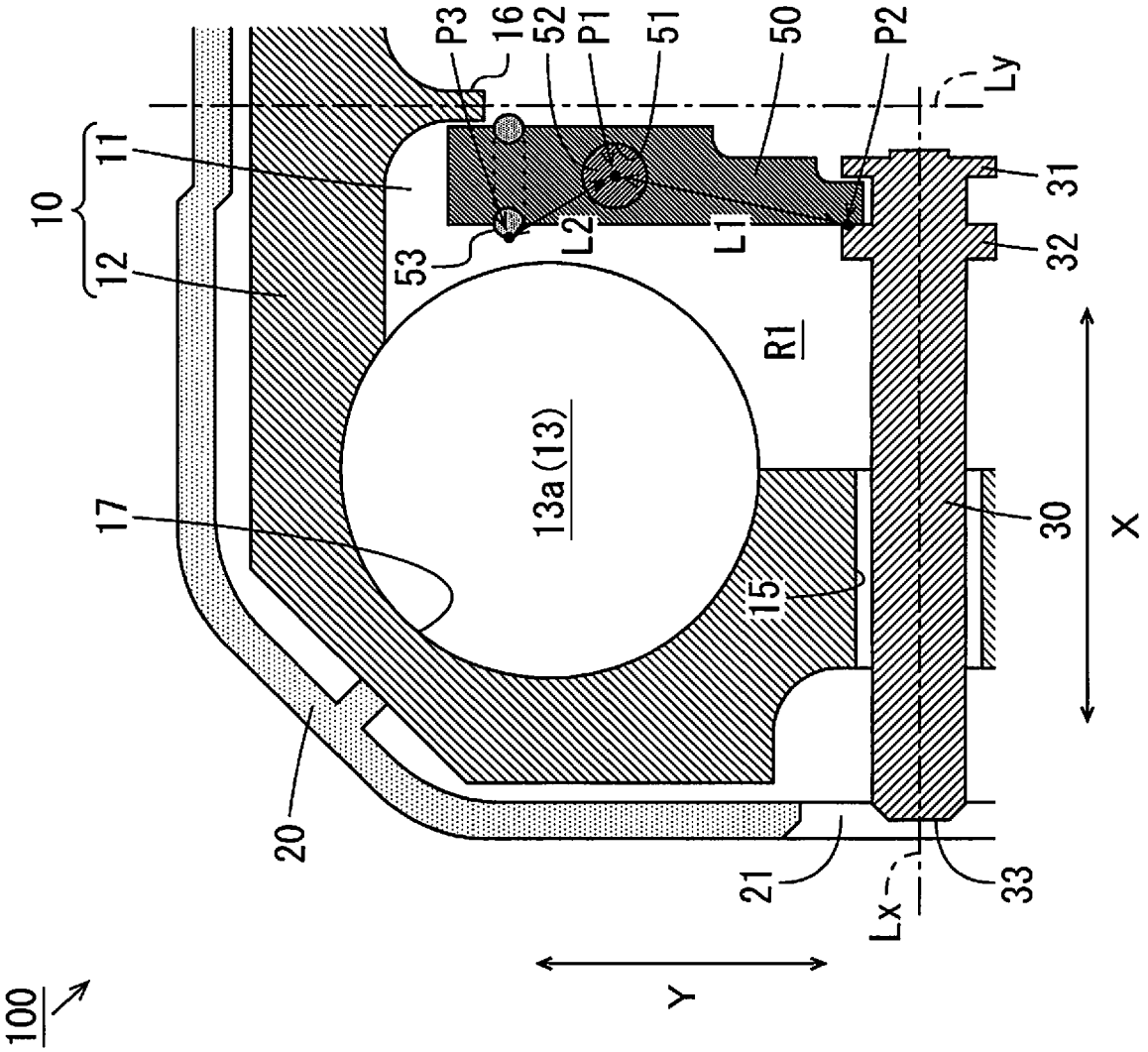

100
10
11
12
13a(13)
15
16
17
20
21
30
31
32
33
50
51
52
53
P1
P2
P3
L1
L2
R1
Lx
Ly
X
Y

FIG. 4

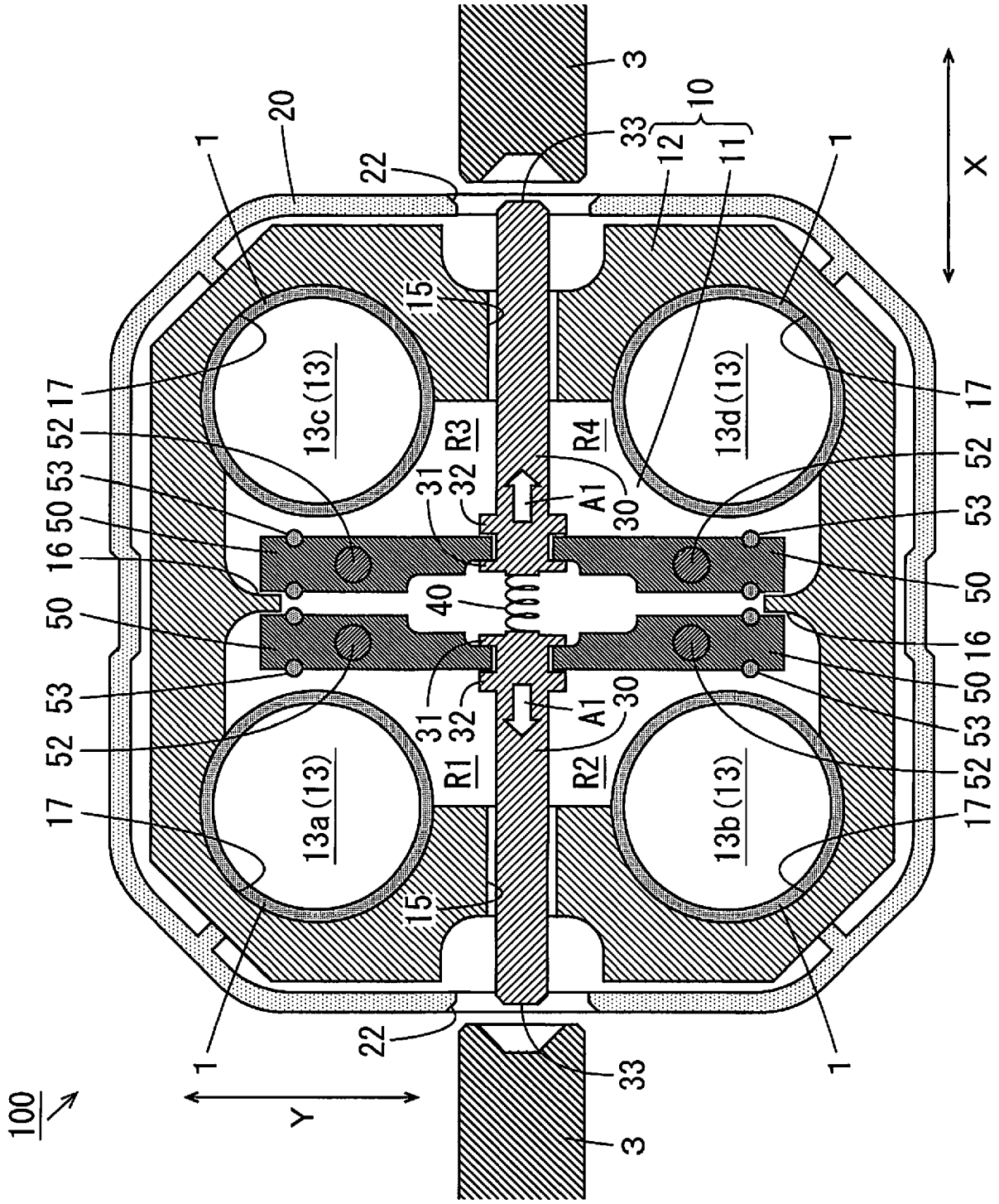

100
X
Y
1
20
22
3
33
10
12
11
15
13c (13)
13d (13)
13a (13)
13b (13)
17
52
53
50
16
31
32
R3
R4
R1
R2
A1
30
40

FIG. 5

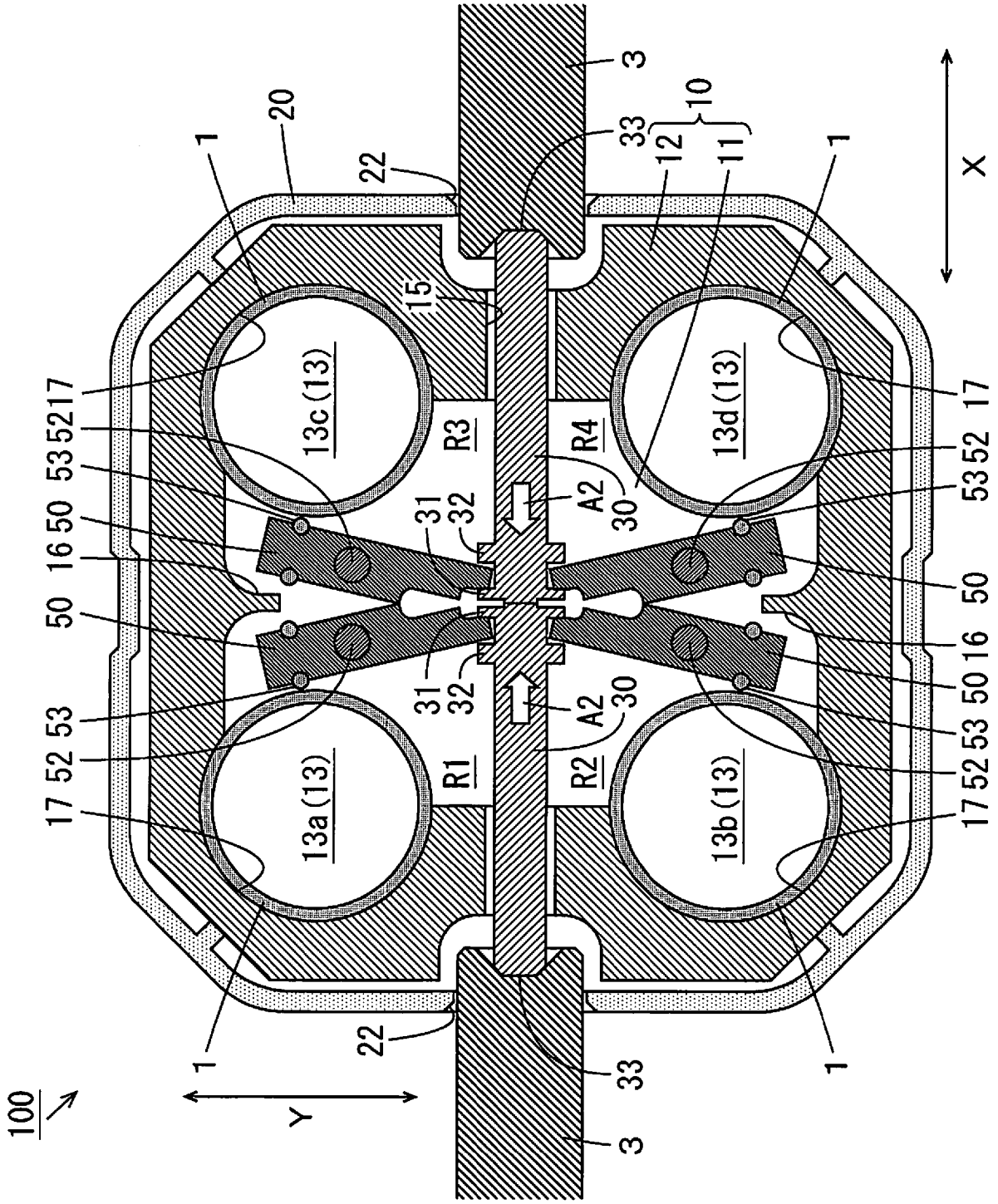

100
X
Y
1
20
22
3
33
10
12
11
15
13c(13)
13d(13)
13a(13)
13b(13)
R1
R2
R3
R4
A2
30
31
32
16
50
53
52
17

FIG. 6

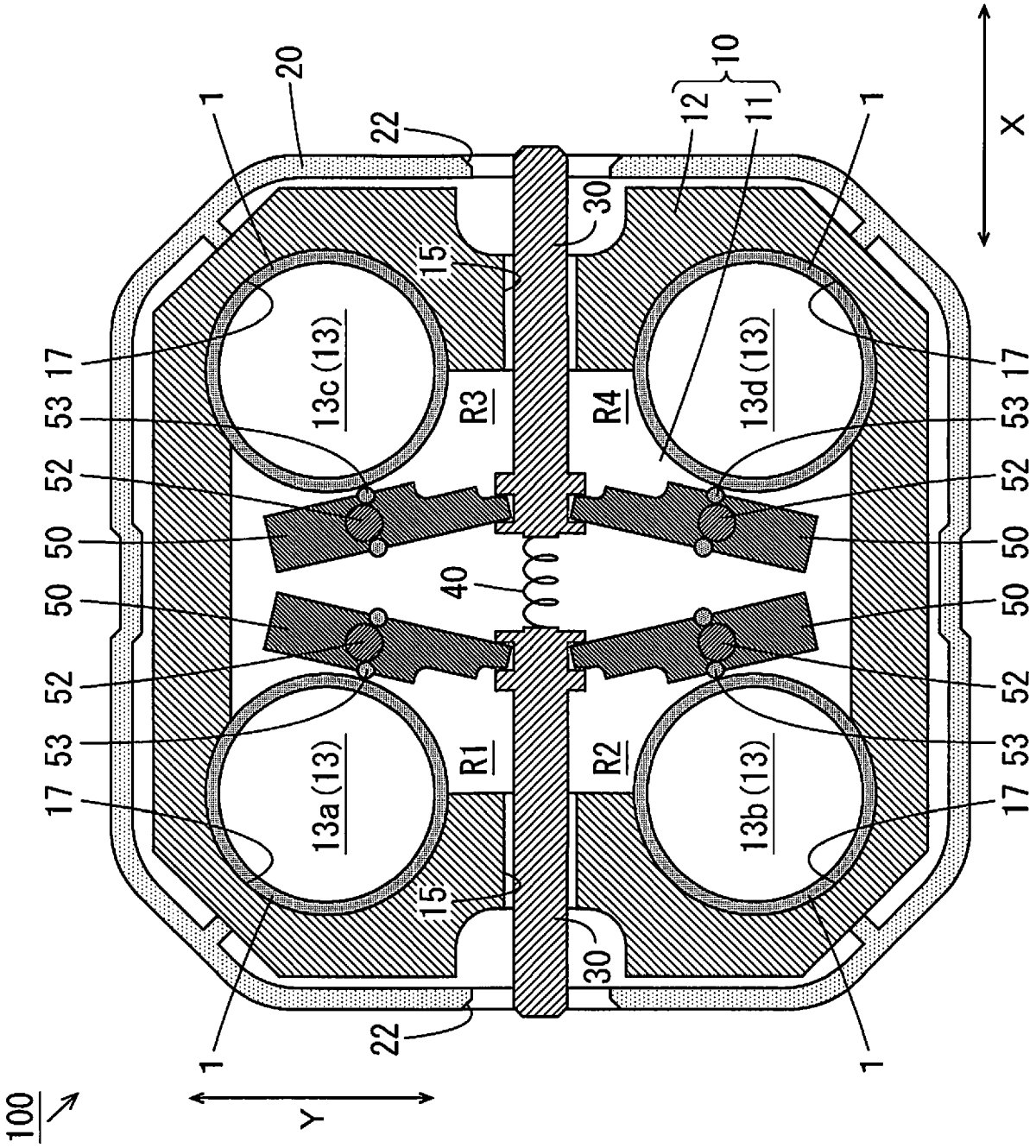

100
Y
X
1
20
22
10
12
11
30
15
13c(13)
13d(13)
13a(13)
13b(13)
R1
R2
R3
R4
40
17
53
52
50

FIG. 7

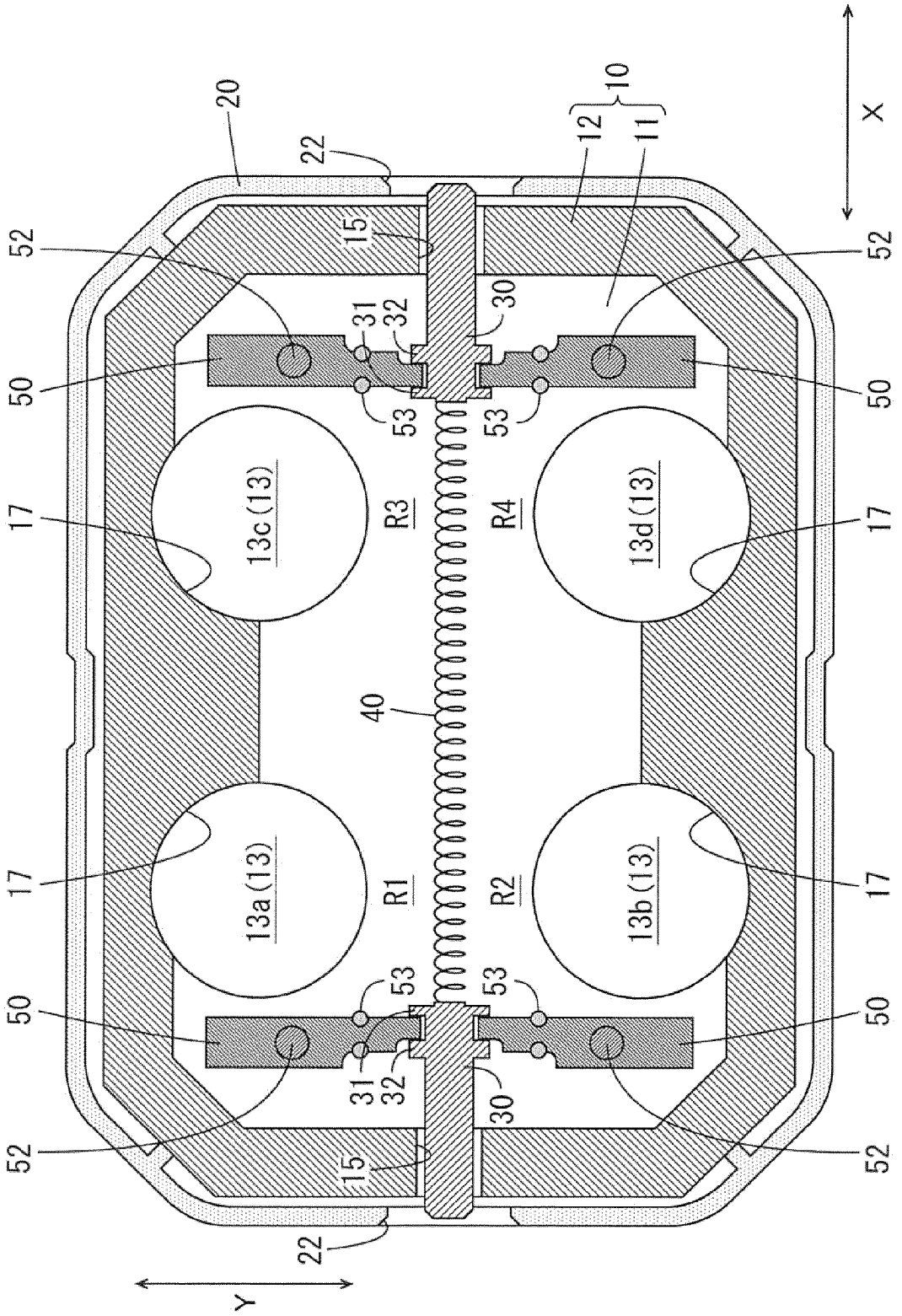

100
20
22
10
12
11
X
Y
52
50
15
31
32
30
53
17
13a(13)
13b(13)
13c(13)
13d(13)
R1
R2
R3
R4
40

FIG. 8

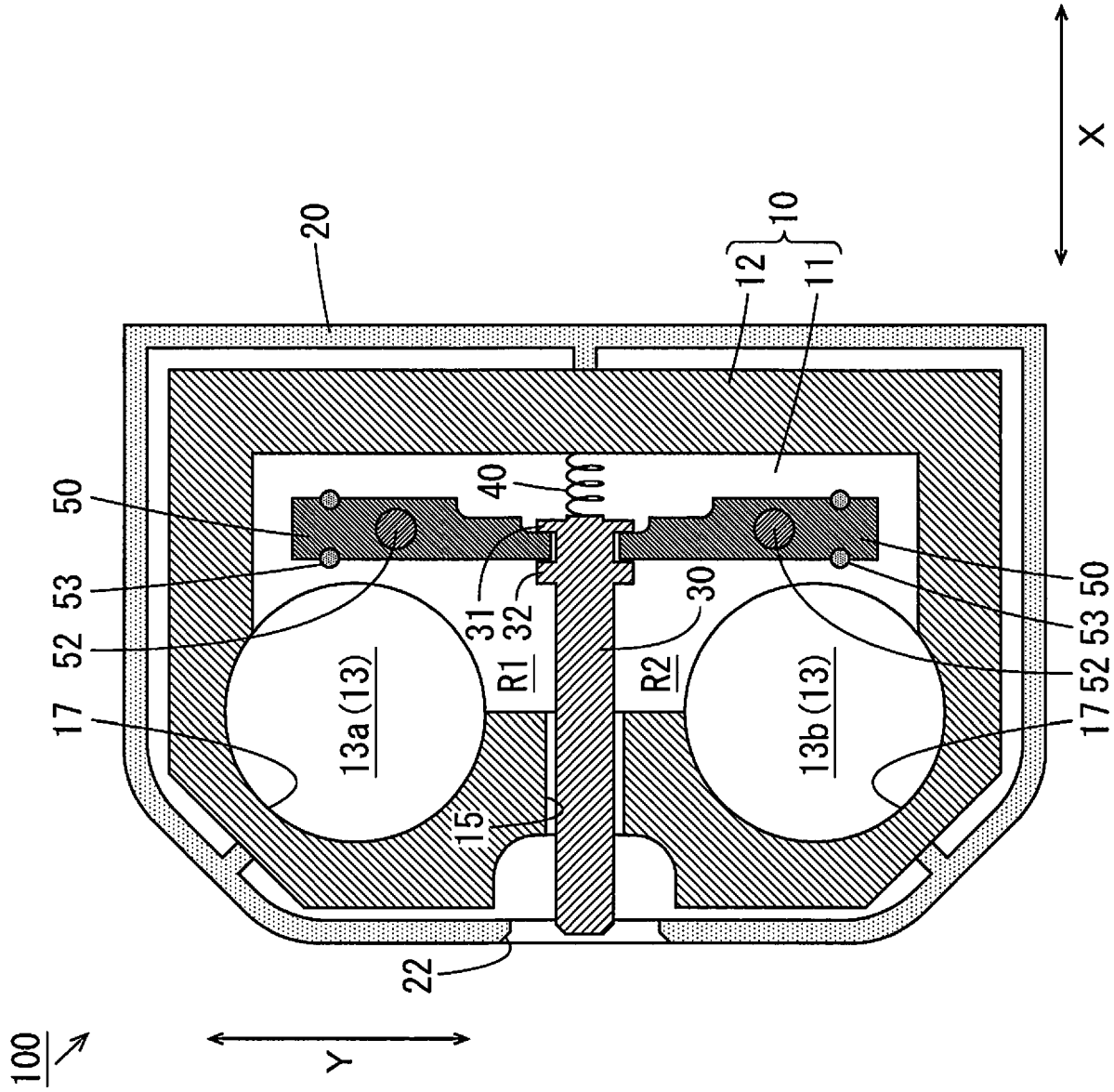


FIG. 9

FIG. 10

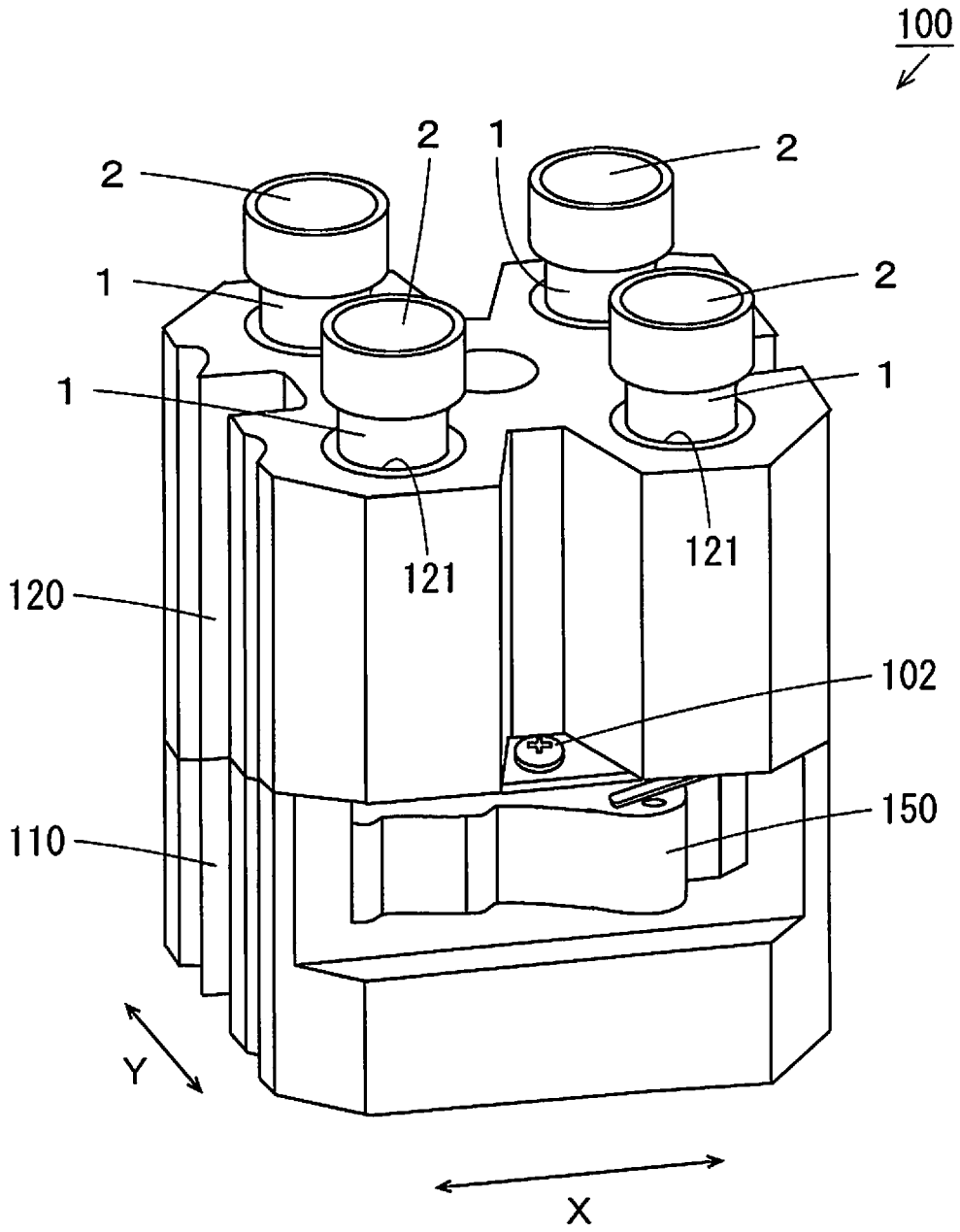


FIG. 11

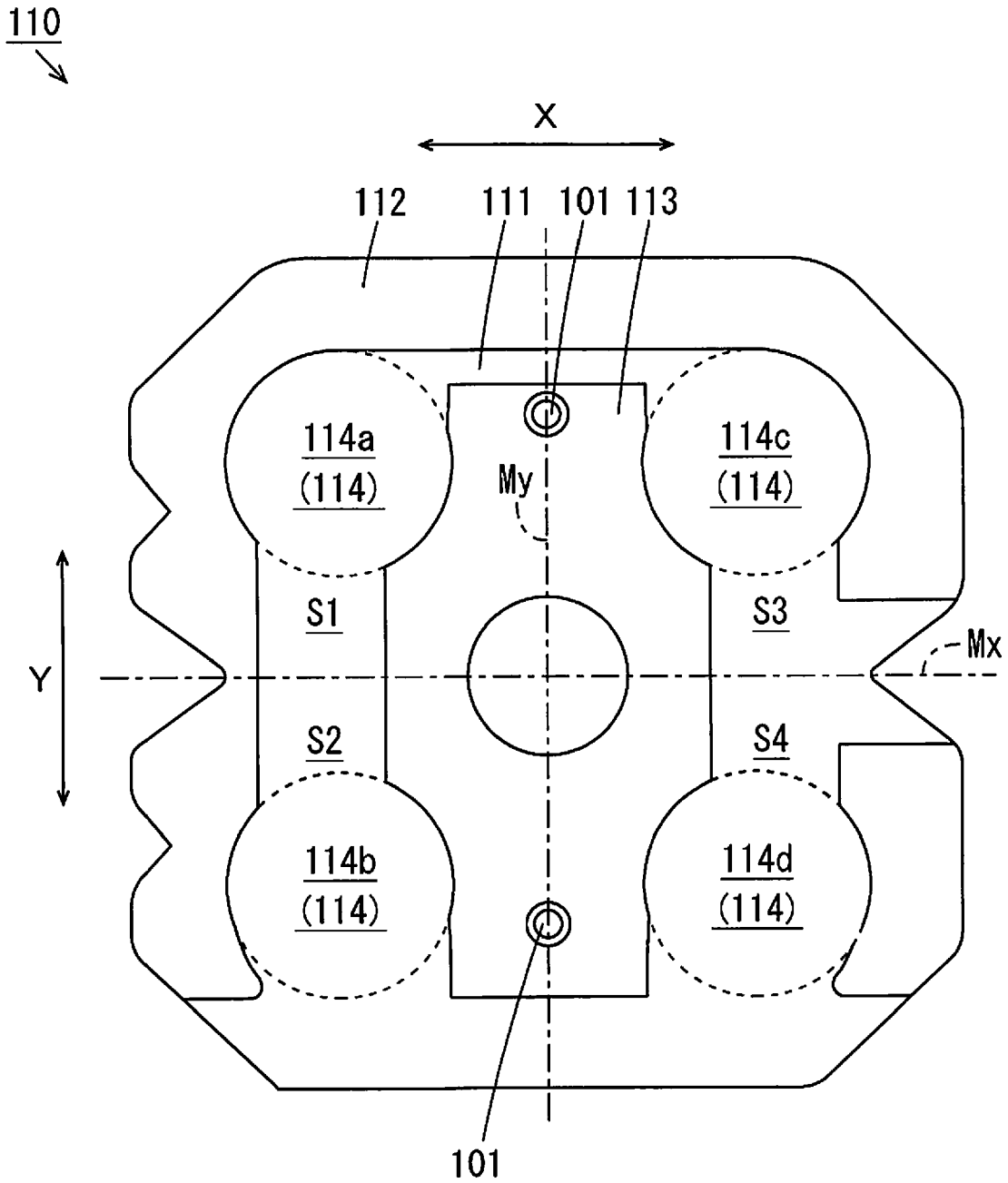

110
X
112
111
101
113
114a
(114)
My
114c
(114)
S1
S3
Y
Mx
S2
S4
114b
(114)
114d
(114)
101

FIG. 12

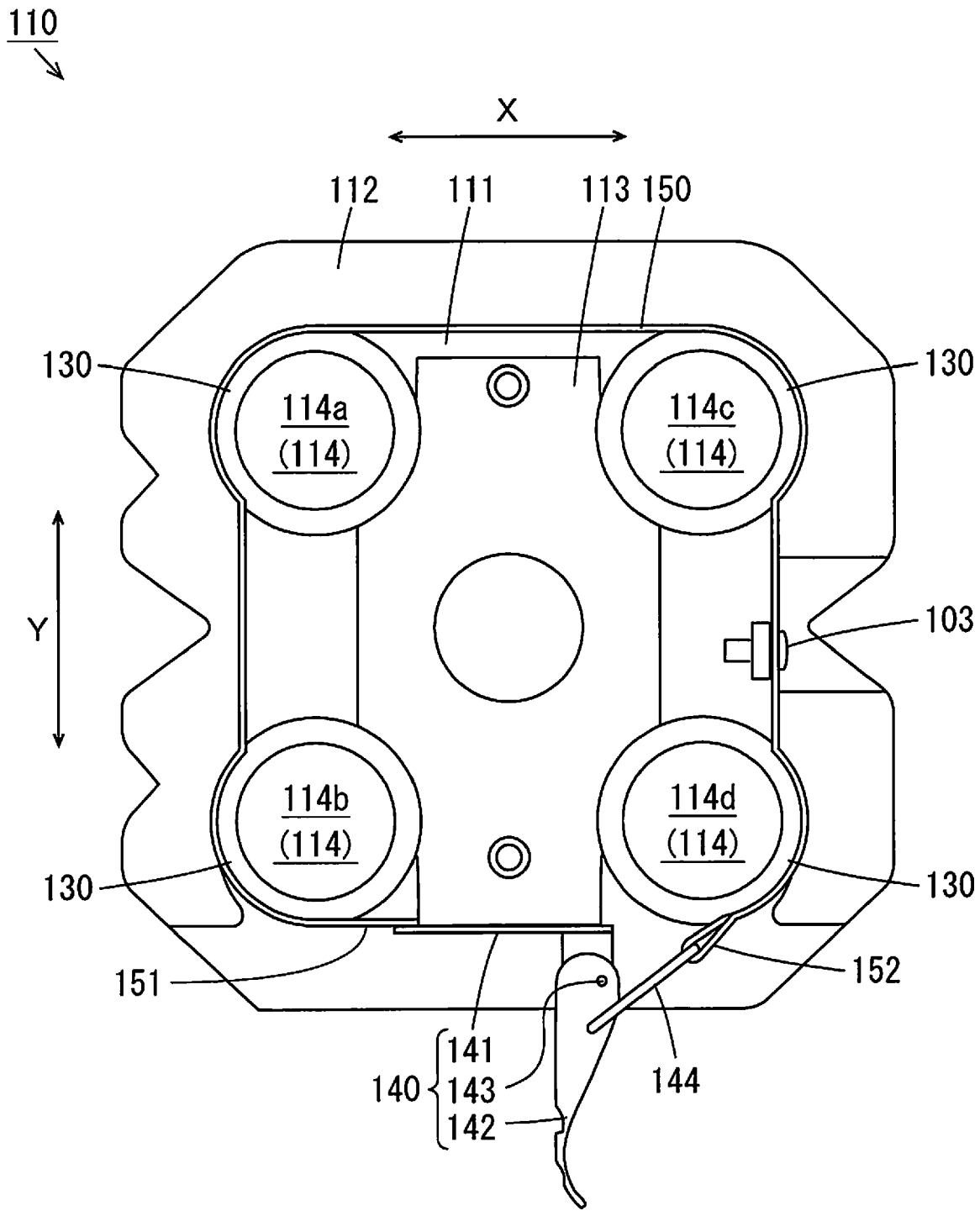

110
X
112
111
113
150
130
130
114a
(114)
114c
(114)
Y
103
114b
(114)
114d
(114)
130
130
151
152
141
140
143
142
144

FIG. 13

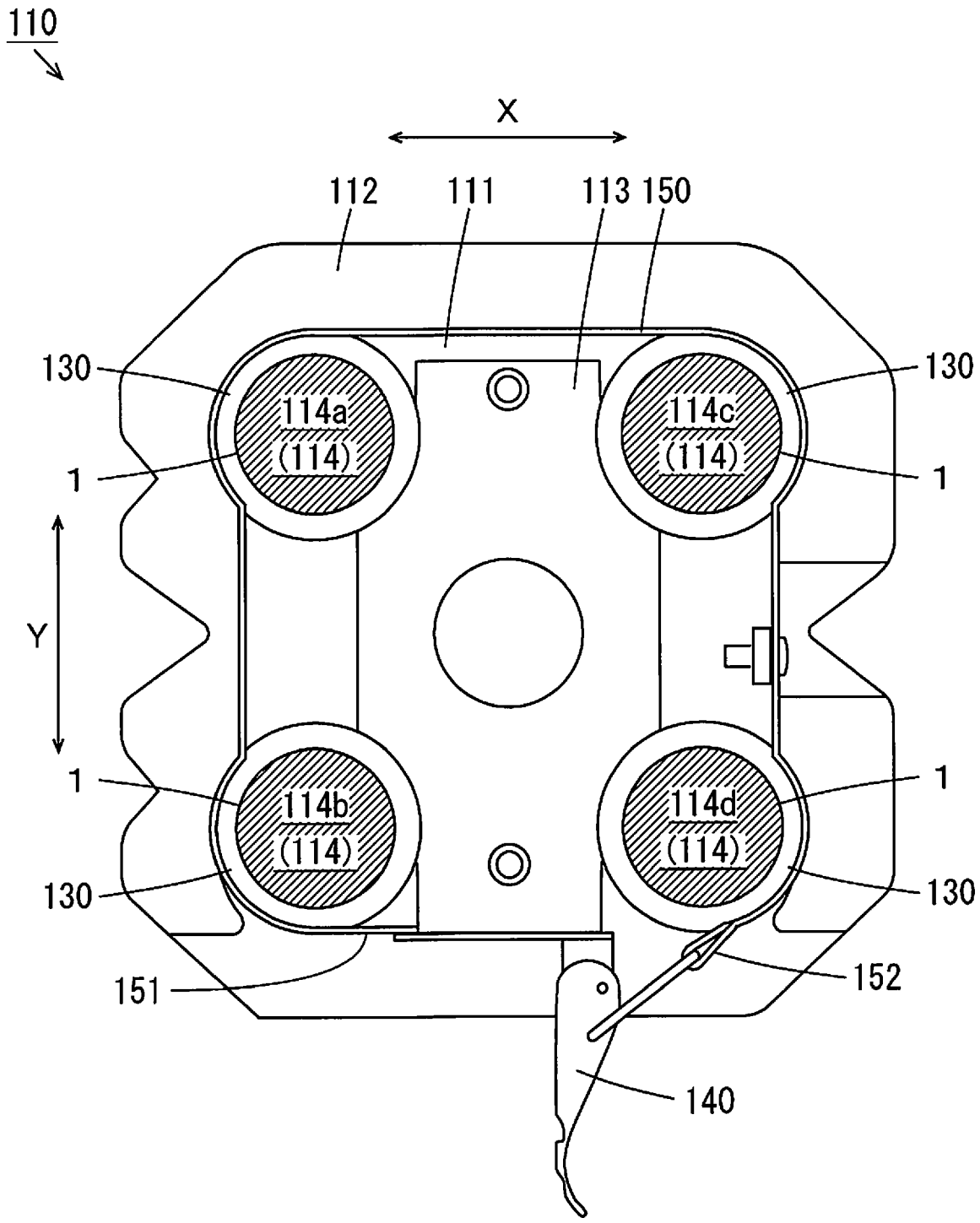

110
X
112
111
113
150
130
114a
(114)
130
1
114c
(114)
1
Y
1
114b
(114)
1
114d
(114)
130
130
151
152
140

FIG. 14

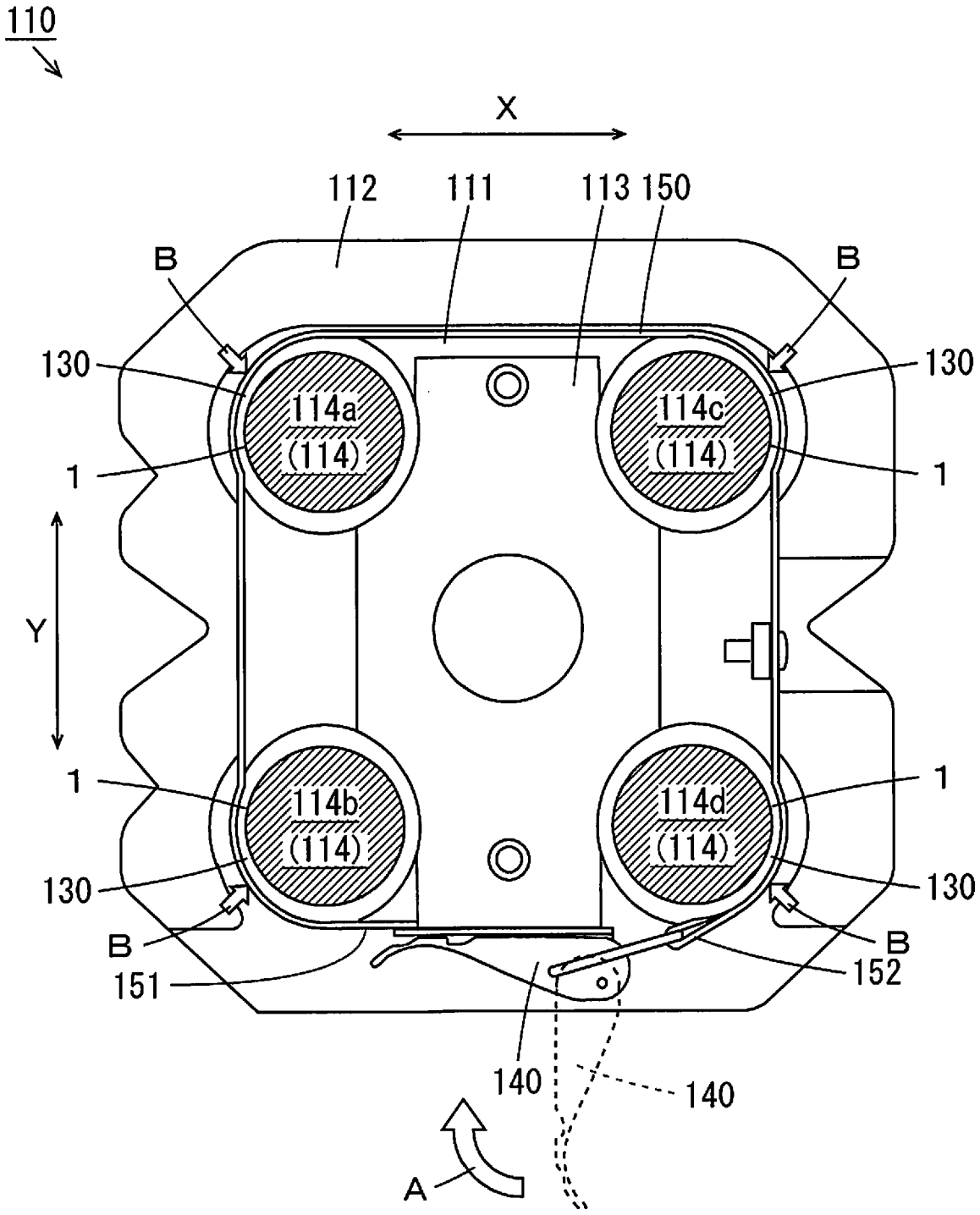

110
X
112
111
113
150
B
B
130
130
114a
(114)
114c
(114)
1
1
Y
1
1
114b
(114)
114d
(114)
130
130
B
B
151
152
140
140
A

FIG. 15

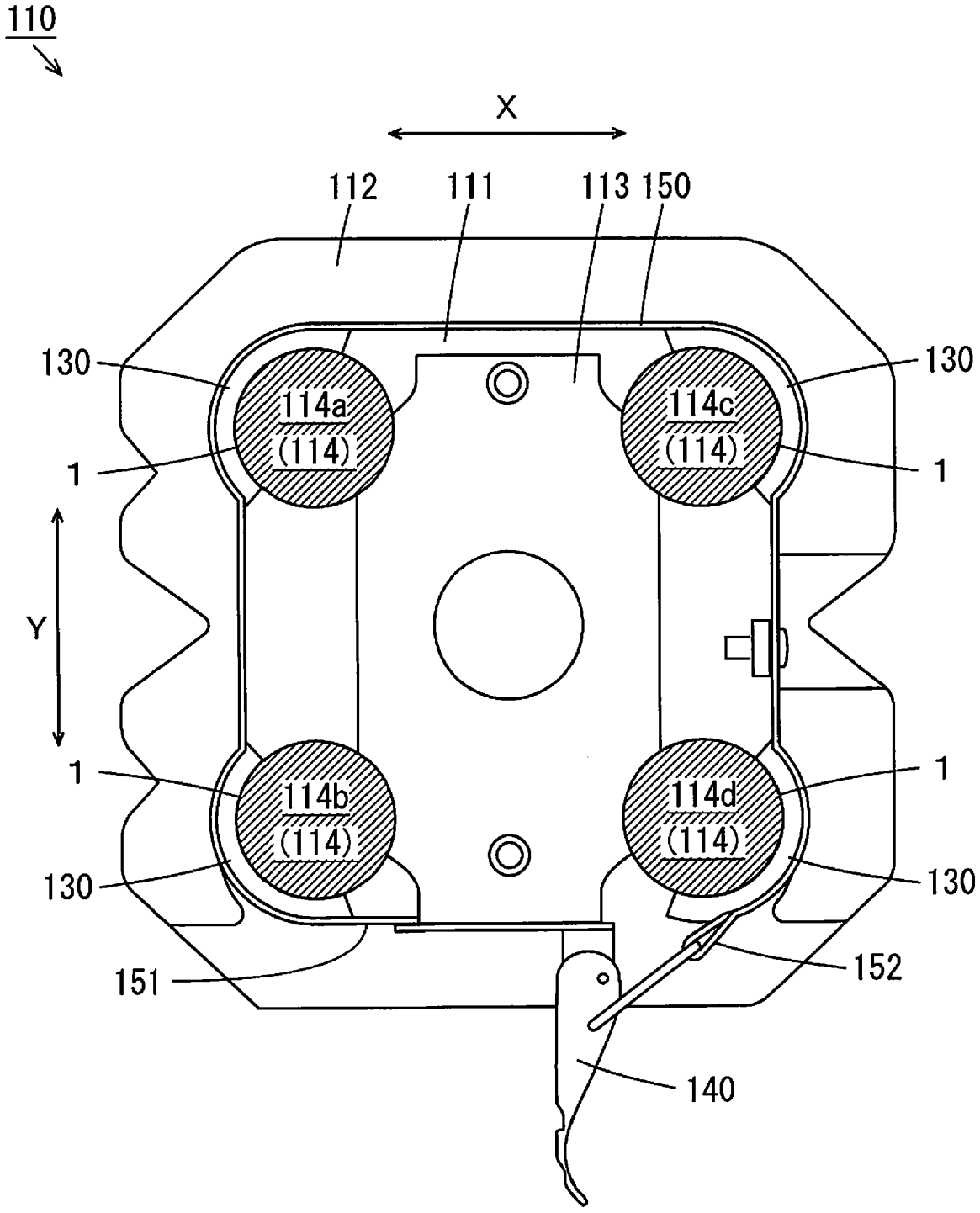

110
X
112
111
113
150
130
114a
(114)
114c
(114)
130
1
1
Y
1
114b
(114)
114d
(114)
1
130
130
151
152
140

FIG. 16

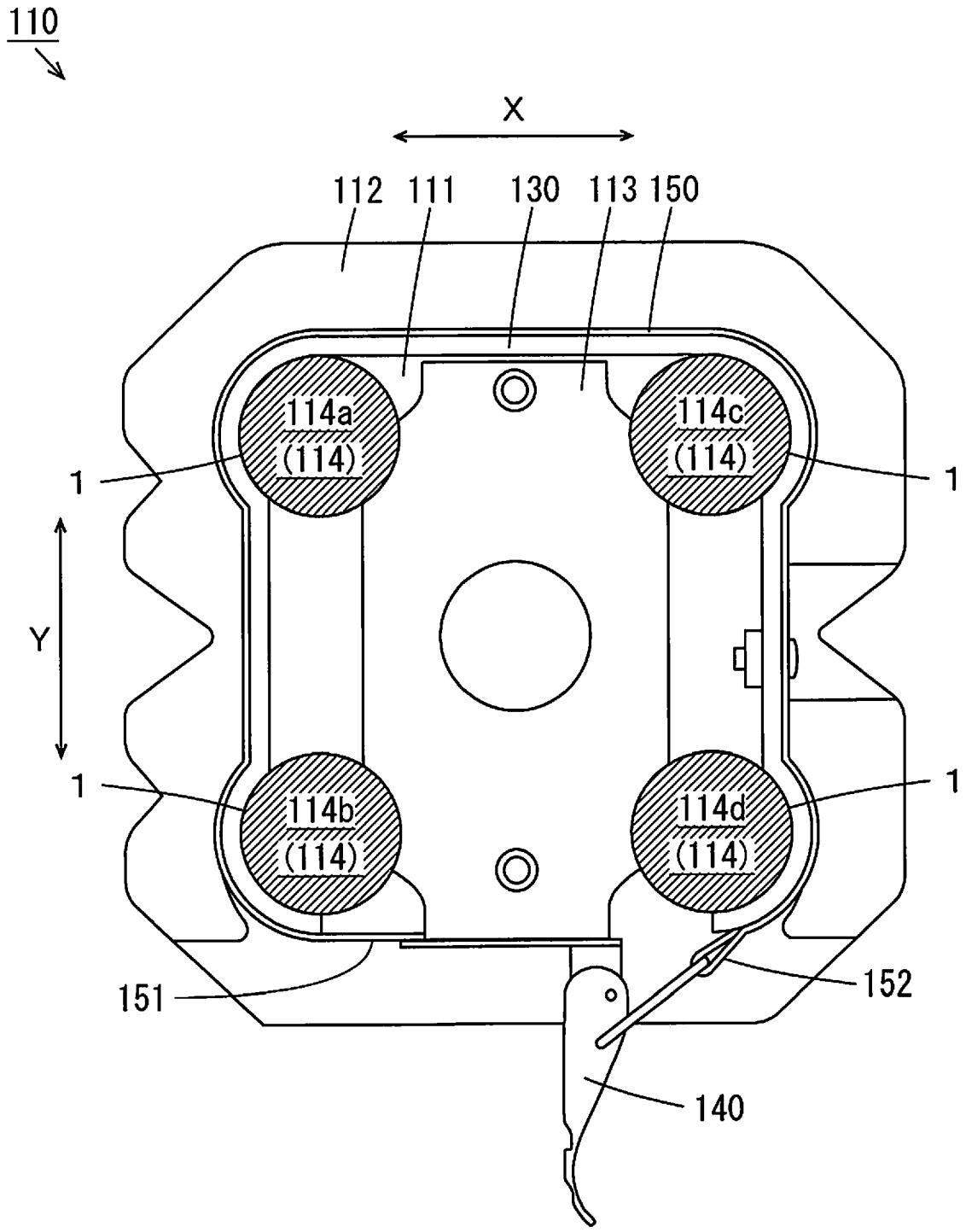

110
X
112
111
130
113
150
114a
(114)
114c
(114)
1
1
Y
1
1
114b
(114)
114d
(114)
151
152
140

FIG. 17

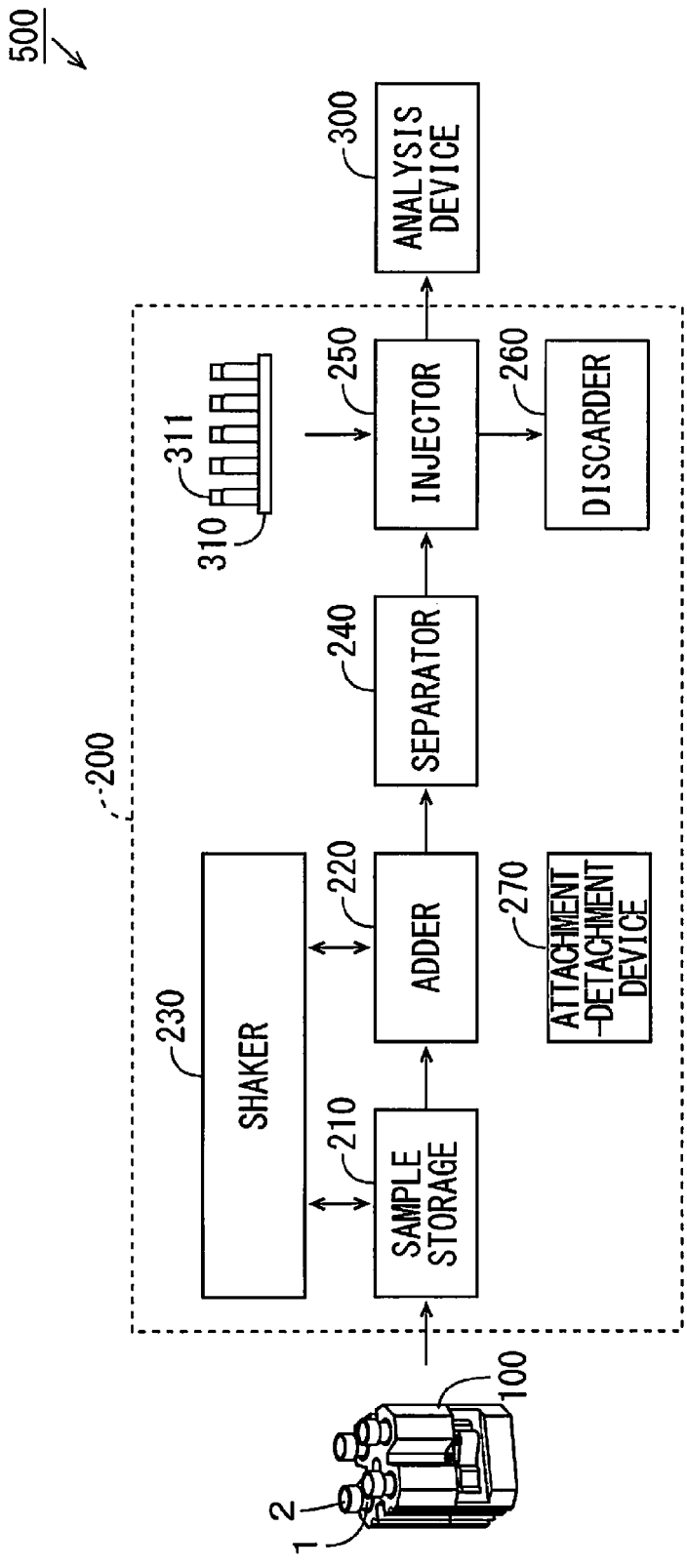

500
300
ANALYSIS DEVICE
311
310
250
INJECTOR
260
DISCARDER
200
240
SEPARATOR
230
SHAKER
220
ADDER
270
ATTACHMENT DETACHMENT DEVICE
210
SAMPLE STORAGE
100
2
1

FIG. 18

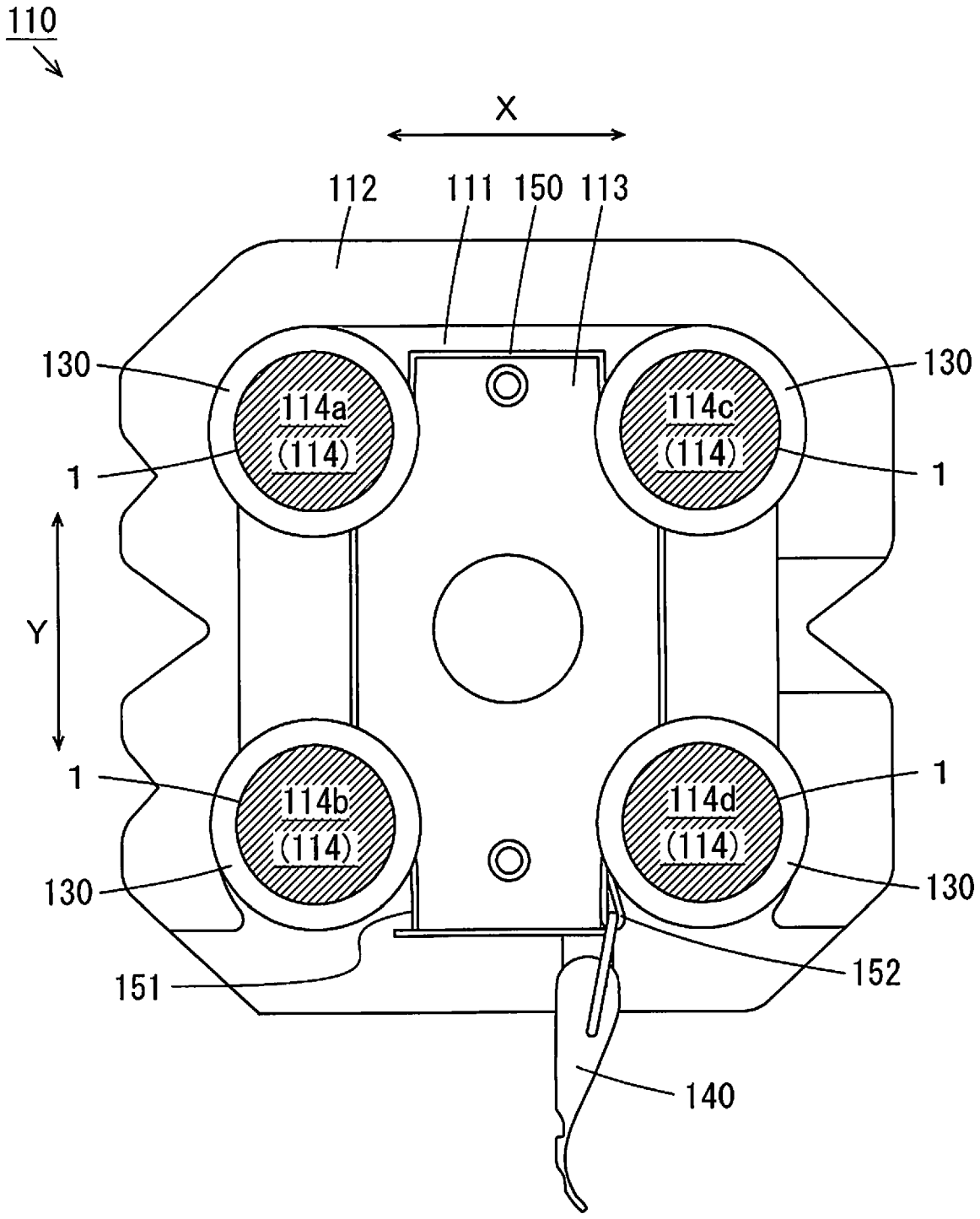
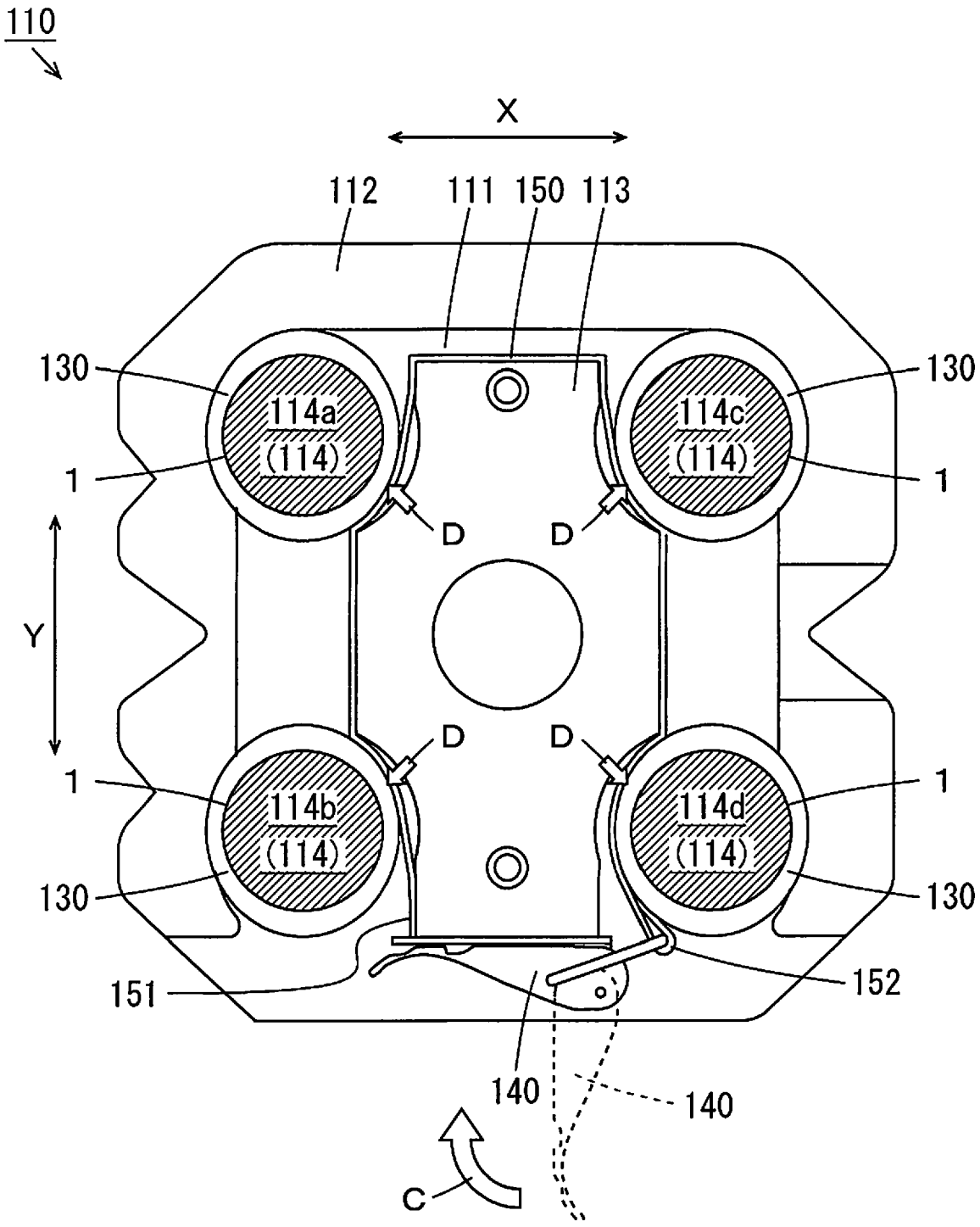

110
X
112
111
150
113
130
114a
(114)
130
1
1
Y
1
114b
(114)
114d
(114)
1
130
130
151
152
140

FIG. 19


110
X
112
111
150
113
130
114a
(114)
130
1
1
D
D
Y
D
D
1
114b
(114)
114d
(114)
1
130
130
151
152
140
140
C

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 21 19 1460

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2004/092731 A1 (HEATH ELLEN M [US] ET AL) 13 May 2004 (2004-05-13) * paragraphs [0059] - [0062], [0081] - [0087]; figures 11, 14-15 *	1,8-16	INV. B01L9/00
X	JP H08 143098 A (NIIGATA ENGINEERING CO LTD) 4 June 1996 (1996-06-04) * paragraphs [0087] - [0094], [0101] - [0125]; figures 6-8 *	1-7,16	
X	WO 2012/026484 A1 (NIFCO INC [JP]; FUKAZAWA KUNIYASU [JP]) 1 March 2012 (2012-03-01) * paragraphs [0017] - [0020]; figures 1-4b *	1	
A	US 2007/059209 A1 (PANG WING S [US] ET AL) 15 March 2007 (2007-03-15) * paragraph [0166]; figures 18A-B *	8-15	

TECHNICAL FIELDS SEARCHED (IPC)

B01L
G01N
B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 May 2022	Ruiz-Echarri Rueda

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Application Number
EP 21 19 1460

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

Europäisches Patentamt
European Patent Office
Office européen des brevets

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 21 19 1460

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-7(completely); 16(partially)

Container holding rack comprising a plurality of containers including a cap, and a clamping member to restrict the rotation of the container, wherein the clamping member comprises a first swinging member, a second swinging member and a movable member.

---

2. claims: 8-15(completely); 16(partially)

Container holding rack comprising a plurality of containers including a cap, and a clamping member comprising a latch member and a belt member arranged around the containers. In order to push the containers towards an external direction of the rack where they are placed and being pressed against the walls of said rack.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 19 1460

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-05-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004092731 A1	13-05-2004	AT 337096 T	15-09-2006
		AU 770402 B2	19-02-2004
		CA 2387500 A1	26-04-2001
		DE 60030310 T2	23-08-2007
		EP 1227886 A2	07-08-2002
		JP 4559003 B2	06-10-2010
		JP 2003515103 A	22-04-2003
		JP 2010168122 A	05-08-2010
		US 2002048810 A1	25-04-2002
		US 2002073647 A1	20-06-2002
		US 2004092731 A1	13-05-2004
		WO 0128680 A2	26-04-2001
JP H08143098 A	04-06-1996	JP 3225760 B2	05-11-2001
		JP H08143098 A	04-06-1996
WO 2012026484 A1	01-03-2012	JP 5657310 B2	21-01-2015
		JP 2012046036 A	08-03-2012
		KR 20120041105 A	30-04-2012
		WO 2012026484 A1	01-03-2012
US 2007059209 A1	15-03-2007	US 7141213 B1	28-11-2006
		US 2007059209 A1	15-03-2007

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 3226484 A **[0003] [0004]**