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(54) **Liquid container, liquid supply device, and image printing apparatus**

(57) A liquid container is configured to be inserted into a mounting portion in an insertion direction and to be removed from the mounting portion in a removal direction opposite the insertion direction. The liquid container includes a main body comprising a liquid chamber configured to store liquid therein, a liquid supply portion positioned at the main body and configured to supply liquid from an interior of the liquid chamber to an exterior

of the liquid chamber, and a first cartridge-surface positioned vertically below the main body and extending in the insertion direction and the removal direction, wherein the first cartridge-surface comprises a first deformable portion configured to be resiliently deformable in a width direction perpendicular to the insertion direction and the removal direction, and the first deformable portion comprises a first protrusion.

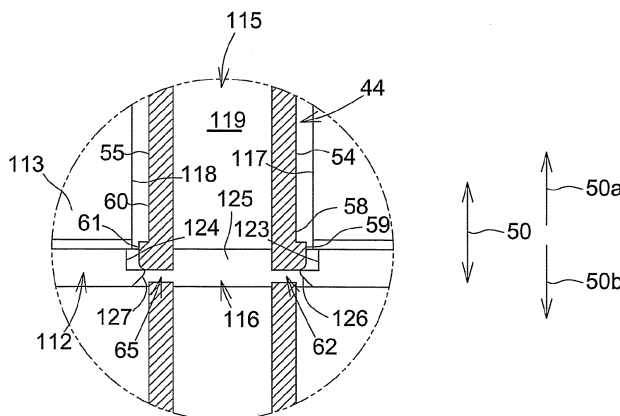


Fig.11

Description**BACKGROUND OF THE INVENTION**5 **1. Field of the Invention**

[0001] The present invention relates to a liquid container configured to be mounted to a mounting portion comprising a stopper, a liquid supply device comprising such a liquid container and a mounting portion, and an image printing apparatus comprising such a liquid supply device.

10 **2. Description of Related Art**

[0002] A known image printing apparatus is configured to print images on a sheet of paper using ink. The image printing apparatuses has an ink-jet print-head configured to selectively eject ink droplets from nozzles of the print-head toward the sheet of paper. A desired image is printed on the sheet of paper when the ink droplets land on the sheet of paper. The image printing apparatuses has a liquid container which contains ink to be supplied to the print-head. One example of the liquid container is a liquid cartridge, which is configured to be inserted into and removed from a mounting portion provided in the image printing apparatus. A liquid cartridge storing ink is also referred to as an ink cartridge.

[0003] When the ink cartridge runs out of ink, the ink cartridge is removed from the mounting portion of the image printing apparatus, and a new ink cartridge having ink stored therein is mounted to the mounting portion. The mounting portion has a locking structure configured to lock or retain the ink cartridge in a specific position in the mounting portion. The mounting portion also has an urging member configured to urge the ink cartridge positioned in the mounting portion in a direction in which the ink cartridge is removed from the mounting portion when the ink cartridge is locked or retained by the locking structure. When a user intends to remove the ink cartridge from the mounting portion, the ink cartridge is released from the locked state, and the ink cartridge moves toward the outside of the mounting portion with a force applied by the urging member. Accordingly, a user is allowed to readily remove the ink cartridge from the mounting portion.

[0004] When the ink cartridge is moved with a great force, the ink cartridge may jump out of the mounting portion. If the ink cartridge jumps out of the mounting portion, the ink cartridge may fall down and hit a surface, and the impact of hitting the surface may cause the ink stored in the ink cartridge to splash out. The cartridge also may be broken when the ink cartridge hit the surface.

[0005] A known mounting portion such as a mounting portion described in JP-A-2005-288866 has a structure for preventing the ink cartridge from jumping out of the mounting portion. More specifically, the mounting portion has a resiliently deformable claw hook, and the claw hook is configured to engage an edge of an engaging recess formed in a bottom surface of an ink cartridge when the ink cartridge moves toward the outside of the mounting portion. With this engagement, the ink cartridge is prevented from jumping out of the mounting portion.

[0006] However, when replacement of the ink cartridge is repeated and the claw hook is resiliently deformed repeatedly many times, the claw hook may be fatigued and may become unable to resiliently return to its original position or the deformation amount thereof may be reduced due to the fatigue, or the claw hook may even be fractured off. In such cases, the function of the claw hook, i.e., the prevention of the ink cartridge from jumping out of the mounting portion, is no longer effective. In order to restore its function, the mounting portion having the claw hook needs to be replaced.

SUMMARY OF THE INVENTION

[0007] Therefore, a need has arisen for a liquid container, a liquid supply device, and an image printing apparatus, which overcome these and other shortcomings of the related art. A technical advantage of the present invention is that chances are reduced that a liquid container jumps out of a mounting portion, with a structure of the mounting portion, which is suitable for repeated use.

[0008] According to an aspect of the invention, a liquid container is configured to be inserted into a mounting portion in an insertion direction and to be removed from the mounting portion in a removal direction opposite the insertion direction. The liquid container comprise a main body comprising a liquid chamber configured to store liquid therein, a liquid supply portion positioned at the main body and configured to supply liquid from an interior of the liquid chamber to an exterior of the liquid chamber, and a first cartridge-surface positioned vertically below the main body and extending in the insertion direction and the removal direction. The first cartridge-surface comprises a first deformable portion configured to be resiliently deformable in a width direction perpendicular to the insertion direction and the removal direction, and the first deformable portion comprises a first protrusion.

[0009] According to another aspect of the invention, a liquid supply device comprises the liquid container as described above further comprising a guide portion comprising the first cartridge-surface, and a mounting portion having an opening. The liquid container is configured to be inserted into the mounting portion in the insertion direction via the opening and

to be removed from the mounting portion in the removal direction via the opening. The mounting portion comprises an end portion opposite the opening in the insertion direction, an urging member configured to urge the liquid container positioned in the mounting portion toward the opening, a groove extending from the opening to the end portion in the insertion direction. The groove is partially defined by a first groove-surface extending in the insertion direction and the removal direction and a second groove-surface extending in the insertion direction and the removal direction and opposing to the first groove-surface, and the guide portion is configured to be positioned and moved in the groove when the liquid container is inserted into and removed from the mounting portion. The mounting portion also comprises a first stopper projecting from the first groove-surface into the groove. The first cartridge-surface faces the first groove-surface when the liquid container is inserted into and removed from the mounting portion. The first protrusion of the first deformable portion is configured to contact the first stopper when the liquid container is inserted into and removed from the mounting portion, and the first deformable portion is configured to resiliently deform when the first protrusion contacts the first stopper. The mounting portion also comprises a retaining member configured to releasably retain the liquid container in a mount position in the mounting portion against an urging force of the urging member.

[0010] According to yet another aspect of the invention, an image printing apparatus comprises the liquid supply device as described above, and a printing portion configured to selectively eject liquid supplied from the liquid supply device.

[0011] With these configurations, the liquid container is inserted into the mounting portion via the opening and mounted to the mounting portion. When the liquid container is mounted in the mounting portion, the liquid container is urged by the urging member, but the retaining member retains the liquid container in the mount position against the urging force of the urging member. The guide portion of the liquid container is positioned in the groove of the mounting portion.

[0012] When the liquid container is released from the retained state by the retaining member, the liquid container is moved toward the opening by the urging force of the urging member. When the liquid container is moved toward the opening, the guide portion moves along the groove of the mounting portion, and the first protrusion of the first deformable portion comes into contact with the first stopper of the groove. The liquid container is stopped by this contact between the first protrusion of the first deformable portion and the first stopper.

[0013] The position where the liquid container stops is not limited to the position where the first protrusion of the first deformable portion contacts the first stopper. For example, the liquid container may move with the first protrusion of the first deformable portion sliding on the first stopper while the first deformable portion is resiliently deformed. The velocity of the liquid container may be attenuated by the contact between the first protrusion of the first deformable portion and the first stopper, and the liquid container may be stopped after the first protrusion has passed the first stopper.

[0014] Accordingly, chances are reduced that the liquid container jumps out of the mounting portion. Moreover, it is the liquid container that comprises the deformable portion, and therefore the first stopper may not be fatigued even after the liquid containers are repeatedly inserted into and removed from the mounting portion.

[0015] Other objects, features, and advantages will be apparent to persons of ordinary skill in the art from the following detained description of the invention and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] For a more complete understanding of the present invention, needs satisfied thereby, and the objects, features, and advantages thereof, reference now is made to the following description taken in connection with the accompanying drawings.

[0017] Fig. 1 is a schematic vertical cross-sectional view of a printer comprising an ink supply device according to an embodiment of the present invention.

[0018] Fig. 2 is a perspective view of an ink cartridge according to an embodiment of the present invention.

[0019] Fig. 3 is a bottom view of the ink cartridge of Fig. 2.

[0020] Fig. 4 is a side view of the ink cartridge of Fig. 2.

[0021] Fig. 5 is an enlarged partial bottom view of the ink cartridge of Fig. 2.

[0022] Fig. 6 is an enlarged partial side view of the ink cartridge of Fig. 2.

[0023] Fig. 7 is a perspective view of a mounting portion.

[0024] Fig. 8 is an enlarged partial plan view of a first groove and a second groove in the vicinity of an opening of a mounting portion of Fig. 7.

[0025] Fig. 9 is a vertical cross-sectional view of the ink cartridge of Fig. 2 and the mounting portion of Fig. 7, in which the ink cartridge 30 is mounted in the mounting portion 110.

[0026] Fig. 10 is a vertical cross-sectional view of the ink cartridge of Fig. 2 and the mounting portion of Fig. 7, in which the ink cartridge is inserted into the mounting portion or the ink cartridge is removed from the mounting portion.

[0027] Fig. 11 is an enlarged partial horizontal cross-sectional view of the ink cartridge of Fig. 2 and the mounting portion of Fig. 7, in which protrusions of the ink cartridge contact stoppers of the mounting portion.

[0028] Fig. 12 is an enlarged partial vertical cross-sectional view of an ink cartridge and a mounting portion according to a first modified embodiment.

[0029] Fig. 13 is an enlarged partial horizontal cross-sectional view of an ink cartridge and a mounting portion according to a second modified embodiment.

[0030] Fig. 14 is an enlarged partial horizontal cross-sectional view of an ink cartridge and a mounting portion according to a third modified embodiment.

[0031] Fig. 15 is an enlarged partial horizontal cross-sectional view of the ink cartridge and the mounting portion of Fig. 14, in which a center of a first groove of the mounting portion in a width direction and a center of a guide portion of the ink cartridge in the width direction are offset in the width direction

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0032] Embodiments of the present invention, and their features and advantages, may be understood by referring to Figs 1-15, like numerals being used for like corresponding parts in the various drawings.

[0033] Referring to Fig. 1, a printer 10 is configured to print an image by selectively ejecting ink droplets on a printing sheet of paper. The printer 10 comprises the ink supply device 100. The ink supply device 100 comprises a mounting portion 110. The mounting portion 110 allows an ink cartridge 30 to be mounted therein. The mounting portion 110 has an opening 112 and the inside of the mounting portion 110 is configured to be exposed to the outside of the mounting portion 110 via the opening 112. The ink cartridge 30 is configured to be inserted into the mounting portion 110 in an insertion direction 50a (see Fig. 2) via the opening 112 and thereby mounted in the mounting portion 110. The ink cartridge 30 also is configured to be removed from the mounting portion 110 in a removal direction 50b (See Fig. 2) via the opening 112. The removal direction 50b is opposite the insertion direction 50a. In this embodiment, the insertion direction 50a and the removal direction 50b are substantially a horizontal direction. The printer 10 is an example of an image printing apparatus. The ink supply device 100 is an example of a liquid supply device.

[0034] The ink cartridge 30 is configured to store ink which is usable by the printer 10. The printer 10 comprises an ink-jet print-head 21 and an ink tube 20, and the ink cartridge 30 and the print-head 21 are fluidically connected via the ink tube 20 when the ink cartridge 30 is mounted in the mounting portion 110. The print-head 21 comprises a sub tank 28. The sub tank 28 is configured to temporarily store ink supplied via the ink tube 20 from the ink cartridge 30. The print-head 21 is configured to selectively eject ink supplied from the sub tank 28 through nozzles 29. The print-head 21 is an example of a printing portion.

[0035] A printing sheet of paper fed from a paper feed tray 15 to a conveying path 24 by a paper feed roller 23 is conveyed onto a platen 26 by a conveying roller pair 25. The print-head 21 is configured to selectively eject ink onto the printing sheet of paper passing over the platen 26. Accordingly, an image is printed on the printing sheet of paper. The printing sheet of paper having passed over the platen 26 is discharged to a paper discharge tray 16 disposed at the most downstream side of the conveying path 24 by a discharge roller pair 22.

[0036] Referring to Fig. 2 to Fig. 4, the ink cartridge 30 is a container configured to store ink therein. A space formed in the interior of the ink cartridge 30 is an ink chamber 36. The ink cartridge 30 comprises a main body 31 forming an outer appearance of the ink cartridge 30. The ink chamber 36 is a space directly formed in the interior of the main body 31. In another embodiment, the ink chamber 36 may be a space formed in the interior of a container which is disposed in the main body 31. The ink cartridge 30 is an example of a liquid container, and the ink chamber 36 is an example of a liquid chamber.

[0037] The ink cartridge 30 is configured to be inserted into and removed from the mounting portion 110 in an upright position as shown in Fig. 2, with the top surface of the ink cartridge 30 in Fig. 2 facing upward and the bottom surface of the ink cartridge 30 in Fig. 2 facing downward. The ink cartridge 30 is configured to be inserted into and the mounting portion 110 in the insertion direction 50a and to be removed from the mounting portion 110 in the removal direction 50b, in other words, the ink cartridge 30 is configured to be inserted into and removed from the mounting portion 110 in insertion/removal directions 50 which are the combination of the insertion direction 50a and the removal direction 50b.

[0038] The main body 31 of the ink cartridge 30 has substantially a rectangular parallelepiped shape. The main body 31 has a width in a width direction 51, a height in a height direction 52, and a depth in a depth direction 53. The width direction 51, the height direction 52, and the depth direction 53 are perpendicular to each other. The width of the main body 31 is less than the height and the depth of the main body 31. A wall of the main body 31 positioned on the front side of the main body 31 when the ink cartridge 30 is inserted into the mounting portion 110 is a front wall 40, and a wall of the main body 31 positioned on the rear side of the main body 31 when the ink cartridge 30 is inserted into the mounting portion 110 is a rear wall 42. The front wall 40 and the rear wall 42 are aligned in the depth direction 53. When the ink cartridge 30 is inserted into the mounting portion 110, the depth direction 53 is parallel to the insertion/removal directions 50, and the width direction 51 and the height direction 52 are perpendicular to the insertion/removal directions 50. Therefore, the front wall 40 and the rear wall 42 are aligned in the insertion/removal directions 50 when the ink cartridge 30 is inserted into the mounting portion 110.

[0039] The main body 31 comprises a remaining amount detection portion 33 provided at the front wall 40 of the main body 31 at substantially the center of the front wall 40 in the height direction 52. The remaining amount detection portion

33 has a box shape having an opening through which the inside of the remaining amount detection portion 33 is in fluid communication with the inside of the ink chamber 36. The remaining amount detection portion 33 comprises a pair of walls made of a light-transmissive resin which allow infrared light emitted from an optical sensor 114 (see Fig. 9) provided in the mounting portion 110 to pass therethrough. When the ink cartridge 30 is mounted in the mounting portion 110, the remaining amount detection portion 33 is configured to either allow the infrared light emitted from the optical sensor 114 to pass therethrough, or block or substantially attenuate the infrared light, depending on the amount of ink in the ink chamber 36. Whether the remaining amount detection portion 33 allows the infrared light to pass therethrough or blocks or substantially attenuates the infrared light tells a controller of the printer whether or not the amount of ink stored in the ink chamber 36 is less than a predetermined amount. A wall of the remaining amount detection portion which is irradiated with the infrared light of the optical sensor 114 may extend in the vertical direction (height direction 52) or in a direction intersecting the vertical direction (height direction 52).

[0040] The main body 31 has an opening formed through the front wall 40 in the depth direction 53, and the opening is positioned above the remaining amount detection portion 33. The main body 31 has an atmospheric air communication opening 32 behind the opening of the front wall 40. The atmospheric air communication opening 32 and the opening of the front wall 40 are aligned in the depth direction 53. The atmospheric air communication opening 32 penetrates through a wall defining the ink chamber 36 in the depth direction 53. The ink chamber 30 stores ink therein and an air layer is formed above the ink surface in the ink chamber 36. The air layer in the ink chamber 36 and atmospheric air outside the main body 31 can be brought into communication with each other via the atmospheric air communication opening 32. Although not shown in the respective drawings, the atmospheric air communication opening 32 is configured to be selectively opened and closed by a valve. The air pressure in the ink chamber 36 becomes equal to the atmospheric pressure outside the main body 31 when the atmospheric air communication opening 32 is opened. The atmospheric air communication opening 32 does not necessarily have to be provided adjacent to the front wall 40 as long as the interior and the exterior of the ink chamber 36 are brought into communication with each other via the atmospheric air communication opening 32. Moreover, when the ink cartridge 30 is used with the inside of the ink chamber 36 kept in a negative pressure, the main body 31 may not comprise the atmospheric air communication opening 32.

[0041] The main body 31 comprises an ink supply portion 37 positioned the front wall 40 below the remaining amount detection portion 33. The ink supply portion 37 has a cylindrical outer surface, and protrudes outward from the front wall 40 in the insertion direction 50a. The ink supply portion 37 has an ink flow channel 38 formed therein, and the ink flow channel 38 extends in the insertion/removal directions 50. The ink supply portion 37 is configured such that ink is flowed out from the ink chamber 36 through the ink flow channel 38 into an ink supply tube 122 (See Figs. 1 and 9) provided in the mounting portion 110. The ink supply portion 37 is an example of a liquid supply portion.

[0042] The main body 31 comprises an upper wall 39 extending from the upper end of the front wall 40 to the upper end of the rear wall 42. The main body 31 also comprises an engaging portion 43 at substantially the center of the upper wall 39 in the depth direction 53. The engaging portion 43 comprises a plane extending in the width direction 51 and the height direction 52. A locking lever 145, described later (see Fig. 9), is configured to engage the engaging portion 43 when the ink cartridge 30 is mounted in the mounting portion 110.

[0043] The main body 31 comprises a first projection 45 and a second projection 46. The first projection 45 extends from the upper end of the front wall 40 of the main body 31 in the insertion direction 50a away from the rear wall 42. The width of the first projection 45 is equal to the width of the front wall 40 in the width direction 51. In another embodiment, the first projection 45 may be a plate-shaped member having a narrower width than the width of the front wall 40 in the width direction 51.

[0044] The second projection 46 extends from the lower end of the front wall 40 of the main body 31 in the insertion direction 50a away from the rear wall 42. The second projection 46 is positioned below the ink supply portion 37. The width of the second projection 46 is equal to the width of the front wall 40 in the width direction 51. The distal end of the second projection 46 extends to a position farther from the ink chamber 36 than the distal end of the ink supply portion 37.

[0045] Referring to Figs. 3 to 6, the main body 31 comprises a lower wall 41 opposite the upper wall 39 in the height direction 52, and the ink cartridge 30 comprises a guide portion 44 positioned vertically below the main body 31 and extending downward from the lower wall 41 of the main body 31. The guide portion 44 extends in the depth direction 53. The guide portion 44 comprises a pair of surfaces 54, 55 extending in the height direction 52 and the depth direction 53 and positioned away from each other in the width direction 51. The surfaces 54, 55 extend in the insertion direction 50a and the removal direction 50b. The main body 31 comprises a right end surface 47 and a left end surface 48 in the width direction 51, and the surfaces 54, 55 of the guide portion 44 are positioned more inside than the right end surface 47 and the left end surface 48 of the main body 31 in the width direction 51. In other words, a distance E between the right end surface 47 and the left end surface 48 of the main body 31 in the width direction 51 is greater than a distance A between the surfaces 54, 55 in the width direction 51 (distance A < distance E). The guide portion 44 is configured to be positioned and moved in a first groove 115 and a second groove 116 of the mounting portion 110, described later (see Figs. 7 and 8), when the ink cartridge 30 is inserted into and removed from the mounting portion 110. The surfaces 54, 55 face side surfaces 117, 118, 123, 124 of the first groove 115 and the second groove 116 when the ink cartridge

30 is inserted into and removed from the mounting portion 110. The surfaces 54, 55 are examples of first and second cartridge-surfaces.

[0046] The surfaces 54, 55 of the guide portion 44 comprises deformable portions 56, 57, respectively. The deformable portions 56, 57 are positioned at the same position in the depth direction 53, i.e., the directions of insertion and disconnection 50. In other words, the deformable portions 56, 57 are aligned in the width direction 51. The deformable portion 56 comprises a base 58 and a protrusion 59. The deformable portion 57 comprises a base 60 and a protrusion 61. The ribs 58, 60 are aligned to each other in the width direction 51, and the protrusion 59 and the protrusion 61 protrudes from the ribs 58, 60 outward in the width direction 51 in opposite directions.

[0047] The surface 54 has a slit 62 formed therethrough, and the rear end of the base 58 is defined by the slit 62. The base 58 has no distinctive front end. The base 58 is made of synthetic resin or the like integrally with the main body 31 and is resiliently deformable in the width direction 51 by the formation of the slit 62. The amount of resilient deformation of the base 58 is greater than or equal to the dimension of the protrusion 59 in the width direction 51.

[0048] The distal end of the protrusion 59 is positioned more inside than the right end surface 47 of the main body 31 is in the width direction 51 and positioned more closer to the surface 54 than the right end surface 47 is in the width direction 51. In other words, the protrusion 59 does not extend outward beyond the right end surface 47 in the width direction 51. The protrusion 59 has a triangular shape with its base positioned above its apex, in side view. An inclined surface 63 of the protrusion 59 on the side of the front wall 40 is inclined, such that a portion of the inclined surface 63 closer to the base of the triangle is positioned closer to the front wall 40 than a portion of the inclined surface 63 farther from the base of the triangle, and an inclined surface 64 of the protrusion 59 on the side of the rear wall 42 is inclined, such that a portion of the inclined surface 64 closer to the base of the triangle is positioned closer to the rear wall 42 than a portion of the inclined surface 64 farther from the base of the triangle.

[0049] The surface 55 has a slit 65 formed therethrough, and the rear end of the base 60 is defined by the slit 65. The base 60 has no distinctive front end. The base 60 is made of synthetic resin or the like integrally with the main body 31 and is resiliently deformable in the width direction 51 by the formation of the slit 65. The amount of resilient deformation of the base 60 is greater than or equal to the dimension of the protrusion 61 in the width direction 51.

[0050] The distal end of the protrusion 61 is positioned more inside than the left end surface 48 of the main body 31 in the width direction 51 and positioned more closer to the surface 55 than the left end surface 48 is in the width direction 51. In other words, the protrusion 61 does not extend outward beyond the left end surface 48 in the width direction 51. The protrusion 61 has a triangular shape with its base positioned above its apex, in side view. An inclined surface 66 of the protrusion 61 on the side of the front wall 40 is inclined, such that a portion of the inclined surface 66 closer to the base of the triangle is positioned closer to the front wall 40 than a portion of the inclined surface 66 farther from the base of the triangle, and an inclined surface 67 of the protrusion 61 on the side of the rear wall 42 is inclined, such that a portion of the inclined surface 67 closer to the base of the triangle is positioned closer to the front wall 40 than a portion of the inclined surface 67 farther from the base of the triangle.

[0051] As described above, the protrusions 59, 61 do not extend outward beyond the right end surface 47 and the left end surface 48 of the main body 31 in the width direction 51, and the distal ends of the protrusions 59, 61 are positioned more inside the right end surface 47 and the left end surface 48 of the main body 31 in the width direction 51. In other words, the distance E between the right end surface 47 and the left end surface 48 of the main body 31 in the width direction 51 is greater than a distance B between the distal ends of the protrusions 59, 61 in the width direction 51 (distance B < distance E). Because the protrusions 59, 61 protrude outward from the ribs 58, 60, the distance B between the distal ends of the protrusions 59, 61 in the width direction 51 is greater than the distance A between the surfaces 54, 55 of the guide portion 44 in the width direction (distance A < distance B).

[0052] Referring to Fig. 1 and Fig. 7, the mounting portion 110 has the opening 112, and the ink cartridge 30 is configured to be inserted into the mounting portion 110 in the insertion direction 50a via the opening 112 and thereby mounted in the mounting portion 110. The ink cartridge 30 also is configured to be removed from the mounting portion 110 in the removal direction 104 via the opening 112. The mounting portion 110 comprises the first groove 115 and the second groove 116 formed in a bottom surface 113 which defines the bottom of the inner space of the mounting portion 110. The first groove 115 is aligned with the second groove 116 in the insertion direction 50a, and the first groove 115 and the second groove 116 extends from the opening 112 in the insertion direction 50a. The ink cartridge 30 is guided in the insertion/removal directions 50 by the guide portion 44 positioned in the first groove 115 and the second groove 116 when the ink cartridge 30 is inserted into and removed from the mounting portion 110.

[0053] The mounting portion 110 comprises the optical sensor 114, a locking mechanism 144, a sliding member 135, a coil spring 139, and a joint portion 121.

[0054] Referring to Fig. 9, the optical sensor 114 is provided at an end portion of the mounting portion 110 opposing the opening 112 in the insertion/removal directions 50. The optical sensor 114 is a photo interrupter comprising a light-emitting element, e.g., a light-emitting diode, configured to emit infrared light, and a light-receiving element, e.g., a photo transistor, configured to receive the infrared light emitted from the light-emitting element. The light-emitting element and the light-receiving element are aligned in a direction perpendicular to the paper plane on which Fig. 9 is illustrated. When

the ink cartridge 30 is positioned in the mounting portion 110, the remaining amount detection portion 33 is positioned between the light-emitting element and the light-receiving element of the optical sensor 114. Whether or not the remaining amount of stored in the ink chamber 36 is less than the predetermined amount is determined by the controller of the printer 10, depending on whether or not the light-receiving element of the optical sensor 114 receives the infrared light passing through the remaining amount detection portion 33.

[0055] The sliding member 135 is disposed in a space 130 formed in the lower end of the end portion of the mounting portion 110. The space 130 is contiguous with the inner space of the mounting portion 110. The sliding member 135 is configured to slide in the insertion/removal directions 50 in the space 130. The sliding member 135 is positioned in the line of travel of the second projection 46 of the ink cartridge 30 and is configured to come into contact with the second projection 46 when the ink cartridge 30 is inserted in to the mounting portion 110.

[0056] The coil spring 139 is disposed in the space 130. The coil spring 139 is configured to resiliently bias the sliding member 135 toward the opening 112, that is, in the removal direction 50b. The coil spring 139 is fitted around a supporting rod 133 extending in the space 130 in the insertion/removal directions 50. One end of the coil spring 139 is connected to a back wall which defines an end of the space 130 opposite the inner space of the mounting portion 110 in the insertion/removal directions 50, and the other end of the coil spring 139 is connected to the sliding member 135. When the coil spring 139 has a natural length, that is, when an external force is not applied to the sliding member 135, the sliding member 135 is positioned at the opening 112-side end of the space 130 (see Fig. 10). The second projection 46 of the ink cartridge 30 comes into contact with the sliding member 135 when the ink cartridge 30 is inserted into the mounting portion 110, and the sliding member 135 is pressed by the ink cartridge 30 toward the back wall of the space 130. Accordingly, the coil spring 139 is contracted, and the sliding member 135 is slid to the back wall side (see Fig. 9). The sliding member 135 and the coil spring 139 are configured to urge the ink cartridge 30 positioned in the mounting portion 110 toward the opening 112. The sliding member 135 and the coil spring 139 are an example of an urging member.

[0057] The locking mechanism 144 is configured to releasably retain the ink cartridge 30 in a mount position in the mounting portion 110 against an urging force of the sliding member 135 and the spring 139 and prevent the ink cartridge 30 from moving in the removal direction 104.

[0058] The locking mechanism 144 comprises the locking lever 145 and a coil spring 148 which applies an urging force to the locking lever 145. The locking lever 145 is configured to pivot between an unlock position shown in Fig. 10 and a lock position shown in Fig. 9. When an external force is not applied to the locking lever 145, the locking lever 145 is constantly urged toward the lock position by the coil spring 148. The locking lever 145 comprises an engaging end 146 positioned at one end of the locking lever 145. The ink cartridge 30 is locked or retained in the mount position in the mounting portion 110 when the engaging end 146 of the lock mechanism 144 engages the engaging portion 43 of the ink cartridge 30. The locking lever 145 comprises an operating member 147 at the other end of the locking lever 145. When a user presses the operating member 147 downward, the locking lever 145 in the lock position moves to the unlock position. The locking lever 145 is an example of a retaining member.

[0059] The joint portion 121 is provided at the end portion of the mounting portion 110. The joint portion 121 comprises the ink supply tube 122. The ink supply tube 122 is a tubular member extending in the insertion/removal directions 50. The ink supply tube 122 is in fluid communication with the ink tube 20. When the ink cartridge 30 is mounted in the mounting portion 110, the ink supply tube 122 is inserted into the ink supply portion 37, and the ink supply portion 37 and the joint portion 121 are joined. Accordingly, ink is supplied from the ink chamber 36 to the ink tube 20 via the ink supply tube 122.

[0060] Referring to Fig. 8, the bottom surface 113 which defines the bottom of the inner space of the mounting portion 110 has the first groove 115 formed therein, and the first groove 115 extends from the second groove 116 to the end portion of the mounting portion 110 in the insertion direction 50a. The first groove 115 is a space recessed vertically downward from the bottom surface 113, defined by the side surfaces 117, 118 extending in the insertion/removal directions 50 and opposing to each other and a bottom surface 119 which connects the side surfaces 117, 118. In the width direction 51, a distance D between the side surfaces 117, 118 is greater than the distance A between the surfaces 54, 55 of the guide portion 44 of the ink cartridge 30 (distance A < distance D), is greater than the distance B between the distal ends of the protrusions 59, 61 (distance B < distance D), and is less than the distance E between the right end surface 47 and the left end surface 48 of the main body 31 (distance D < distance E). Therefore, the guide portion 44 of the ink cartridge 30 is allowed to be inserted into the first groove 115, but the main body 31 of the ink cartridge 30 cannot be inserted into the first groove 115.

[0061] Referring to Fig. 8, the mounting portion 110 comprises a sliding member 120 which is slidable in the width direction 51 relative to the first groove 115. The sliding member 120 is positioned at an opening 112-side end of the bottom surface 113 of the mounting portion 110. The sliding member 120 is a flat plate being thin in the insertion/removal directions 50. The sliding member 120 has the second groove 116 formed therein, and the second groove 116 is contiguous with the first groove 115. The second groove 116 is a space penetrating through the sliding member 120 in the insertion/removal directions 50. The second groove 116 is defined by the side surfaces 123, 124 extending in the insertion/removal directions 50 and opposing to each other and a bottom surface 125 which connects the side surfaces

123, 124. In the width direction 51, a distance F between the side surfaces 123, 124 of the second groove 116 is greater than the distance D between the side surfaces 117, 118 of the first groove 115 (distance D < distance F). The sliding member 120 is configured to slide in the width direction 51 in a range where the first groove 115 and the second groove 116 are overlapped with each other in the insertion/removal directions 50. The distance the sliding member 120 slides is much less than the distance D and the distance F. Therefore, even when the sliding member 120 is slid by a maximum amount, at least portion of the first groove 115 overlaps at least portion of the second groove 116 in the insertion/removal directions 50.

[0062] The mounting portion 110 comprises stoppers 126, 127 projecting from the side surfaces 123, 124 in the width direction 51, respectively, into the second groove 116. The stoppers 126, 127 are positioned at the same position in the insertion/removal directions 50. In other words, the stoppers 126, 127 are aligned in the width direction 51. The stoppers 126, 127 extend over the substantially entire areas of the side surfaces 123, 124 in the height direction 52, respectively. Each of the stoppers 126, 127 is tapered toward the distal end of the stopper 126, 127 in the width direction 51, such that the dimension thereof in the insertion/removal directions 50 decreases toward the distal end.

[0063] The distal ends of the stoppers 126, 127 are positioned more inside than the side surfaces 117, 118 of the first groove 115 in the width direction 51 irrespective of the position of the sliding member 120. In the width direction 51, a distance C between the distal ends of the stoppers 126, 127 is greater than the distance A between the surfaces 54, 55 of the guide portion 44 of the ink cartridge 30 (distance A < distance C) and, also, is less than the distance B between the distal ends of the protrusions 59, 61 (distance C < distance B). Therefore, the respective distances A, B, C, D, E, and F described above have a following relationship:

$$(\text{distance A}) < (\text{distance C}) < (\text{distance B}) < (\text{distance D}) < (\text{distance F}) < (\text{distance E}).$$

[0064] When a user inserts the ink cartridge 30 into the mounting portion 110 by pushing the ink cartridge 30 in the insertion direction 50a, the guide portion 44 is inserted into the first groove 115 and the second groove 116, and the protrusions 59, 61 of the deformable portions 56, 57 of the ink cartridge 30 come into contact with the stoppers 126, 127. At this time, the user who is pushing the ink cartridge 30 into the mounting portion 110 feels resistance to some degree. However, when the user further pushes the ink cartridge 30 inward, the bases 58, 60 of the deformable portions 56, 57 are resiliently deformed toward each other in the width direction 51, i.e., in the direction the stoppers 126, 127 projects, while the protrusions 59, 61 slide on and climb over the stoppers 126, 127.

[0065] Referring to Fig. 9, when the ink cartridge 30 is inserted into the mounting portion 110, the sliding member 135 is pressed by the second projection 46, and is slid toward the back wall of the space 130. Also, the coil spring 139 contracts from the natural length, and the sliding member 135 receives a biasing force from the coil spring 139 toward the opening 112. Accordingly, the ink cartridge 30 in the mounting portion 110 is resiliently urged in the removal direction toward the opening 112.

[0066] During the insertion of the ink cartridge 30 into the mounting portion 110, the engaging end 146 of the locking lever 145 climbs onto the upper wall 39 of the ink cartridge 30. Accordingly, the locking lever 145 pivots counterclockwise, and moves from the lock position to the unlock position (see Fig. 10). When the ink cartridge 30 is further inserted, the engaging portion 43 of the ink cartridge 30 moves toward the end portion of the mounting portion 110 relative to the engaging end 146 of the locking lever 145, and the locking lever 145 pivots to a position where the engaging end 146 engages the engaging portion 43. In other words, the locking lever 145 pivots clockwise, and moves from the unlock position to the lock position (see Fig. 9). Although the ink cartridge 30 urged by the sliding member 135 and the coil spring 139 tries to move in the removal direction 50b toward the opening 112, the ink cartridge 30 is retained in the mount position in the mounting portion 110 because the engaging end 146 of the locking lever 145 engages the engaging portion 43. The ink cartridge 30 is thus mounted to the mounting portion 110. When the ink cartridge 30 is mounted in the mount position in the mounting portion 110, the ink supply tube 122 of the joint portion 121 is inserted into the ink flow channel 38 of the ink cartridge 30, and the supply of ink from the ink chamber 36 to the outside of the ink cartridge 30 is enabled.

[0067] When a user intends to remove the ink cartridge 30 from the mounting portion 110, the user presses down the operating member 147 of the locking lever 145. Accordingly, the locking lever 145 pivots counterclockwise, and moves from the lock position to the unlock position (see Fig. 10). When the locking lever 145 is in the unlock position, the engaging end 146 is positioned above the engaging portion 43 of the ink cartridge 30. Accordingly, the engaging end 146 moves away from the engaging portion 43. Therefore, the ink cartridge 30 is moved toward the opening 112 in the removal direction 50b (leftward in Fig. 9) upon receipt of the urging force from the sliding member 135 and the coil spring 139. Accordingly, the ink supply tube 122 of the joint portion 121 is removed from the ink flow channel 38 of the ink cartridge 30.

[0068] Referring to Fig. 10, after the coil spring 139 has restored to its natural length, the protrusions 59, 61 of the ink

cartridge 30 come into contact with the stoppers 126, 127 as shown in Fig. 11. By the contact between the protrusions 59, 61 and the stoppers 126, 127, the ink cartridge 30 moving toward the opening 112 in the removal direction 50b is stopped.

[0069] After the ink cartridge 30 has stopped, when the ink cartridge 30 is pulled out from the mounting portion 110 by the user, the bases 58, 60 of the deformable portions 56, 57 are resiliently deformed toward each other, i.e., in the direction the stoppers 126, 127 projects, such that the distance B between the distal ends of the protrusions 59, 61 decreases in the width direction 51, while the protrusions 59, 61 slide on and climb over the stoppers 126, 127. Accordingly, the user is allowed to pull out the ink cartridge 30 after it has stopped.

[0070] The position where the ink cartridge 30 stops is not limited to the position where the protrusions 59, 61 contact the stoppers 126, 127. For example, the ink cartridge 30 may move with the protrusions 59, 61 slide on the stoppers 126, 127 while the bases 58, 60 are resiliently deformed to reduce the distance B between the distal ends of the protrusions 59, 61. The velocity of the ink cartridge 30 may be attenuated by the frictional resistance between the protrusions 59, 61 and the stoppers 126, 127, and the ink cartridge 30 may be stopped after the protrusions 59, 61 have passed the stoppers 126, 127.

[0071] According to the embodiment as described above, when the ink cartridge 30 is moved upon receipt of the urging force from the sliding member 135 and the coil spring 139, the protrusions 59, 61 of the guide portion 44 moving along the first groove 115 come into contact with the stoppers 126, 127 provided in the second groove 116, such that the ink cartridge 30 reduces its speed or even is stopped. Accordingly, chances are reduced that the ink cartridge 30 jumps out of the mounting portion 110.

[0072] Also, it is the ink cartridge 30 that comprises the deformable portions 56, 57 and therefore the stoppers 126, 127 may not be fatigued even after the ink cartridges 30 are repeatedly inserted into and removed from the mounting portion 110.

[0073] Because the ink cartridge 30 comprises two deformable portions 56, 57 separated away from each other in the width direction 51, and the mounting portion 110 comprises the stoppers 126, 127 separated away from each other in the width direction 51, even when a clearance suitable for the movement of the ink cartridge 30 in the width direction 51 is provided between the surfaces 54, 55 of the guide portion 44 and the side surfaces 117, 118 of the first groove 115, at least one of the protrusions 59, 61 of the deformable portions 56, 57 comes into contact with a corresponding one of the stoppers 126, 127, and chances are reduced that the ink cartridge 30 jumps out of the mounting portion 110.

[0074] Because a relationship distance $A < \text{distance } C$ is satisfied, portions of the guide portion 44 other than the deformable portions 56, 57 can pass easily between the stoppers 126, 127. Because a relationship distance $C < \text{distance } B$ is satisfied, the protrusions 59, 61 reliably come into contact with the stoppers 126, 127. Because a relationship distance $B < \text{distance } D$ is satisfied, the protrusions 59, 61 are allowed to move in the first groove 115.

[0075] Because the deformable portions 56, 57 are aligned in the width direction 51, and the stoppers 126, 127 are aligned in the width direction 51, the guide portion 44 is prevented from moving in the width direction 51 with respect to the first groove 115 by the contact between the protrusions 59, 61 and the stoppers 126, 127.

[0076] Because the protrusions 59, 61 are positioned more inside than the right end surface 47 and the left end surface 48 of the main body 31 in the width direction 51, the protrusions 59, 61 do not extend outward beyond the right end surface 47 and the left end surface 48 in the width direction 51. Therefore, chances are reduced that the protrusions 59, 61 are damaged or deformed when the ink cartridge 30 is dropped onto a floor or when the ink cartridge 30 is packed in a package formed of film and the inside of the package is depressurized.

[0077] The locking lever 145 is configured to engage an upper portion of the ink cartridge 30, i.e., the engaging portion 43 of the ink cartridge 30, opposite a lower portion of the ink cartridge 30 where the deformable portions 56, 57 are provided, in the direction of gravity. Therefore, the engaging portion 43 can be provided without interference with the deformable portions 56, 57, which expands the flexibility of laying out the respective elements of the ink cartridge 30.

[0078] In another embodiment, the mounting portion 110 may not comprise the sliding member 120, and the stoppers 126, 127 may protrude from the side surfaces 117, 118 of the first groove 115, respectively.

[0079] In another embodiment, the mounting portion 110 may comprise only one of the stopper 126, 127, and the ink cartridge 30 may comprise only one of the deformable portions 56, 57 configured to contact the only one of the stoppers 126, 127.

[0080] The shapes of the protrusions 59, 61 or the stoppers 126, 127 in the embodiment described above may be modified. For example, referring to Fig. 12, the stopper 126, according to a first modified embodiment, comprises an inclined surface 128 facing the end portion of the mounting portion 110 in the insertion direction 50a, and the inclined surface 128 is inclined, such that a first portion of the inclined surface 128 is closer to the opening 112 than a second portion of the inclined surface 128 is. The first portion of the inclined surface 128 is closer to the bottom surface 125 of the second groove 126 than the second portion of the inclined surface 128 is. In other words, the inclined surface 128 is inclined, such that the first portion of the inclined surface 128 is farther from the end portion of the mounting portion 110 than the second portion of the inclined surface 128 is. Although a surface of the stopper 127 facing the end portion of the mounting portion 110 is not shown in the drawings, the surface of the stopper 127, according to the first modified

embodiment, is inclined in the same manner as the inclined surface 128.

[0081] When the ink cartridge 30 is mounted in the mounting portion 110, the inclined surface 64 of the protrusion 59, according to the first modified embodiment, is inclined, such that a first portion of the inclined surface 64 is closer to opening 112 than a second portion of the inclined surface 64 is, and the first portion of the inclined surface 64 is closer to the bottom surface 119 of the first groove 115 than the second portion of the inclined surface 64. In other words, the inclined surface 64 is inclined, such that the first portion of the inclined surface 64 is farther from the end portion of the mounting portion 110 than the second portion of the inclined surface 64. Although the protrusion 61, according to the first modified embodiment, is not shown in the drawings, the protrusion 61 has the same shape as the protrusion 59 according to the first modified embodiment.

[0082] In the embodiment of Figs. 1- 11 described above, the protrusions 59, 61 comprise the inclined surfaces 64, 67 which are inclined, such that first portions of the inclined surfaces 64, 67 are farther from the opening 112 than second portions of the inclined surfaces 64, 67 are, and the first portions of the inclined surfaces 64, 67 are closer to the bottom surface 119 than the second portions of the inclined surfaces 64, 67 are, when the ink cartridge 30 is mounted in the mounting portion 110. Therefore, the protrusions 59, 61 might climb over the stoppers 126, 127 upward along the inclined surfaces 64, 67 when the ink cartridge 30 moves in the removal direction 50b. Therefore, the effect to decelerate the velocity of the ink cartridge 30 may be reduced. In contrast, according to the first modified embodiment, when the ink cartridge 30 moves toward the opening 112 in the removal direction 50b and the stopper 126 and the protrusion 59 come into contact with each other, the inclined surface 128 of the stopper 126 and the inclined surface 64 of the protrusion 59 contact each other, and the ink cartridge 30 is guided along these inclinations toward the bottom surface 125 of the second groove 116. Accordingly, the protrusion 59 is prevented from moving upward away from the bottom surface 125, and therefore prevented from climbing over the stopper 126 in the vertical direction. Accordingly, the effect to decelerate the velocity of the ink cartridge 30 is obtained reliably.

[0083] Referring to Fig. 13, according to a second modified embodiment, the inclined surface 128 of the stopper 126 facing the end portion of the mounting portion 110 is inclined, such that a third portion of the inclined surface 128 is closer to the opening than a fourth portion of the inclined surface 128 is, and the third portion of the inclined surface 128 is farther from the side surface 123 than the fourth portion of the inclined surface 128 is. In other words, the inclined surface 128 is inclined, such that the third portion of the inclined surface 128 is farther from the end portion of the mounting portion 110 than the fourth portion of the inclined surface 128 is. Similarly, an inclined surface 129 of the stopper 127 facing the end portion of the mounting portion 110 is inclined, such that a third portion of the inclined surface 129 is closer to the opening than a fourth portion of the inclined surface 129 is, and the third portion of the inclined surface 129 is farther from the side surface 124 than the fourth portion of the inclined surface 129 is. In other words, the inclined surface 129 is inclined, such that the third portion of the inclined surface 129 is farther from the end portion of the mounting portion 110 than the fourth portion of the inclined surface 129 is.

[0084] When a user pulls the ink cartridge 30 after the moving ink cartridge 30 is stopped by the contact between the stoppers 126, 127 and the protrusions 59, 61, the bases 58, 60 are more readily deformed toward each other because the protrusions 59, 61 are guided toward each other by the inclined surfaces 128, 129 of the stoppers 126, 127. Accordingly, the user can pull out the ink cartridge 30 without feeling a significant resistance caused by the stoppers 126, 127.

[0085] Referring to Fig. 14, according to a third modified embodiment, instead of the stoppers 126, 127, the protrusions 59, 61 of the ink cartridge 30 comprise inclined surfaces 64, 66 which are inclined, such that third portions of the inclined surfaces 64, 66 are closer to the opening than fourth portions of the inclined surface 64, 66 are, and the third portions of the inclined surfaces 64, 66 are farther from the distal ends of the protrusions 59, 61 than the fourth portions of the inclined surfaces 64, 66 are. In other words, the inclined surfaces 64, 66 are inclined, such that the third portions of the inclined surfaces 64, 66 are farther from the end portion of the mounting portion than the fourth portions of the inclined surfaces 64, 66 are. When a user pulls the ink cartridge 30 after the moving ink cartridge 30 is stopped by the contact between the stoppers 126, 127 and the protrusions 59, 61, the bases 58, 60 are more readily deformed toward each other because the protrusions 59, 61 are guided toward each other by the inclined surfaces 64, 66 of the protrusions 59, 61. Accordingly, the user can pull out the ink cartridge 30 without feeling a significant resistance caused by the stoppers 126, 127.

[0086] When the ink cartridge 30 is moved toward the opening 112 in the removal direction 50b while the center of the first groove 115 in the width direction 51 is shifted from the center of the guide portion 44 in the width direction 51, the protrusions 59, 61 of the ink cartridge 30 may come into contact with the stoppers 126, 127 while the overlapping area of one of the protrusions 59, 61 with the corresponding one of the stoppers 126, 127 in the insertion/ removal directions 50 is greater than the overlapping area of the other one of the protrusions 59, 61 with the corresponding one of the stoppers 126, 127. For example, as shown in Fig. 15, when the overlapping area between the protrusion 59 and the stopper 126 in the insertion/ removal directions 50 is greater than the overlapping area between the protrusion 61 and the stopper 127 in the insertion/removal directions 50, the protrusion 61 may not come into contact with the stopper 127 when the protrusion 59 initially comes into contact with the stopper 126. When the ink cartridge 30 is further moved in the removal direction 50b, the stopper 126 moves along the inclined surface 64 of the protrusion 59, and thereby the

sliding member 120 is moved rightward in Fig. 15. When the sliding member 120 is moved rightward in Fig. 15, the stopper 127 approaches and comes into contact with the protrusion 61. In this manner, owing to the sliding member 120, the protrusions 59, 61 come into contact with the stoppers 126, 127 in a well balanced manner.

[0087] According to a fourth modified embodiment, the bases 58, 60 of the deformable portions 56, 57 may not be configured to be resiliently deformable, but the protrusion 59, 61 of the deformable portions 56, 57 may be configured to be resiliently deformable. For example, the protrusion 59, 61 may be made of rubber attached to the bases 58, 60, respectively. In this case, when the protrusions 59, 61 contact the stoppers 126, 127, the protrusions 59, 61 are resiliently deformed inward in the width direction 51.

[0088] While the invention has been described in connection with various example structures and illustrative embodiments, it will be understood by those skilled in the art that other variations and modifications of the structures and embodiments described above may be made without departing from the scope of the invention. Other structures and embodiments will be apparent to those skilled in the art from a consideration of the specification or practice of the invention disclosed herein. It is intended that the specification and the described examples are illustrative with the true scope of the invention being defined by the following claims.

Claims

1. A liquid container (30) configured to be inserted into a mounting portion (110) in an insertion direction (50a) and to be removed from the mounting portion (110) in a removal direction (50b) opposite the insertion direction (50a), comprising:

a main body (31) comprising a liquid chamber (36) configured to store liquid therein;
a liquid supply portion (37) positioned at the main body (31) and configured to supply liquid from an interior of the liquid chamber (36) to an exterior of the liquid chamber (36); and
a first cartridge-surface (54, 55) positioned vertically below the main body (31) and extending in the insertion direction (50a) and the removal direction (50b), wherein the first cartridge-surface (54, 55) comprises a first deformable portion (56, 57) configured to be resiliently deformable in a width direction (51) perpendicular to the insertion direction (50a) and the removal direction (50b), and the first deformable portion (56, 57) comprises a first protrusion (59, 61).

2. The liquid container (30) of claim 1, wherein the first protrusion (59, 61) protrudes in the width direction (51).

3. The liquid container (30) of claim 1 or 2, further comprising a second cartridge-surface (54, 55) positioned away from the first cartridge-surface (54, 55) in the width direction (51), wherein the second cartridge-surface (54, 55) comprises a second deformable portion (56, 57) configured to be resiliently deformable in the width direction (51), and the second deformable portion (56, 57) comprises a second protrusion (59, 61) protruding in the width direction (51).

4. The liquid container (30) of claim 3, wherein a distance between the first cartridge-surface (54, 55) and the second cartridge-surface (54, 55) in the width direction (51) is less than a distance between ends (47, 48) of the main body (31) in the width direction (51), and the first protrusion (59, 61) and the second protrusion (59, 61) are positioned more inside than the ends (47, 48) of the main body (31) in the width direction (51).

5. A liquid supply device (100) comprising:

the liquid container (30) of claim 1, wherein the liquid container (30) further comprises a guide portion (44) comprising the first cartridge-surface (54, 55); and
a mounting portion (110) having an opening (112), wherein the liquid container (30) is configured to be inserted into the mounting portion (110) in the insertion direction (50a) via the opening (112) and to be removed from the mounting portion (110) in the removal direction (50b) via the opening (112), the mounting portion (110) comprising:

an end portion opposite the opening (112) in the insertion direction (50a);
an urging member (135, 139) configured to urge the liquid container (30) positioned in the mounting portion (110) toward the opening (112);
a groove (115, 116) extending from the opening (112) to the end portion in the insertion direction (50a), wherein the groove (115, 116) is partially defined by a first groove-surface (117, 118, 123, 124) extending

in the insertion direction (50a) and the removal direction (50b) and a second groove-surface (117, 118, 123, 124) extending in the insertion direction (50a) and the removal direction (50b) and opposing to the first groove-surface (117, 118, 123, 124), and the guide portion (44) is configured to be positioned and moved in the groove (115, 116) when the liquid container (30) is inserted into and removed from the mounting portion (110);

a first stopper (126, 127) projecting from the first groove-surface (117, 118, 123, 124) into the groove (115, 116), wherein the first cartridge-surface (54, 55) faces the first groove-surface (117, 118, 123, 124) when the liquid container (30) is inserted into and removed from the mounting portion (110), wherein the first protrusion (59, 61) of the first deformable portion (56, 57) is configured to contact the first stopper (126, 127) when the liquid container (30) is inserted into and removed from the mounting portion (110), and the first deformable portion (56, 57) is configured to resiliently deform when the first protrusion (59, 61) contacts the first stopper (126, 127); and

a retaining member (145) configured to releasably retain the liquid container (30) in a mount position in the mounting portion (110) against an urging force of the urging member (135, 139).

6. The liquid supply device (100) of claim 5, wherein the first protrusion (59, 61) protrudes in the width direction (51).

7. The liquid supply device (100) of claim 5 or 6, wherein the guide portion (44) comprises a second cartridge-surface (54, 55) positioned away from the first cartridge-surface (54, 55) in the width direction (51), wherein the second cartridge-surface (54, 55) comprises a second deformable portion (56, 57) configured to be resiliently deformable in the width direction (51), and the second deformable portion (56, 57) comprises a second protrusion (59, 61) protruding in the width direction (51),

the second cartridge-surface (54, 55) faces the second groove-surface (117, 118, 123, 124) when the liquid container (30) is inserted into and removed from the mounting portion (110),

the mounting portion (110) comprising a second stopper (126, 127) projecting from the second groove-surface (117, 118, 123, 124) into the groove (115, 116), and

the second protrusion (59, 61) of the second deformable portion (56, 57) is configured to contact the second stopper (126, 127) when the liquid container (30) is inserted into and removed from the mounting portion (110), and the second deformable portion (56, 57) is configured to resiliently deform when the second protrusion (59, 61) contacts the second stopper (126, 127).

8. The liquid supply device (100) of claim 7 wherein a distance A, a distance B, a distance C, and a distance D have a relationship of

$(\text{distance A}) < (\text{distance C}) < (\text{distance B}) < (\text{distance D})$,

wherein the distance A is a distance between the first cartridge-surface (54, 55) and the second cartridge-surface (54, 55) of the guide portion (44) in the width direction (51),

a distance B is a distance between a distal end of the first protrusion (59, 61) and a distal end of the second protrusion (59, 61) in the width direction (51),

a distance C is a distance between the first stopper (126, 127) and the second stopper (126, 127) in the width direction (51), and

a distance D is a distance between the first groove-surface (117, 118, 123, 124) and the second groove-surface (117, 118, 123, 124) in the width direction (51).

9. The liquid supply device (100) of claim 7 or 8, wherein the first deformable portion (56, 57) and the second deformable portion (56, 57) are aligned in the width direction (51), and the first stopper (126, 127) and the second stopper (126, 127) are aligned in the width direction (51).

10. The liquid supply device (100) of one of claims 7 to 9, wherein the groove (115, 116) comprises a first groove (115) and second groove (116) which is wider than the first groove (115) in the width direction (51), and the mounting portion (110) comprises a sliding member (120) which is movable in the width direction (51) relative to the first groove (115), wherein the first stopper (126, 127) projects from the first groove-surface (117, 118, 123, 124) of the second groove (116) and the second stopper (126, 127) projects from the second groove-surface (117, 118, 123, 124) of the second groove (116).

11. The liquid supply device (100) of one of claims 5 to 10, wherein the groove (115, 116) is defined by the first groove-surface (117, 118, 123, 124), the second groove-surface (117, 118, 123, 124), and a bottom surface (119, 125) which connects the first groove-surface (117, 118, 123, 124) and the second groove-surface (117, 118, 123, 124), the first stopper (126, 127) comprises a first inclined surface (128) facing the end portion of the mounting portion

(110) in the insertion direction (50a),

the first protrusion (59, 61) comprises a second inclined surface (64) facing the first inclined surface (128) in the removal direction (50b) when the liquid container (30) is mounted in the mounting portion (110) in the mount position, the first inclined surface (128) is inclined, such that a first portion of the first inclined surface (128) is closer to the opening (112) than a second portion of the first inclined surface (128) is, wherein the first portion of the first inclined surface (128) is closer to the bottom surface (119, 125) of the groove (115, 116) than the second portion of the first inclined surface (128) is, and

the second inclined surface (64) is inclined, such that a first portion of the second inclined surface (64) is closer to the opening (112) than a second portion of the second inclined surface (64) is, wherein the first portion of the second inclined surface (64) is closer to the bottom surface (119, 125) of the groove (115, 116) than the second portion of the second inclined surface (64) is.

12. The liquid supply device (100) of claim 11, wherein the first inclined surface (128, 129) is inclined, such that a third portion of the first inclined surface (128, 129) is closer to the opening (112) than a fourth portion of the first inclined surface (128, 129) is, wherein the third portion of the first inclined surface (128, 129) is farther from the first groove-surface (117, 118, 123, 124) than the fourth portion of the first inclined surface (128, 129) is, and/or the second inclined surface (64, 66) is inclined, such that a third portion of the second inclined surface (64, 66) is closer to the opening (112) than a fourth portion of the second inclined surface (64, 66) is, wherein the third portion of the second inclined surface (64, 66) is farther from a distal end of the first protrusion (59, 61) than the fourth portion of the second inclined surface (64, 66) is.

13. The liquid supply device (100) of one of claims 5 to 12, wherein the main body (31) has a first width and the guide portion (44) has a second width in the width direction (51), wherein the first width is greater than the second width, and the first protrusion (59, 61) is positioned more inside than an end of the main body (31) in the width direction (51).

14. The liquid supply device (100) of one of claims 5 to 13, wherein the first deformable portion (56, 57) comprises a resiliently deformable base (58, 60) extending in the insertion direction (50a) and the removal direction (50b), and the first protrusion (59, 61) protrudes from the base (58, 60).

15. The liquid supply device (100) of one of claims 5 to 14, wherein the groove (115, 116) extends in a horizontal direction and is positioned underneath the liquid container (30) when the liquid container (30) is mounted in the mounting portion (110) in the mount position, and the retaining member (145) is configured to engage an upper portion of the liquid container (30) when the liquid container (30) is mounted in the mounting portion (110) in the mount position.

16. An image printing apparatus comprising the liquid supply device (100) of one of claims 5 to 15, and a printing portion (21) configured to selectively eject liquid supplied from the liquid supply device (100).

Amended claims in accordance with Rule 137(2) EPC.

1. A liquid container (30) configured to be inserted into a mounting portion (110) in an insertion direction (50a) and to be removed from the mounting portion (110) in a removal direction (50b) opposite the insertion direction (50a), comprising:

a main body (31) comprising a liquid chamber (36) configured to store liquid therein, the main body (31) having a width in a width direction (51), a height in a height direction (52), and a depth in a depth direction (53), the width direction (51), the height direction (52), and the depth direction (53) are perpendicular to each other, and the width of the main body (31) is less than the height and the depth of the main body (31);

a liquid supply portion (37) positioned at the main body (31) and configured to supply liquid from an interior of the liquid chamber (36) to an exterior of the liquid chamber (36); and

a first cartridge-surface (54, 55) positioned vertically below the main body (31) and extending in the height direction (52) and the depth direction (53) and extending in the insertion direction (50a) and the removal direction (50b), wherein the first cartridge-surface (54, 55) comprises a first deformable portion (56, 57) configured to be resiliently deformable in a width direction (51) perpendicular to the insertion direction (50a) and the removal direction (50b), and the first deformable portion (56, 57) comprises a base (58, 60) and a first protrusion (59, 61) protruding from the base (58, 60).

2. The liquid container (30) of claim 1, wherein the first protrusion (59, 61) protrudes in the width direction (51).

3. The liquid container (30) of claim 1 or 2, further comprising a second cartridge-surface (54, 55) positioned away from the first cartridge-surface (54, 55) in the width direction (51), wherein the second cartridge-surface (54, 55) comprises a second deformable portion (56, 57) configured to be resiliently deformable in the width direction (51), and the second deformable portion (56, 57) comprises a second protrusion (59, 61) protruding in the width direction (51).

4. The liquid container (30) of claim 3, wherein a distance between the first cartridge-surface (54, 55) and the second cartridge-surface (54, 55) in the width direction (51) is less than a distance between ends (47, 48) of the main body (31) in the width direction (51), and the first protrusion (59, 61) and the second protrusion (59, 61) are positioned more inside than the ends (47, 48) of the main body (31) in the width direction (51).

5. A liquid supply device (100) comprising:

the liquid container (30) of claim 1, wherein the liquid container (30) further comprises a guide portion (44) comprising the first cartridge-surface (54, 55); and
a mounting portion (110) having an opening (112), wherein the liquid container (30) is configured to be inserted into the mounting portion (110) in the insertion direction (50a) via the opening (112) and to be removed from the mounting portion (110) in the removal direction (50b) via the opening (112), the mounting portion (110) comprising:

an end portion opposite the opening (112) in the insertion direction (50a);
an urging member (135, 139) configured to urge the liquid container (30) positioned in the mounting portion (110) toward the opening (112);

a groove (115, 116) extending from the opening (112) to the end portion in the insertion direction (50a), wherein the groove (115, 116) is partially defined by a first groove-surface (117, 118, 123, 124) extending in the insertion direction (50a) and the removal direction (50b) and a second groove-surface (117, 118, 123, 124) extending in the insertion direction (50a) and the removal direction (50b) and opposing to the first groove-surface (117, 118, 123, 124), and the guide portion (44) is configured to be positioned and moved in the groove (115, 116) when the liquid container (30) is inserted into and removed from the mounting portion (110);

a first stopper (126, 127) projecting from the first groove-surface (117, 118, 123, 124) into the groove (115, 116), wherein the first cartridge-surface (54, 55) faces the first groove-surface (117, 118, 123, 124) when the liquid container (30) is inserted into and removed from the mounting portion (110), wherein the first protrusion (59, 61) of the first deformable portion (56, 57) is configured to contact the first stopper (126, 127) when the liquid container (30) is inserted into and removed from the mounting portion (110), and the first deformable portion (56, 57) is configured to resiliently deform when the first protrusion (59, 61) contacts the first stopper (126, 127); and

a retaining member (145) configured to releasably retain the liquid container (30) in a mount position in the mounting portion (110) against an urging force of the urging member (135, 139).

6. The liquid supply device (100) of claim 5, wherein the first protrusion (59, 61) protrudes in the width direction (51).

7. The liquid supply device (100) of claim 5 or 6, wherein the guide portion (44) comprises a second cartridge-surface (54, 55) positioned away from the first cartridge-surface (54, 55) in the width direction (51), wherein the second cartridge-surface (54, 55) comprises a second deformable portion (56, 57) configured to be resiliently deformable in the width direction (51), and the second deformable portion (56, 57) comprises a second protrusion (59, 61) protruding in the width direction (51),

the second cartridge-surface (54, 55) faces the second groove-surface (117, 118, 123, 124) when the liquid container (30) is inserted into and removed from the mounting portion (110),

the mounting portion (110) comprising a second stopper (126, 127) projecting from the second groove-surface (117, 118, 123, 124) into the groove (115, 116), and

the second protrusion (59, 61) of the second deformable portion (56, 57) is configured to contact the second stopper (126, 127) when the liquid container (30) is inserted into and removed from the mounting portion (110), and the second deformable portion (56, 57) is configured to resiliently deform when the second protrusion (59, 61) contacts the second stopper (126, 127).

8. The liquid supply device (100) of claim 7, wherein a distance A, a distance B, a distance C, and a distance D have a relationship of

(distance A) < (distance C) < (distance B) < (distance D),

wherein the distance A is a distance between the first cartridge-surface (54, 55) and the second cartridge-surface (54, 55) of the guide portion (44) in the width direction (51),
 a direction B is a distance between a distal end of the first protrusion (59, 61) and a distal end of the second protrusion (59, 61) in the width direction (51),
 a distance C is a distance between the first stopper (126, 127) and the second stopper (126, 127) in the width direction (51), and
 a distance D is a distance between the first groove-surface (117, 118, 123, 124) and the second groove-surface (117, 118, 123, 124) in the width direction (51).

9. The liquid supply device (100) of claim 7 or 8, wherein the first deformable portion (56, 57) and the second deformable portion (56, 57) are aligned in the width direction (51), and the first stopper (126, 127) and the second stopper (126, 127) are aligned in the width direction (51).

10. The liquid supply device (100) of one of claims 7 to 9, wherein the groove (115, 116) comprises a first groove (115) and second groove (116) which is wider than the first groove (115) in the width direction (51), and the mounting portion (110) comprises a sliding member (120) which is movable in the width direction (51) relative to the first groove (115), wherein the first stopper (126, 127) projects from the first groove-surface (117, 118, 123, 124) of the second groove (116) and the second stopper (126, 127) projects from the second groove-surface (117, 118, 123, 124) of the second groove (116).

11. The liquid supply device (100) of one of claims 5 to 10, wherein the groove (115, 116) is defined by the first groove-surface (117, 118, 123, 124), the second groove-surface (117, 118, 123, 124), and a bottom surface (119, 125) which connects the first groove-surface (117, 118, 123, 124) and the second groove-surface (117, 118, 123, 124),
 the first stopper (126, 127) comprises a first inclined surface (128) facing the end portion of the mounting portion (110) in the insertion direction (50a),
 the first protrusion (59, 61) comprises a second inclined surface (64) facing the first inclined surface (128) in the removal direction (50b) when the liquid container (30) is mounted in the mounting portion (110) in the mount position, the first inclined surface (128) is inclined, such that a first portion of the first inclined surface (128) is closer to the opening (112) than a second portion of the first inclined surface (128) is, wherein the first portion of the first inclined surface (128) is closer to the bottom surface (119, 125) of the groove (115, 116) than the second portion of the first inclined surface (128) is, and
 the second inclined surface (64) is inclined, such that a first portion of the second inclined surface (64) is closer to the opening (112) than a second portion of the second inclined surface (64) is, wherein the first portion of the second inclined surface (64) is closer to the bottom surface (119, 125) of the groove (115, 116) than the second portion of the second inclined surface (64) is.

12. The liquid supply device (100) of claim 11, wherein the first inclined surface (128, 129) is inclined, such that a third portion of the first inclined surface (128, 129) is closer to the opening (112) than a fourth portion of the first inclined surface (128, 129) is, wherein the third portion of the first inclined surface (128, 129) is farther from the first groove-surface (117, 118, 123, 124) than the fourth portion of the first inclined surface (128, 129) is, and/or
 the second inclined surface (64, 66) is inclined, such that a third portion of the second inclined surface (64, 66) is closer to the opening (112) than a fourth portion of the second inclined surface (64, 66) is, wherein the third portion of the second inclined surface (64, 66) is farther from a distal end of the first protrusion (59, 61) than the fourth portion of the second inclined surface (64, 66) is.

13. The liquid supply device (100) of one of claims 5 to 12, wherein the main body (31) has a first width and the guide portion (44) has a second width in the width direction (51), wherein the first width is greater than the second width, and the first protrusion (59, 61) is positioned more inside than an end of the main body (31) in the width direction (51).

14. The liquid supply device (100) of one of claims 5 to 13, wherein the first deformable portion (56, 57) comprises a resiliently deformable base (58, 60) extending in the insertion direction (50a) and the removal direction (50b), and the first protrusion (59, 61) protrudes from the base (58, 60).

5 **15.** The liquid supply device (100) of one of claims 5 to 14, wherein the groove (115, 116) extends in a horizontal direction and is positioned underneath the liquid container (30) when the liquid container (30) is mounted in the mounting portion (110) in the mount position, and the retaining member (145) is configured to engage an upper portion of the liquid container (30) when the liquid container (30) is mounted in the mounting portion (110) in the mount position.

10 **16.** An image printing apparatus comprising the liquid supply device (100) of one of claims 5 to 15, and a printing portion (21) configured to selectively eject liquid supplied from the liquid supply device (100).

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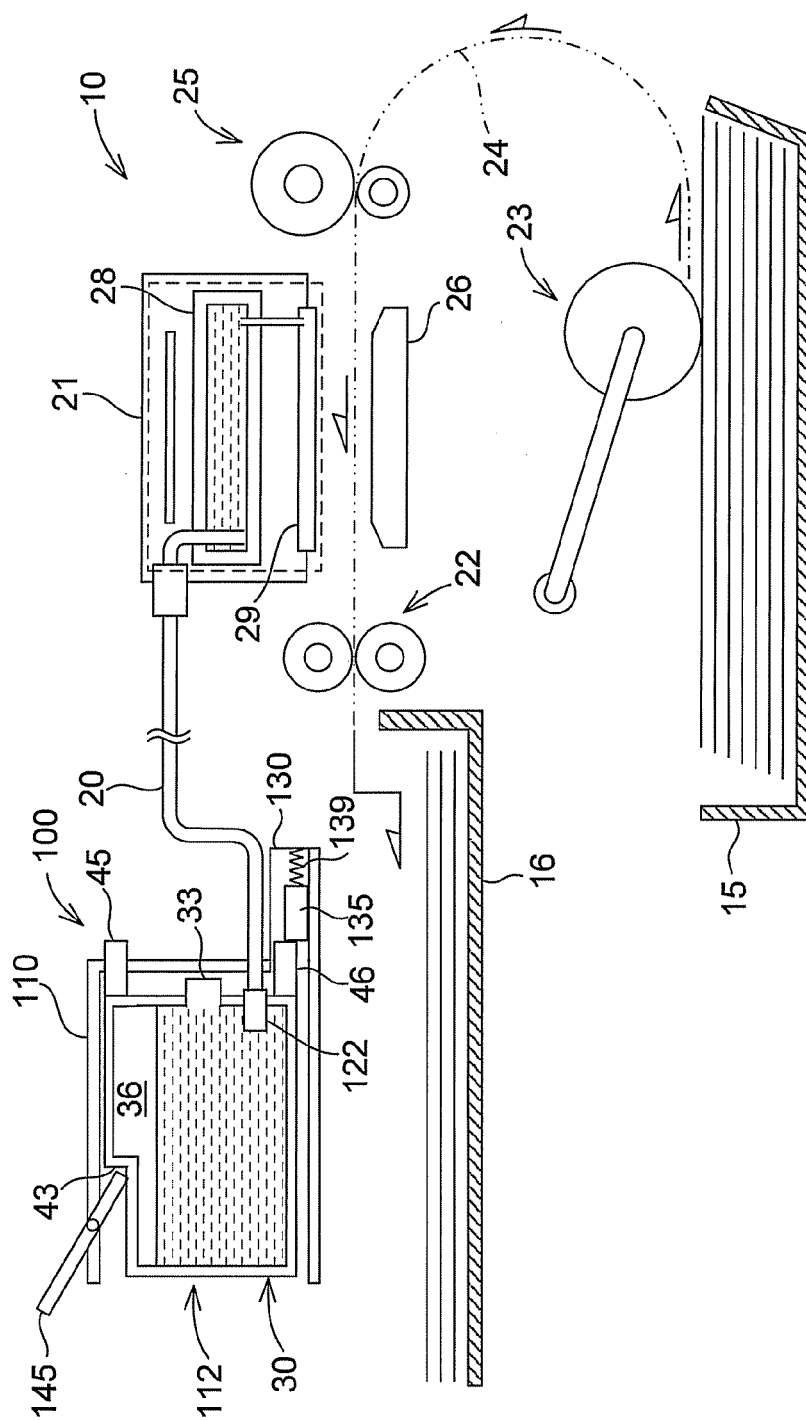


Fig.1

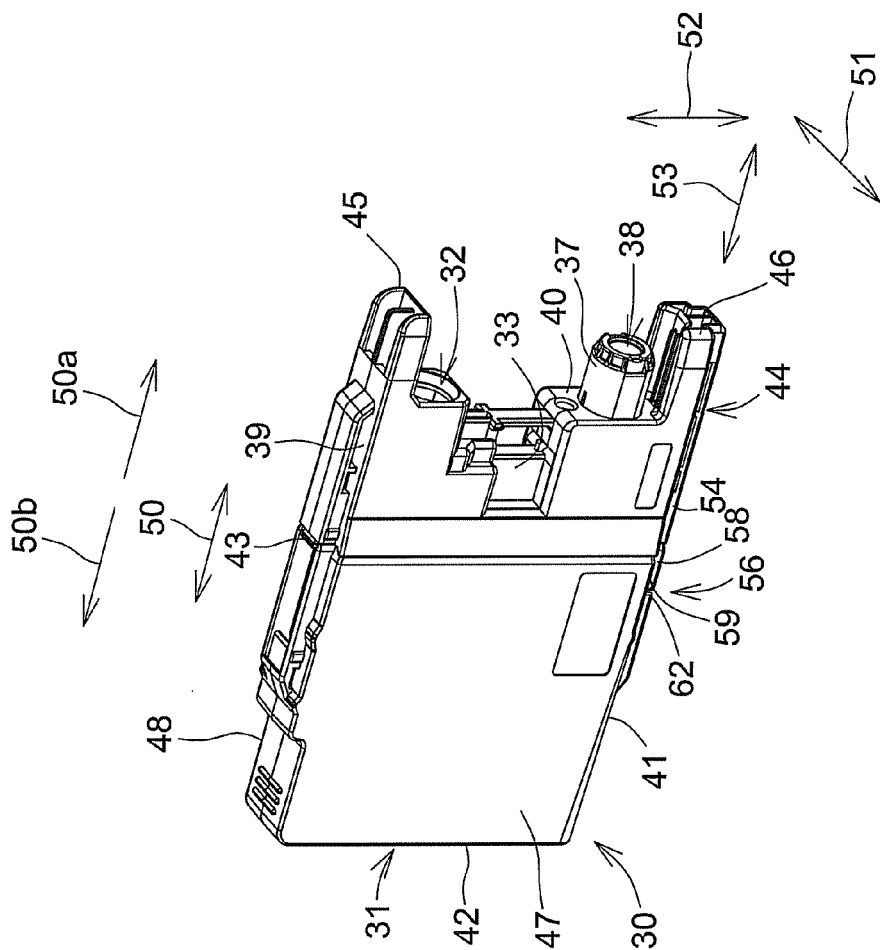


Fig.2

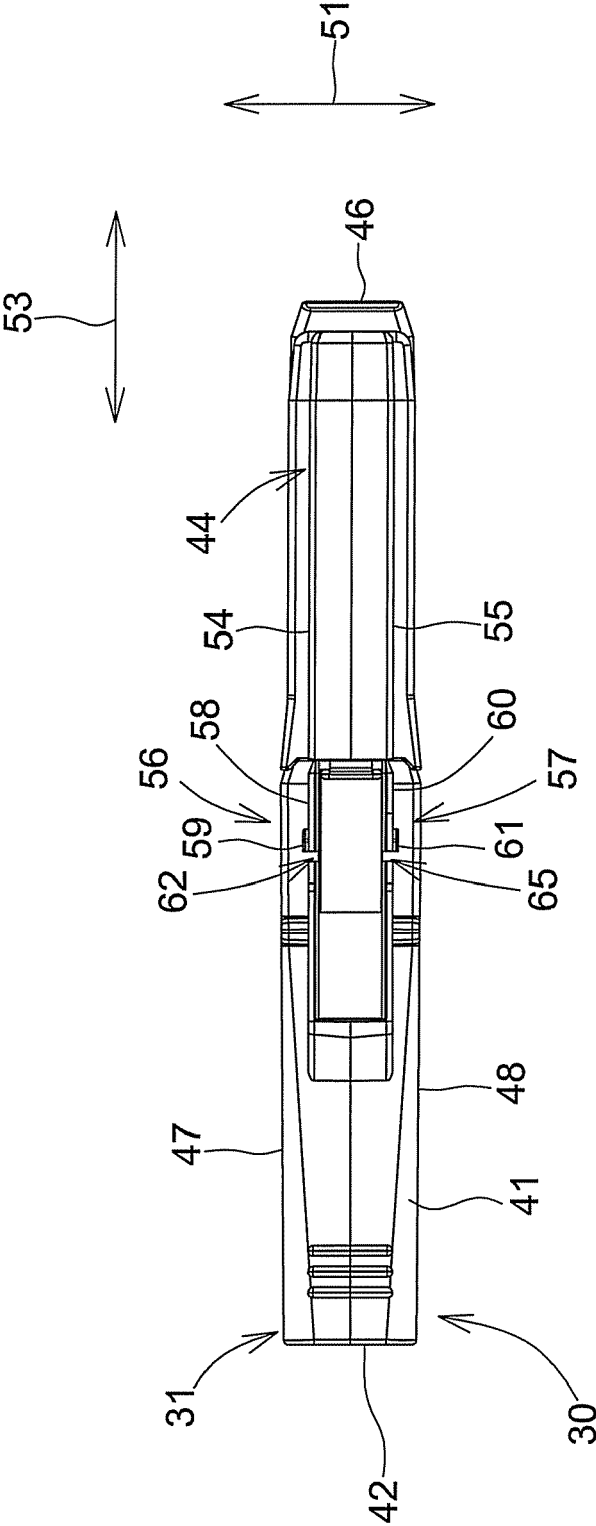


Fig.3

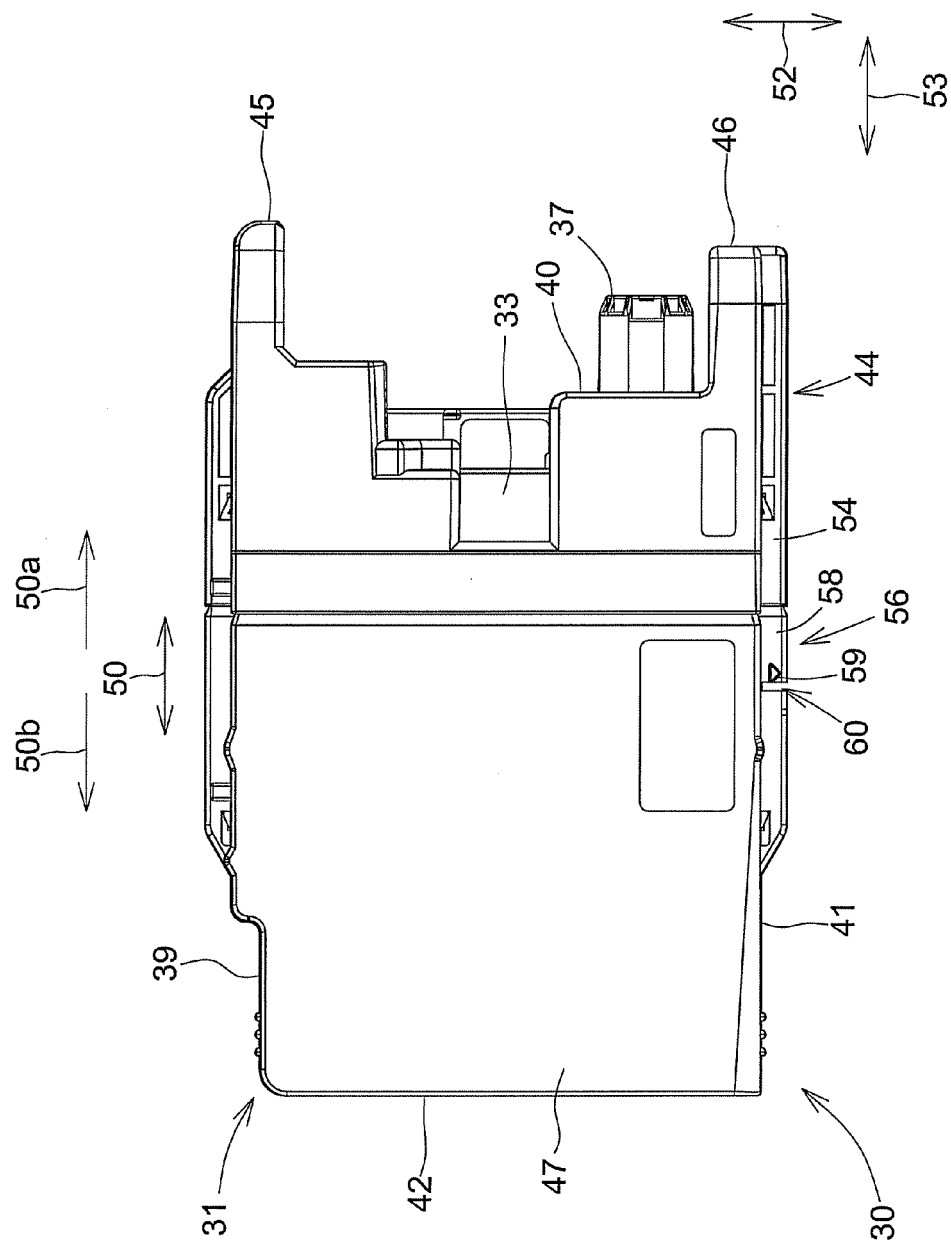


Fig. 4

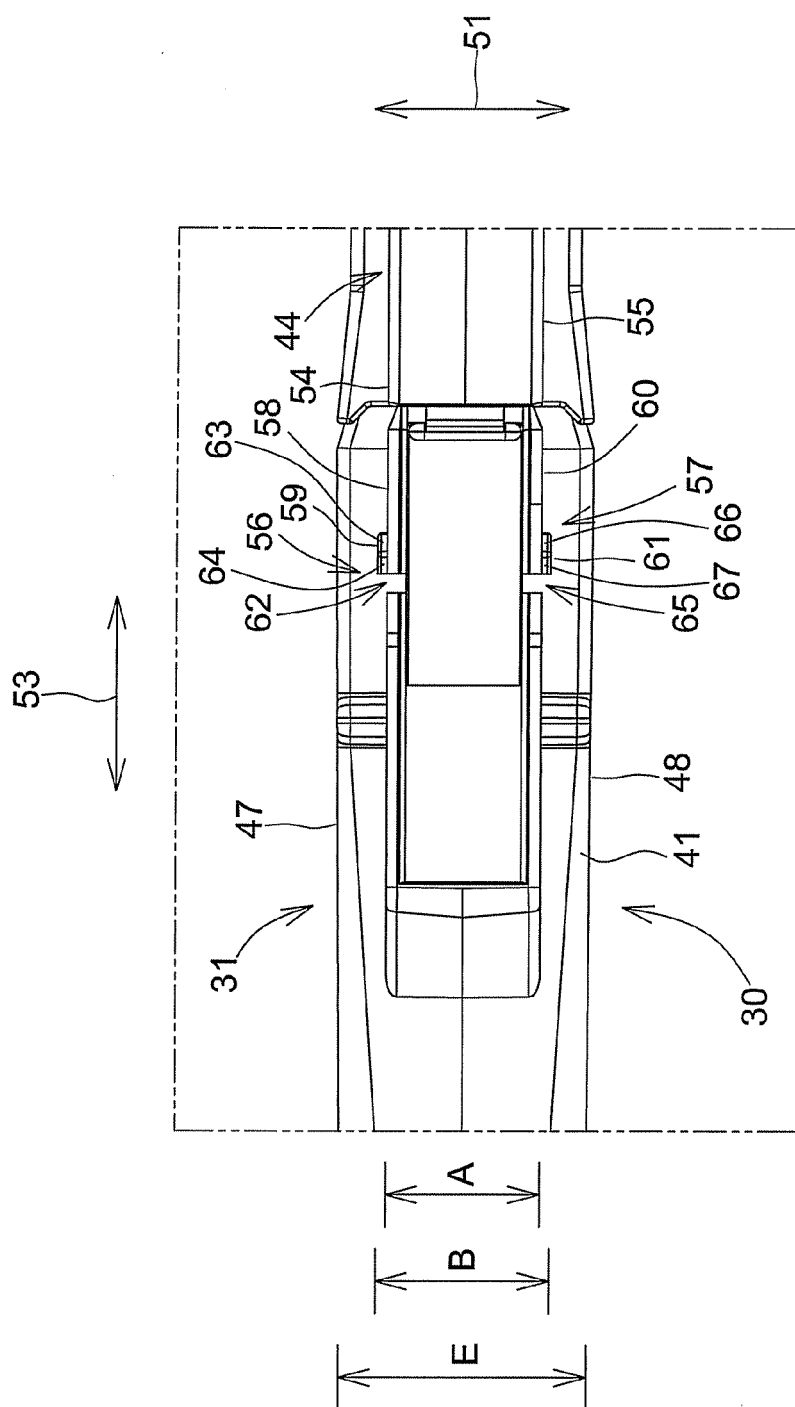


Fig.5

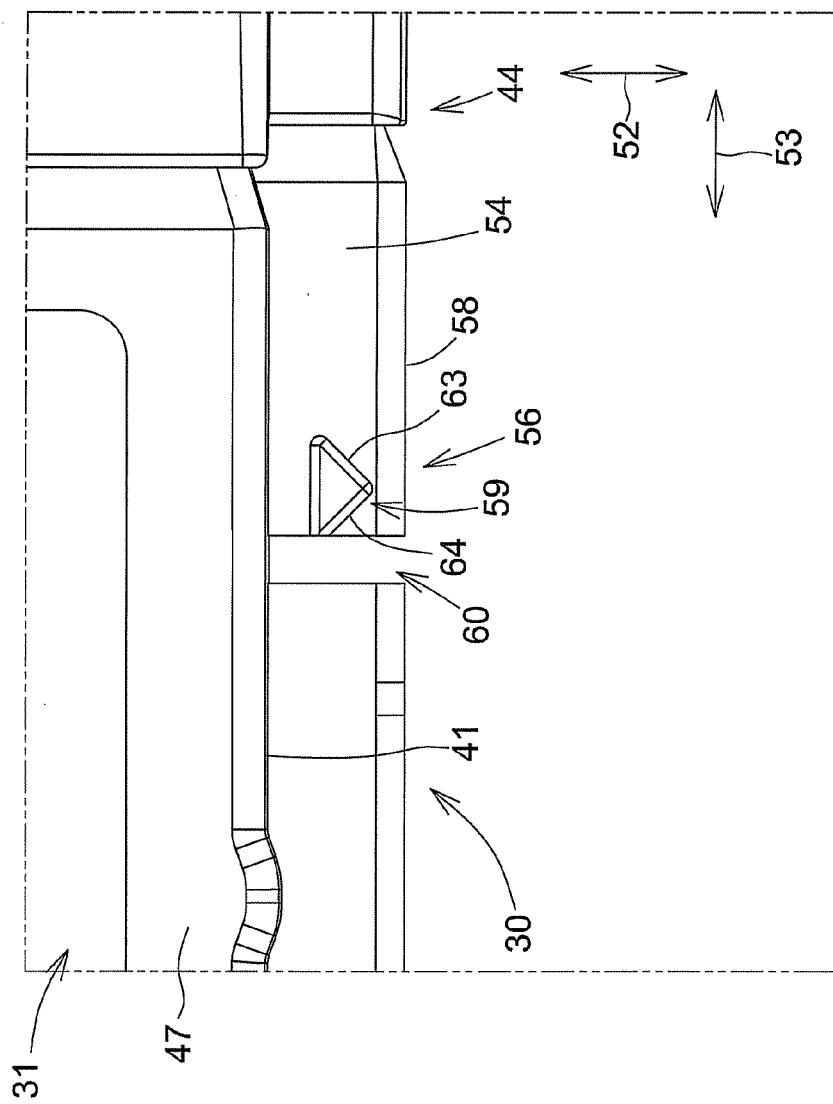


Fig. 6

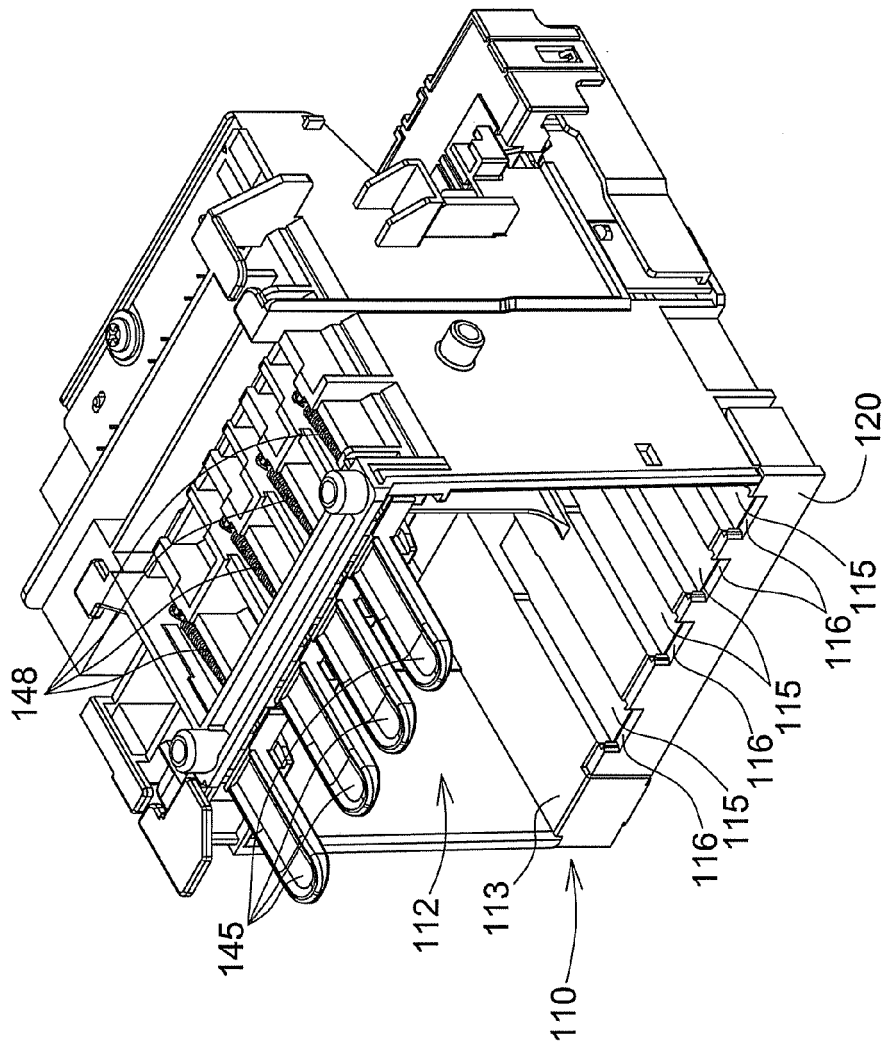


Fig.7

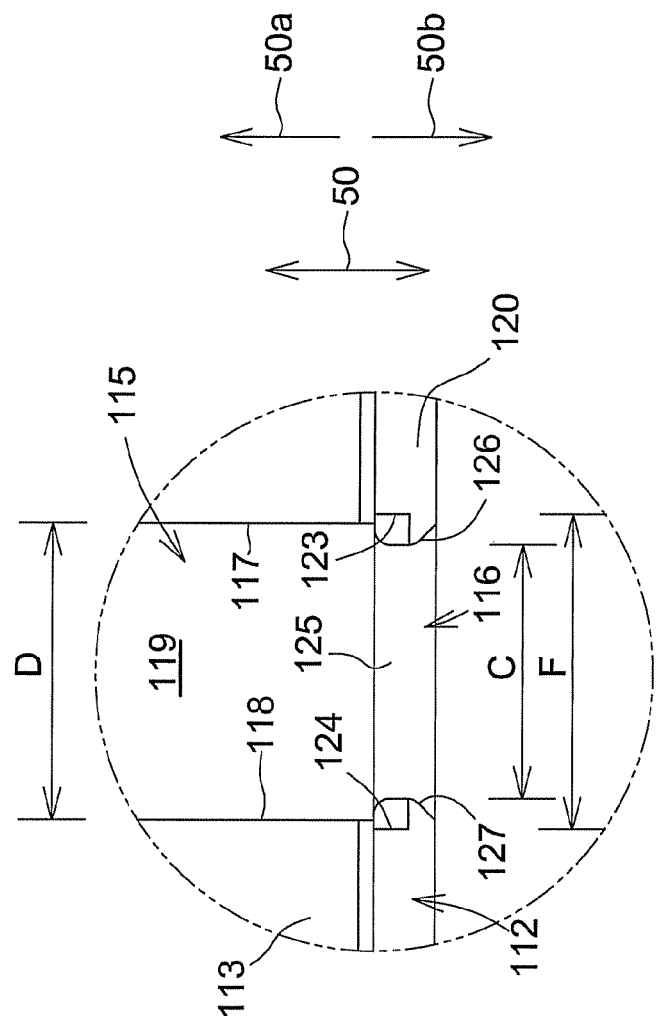


Fig.8

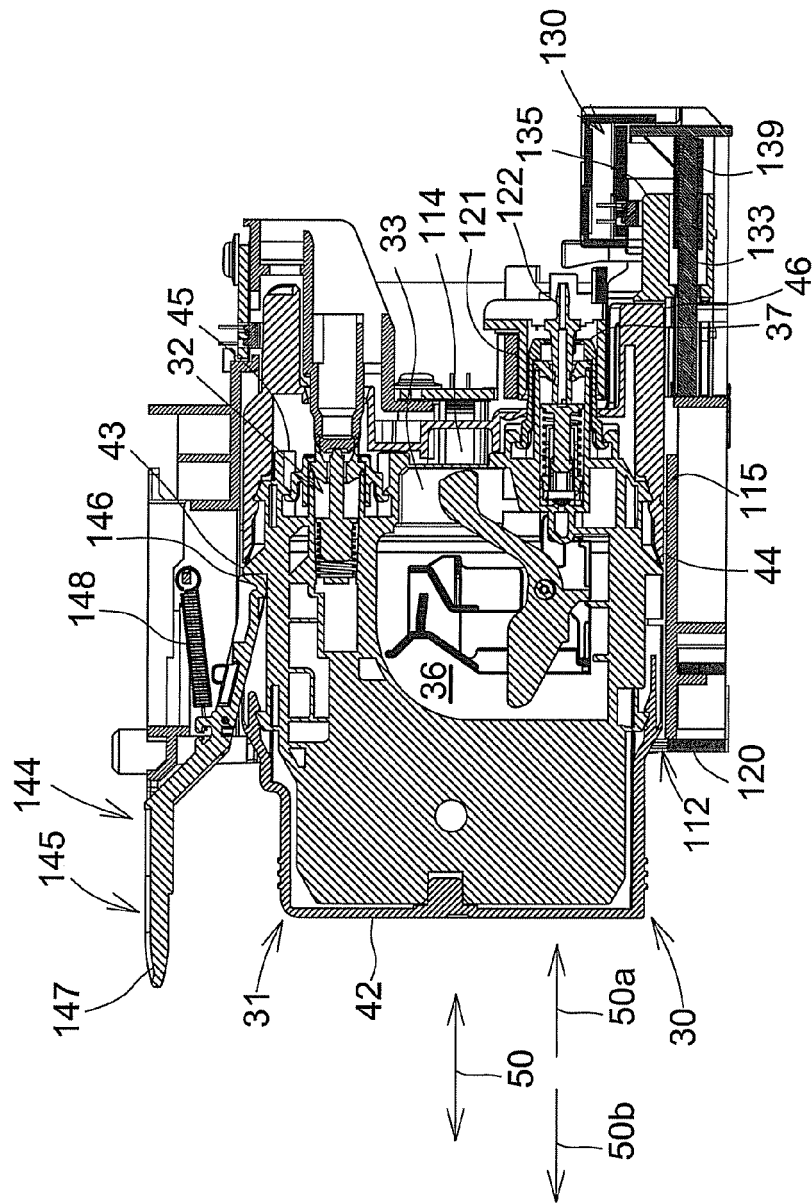


Fig.9

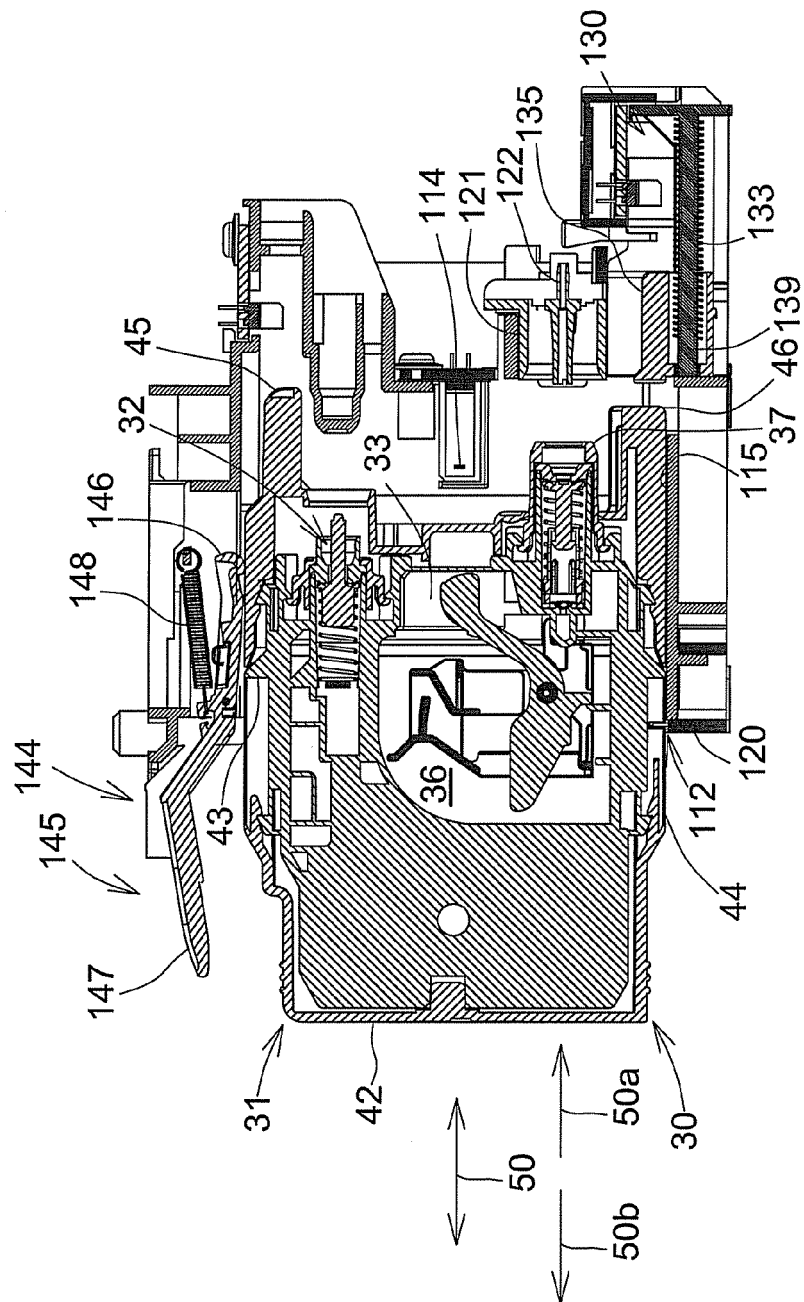
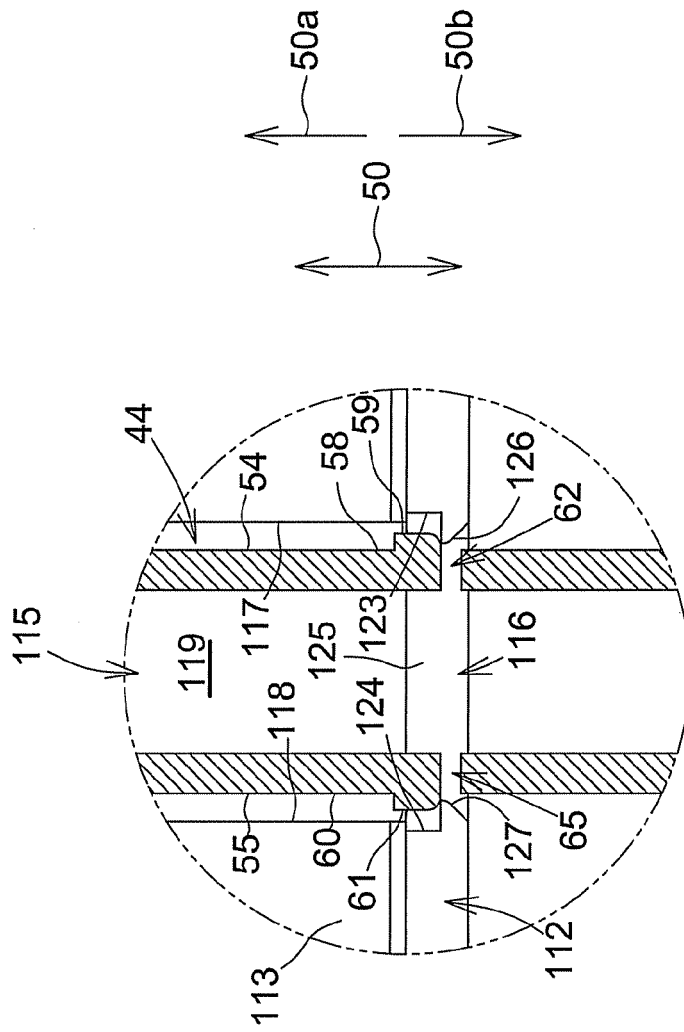


Fig.10



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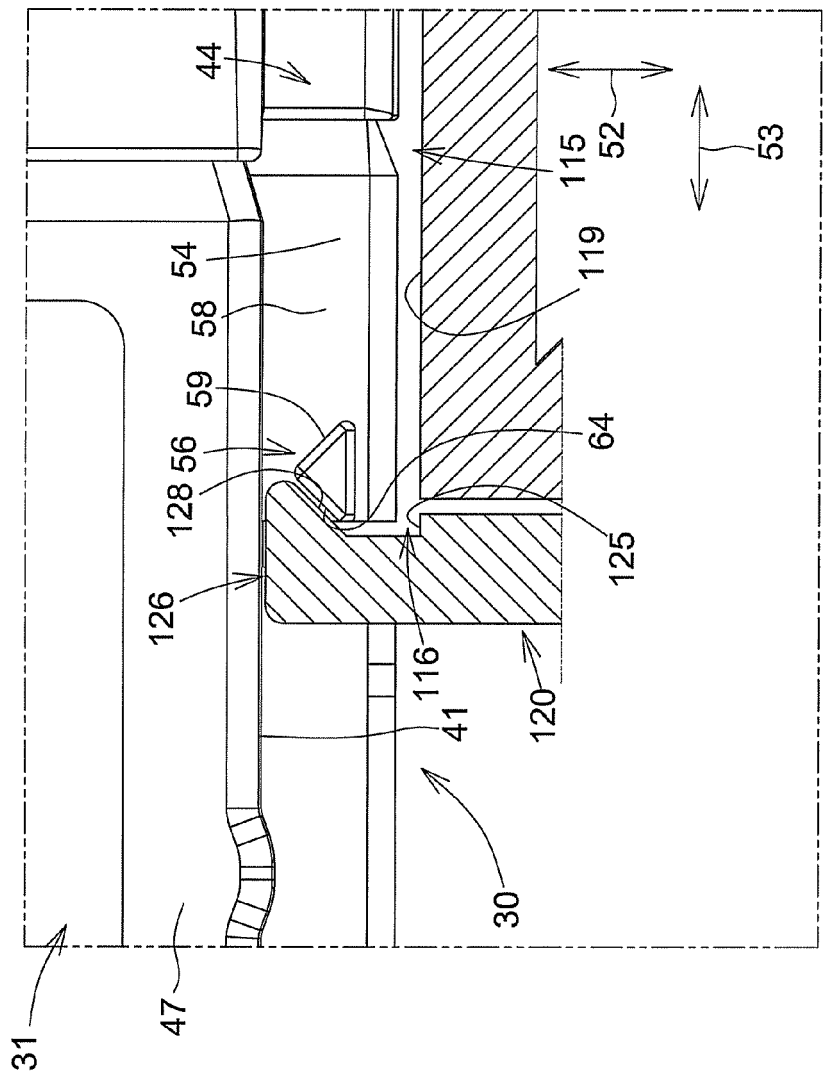


Fig.12

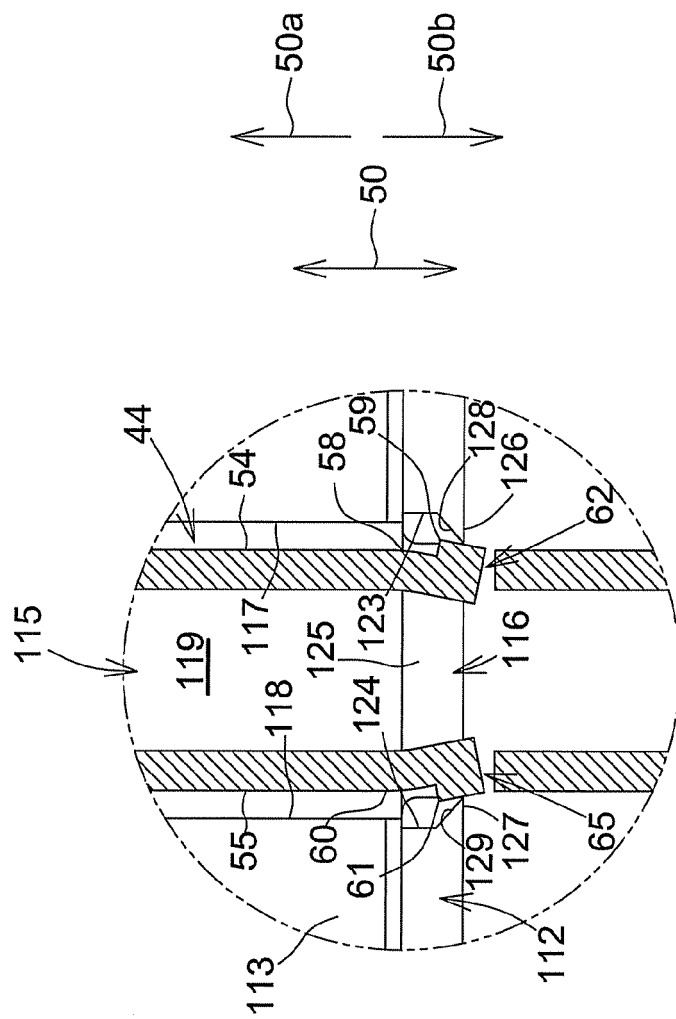
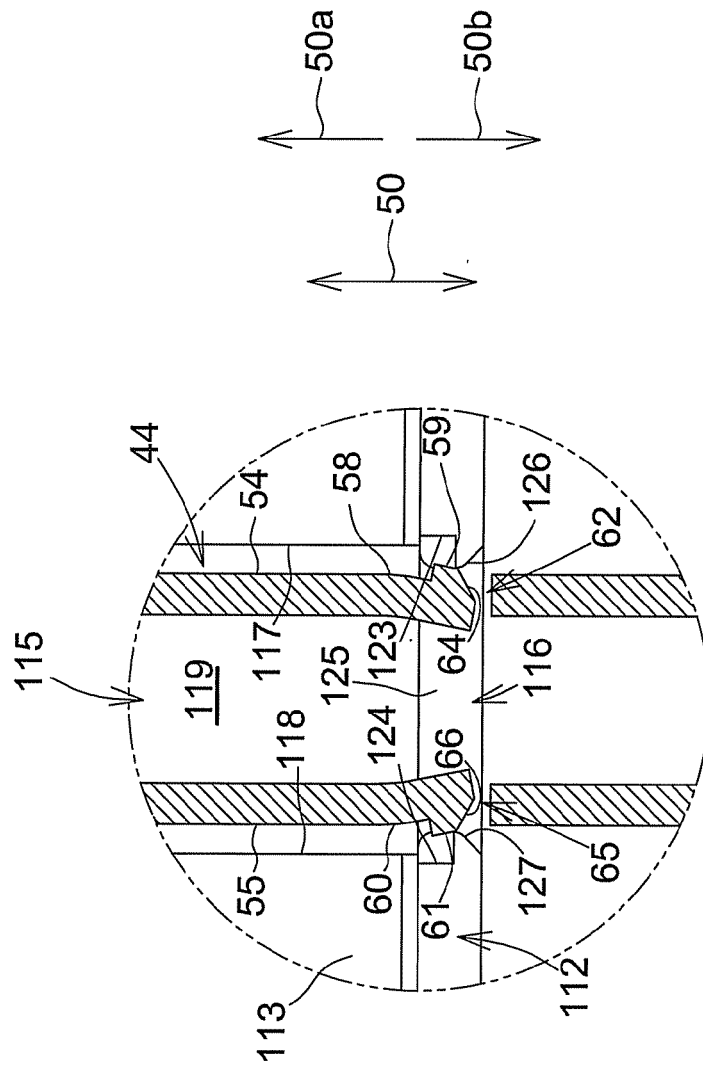
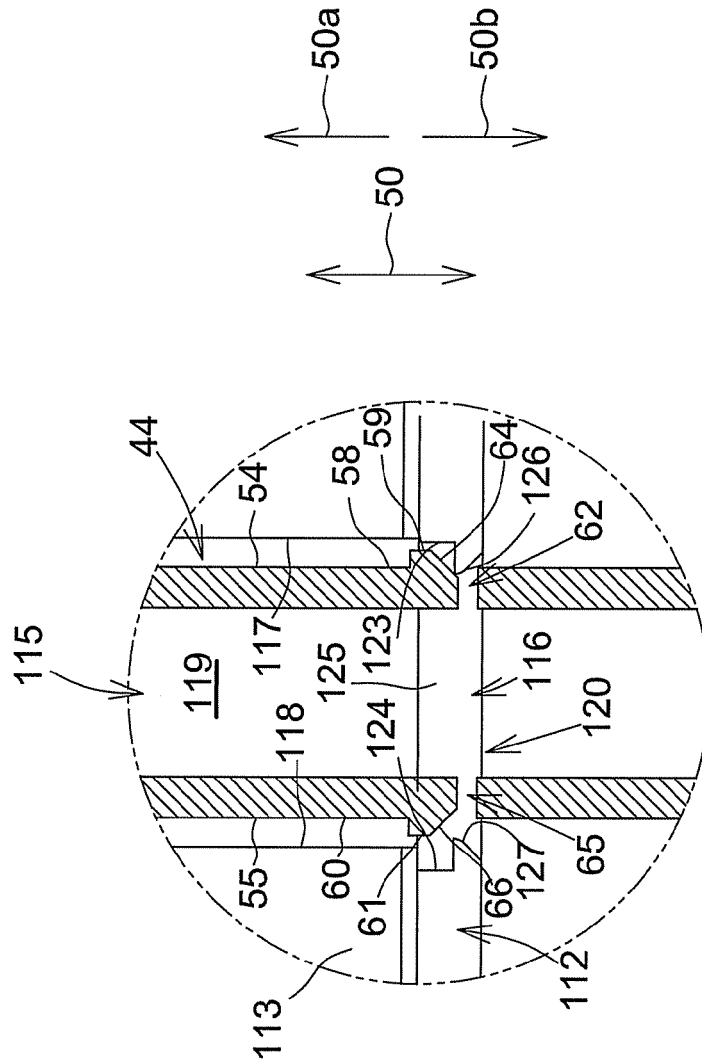


Fig.13



14.5



15.15



EUROPEAN SEARCH REPORT

Application Number
EP 10 19 3098

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Place of search The Hague		Date of completion of the search 3 February 2011	Examiner Adam, Emmanuel
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