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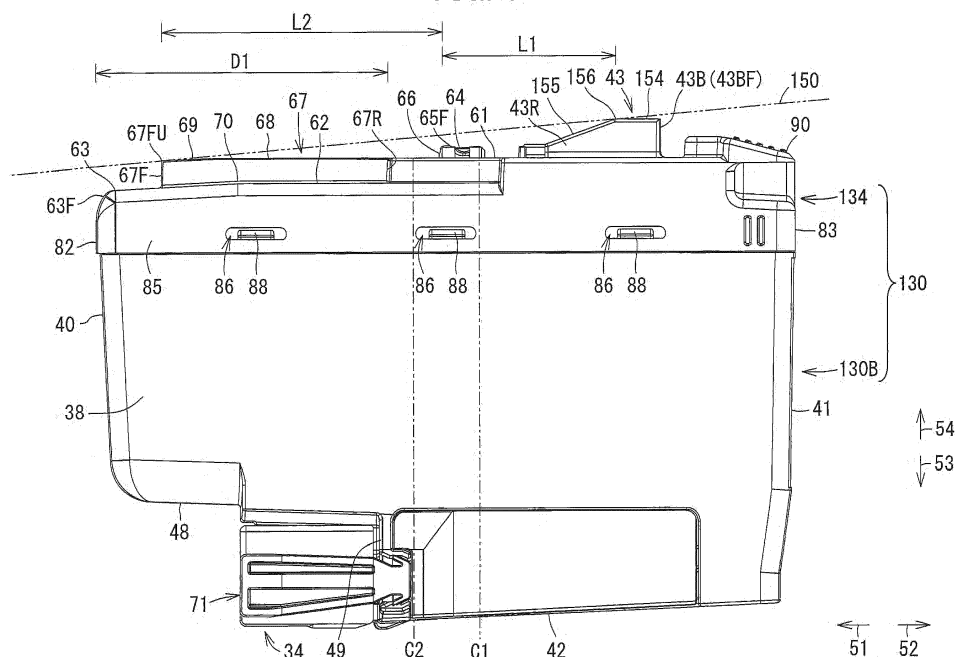
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(54) **LIQUID CARTRIDGE**

(57) A liquid cartridge includes a housing (130), a circuit board (64) including an electrode (65), and a liquid supply portion (34) extending from the housing (130) in a depth direction. The housing (130) includes a top wall (39), and first and second protrusions protruding upward from the top wall (39). The first protrusion (43) is positioned rearward but the second protrusion (67) is positioned frontward relative to the circuit board (64). The first protrusion (43) is higher than an upper edge of a

front end of the second protrusion (67). No part of the liquid cartridge is positioned higher in a height direction than an imaginary plane (150) in a region between a first point on the first protrusion and a second point on the second protrusion (the upper edge of the front end of the second protrusion) in the depth direction. The imaginary plane (150) passes through the first and second points, and extends perpendicularly to the depth direction.

**FIG. 5**



## Description

**[0001]** The present disclosure relates to a liquid cartridge including a housing having a liquid chamber therein, and a liquid supply portion for supplying liquid stored in the liquid chamber to an outside thereof.

**[0002]** There has been known a printer including a recording head for ejecting, through nozzles, ink supplied from an ink cartridge (for example, refer to Japanese Patent Application Publication No. 2019-64046). In this kind of printer, a new ink cartridge is to be mounted once the ink in the liquid cartridge is used up. The ink cartridge includes a housing having an ink chamber therein, and a light-blocking plate. The light-blocking plate is provided at a top surface of the housing, and is configured to block or attenuate light emitted in a left-right direction.

**[0003]** In a case that an ink cartridge is dropped onto a flat surface, such as a floor, and collides against the same, a posture of the ink cartridge may be changed while a plurality of portions of the ink cartridge successively comes into collision with the flat surface. Such a change in posture of the ink cartridge may cause scattering of ink adhered to the ink supply portion, and would possibly result in contamination of the floor.

**[0004]** In view of the foregoing, it is an object of the present disclosure to provide a liquid cartridge that is less likely to change a posture thereof upon collision against a flat plane.

(1) According to one aspect, the disclosure provides a liquid cartridge including a housing, a circuit board, and a liquid supply portion. The housing defines a liquid storage chamber therein. The circuit board includes an electrode. The liquid supply portion extends in a depth direction crossing a gravitational direction from the housing and having an opening facing forward in the depth direction. The liquid supply portion defines therein a liquid passage connecting the liquid storage chamber to the opening and is configured to allow liquid in the liquid storage chamber to flow out of the housing through the opening. The housing includes: a top wall at which the circuit board is provided; a first protrusion protruding upward from the top wall; and a second protrusion protruding upward from the top wall. The top wall faces upward and is positioned upward of the liquid supply portion in an upright posture of the liquid cartridge. The first protrusion is positioned rearward of the circuit board in the depth direction. The second protrusion is positioned forward of the circuit board in the depth direction, and extends in the depth direction, and has a front end facing forward in the depth direction. The first protrusion is positioned higher than an upper edge of the front end of the second protrusion in the upright posture of the liquid cartridge. The front end of the second protrusion is positioned forward of the opening of the liquid supply portion in the depth direction. In the upright posture of the liquid

cartridge, no part of the liquid cartridge is positioned higher in a height direction opposite the gravitational direction than an imaginary plane in a region between a first point on the first protrusion and a second point on the second protrusion in the depth direction, the second point being the upper edge of the front end of the second protrusion, the imaginary plane passing through each of the first point and the second point and extending in a width direction perpendicular to the depth direction and the gravitational direction. The first protrusion and the second protrusion are positioned below the imaginary plane.

With this structure, any outer surface of the liquid cartridge is located below the imaginary plane in the region between the first point on the first protrusion and the second point (the upper edge of the front end of the second protrusion) in the depth direction. Hence, when the liquid cartridge is dropped onto a flat plane such as a floor, the first protrusion first collides against the flat plane, and the upper edge of the front end of the second protrusion subsequently collides against the flat plane or the floor. Compared to a configuration without the second protrusion, there is a smaller change in posture of the housing upon collision of the dropped liquid cartridge against the flat plane or the floor. Thus, splash of ink through the opening of the liquid supply portion is less likely to occur.

(2) Preferably, in the above liquid cartridge according to the aspect (1), the top wall has a front end facing forward in the depth direction, the front end being positioned below the imaginary plane in the upright posture of the liquid cartridge.

With this structure, since the front end of the top wall is positioned below the imaginary plane, the front end of the top wall is less likely to be damaged when the liquid cartridge is dropped onto a flat surface or a floor.

(3) Preferably, in the above liquid cartridge according to the aspect (1) or (2), the first protrusion has an upper surface including the first point; and the housing defines a center point thereof in the depth direction; the upper surface of the first protrusion is positioned rearward relative to the center point of the housing in the depth direction; and the upper edge of the front end of the second protrusion is positioned forward relative to the center point of the housing in the depth direction.

(4) Preferably, in the above liquid cartridge according to any one of the aspects (1)-(3), the top wall supports the circuit board directly or indirectly.

(5) Preferably, in the above liquid cartridge according to any one of the aspects (1)-(4), the first protrusion includes a first protruding portion, a second protruding portion, and a third protruding portion. The first protruding portion extends in the depth direction and has a rear end facing backward in the depth direction. The second protruding portion extends in the depth

direction and is positioned to be spaced away from the first protruding portion in the width direction, the second protruding portion having a rear end facing backward in the depth direction. The third protruding portion extends in the width direction and connects the rear end of the first protruding portion to the rear end of the second protruding portion. Preferably, the second protrusion has a dimension in the depth direction that is greater than dimensions thereof in the gravitational direction and in the width direction.

With this structure, since the dimension of the second protrusion in the depth direction is greater than the dimensions thereof in the gravitational direction and width direction, the second protrusion is hard to get damaged even when the second protrusion is made into contact with a flat plane such as a floor as a result of a fall of the liquid cartridge onto the floor. Further, since the first protrusion is constituted by the first protruding portion and the second protruding portion connected to each other by the third protruding portion, the first protrusion has a higher impact-resistance than that of the second protrusion.

(6) Preferably, in the above liquid cartridge according to the aspect (6), the third protruding portion has an engaging surface facing backward in the depth direction for engagement with a part of a cartridge case in a state where the liquid cartridge is attached to the cartridge case.

With this structure, the backward-facing surface of the first protrusion can be used for positioning of the liquid cartridge in the cartridge case, without provision of a separate engaging member on the liquid cartridge.

(7) Preferably, in the above liquid cartridge according to any one of the aspects (1)-(6), the top wall of the housing has: a first part extending in the depth direction; and a second part sloping relative to the depth direction to extend downward and forward from the first part in the upright posture of the liquid cartridge. The first part and the second part define a boundary therebetween. The front end of the second protrusion is positioned on the second part. The second protrusion extends across the boundary between the first part and the second part.

With this structure, the sloped second part is positioned forward of the first part in the depth direction. Hence, even when the liquid cartridge is dropped onto a flat surface such as a floor, the sloped second part is less likely to collide against the floor. Further, since the second protrusion is positioned to extend across the boundary between the first part and the second part, the boundary can be reinforced by the second protrusion.

(8) Preferably, in the above liquid cartridge according to the aspect (8), the boundary is positioned below the imaginary plane in the upright posture of the liquid cartridge.

With this structure, even when the liquid cartridge is

dropped onto a flat surface such as a floor, the collision of the boundary of the top wall against the floor can be avoided. Thus, deformation of the top wall near the boundary can be suppressed.

(9) Preferably, in the above liquid cartridge according to any one of the aspects (1)-(9), an entirety of the circuit board is positioned below the imaginary plane in the upright posture of the liquid cartridge.

With this structure, since the circuit board as a whole is positioned below the imaginary plane, the circuit board is less likely to be damaged when the liquid cartridge is dropped onto a flat surface or a floor.

(10) Preferably, in the above liquid cartridge according to any one of the aspects (1)-(9), the housing includes a base and a cover. The base defines the liquid storage chamber therein, and the base has an upper end portion that is open upward in the upright posture of the liquid cartridge. The cover is in engagement with the base to cover the upper end portion of the base. The cover includes the top wall and supports the circuit board directly or indirectly.

(11) Preferably, in the above liquid cartridge according to the aspect (10), the base includes a plurality of engaging pawls for engagement with the cover; the cover further includes a peripheral wall extending downward from a periphery of the top wall, the peripheral wall being formed with a plurality of engaging holes each receiving a corresponding one of the engaging pawls; and the front end of the second protrusion is positioned further forward than any one of the engaging holes in engagement with the respective engaging pawls in the depth direction.

With this structure, the front end of the second protrusion, which tends to be applied with an external force, is positioned frontward than any one of the engaging pawls in the depth direction. Accordingly, the external force applied to the second protrusion is less likely to be transmitted to the engaging pawls.

(12) Preferably, in the above liquid cartridge according to the aspect (11), the second protrusion has a rear end opposite the front end in the depth direction; and the rear end of the second protrusion is positioned further rearward than one of the engaging holes that is positioned frontmost thereamong in the depth direction.

With this structure, since the second protrusion extends in the depth direction to have a length long enough to span an entire dimension of the frontmost engaging hole in the depth direction, the cover is further reinforced.

(13) Preferably, in the above liquid cartridge according to any one of the aspects (1)-(9), the housing further includes a peripheral wall extending downward from a periphery of the top wall. The peripheral wall includes: a front wall facing forward in the depth direction; a first side wall extending in the depth direction from the front wall; and a second side wall extending in the depth direction from the front wall

and spaced apart from the first side wall in the width direction. Preferably the front end of the second protrusion is positioned to be spaced apart from the front wall in the depth direction and from each of the first side wall and the second side wall in the width direction.

With this structure, since the front end of the second protrusion is spaced away from each of the front wall, the first side wall and the second side wall, an external impact applied onto the front wall and the first and second side walls is less likely to be transmitted to the second protrusion. Hence, there is a reduced likelihood that the second protrusion undergoes deformation by the impact.

(14) Preferably, in the above liquid cartridge according to any one of the aspects (1)-(13), the first protrusion includes: a sloped surface sloping relative to the depth direction; and a horizontal surface connected to the sloped surface and positioned backward of the sloped surface in the depth direction. The horizontal surface extends in the depth direction in the upright posture. The first point is on a boundary between the sloped surface and the horizontal surface.

(15) Preferably, in the above liquid cartridge according to any one of the aspects (1)-(14), the second protrusion is plate-shaped and has a front surface, a main upper surface, and a sub upper surface. The front surface extends from the top wall and faces forward in the depth direction. The front end of the second protrusion has the front surface. The main upper surface extends in the depth direction, and faces upward in the upright posture of the liquid cartridge. The sub upper surface extends from the main upper surface and slopes relative to the depth direction such that the sub upper surface slopes downward and forward in the upright posture of the liquid cartridge. The upper edge of the front end of the second protrusion is defined by the front surface and the sub upper surface.

With this structure, since the second protrusion is plate-shaped (for example, in a form of a wall) elongated in the depth direction, the second protrusion is hard to interfere with a component of a cartridge case during the attachment of the liquid cartridge into the cartridge case.

(16) Preferably, in the above liquid cartridge according to any one of the aspects (1)-(15), the electrode has a front edge facing forward in the depth direction; and the front edge being positioned rearward relative to a center point of the region in the depth direction. With this structure, since the front edge of the electrode is positioned further rearward than the center point of the region in the depth direction, clearance (a gap) can be reliably ensured between the imaginary plane and the circuit board (electrical contact) vertically even when the liquid cartridge is dropped onto a flat plane such as a floor. Accordingly, in a

case where the dropped liquid cartridge collides against the flat plane, the impact may hardly result in loss of any function in the circuit board.

(17) Preferably, in the above liquid cartridge according to any one of the aspects (1)-(16), the housing has a support portion supporting the circuit board and detachably attached to the housing.

(18) According to another aspect, the present disclosure provides a cartridge set configured of a plurality of the liquid cartridges according to any one of the aspects (1)-(17). The plurality of the liquid cartridges is configured to be accommodated in spaces different from one another in a cartridge case, and the second protrusions of the plurality of the liquid cartridges are at positions different from one another in the width direction.

With this structure, the positions of the second protrusions in the width direction can be made variant according to a type of the liquid cartridge, for example, a type and an initial amount of the ink stored in the liquid cartridge. Accordingly, a user can visually confirm the position of the second protrusion to identify the type of the liquid cartridge.

(19) According to still another aspect, the disclosure provides a liquid cartridge including a housing, a circuit board, and a liquid supply portion. The housing defines a liquid storage chamber therein. The housing includes a plurality of walls defining an outline of the liquid cartridge when viewed in a width direction crossing a gravitational direction. The plurality of walls includes: a pair of side walls; a front wall and a rear wall; and a top wall and a bottom wall. The pair of side walls is spaced away from each other in the width direction. The front wall and the rear wall are spaced away from each other in a depth direction perpendicular to the width direction. The top wall and the bottom wall are spaced away from each other in a height direction perpendicular to the width direction and the depth direction. The circuit board includes an electrode. The liquid supply portion is provided at the housing and has a liquid passage extending in the depth direction from the liquid storage chamber. The housing further includes: a first protrusion protruding upward from the top wall and positioned rearward of the circuit board in the depth direction; and a second protrusion protruding upward from the top wall and positioned forward of the circuit board in the depth direction. The second protrusion extends in the depth direction and has a front end facing forward in the depth direction. The first protrusion is positioned higher than an upper edge of the front end of the second protrusion. The front end of the second protrusion is positioned forward of the opening of the liquid supply portion in the depth direction. When viewed in the width direction, the outline of the liquid cartridge is positioned lower in the height direction than an imaginary line in an entire region between a first point on the first protrusion and a second

point on the second protrusion in the depth direction, the second point being the upper edge of the front end of the second protrusion, the imaginary line passing through each of the first point of the first protrusion and the second point of the second protrusion. The first protrusion and the second protrusion are positioned below the imaginary line.

**[0005]** With this structure, the same technical and operational advantages as those of the liquid cartridge according to the aspect (1) can be obtained.

**[0006]** The features of the above-described aspects (2)-(17) can be combined with the liquid cartridge according to the aspect (19) appropriately. As a result of the combination, the resultant liquid cartridge can obtain the same technical and operational advantages with regard to the liquid cartridge according to the aspect (1) combined with the features of above-described aspects (2)-(17).

**[0007]** The particular features and advantages of the embodiment(s) as well as other objects will become apparent from the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a vertical cross-sectional view schematically illustrating an internal configuration of a printer 10 according to one embodiment of the disclosure;

Fig. 2 is a horizontal cross-sectional view of a cartridge-attachment section 110 of the printer 10 according to the embodiment;

Fig. 3 is a vertical cross-sectional view illustrating a state where an ink cartridge 30 is attached to the cartridge-attachment section 110;

Fig. 4 is a rear perspective view of the ink cartridge 30;

Fig. 5 is a side view of the ink cartridge 30;

Fig. 6 is a side view illustrating a state where the ink cartridge 30 turned upside down collides against a floor 160 with a horizontal surface 154 of a protrusion 43;

Fig. 7 is a side view illustrating a state where the ink cartridge 30 turned upside down collides against the floor 160 with a boundary 156 of the protrusion 43 and an upper edge 67FU of a front end 67F of a rib 67;

Fig. 8 is a rear perspective view of the ink cartridge having the rib 67 at a different left-right position; and

Fig. 9 is a partial perspective view illustrating a structure for supporting an IC substrate 64 according to a variation of the embodiment.

**[0008]** Hereinafter, an embodiment of the disclosure will be described with reference to accompanying drawings. It would be apparent to those skilled in the art that the embodiment described below is merely an example of the present disclosure and modifications and variations may be made therein without departing from the scope of the disclosure.

**[0009]** In the following description, a frontward direc-

tion 51 is defined as a direction in which an ink cartridge 30 is inserted into a cartridge-attachment section 110. A rearward direction 52 is defined as a direction in which the ink cartridge 30 is extracted from the cartridge-attachment section 110.

**[0010]** In the following example, the ink cartridge 30 is inserted and extracted horizontally relative to the cartridge-attachment section 110. Hence, description will be made assuming that the frontward direction 51 and rearward direction 52 are horizontal, but the frontward direction 51 and rearward direction 52 may not be horizontal. Further, a downward direction 53 is defined as a direction perpendicular to the frontward direction 51 or the rearward direction 52. An upward direction 54 is defined as a direction opposite the downward direction 53. Further, a rightward direction 55 is defined as a direction perpendicular to the frontward direction 51 and the downward direction 53. A leftward direction 56 is defined as a direction opposite the rightward direction 55. Accordingly, in a state where the ink cartridge 30 is attached to the cartridge-attachment section 110 and is used therewith, the downward direction 53 coincides with the gravitational direction and the upward direction 54 is opposite the gravitational direction. That is, in the state where the ink cartridge 30 is attached to the cartridge-attachment section 110 and is used therewith, an outer surface of a main bottom wall 42 of a housing 130 faces downward in the gravitational direction.

**[0011]** Further, the rightward direction 55 and the leftward direction 56 are defined as directions perpendicular to the frontward direction 51 and the downward direction 53. More specifically, in the state where the ink cartridge 30 is attached to the cartridge-attachment section 110 and is used therewith, the rightward direction 55 is a direction toward the right and the leftward direction 56 is a direction toward the left when the ink cartridge 30 is viewed from a rear side thereof.

**[0012]** Note that a state where the ink cartridge 30 is attached to the cartridge-attachment section 110 and is used therewith implies a state where the ink cartridge 30 has been completely inserted into an attached position in the cartridge-attachment section 110. At the attached position of the ink cartridge 30, an ink supply tube 102 of the cartridge-attachment section 110 is inserted in an ink supply portion 34 of the ink cartridge 30 and is connected thereto. Further, hereinafter, a posture of the ink cartridge 30 in a state where the ink cartridge 30 is attached to the cartridge-attachment section 110 and is used thereby will be referred to as an "operable posture."

**[0013]** Further, in the following description, the frontward direction 51 and the rearward direction 52 may be collectively referred to as a front-rear direction. The upward direction 54 and the downward direction 53 may be collectively referred to as an up-down direction. The rightward direction 55 and the leftward direction 56 may be collectively referred to as a left-right direction.

**[0014]** In the following description, "facing frontward" includes facing in a direction including a frontward com-

ponent, and "facing rearward" includes facing in a direction including a rearward component. Further, "facing downward" includes facing in a direction including a downward component, and "facing upward" includes facing in a direction including an upward component. For example, "a front surface faces frontward" denotes that the front surface may face in a frontward direction, or the front surface may face in a direction inclined relative to the frontward direction.

[Overview of Printer 10]

**[0015]** As illustrated in Fig. 1, a printer 10 is an image-recording apparatus configured to record an image by selectively ejecting ink droplets onto a sheet based on an inkjet recording system. For example, the printer 10 is an inkjet printer. The printer 10 includes a recording head 21, an ink-supplying device 100, and an ink tube 20 connecting the recording head 21 to the ink-supplying device 100. The ink-supplying device 100 includes the cartridge-attachment section 110. To the cartridge-attachment section 110, the ink cartridge 30 is attachable. The cartridge-attachment section 110 has a surface formed with an opening 112. The ink cartridge 30 is inserted forward into the cartridge-attachment section 110 through the opening 112, and extracted rearward from the cartridge-attachment section 110 through the opening 112.

**[0016]** The ink cartridge 30 stores ink therein. For example, the ink cartridge 30 stores ink that the printer 10 can use for printing. In a state where the ink cartridge 30 has completely attached to the cartridge-attachment section 110, the ink cartridge 30 and the recording head 21 are connected to each other through the ink tube 20. The recording head 21 includes a damper chamber 28 for temporarily storing ink supplied through the ink tube 20. The recording head 21 is configured to eject the ink supplied from the damper chamber 28 through a plurality of nozzles 29. More specifically, a head control board provided in the recording head 21 is configured to selectively apply drive voltages to piezoelectric elements provided in correspondence with the plurality of nozzles 29. Thus, ink can be ejected selectively through the nozzles 29. That is, the recording head 21 is configured to consume the ink stored in the ink cartridge 30 attached to the cartridge-attachment section 110.

**[0017]** The printer 10 includes a sheet tray 15, a sheet feeding roller 23, a conveying roller pair 25, a platen 26, a discharge roller pair 27, and a sheet discharge tray 16. The sheet feeding roller 23 is configured to convey a sheet in the sheet tray 15 toward a conveying path 24. The sheet conveyed onto the conveying path 24 reaches the conveying roller pair 25. The conveying roller pair 25 is configured to convey the arrived sheet onto the platen 26. The recording head 21 is configured to selectively eject ink onto the sheet that is moving over the platen 26, thereby recording an image on the sheet. The sheet that have passed the platen 26 then arrives at the dis-

charge roller pair 27. The discharge roller pair 27 is configured to discharge the arrived sheet onto the sheet discharge tray 16 that is disposed at a downstream end of the conveying path 24.

[Ink-Supplying Device 100]

**[0018]** The printer 10 includes the ink-supplying device 100, as illustrated in Fig. 1. The ink-supplying device 100 is configured to supply ink to the recording head 21. As described above, the ink-supplying device 100 includes the cartridge-attachment section 110 to which the ink cartridge 30 is attachable. Incidentally, Fig. 1 depicts a state where attachment of the ink cartridge 30 to the cartridge-attachment section 110 is completed. In other words, in Fig. 1, the ink cartridge 30 is in an attached state. A posture of the ink cartridge 30 in this state is the operable posture.

[Cartridge-Attachment Section 110]

**[0019]** As illustrated in Figs. 1 through 3, the ink-supplying device 100 includes a cartridge case 101, and the ink supply tube 102. In the cartridge-attachment section 110, four kinds of the ink cartridges 30 corresponding to respective colors of cyan, magenta, yellow and black can be accommodated. Further, four of the ink supply tubes 102 are provided in correspondence with the four kinds of ink cartridges 30.

[Cartridge Case 101]

**[0020]** As depicted in Fig. 2, the cartridge case 101 constitutes a housing of the cartridge-attachment section 110. The cartridge case 101 is in a shape of a box and has a top surface 57, a bottom surface, a right side surface 107, a left side surface 108, an end surface 59, and the opening 112. The top surface 57 defines a ceiling which is an upper end of an internal space of the cartridge case 101. The bottom surface defines a bottom which is a lower end of the internal space of the cartridge case 101. The right side surface 107 defines a right edge of the internal space of the cartridge case 101. The left side surface 108 defines a left edge of the internal space of the cartridge case 101. The end wall 59 is connected to the top surface 57, the bottom surface, the right side surface 107 and the left side surface 108. The opening 112 is formed to oppose the end surface 59 in the front-rear direction in the cartridge case 101. The opening 112 can be exposed to a user-interface surface which is a surface that a user can face when using the printer 10.

**[0021]** The ink cartridge 30 is insertable into the cartridge case 101 through the opening 112, and is removable from the cartridge case 101 through the opening 112. In a bottom portion of the cartridge case 101, guide grooves 109 are formed. By a lower end of the ink cartridge 30 being inserted in the guide groove 109, the ink cartridge 30 is guided by the guide groove 109 in the

front-rear direction (a direction orthogonal to a sheet surface of Fig. 2). The cartridge case 101 also includes three plates 104 that partition the internal space into four different spaces elongated in the up-down direction. In each of the four spaces partitioned by the plates 104, one ink cartridge 30 is accommodated.

#### [Ink Supply Tube 102]

**[0022]** As illustrated in Figs. 2 and 3, the ink supply tube 102 is hollow cylindrical shaped, and is disposed at a lower end portion of the end surface 59 of the cartridge case 101. The ink supply tube 102 is disposed at a position corresponding to an ink supply portion 34 of the ink cartridge 30 attached to the cartridge-attachment section 110. The ink supply tube 102 protrudes rearward from the end surface 59 of the cartridge case 101, and has a tip end that is open rearward (opening 116).

**[0023]** In an internal space of the ink supply tube 102, a tube valve 114 and a coil spring 115 are accommodated. In the internal space of the ink supply tube 102, the tube valve 114 is movable in the frontward direction 51 and the rearward direction 52 between an open position for opening the opening 116 and a closing position for closing the opening 116. The coil spring 115 urges the tube valve 114 in a direction for moving the tube valve 114 toward the closing position, i.e., in the rearward direction 52. At the closing position, a tip end (rear end) of the tube valve 114 protrudes further in the rearward direction 52 than the opening 116.

#### [Lock Shaft 145]

**[0024]** As illustrated in Fig. 3, a lock shaft 145 is provided at the cartridge case 101 at a position near the top surface 57 and the opening 112 to extend in the left-right direction. The lock shaft 145 is a bar-like member extending in the left-right direction. The lock shaft 145 is columnar-shaped metal, for example. The lock shaft 145 has both ends in the left-right direction that are fixed to respective walls defining left and right end portions of the cartridge case 101 in the left-right direction. Accordingly, the lock shaft 145 does not make any movement, such as pivoting, relative to the cartridge case 101. The lock shaft 145 extends across the four spaces in which four of the ink cartridges 30 can be respectively accommodated. In each of the four spaces for accommodating one ink cartridge 30, a space is provided around the lock shaft 145. Hence, the lock shaft 145 is accessible by, for example, a rear surface 43BF of the ink cartridge 30 that is moving upward or rearward.

**[0025]** The lock shaft 145 functions to retain the ink cartridge 30 attached to the cartridge-attachment section 110 at the attached position. By the ink cartridge 30 being inserted in the cartridge-attachment section 110 and pivoted into the operable posture, the lock shaft 145 is engaged with the rear surface 43BF of a rear protruding portion 43B (see Fig. 4). Further, the lock shaft 145 re-

tains the ink cartridge 30 inside the cartridge-attachment section 110 against a pressing force of a coil spring 78 that pushes the ink cartridge 30 rearward.

**[0026]** As illustrated in Fig. 2, at the top surface 57 of the cartridge case 101, openings 111 are formed one for each of the four spaces partitioned by the plates 104. A gate 113 is exposed through a corresponding one of the openings 111. Each gate 113 has a slit 117 that is open downward and that extends in the front-rear direction. Left-right positions of the respective slits 117 of the gates 113 are different from one another depending on partitioning positions of the plates 104. The position of each slit 117 in each space coincides with a type of the ink cartridge 30 that is to be mounted in the space in the cartridge case 101. Accordingly, a rib 67 (see Fig. 4) of the ink cartridge 30 that is inserted into the correct space to which the ink cartridge 30 is to be attached in the cartridge case 101 can pass through the slit 117 of the gate 113 in the correct space. On the other hand, the rib 67 of the ink cartridge 30 that is inserted into a wrong space to which the ink cartridge 30 is not to be attached in the cartridge case 101 cannot pass through the slit 117 of the gate 113 in that wrong space.

#### [Overall Configuration of the Ink Cartridge 30]

**[0027]** The ink cartridge 30 is a container for storing ink as liquid. In the present embodiment, four of the ink cartridges 30 corresponding to respective colors of cyan, magenta, yellow and black can be attached to the cartridge-attachment section 110. Of the four ink cartridges 30, configurations of the three ink cartridges 30 corresponding to the colors of cyan, magenta and yellow are identical to one another, except the positions of the ribs 67 in the left-right direction, as illustrated in Figs. 4 and 8. On the other hand, the ink cartridge 30 corresponding to the color of black has a structure different from those of the other three ink cartridges 30 in that the ink cartridge 30 for black has a larger left-right width than those of the three ink cartridges 30. Other than this point, the configuration of the ink cartridge 30 for black is generally identical to those of the other three ink cartridges 30, except the left-right position of the rib 67.

**[0028]** Hereinafter, a structure of the ink cartridge 30 corresponding to one of the colors of cyan, magenta and yellow will be described.

**[0029]** The posture of the ink cartridge 30 depicted in Figs. 4 and 5 is a posture in which the ink cartridge 30 can be used, i.e., the operable posture. Hereinafter, the posture of the ink cartridge 30 illustrated in Figs. 4-5 will also be referred to as an upright posture, and description will be made assuming that the ink cartridge 30 is in its upright posture unless specified otherwise. That is, the upright posture of the ink cartridge 30 coincides with the operable posture of the ink cartridge 30 in which the ink cartridge 30 is attached to the cartridge-attachment section 110.

**[0030]** The ink cartridge 30 includes a lower base

130B, and an outer cover 134. The outer cover 134 is assembled to the lower base 130B to constitute the housing 130.

**[0031]** The housing 130 includes a front wall (front walls 40 and 82), a rear wall (rear walls 41 and 83), a top wall 39, and a bottom wall (bottom walls 42 and 48), and a pair of side walls (side walls 37, 84 and 38, 85).

**[0032]** The front wall of the housing 130 is a wall that faces frontward in the upright posture of the ink cartridge 30. The rear wall of the housing 130 is a wall that faces rearward in the upright posture of the ink cartridge 30. The top wall 39 of the housing 130 faces upward in the upright posture of the ink cartridge 30. The top wall 39 has a front end connected to an upper end of the front wall 82, and a rear end connected to an upper end of the rear wall 83.

**[0033]** The bottom wall of the housing 130 faces downward in the upright posture of the ink cartridge 30. The bottom wall has a front end connected to a lower end of the front wall 40, and a rear end connected to a lower end of the rear wall 41. In the present embodiment, the bottom wall of the housing 130 includes a step wall 49. In the present embodiment, the bottom wall includes a main bottom wall 42 and a sub bottom wall 48. In the bottom wall, the main bottom wall 42 is a wall connecting the lower end of the rear wall 41 to a lower end of the step wall 49. In the bottom wall, the sub bottom wall 48 is a wall connecting the lower end of the front wall 40 to an upper end of the step wall 49.

**[0034]** In the upright posture (operable posture) of the ink cartridge 30, a direction from the rear wall toward the front wall of the housing 130 is coincident with the frontward direction 51, and a direction from the front wall toward the rear wall of the housing 130 is coincident with the rearward direction 52. Further, in the upright posture (operable posture) of the ink cartridge 30, a direction from the top wall 39 toward the bottom wall of the housing 130 is coincident with the downward direction 53 (gravitational direction), and a direction from the bottom wall of the housing 130 to the top wall 39 is coincident with the upward direction 54. Further, in the upright posture (operable posture) of the ink cartridge 30, a direction from the side walls 38, 85 toward the side walls 37, 84 of the housing 130 is coincident with the rightward direction 55, and a direction from the side walls 37, 84 to the side walls 38, 85 of the housing 130 is coincident with the leftward direction 56. Further, when the ink cartridge 30 is attached to the cartridge-attachment section 110, an outer surface of the front wall of the housing 130 faces frontward; an outer surface of the rear wall of the housing 130 faces rearward; an outer surface of the bottom wall of the housing 130 faces downward; and an outer surface of the top wall 39 of the housing 130 faces upward.

**[0035]** As illustrated in Fig. 4, the ink cartridge 30, as a whole, has a flat shape whose dimensions in the up-down direction and front-rear direction are respectively greater than a dimension thereof in the left-right direction.

[Lower Base 130B]

**[0036]** As described above, the housing 130 includes the lower base 130B and the outer cover 134.

**[0037]** As illustrated in Fig. 3, the lower base 130B has a box-like shape that is open upward. In other words, the lower base 130B has an upper end portion formed with an opening. In the present embodiment, the lower base 130B is a container made of resin. Inside the lower base 130B, a first storage chamber 32 and a second storage chamber 33 are formed.

**[0038]** The lower base 130B includes, as outer walls, the front wall 40, the rear wall 41, the side wall 37, the side wall 38, the main bottom wall 42, and the sub bottom wall 48. A distance between the front wall 40 and the rear wall 41 is greater than a distance between the side wall 37 and the side wall 38. The front wall 40, the rear wall 41, the side wall 37, the side wall 38, the main bottom wall 42 and the sub bottom wall 48 define the first storage chamber 32.

**[0039]** In the upright posture of the ink cartridge 30, a surface of the lower base 130B facing frontward is the front wall 40, and a surface of the lower base 130B facing rearward is the rear wall 41. The side walls 37 and 38 respectively extend to cross the front wall 40 and the rear wall 41. The side walls 37 and 38 respectively connect the front wall 40, the rear wall 41, the main bottom wall 42 and the sub bottom wall 48. In the upright posture, the side wall 37 faces rightward, and the side wall 38 faces leftward.

**[0040]** As illustrated in Fig. 4, the main bottom wall 42 is sloped relative to the front-rear direction such that a rear end thereof is positioned higher than a front end thereof. The front end of the main bottom wall 42 is positioned frontward of the rear surface 43BF described later. The rear end of the main bottom wall 42 is connected to the lower end of the rear wall 41. That is, the main bottom wall 42 extends frontward from the lower end of the rear wall 41. The sub bottom wall 48 is positioned higher than and frontward of the main bottom wall 42.

**[0041]** As illustrated in Fig. 3, an inner cover 131 is also provided to close the opening in the upper end portion of the lower base 130B. In the present embodiment, two kinds of inner covers 131 and 132 close the opening in the upper end portion of the lower base 130B. A space between the inner covers 131 and 132 serves as an airflow path 72 for allowing the first storage chamber 32 to be open to an atmosphere. Of the two inner covers 131 and 132, the inner cover 131 is positioned below the inner cover 132 and defines a ceiling of the first storage chamber 32. The inner cover 131 is formed with a through-hole 146. Through the through-hole 146, the first storage chamber 32 and the space between the two inner covers 131 and 132 (i.e., the airflow path 72) is allowed to communicate with each other. Incidentally, the through-hole 146 can be opened and closed by a valve mechanism 147 provided at the inner cover 132.

**[0042]** As illustrated in Fig. 3, the outer cover 134 has



a box-like shape that is open downward. The outer cover 134 is coupled to the upper end portion of the lower base 130B such that the outer cover 134 covers the inner covers 131 and 132.

#### [Internal Structure of the Lower Base 130B]

**[0043]** As illustrated in Fig. 3, the first storage chamber 32, the second storage chamber 33, an ink valve chamber 35, and the airflow path 72 are formed inside the housing 130 (lower base 130B) of the ink cartridge 30.

**[0044]** The lower base 130B of the housing 130 further includes a lower wall 45. The lower wall 45 is a wall extending in the front-rear direction and the left-right direction. The lower wall 45 and the inner cover 131 oppose each other in the up-down direction. The first storage chamber 32 and the second storage chamber 33 are partitioned by the lower wall 45.

**[0045]** In the upright posture, the second storage chamber 33 is positioned below the first storage chamber 32 in an internal space of the housing 130 and functions to storing ink therein. A capacity of the second storage chamber 33 for accommodating ink therein is smaller than a capacity of the first storage chamber 32 for accommodating ink therein.

**[0046]** The second storage chamber 33 is in communication with the first storage chamber 32 through a communication port 47 formed in the lower wall 45. The communication port 47 is formed in a rear and right end portion of the lower wall 45. Further, the second storage chamber 33 is communication with the ink valve chamber 35 through a through-hole 99 formed in a partitioning wall 50 (see Fig. 3).

#### [Airflow Path 72]

**[0047]** As illustrated in Fig. 3, the airflow path 72 is a space that allows the first storage chamber 32 to communicate with the atmosphere. The space between the two inner covers 131 and 132 is in communication with the atmosphere through a through-hole (not shown) formed in the higher inner cover 132, and another through-hole formed in the outer cover 134. The airflow path 72 can be opened and closed by the valve mechanism 147. The valve mechanism 147 is configured to abut against a rib 118 of the cartridge case 101 (see Fig. 3) that protrudes downward from the top surface 57 of the cartridge case 101 during the attachment of the ink cartridge 30 to the cartridge case 101. As a result of the abutment against the rib 118, the valve mechanism 147 is pressed downward to open the airflow path 72.

#### [Ink Supply Portion 34]

**[0048]** As illustrated in Figs. 3 and 4, the ink supply portion 34 extends frontward from the housing 130, more specifically, from the step wall 49 of the lower base 130B. As illustrated in Fig. 3, the ink supply portion 34 includes

a hollow cylinder 75, a sealing 76, a valve 77, the coil spring 78, and a cap 79.

**[0049]** The cylinder 75 protrudes in the frontward direction 51 from the step wall 49. The cylinder 75 has a cylindrical-shaped contour. The cylinder 75 has a front end formed with an opening. The cylinder 75 defines an inner space therein that serves as the ink valve chamber 35. The ink valve chamber 35 extends in the front-rear direction. The cylinder 75 has a tip end portion that faces frontward. The tip end portion of the cylinder 75 is positioned below and rearward of the front wall 40.

**[0050]** The sealing 76 is a generally disk-shaped member. The sealing 76 is made of an elastic material such as rubber or elastomer. The sealing 76 is provided at the front end of the cylinder 75 so as to cover the opening in the front end. The sealing 76 has a center portion formed with a through hole that penetrates the same in the front-rear direction. A tubular-shaped inner peripheral surface defining the through hole provides a through-hole 73 in the sealing 76. The through-hole 73 has a diameter that is slightly smaller than an outer diameter of the ink supply tube 102.

**[0051]** The valve 77 and the coil spring 78 are accommodated in the ink valve chamber 35. The valve 77 is movable in the frontward direction 51 and rearward direction 52 so as to be capable of contacting and separating from the sealing 76. The coil spring 78 urges the valve 77 forward. Accordingly, without application of an external force, the valve 77 closes the through-hole 73 of the sealing 76.

**[0052]** As illustrated in Fig. 4, the cap 79 has an outer shape of a generally rectangular parallelepiped. The cap 79 is hollow. Incidentally, the cap 79 may have a shape other than the rectangular parallelepiped, provided that the cap 79 is a hollow member whose front and rear ends are opened. As illustrated in Fig. 3, the cap 79 has a front surface formed with an ink supply port 71. In a state where the cap 79 covers the cylinder 75 and the sealing 76, the ink valve chamber 35 is in communication with an outside of the ink cartridge 30 through the through-hole 73 of the sealing 76 and the ink supply port 71 of the cap 79.

**[0053]** As illustrated in Fig. 3, in the state where the cap 79 covers the cylinder 75 and the sealing 76, the sealing 76 is fixed while being nipped between the cap 79 and the cylinder 75. Further, a gap between the sealing 76 and cylinder 75, and a gap between the sealing 76 and the cap 79 are liquid-tightly sealed.

#### [Outer Cover 134]

**[0054]** As illustrated in Figs. 3 through 5, the outer cover 134 is positioned on top of the lower base 130B. In other words, the outer cover 134 is positioned higher than the ink supply portion 34. The outer cover 134 has a box-like shape that is open downward. The outer cover 134 includes the top wall 39, the front wall 82, the rear wall 83, the side wall 84, and the side wall 85. The front wall 82 is connected to the front end of the top wall 39, and

extend downward therefrom. The rear wall 83 is connected to the rear end of the top wall 39 and extends downward therefrom. The side wall 84 extends downward from a right end of the top wall 39 to connect the front wall 82 and the rear wall 83. The side wall 85 extends downward from a left end of the top wall 39 to connect the front wall 82 and the rear wall 83.

**[0055]** As illustrated in Fig. 4, the side wall 85 is formed with three engaging holes 86. Although not shown in the drawings, the side wall 84 is also formed with three engaging holes 86. In each of the side walls 84 and 85, the three engaging holes 86 are arranged to be spaced away from one another in the front-rear direction. The three engaging holes 86 formed in the side wall 84 and the three engaging holes 86 formed in the side wall 85 are respectively at the same front-rear positions overlapping with each other when viewed in the left-right direction.

**[0056]** With each of the engaging holes 86, an engaging pawl 88 of the lower base 130B is engaged. The outer cover 134 is thus coupled to the lower base 130B from above to cover the same. Incidentally, in the present embodiment, the engaging holes 86 are formed in the outer cover 134 and the engaging pawls 88 are formed at the lower base 130B. Alternatively, the engaging pawls 88 may be formed at the outer cover 134 and the engaging hole 86 may be formed in the lower base 130B. In a state where the outer cover 134 is assembled to the lower base 130B, the front walls 82 and 40 constitute the outer surface of the ink cartridge 30 facing frontward. Further, the rear walls 83 and 41 constitute the outer surface of the ink cartridge 30 facing rearward. Still further, the side walls 84 and 37, and the side walls 85 and 38 respectively constitute the outer surfaces of the ink cartridge 30 facing laterally.

**[0057]** The top wall 39 includes a first main top wall 61, a second main top wall 62, and a sub top wall 63. The first main top wall 61 is positioned rearward in the front-rear direction. The second main top wall 62 extends from the first main top wall 61 and is positioned frontward of the first main top wall 61. The sub top wall 63 extends from the second main top wall 62 and is positioned frontward of the second main top wall 62. The first main top wall 61 has an upper surface which is a flat plane extending in the left-right direction and front-rear direction. The second main top wall 62 has an upper surface which is a flat plane extending in the left-right direction and front-rear direction and positioned lower than the upper surface of the first main top wall 61. The sub top wall 63 has an upper surface which is a sloped flat plane extending in the left-right direction and sloping downward toward the front. Accordingly, the upper surface of the sub top wall 63 is positioned lower than the upper surface of the second main top wall 62.

**[0058]** As illustrated in Figs. 4 and 5, the first main top wall 61 is formed with a slot 44 extending in the front-rear direction. The slot 44 is positioned above the through-hole 146 of the inner cover 131.

**[0059]** On the first main top wall 61, a protrusion 43 is

formed to protrude upward. The protrusion 43 is immovable in the up-down direction and in the front-rear direction relative to the top wall 39. The protrusion 43 includes a right protruding portion 43R, a left protruding portion 43L, and the rear protruding portion 43B. The right protruding portion 43R and the left protruding portion 43L are positioned to be spaced away from each other in the left-right direction. The right protruding portion 43R and the left protruding portion 43L respectively extend in the front-rear direction. The rear protruding portion 43B extends in the left-right direction to connect rear ends of the right protruding portion 43R and the left protruding portion 43L. The right protruding portion 43R, the left protruding portion 43L and the rear protruding portion 43B define right, left and rear edges of the slot 44, respectively. The rear protruding portion 43B has the rear surface 43BF with which the lock shaft 145 is accessible.

**[0060]** The rear surface 43BF is a surface of the protrusion 43 facing rearward. The rear surface 43BF is positioned higher than the top wall 39. The rear surface 43BF extends in the up-down direction. The rear surface 43BF is a surface that can face rearward and contact the lock shaft 145 in a state where the ink cartridge 30 is attached to the cartridge-attachment section 110. By the rear surface 43BF facing rearward and contacting with the lock shaft 145, the ink cartridge 30 can be held in the cartridge-attachment section 110 against an urging force of the coil spring 78.

**[0061]** In the protrusion 43, the right protruding portion 43R and the left protruding portion 43L are formed frontward of the rear surface 43BF with the slot 44 interposed between the right protruding portion 43R and the left protruding portion 43L. Each of the right protruding portion 43R and the left protruding portion 43L has an upper surface configured of a horizontal surface 154 and a sloped surface 155. The horizontal surface 154 is connected to the rear surface 43BF. The sloped surface 155 is positioned frontward of the horizontal surface 154. The sloped surface 155 is connected to the horizontal surface 154. The sloped surface 155 faces upward and frontward. The sloped surface 155 is sloped relative to the front-rear direction such that a front end thereof is positioned lower than a rear end thereof. The rear surface 43BF and the sloped surface 155 are connected to each other via the horizontal surface 154. Thus, a boundary edge between the rear surface 43BF and the sloped surface 155 does not form a ridge-like shape. The lock shaft 145 can be guided smoothly to the rear surface 43BF by the sloped surface 155 and horizontal surface 154, while being in contact therewith, during the insertion of the ink cartridge 30 into the cartridge-attachment section 110.

**[0062]** On the first main top wall 61, an operation portion 90 is also provided at a position rearward of the rear surface 43BF. The operation portion 90 is adapted to be accessed and operated by a user. The operation portion 90 is formed integrally with the outer cover 134.

**[0063]** Incidentally, each of the outer surfaces of the front walls 40 and 82, the rear walls 41 and 83, the top

wall 39, the main bottom wall 42, the sub bottom wall 48, the side walls 37 and 84, and the side walls 38 and 85 need not be a single flat plane. That is, outer surfaces of the front walls 40 and 82 are surfaces that can be observed when the ink cartridge 30 in the upright posture is viewed from frontward thereof toward the rear, and that are positioned forward than a front-rear center of the ink cartridge 30 in the upright posture. Outer surfaces of the rear walls 41 and 83 are surfaces that can be observed when the ink cartridge 30 in the upright posture is viewed from rearward thereof toward the front, and that are positioned rearward than the front-rear center of the ink cartridge 30 in the upright posture. An outer surface of the top wall 39 (that is, outer surfaces of the first main top wall 61, the second main top wall 62, and the sub top wall 63) is a surface that can be observed when the ink cartridge 30 in the upright posture is viewed from above, and that is positioned upward of a center of the ink cartridge 30 in the upright posture with respect to the up-down direction. Outer surfaces of the main bottom wall 42 and the sub bottom wall 48 are surfaces that can be observed when the ink cartridge 30 in the upright posture is viewed from below, and that are positioned lower than the center of the ink cartridge 30 in the upright posture with respect to the up-down direction. The same can be applied to outer surfaces of the side walls 37, 38, 84 and 85, respectively.

**[0064]** Incidentally, the housing 130 of the ink cartridge 30 does not necessarily include the lower base 130B and the outer cover 134. Further, a chamber for storing ink need not be divided into the first storage chamber 32 and the second storage chamber 33. That is, the ink cartridge 30 may include a housing having a storage chamber therein that is defined by the top wall 39, the front wall 40, the rear wall 41, the side wall 37, the side wall 38, the main bottom wall 42 and the sub bottom wall 48.

**[0065]** As illustrated in Figs. 4 and 5, the rib 67 is formed on the upper surfaces of the second main top wall 62 and the sub top wall 63 to protrude upward. The rib 67 is immovable in the up-down direction and in the front-rear direction relative to the top wall 39. The rib 67 extends in the front-rear direction to span across the upper surfaces of the second main top wall 62 and sub top wall 63. The rib 67 is positioned forward of the protrusion 43. The rib 67 is positioned forward of an IC board 64 described later. The rib 67 has a flat plate-like shape whose front-rear dimension is larger than left-right and up-down dimensions thereof. The rib 67 has a front surface (front end 67F), a main upper surface 68, and a sub upper surface 69. The main upper surface 68 is a flat plane extending in the front-rear direction and left-right direction. The sub upper surface 69 is connected to the main upper surface 68 and positioned frontward of the main upper surface 68. The sub upper surface 69 is a sloped flat plane that is inclined relative to the front-rear direction to slope downward toward the front. The main upper surface 68 has a front-rear dimension that is larger than a front-rear dimension of the sub upper surface 69. The

sub upper surface 69 is positioned higher than the sub top wall 63.

**[0066]** As illustrated in Figs. 4 and 8, the left-right position of the rib 67 on the second main top wall 62 varies according to a type of the ink cartridge 30, such as a type and an initial amount of the ink stored in the ink cartridge 30. The rib 67 can pass through the slit 117 of the gate 113 when inserted into the right place in the cartridge-attachment section 110. However, the rib 67 cannot pass through a slit 117 of another gate 113 when inserted into a place (the another gate 113) to which the ink cartridge 30 should not be attached. Further, the user can visually confirm the left-right position of the rib 67 to identify the type of the ink cartridge 30.

[IC Board 64]

**[0067]** As illustrated in Figs. 4 and 5, the IC board 64 is disposed at the upper surface of the first main top wall 61 at a position between the rib 67 and the protrusion 43 in the front-rear direction. In other words, the IC board 64 is supported directly on the top wall 39 of the outer cover 134. More specifically, a support portion 66 is formed on the upper surface of the first main top wall 61 to protrude upward therefrom, and the IC board 64 is fixed to the outer cover 134 by being coupled to the support portion 66. The IC board 64 is electrically connected to three contacts 106 (see Fig. 3) during the insertion of the ink cartridge 30 into the cartridge-attachment section 110, and is also electrically connected to the contacts 106 in the state where the ink cartridge 30 is attached to the cartridge-attachment section 110.

**[0068]** The IC board 64 includes a substrate, an IC (not shown in the drawings), and three electrodes 65. The substrate supports the IC. The three electrodes 65 are formed on the substrate. The three electrodes 65 and the IC are electrically connected to each other. The three electrodes 65 respectively extend in the front-rear direction, and arrayed in the left-right direction. The three electrodes 65 are arranged on an upper surface of the substrate such that the electrodes 65 are exposed to allow electrical access thereto. With this configuration, the three contacts 106 of the cartridge case 101 can directly make contact with upper surfaces of the three electrodes 65, respectively. The IC is an integrated circuit, and readably stores data indicating information relating to the ink cartridge 30, such as a lot number, a manufacturing date, and a color of the ink. Incidentally, the substrate may be a so-called rigid substrate or may be a flexible substrate having flexibility. Further, the number of electrodes 65 is not limited, and may be four, for example.

[Position of Each Element in the Ink Cartridge 30]

**[0069]** Hereinafter, with reference to the posture of the ink cartridge 30 illustrated in Fig. 5, positions of the respective elements in a state where the ink cartridge 30 is viewed in the left-right direction will be described.

**[0070]** The horizontal surface 154, which is the upper surface of the protrusion 43, is positioned higher than an upper edge 67FU of a front end 67F of the rib 67. The front end 67F of the rib 67 is defined as a front surface extending upward from the sub top wall 63 and facing frontward. The upper edge 67FU is a boundary between the sub upper surface 69 and the front surface (front end 67F) extending upward from the sub top wall 63 and facing frontward. The horizontal surface 154 of the protrusion 43 is positioned rearward of a center point C1 of the housing 130 in the front-rear direction. The protrusion 43 is positioned on the upper surface of the first main top wall 61. The upper edge 67FU of the front end 67F of the rib 67 is positioned frontward of the center point C1. The front end 67F of the rib 67 is positioned frontward of the ink supply port 71 of the ink supply portion 34. The front end 67F of the rib 67 is positioned at the sub top wall 63. More specifically, the front end 67F of the rib 67 is positioned to be spaced apart from the front wall 82 of the front-rear direction and from each of the side walls 84 and 85 in the left-right direction. That is, the front end 67F of the rib 67 is positioned away from a periphery of the top wall 39 with respect to the front-rear direction and left-right direction.

**[0071]** The front end 67F of the rib 67 is positioned forward than any one of the engaging holes 86. A rear end 67R of the rib 67 (i.e., the end opposite the front end 67F in the front-rear direction) is positioned further rearward than one of the engaging holes 86 which is positioned frontmost thereamong in the front-rear direction. The rib 67 extends to span more than a half of a front-rear dimension D1 which is a sum of front-rear dimensions of the upper surfaces of the second main top wall 62 and sub top wall 63. With this structure, since the upper wall 39 of the outer cover 134 is reinforced by the rib 67, the upper wall 39 is hard to deform even when an external force is applied thereto. Accordingly, peripheral walls (side walls 84 and 85) of the outer cover 134 is restrained from deforming in such a way that a gap distance in the left-right direction between the side walls 84 and 85 is enlarged, and, hence, engagement between the engaging pawls 88 and the engaging holes 86 is less likely to be released.

**[0072]** In Fig. 5, an imaginary plane 150 is indicated by a phantom line. The imaginary plane 150 passes through each of a first point and a second point. Here, the first point is a point on the upper surface of the protrusion 43. More specifically, in the present embodiment, the first point on the upper surface of the protrusion 43 is on a boundary 156 between the horizontal surface 154 and the sloped surface 155. In other words, the first point is a highest point on the upper surface of protrusion 43 in the present embodiment. The second point in the present embodiment is defined as the upper edge 67FU of the front end 67F of the rib 67. The imaginary plane 150 also extends in the left-right direction. Note that the protrusion 43 and rib 67 are located below the imaginary plane 150, meaning that the imaginary plane 150 is as-

sumed not to cross the protrusion 43 and the rib 67. Hence, in a side view of the ink cartridge 30 depicted in Fig 5, the imaginary plane 150 is in contact with the protrusion 43 at the boundary 156, and in contact with the rib 67 at the upper edge 67FU.

**[0073]** An entirety of the outer surface (outline) of the ink cartridge 30 is positioned below the imaginary plane 150 in a region between the first point (the boundary 156 of the protrusion 43) and the second point (the upper edge 67FU of the front end 67F of the rib 67) in the front-rear direction. In other words, no part of the ink cartridge 30 is positioned higher than the imaginary plane 150 in the region between the first point (the boundary 156) and the second point (the upper edge 67FU) in the front-rear direction. Accordingly, a boundary 70 between the upper surface of the second main top wall 62 and the upper surface of the sub top wall 63 is positioned below the imaginary plane 150. Further, an entirety of the IC board 64 is positioned below the imaginary plane 150. Further, the front end of the top wall 39, that is, a front end 63F of the sub top wall 63, is positioned below the imaginary plane 150.

**[0074]** Here, the term "part" of the ink cartridge 30 may be: any part integrally formed with the housing 130; any part detachably connected to the housing 130; or any part belonging to a body that is to be attached to the housing 130 when the ink cartridge 30 is mounted in and used in the printer 10.

**[0075]** Further, a front edge 65F of each electrode 65 in the IC board 64 is positioned rearward of a center point C2 in the front-rear direction of the region between the first point (the boundary 156 of the protrusion 43) and the second point (the upper edge 67FU of the front end 67F of the rib 67) each of which the imaginary plane 150 passes through. That is, a distance between the center point C2 and the first point in the front-rear direction is equal to a distance between the center point C2 and the second point in the front-rear direction.

**[0076]** A distance L1 in the front-rear direction from the front edges 65F of the electrodes 65 in the IC board 64 to the boundary 156 (the first point, i.e., a point of contact between the protrusion 43 and the imaginary plane 150), is shorter than a distance L2 in the front-rear direction from the front edges 65F of the electrodes 65 on the IC board 64 to the upper edge 67FU of the front end 67F of the rib 67 (the second point, i.e., a point of contact between the rib 67 and the imaginary plane 150). That is, an equality  $L1 < L2$  is satisfied.

**[0077]** Further, referring to Fig. 5, in a side view of the ink cartridge 30 in the left-right direction, the imaginary plane 150 can also be defined as an imaginary line that includes at least the following two points: the first point (the boundary 156 of the protrusion 43); and the second point (the upper edge 67FU of the front end 67F of the rib 67). At this time, in an entire region in the front-rear direction from the front wall 40 (frontmost edge of the housing 130) to the rear wall 41 (rearmost edge of the housing 130), a contour of the ink cartridge 30 is posi-

tioned below the imaginary plane 150 (the phantom line in Fig. 5).

**[0078]** The distance L1 in the front-rear direction from the front edges 65F of the electrodes 65 in the IC board 64 to the boundary 156 of the protrusion 43 included in the imaginary line (imaginary plane 150) is shorter than the distance L2 in the front-rear direction from the front edges 65F of the electrodes 65 in the IC board 64 to the upper edge 67FU of the rib 67 included in the imaginary line (imaginary plane 150).

**[0079]** Further, the horizontal surface 154, which is the upper surface of the protrusion 43, is positioned closer to the rearmost edge of the housing 130 than to the frontmost edge of the housing 130 in the front-rear direction. The sub upper surface 69 of the rib 67 is positioned closer to the frontmost edge of the housing 130 than to the rearmost edge of the housing 130 in the front-rear direction.

#### [Technical Advantages of the Embodiment]

**[0080]** According to the ink cartridge 30 of the described embodiment, no part of the ink cartridge 30 is positioned higher than the imaginary plane 150 in the region in the front-rear direction between the first point (the boundary 156 of the protrusion 43) and the second point (the upper edge 67FU of the front end 67F of the rib 67). That is, an outer surface of any part of the ink cartridge 30 (outline of the liquid cartridge 30) is located below the imaginary plane 150 in the region between the first point (the boundary 156 of the protrusion 43) and the second point (the upper edge 67FU of the front end 67F of the rib 67) in the front-rear direction. Hence, when the ink cartridge 30 drops upside down onto a floor 160, the horizontal surface 154 of the protrusion 43, among others, first collides against the floor 160, as depicted in Fig. 6. Thereafter, the ink cartridge 30 pivots clockwise in Fig. 6, due to the gravitational force or acceleration thereof, and the upper edge 67FU of the front end 67F of the rib 67 then collides against the floor 160, as illustrated in Fig. 7. With this structure, compared to a configuration where the ink cartridge 30 were without the rib 67, there is a smaller change in posture of the housing 130 (angular rotation) upon collision of the dropped ink cartridge 30 against the floor 160. Thus, splash of ink through the ink supply port 71 of the ink supply portion 34 is less likely to occur. Incidentally, a state depicted in Fig. 7 is a state where the protrusion 43 and the rib 67 of the ink cartridge 30 are in contact with the same plane (i.e., the floor 160, or the imaginary plane 150). In this state, a gap is formed between the imaginary plane 150 and the IC board 64 vertically.

**[0081]** Further, in the ink cartridge 30 of the present embodiment, the front end 67F of the rib 67 is positioned forward of the ink supply port 71 of the ink supply portion 34 in the frontward direction 51. That is, the front-rear dimension of the rib 67 can be made longer, compared to a conventional cartridge whose ink supply portion is positioned forward the front end 67F of the rib 67.

**[0082]** In an attempt to increase a volume of a storage chamber, an ink supply portion tends to be arranged to a position further forward, i.e., in a direction away from the protrusion 43, as in the above-mentioned conventional cartridge. When this conventional cartridge is dropped onto the floor 160, the protrusion 43 first comes into contact with the floor 160 and subsequently the rib 67 comes into contact with the floor 160 as described earlier. While the protrusion 43 and the rib 67 sequentially collide against the floor 160, the ink cartridge may pivot about the protrusion 43. During the pivoting of this ink cartridge, rotational movement is applied to the ink supply portion 34 positioned frontward than the front end 67F of the rib 67. As a result, leakage of ink through the ink supply port 71 of the ink supply portion 34 is likely to occur.

**[0083]** In contrast, in the ink cartridge 30 according to the present embodiment, the front end 67F of the rib 67 is positioned forward of the ink supply portion 34 provided at the housing 130 (lower base 130B) defining the first and second storage chambers 32, 33 therein. With this structure of the embodiment, compared to the above conventional cartridge, the pivoting amount (amount of angular rotation) of the ink cartridge 30 can be made smaller when the ink cartridge 30 is dropped onto the floor 160. Thus, rotational moment imparted on the ink supply portion 34 at the time of collision against the floor 160 can also be made smaller, thereby reducing a risk of ink leakage through the ink supply port 71. The ink cartridge 30 according to the present embodiment can thus suppress occurrence of ink leakage through ink supply portion 34 at the time of dropping onto the floor 160, without decrease in volume of the storage chamber in the housing 130.

**[0084]** Further, the longer front-rear dimension of the rib 67 of the present embodiment can also serve to mitigate the impact to be transmitted to the top wall 39 upon collision of the rib 67 against a flat plane such as the floor 160, and can provide an enhanced strength to the top wall 39 of the housing 130.

**[0085]** Still further, in the present embodiment, the protrusion 43 and the rib 67 protrude upward from the top wall 39 and are immovable in the up-down direction and relative to the top wall 39. The IC board 64 is positioned between the protrusion 43 and the rib 67 in the front-rear direction and is lower than the imaginary plane 150 passing through each of the first point (the boundary 156 on the upper surface of the protrusion 43) and the second point (the upper edge 67FU of the front end 67F of the rib 67) and extending in the left-right direction. With this structure, when the ink cartridge 30 is dropped onto a flat plane such as the floor 160, a gap (clearance) can be reliably formed between the flat plane (the floor 160) and the IC board 64. Accordingly, the IC board 64 can be reliably protected from the impact at the time of fall of the ink cartridge 30 onto the floor 160.

**[0086]** Further, the front end 63F of the sub top wall 63 is positioned below the imaginary plane 150. Accordingly,

the front end 63F of the sub top wall 63 is less likely to be damaged when being dropped on the floor 160.

**[0087]** Further, since the rib 67 is in a form of a wall elongated in the front-rear direction, the rib 67 is hard to interfere with a component of the cartridge case 101 during the attachment of the ink cartridge 30 into the cartridge case 101. Further, since the front-rear dimension of the rib 67 is greater than the vertical dimension thereof, the rib 67 is hard to get damaged even when the rib 67 is made into contact with the floor 160 as a result of a fall of the ink cartridge 30 onto the floor 160. Further, the protrusion 43 is constituted by the right protruding portion 43R and the left protruding portion 43L connected to each other by the rear protruding portion 43B. Accordingly, the protrusion 43 has a higher impact-resistance than that of the rib 67.

**[0088]** Further, the front edges 65F of the electrodes 65 are positioned further rearward than the center point C2. Hence, clearance (a gap) can be reliably ensured between the imaginary plane 150 and the IC board 64 (electrodes 65) in the up-down direction. With this structure, in a case where the ink cartridge 30 is dropped and collides against a flat plane and, for example, the IC board 64 abuts against the floor 160, the impact may hardly result in loss of any function in the IC board 64.

**[0089]** Further, the outer cover 134 includes the front wall 82 and the side walls 84 and 85 as a peripheral wall extending downward from the periphery of the top wall 39. The front end 67F of the rib 67 is positioned to be spaced apart from the front wall 82 in the front-rear direction and from each of the side walls 84 and 85 in the left-right direction. With this structure, since the front end 67F of the rib 67 is spaced away from each of the front wall 82 and the side walls 84 and 85, an external impact applied onto the front wall 82 and the side walls 84, 85 is less likely to be transmitted to the rib 67. Hence, deformation of the rib 67 resulting from the impact can be suppressed.

[Modifications]

**[0090]** In the depicted embodiment, the support portion 66 is provided on the first main top wall 61 of the outer cover 134, and the first main top wall 61 directly supports the IC board 64. However, instead of the support portion 66, a separate supporting member may be assembled to the first main top wall 61 for supporting the IC board 64. That is, the first main top wall 61 may support the IC board 64 indirectly, rather than directly. Incidentally, the supporting member detachably attached to the top wall 39 for supporting the IC board 64 may constitute the "part" of the ink cartridge 30 that is positioned below the imaginary plane 150 in the region between the first point and the second point in the front-rear direction (see paragraph [0107]). Thus, providing such detachable "part" for supporting the IC board 64 separately from the housing 130 can prevent the IC board 64 from directly colliding against a flat plane such as the floor 160, after the pro-

trusion 43 abuts on the floor 160 when the ink cartridge 30 is dropped onto the floor 160.

**[0091]** Further, the IC board 64 as a whole, which the support portion 66 supports, may not necessarily be exposed to the outside. For example, as illustrated in Fig. 9, only a portion of the IC board 64 at which the electrodes 65 are positioned may be exposed to the outside of the support portion 66, while a remaining portion of the IC board 64 may be accommodated in an interior of the support portion 66. Here, the support portion 66 need not be fixed to the top wall 39, but may be a separate member detachably attachable to the top wall 39 for supporting the IC board 64.

**[0092]** Further, in the above-described embodiment, the front edge 65F of each electrode 65 in the IC board 64 is positioned further rearward than the front-rear center point C2 in the region in the front-rear direction between the first point (boundary 156 of the protrusion 43) and the second point (the upper edge 67FU of the front end 67F of the rib 67) with each of which the imaginary plane 150 is in contact. Further preferably, a front edge of the IC board 64 may also be positioned further rearward than the center point C2.

**[0093]** Incidentally, in the present embodiment, the protrusion 43 and rib 67 both protrude upward from the top wall 39. That is, the protrusion 43 and rib 67 are integrally formed with the top wall 39. However, the protrusion 43 and the rib 67 (the first protrusion and second protrusion of the disclosure) need not be integral with the top wall 39 of the outer cover 134, but may be configured as members detachably connected to the top wall 39. That is, the first protrusion and second protrusion of the disclosure may be provided separately from the top wall 39 and penetrate vertically through the top wall 39 (for example, through a through-hole in the top wall 39), so that the first and second protrusions protrude upward relative to the top wall 39.

**[0094]** Further, in the above-described ink cartridge 30, the rear surface 43BF of the protrusion 43 is in engagement with the lock shaft 145 in the state where the ink cartridge 30 is attached to the cartridge case 101. Alternatively, the ink cartridge 30 may be retained in the attached state relative to the cartridge case 101 by engagement or contact of a portion of the ink cartridge 30 other than the protrusion 43 with a component of the cartridge case 101.

**[0095]** Further, in the depicted embodiment, the valve mechanism 147 is positioned between the right protruding portion 43R and the left protruding portion 43L of the protrusion 43. However, the valve mechanism 147 and airflow path 72 may be provided at positions away from the protrusion 43. If this is the case, the right protruding portion 43R and left protruding portion 43L of the protrusion 43 may only function to provide a space for receiving the rib 118 of the cartridge case 101 during the attachment of the ink cartridge 30 to the cartridge case 101.

**[0096]** In the depicted embodiment, the ink is used for description as an example of liquid. However, instead of

the ink, a pretreatment liquid that is to be ejected onto sheets prior to ink during a printing operation may be stored in a liquid cartridge. Alternatively, cleaning water for cleaning the recoding head 21 may be stored in the liquid cartridge. That is, the ink cartridge 30 of the disclosure need not be a cartridge for storing ink, but may be a cartridge for storing liquid to be consumed in the printer 10.

< Remarks >

**[0097]** In the present disclosure, the ink cartridge 30 is an example of a liquid cartridge. The housing 130 is an example of a housing. The IC board 64 is an example of a circuit board. The electrodes 65 are an example of an electrode. The ink supply portion 34 is an example of a liquid supply portion. The ink valve chamber 35 is an example of a liquid passage. The top wall 39 is an example of a top wall. The protrusion 43 is an example of a first protrusion. The rib 67 is an example of a second protrusion. The front end 67F is an example of a front end of the second protrusion. The upper edge 67FU is an example of an upper edge of the front end of the second protrusion. The horizontal surface 154 and sloped surface 155 of the protrusion 43 are an example of an upper surface of the first protrusion. The imaginary plane 150 is an example of an imaginary line. The rear surface 43BF is an example of an engaging surface. The first main top wall 61 and second main top wall 62 are an example of a first part of the top wall. The sub top wall 63 is an example of a second part of the top wall. The main upper surface 68 is an example of a main upper surface of the second protrusion. The rear end 67R is an example of a rear end of the second protrusion. The sub upper surface 69 is an example of a sub upper surface of the second protrusion. The center point C1 is an example of a center point of the housing in the depth direction. The lower base 130B is an example of a base. The outer cover 134 is an example of a cover. The engaging holes 86 are an example of engaging holes. The engaging pawls 88 are an example of engaging pawls. The frontward direction is an example of a depth direction. The rightward direction 55 and leftward direction 56 are an example of a width direction. The downward direction 53 is an example of a gravitational direction. The upward direction 54 is an example of a height direction.

## Claims

### 1. A liquid cartridge comprising:

a housing (130) defining a liquid storage chamber (32, 33) therein;  
a circuit board (64) including an electrode (65);  
and  
a liquid supply portion (34) extending in a depth direction (51) crossing a gravitational direction

(53) from the housing and having an opening (71) facing forward in the depth direction, the liquid supply portion defining therein a liquid passage (35) connecting the liquid storage chamber to the opening and configured to allow liquid in the liquid storage chamber to flow out of the housing through the opening, wherein the housing (130) comprises:

a top wall (39) at which the circuit board is provided, the top wall facing upward and being positioned upward of the liquid supply portion in an upright posture of the liquid cartridge;

a first protrusion (43) protruding upward from the top wall and positioned rearward of the circuit board in the depth direction; and

a second protrusion (67) protruding upward from the top wall and positioned forward of the circuit board in the depth direction, the second protrusion extending in the depth direction and having a front end (67F) facing forward in the depth direction,

wherein the first protrusion (43) is positioned higher than an upper edge (67FU) of the front end (67F) of the second protrusion (67) in the upright posture of the liquid cartridge;

wherein the front end (67) of the second protrusion (67) is positioned forward of the opening (71) of the liquid supply portion (34) in the depth direction, and

wherein, in the upright posture of the liquid cartridge, no part of the liquid cartridge is positioned higher in a height direction (54) opposite the gravitational direction (53) than an imaginary plane (150) in a region between a first point (156) on the first protrusion (43) and a second point (67FU) on the second protrusion (67) in the depth direction, the second point being defined as the upper edge of the front end (67F) of the second protrusion (67), the imaginary plane (150) passing through each of the first point and the second point and extending in a width direction perpendicular to the depth direction and the gravitational direction, the first protrusion (43) and the second protrusion (67) being positioned below the imaginary plane (150).

2. The liquid cartridge according to claim 1, wherein the top wall (39) has a front end (63F) facing forward in the depth direction, the front end being positioned below the imaginary plane (150) in the upright posture of the liquid cartridge.

3. The liquid cartridge according to claim 1 or 2, wherein the first protrusion (43) has an upper surface (154,

- 155) including the first point (156), wherein the housing defines a center point (C1) thereof in the depth direction, and the upper surface (154, 155) of the first protrusion (43) is positioned rearward relative to the center point (C1) of the housing (130) in the depth direction, and wherein the upper edge (67FU) of the front end (67F) of the second protrusion (67) is positioned forward relative to the center point (C1) of the housing (130) in the depth direction.
4. The liquid cartridge according to any one of claims 1 to 3, wherein the top wall (39) supports the circuit board directly or indirectly.
  5. The liquid cartridge according to any one of claims 1 to 4, wherein the first protrusion (43) comprises:
    - a first protruding portion (43L) extending in the depth direction and having a rear end facing backward in the depth direction;
    - a second protruding portion (43R) extending in the depth direction and positioned to be spaced away from the first protruding portion in the width direction, the second protruding portion having a rear end facing backward in the depth direction; and
    - a third protruding portion (43B) extending in the width direction and connecting the rear end of the first protruding portion to the rear end of the second protruding portion, and
    - wherein the second protrusion (67) has a dimension in the depth direction that is greater than dimensions thereof in the gravitational direction and in the width direction.
  6. The liquid cartridge according to claim 5, wherein the third protruding portion (43B) has an engaging surface (43BF) facing backward in the depth direction for engagement with a part of a cartridge case in a state where the liquid cartridge is attached to the cartridge case.
  7. The liquid cartridge according to any one of claims 1 to 6, wherein the top wall (39) of the housing (130) comprises:
    - a first part (61, 62) extending in the depth direction; and
    - a second part (63) sloping relative to the depth direction to extend downward and forward from the first part in the upright posture of the liquid cartridge, the first part and the second part defining a boundary (70) therebetween, wherein the front end (67F) of the second protrusion (67) is positioned on the second part (63), and the second protrusion (67) extends across the boundary (70) between the first part
  - and the second part (63).
  8. The liquid cartridge according to claim 7, wherein the boundary (70) is positioned below the imaginary plane (150) in the upright posture of the liquid cartridge.
  9. The liquid cartridge according to any one of claims 1 to 8, wherein an entirety of the circuit board (64) is positioned below the imaginary plane (150) in the upright posture of the liquid cartridge.
  10. The liquid cartridge according to any one of claims 1 to 9, wherein the housing (130) comprises:
    - a base (130B) defining the liquid storage chamber therein, the base having an upper end portion that is open upward in the upright posture of the liquid cartridge; and
    - a cover (134) in engagement with the base (130B) to cover the upper end portion of the base, the cover including the top wall and supporting the circuit board directly or indirectly.
  11. The liquid cartridge according to claim 10, wherein the base (130B) comprises a plurality of engaging pawls (88) for engagement with the cover (134), and wherein the cover (134) further includes a peripheral wall (82, 83, 84, 85) extending downward from a periphery of the top wall (39), the peripheral wall being formed with a plurality of engaging holes (86) each receiving a corresponding one of the engaging pawls (88), and wherein the front end (67F) of the second protrusion (67) is positioned further forward than any one of the engaging holes (86) in engagement with the respective engaging pawls (88) in the depth direction.
  12. The liquid cartridge according to claim 11, wherein the second protrusion (67) has a rear end (67R) opposite the front end (67F) in the depth direction, and the rear end (67R) of the second protrusion (67) is positioned further rearward than one of the engaging holes (86) that is positioned frontmost thereamong in the depth direction.
  13. The liquid cartridge according to claim 1, wherein the housing (130) further comprises a peripheral wall (82, 83, 84, 85) extending downward from a periphery of the top wall (39), the peripheral wall comprising:
    - a front wall (82) facing forward in the depth direction;
    - a first side wall (84) extending in the depth direction from the front wall (82); and
    - a second side wall (85) extending in the depth direction from the front wall (82) and spaced



apart from the first side wall in the width direction, wherein the front end (67F) of the second protrusion is positioned to be spaced apart from the front wall (82) in the depth direction and from each of the first side wall (84) and the second side wall (85) in the width direction. 5

14. The liquid cartridge according to any one of claims 1 to 13, wherein the first protrusion (43) comprises: 10

a sloped surface (155) sloping relative to the depth direction (51); and  
 a horizontal surface (154) connected to the sloped surface (155) and positioned backward of the sloped surface (155) in the depth direction (51), the horizontal surface (154) extending in the depth direction (51) in the upright posture, and  
 wherein the first point (156) is on a boundary (156) between the sloped surface (155) and the horizontal surface (154). 15 20

15. The liquid cartridge according to any one of claims 1 to 14, wherein the second protrusion is plate-shaped and has: 25

a front surface (67F) extending from the top wall and facing forward in the depth direction, the front end of the second protrusion having the front surface; 30  
 a main upper surface (68) extending in the depth direction, the main upper surface facing upward in the upright posture of the liquid cartridge; and  
 a sub upper surface (69) extending from the main upper surface and sloping relative to the depth direction, the sub upper surface (69) sloping downward and forward in the upright posture of the liquid cartridge, and  
 wherein the upper edge (67FU) of the front end (67F) of the second protrusion (67) is defined by the front surface (67F) and the sub upper surface (69). 35 40 45

16. The liquid cartridge according to any one of claims 1 to 15, wherein the electrode (65) has a front edge (65F) facing forward in the depth direction, the front edge (65F) being positioned rearward relative to a center point (C2) of the region (L1+L2) in the depth direction. 50

17. A cartridge set comprising a plurality of the liquid cartridges (30) according to any one of claims 1 to 16, wherein the plurality of the liquid cartridges (30) is configured to be accommodated in spaces different from one another in a cartridge case, and the second protrusions (67) of the plurality of the liquid cartridges (30) are at positions different from one another in the width direction. 55

FIG. 1

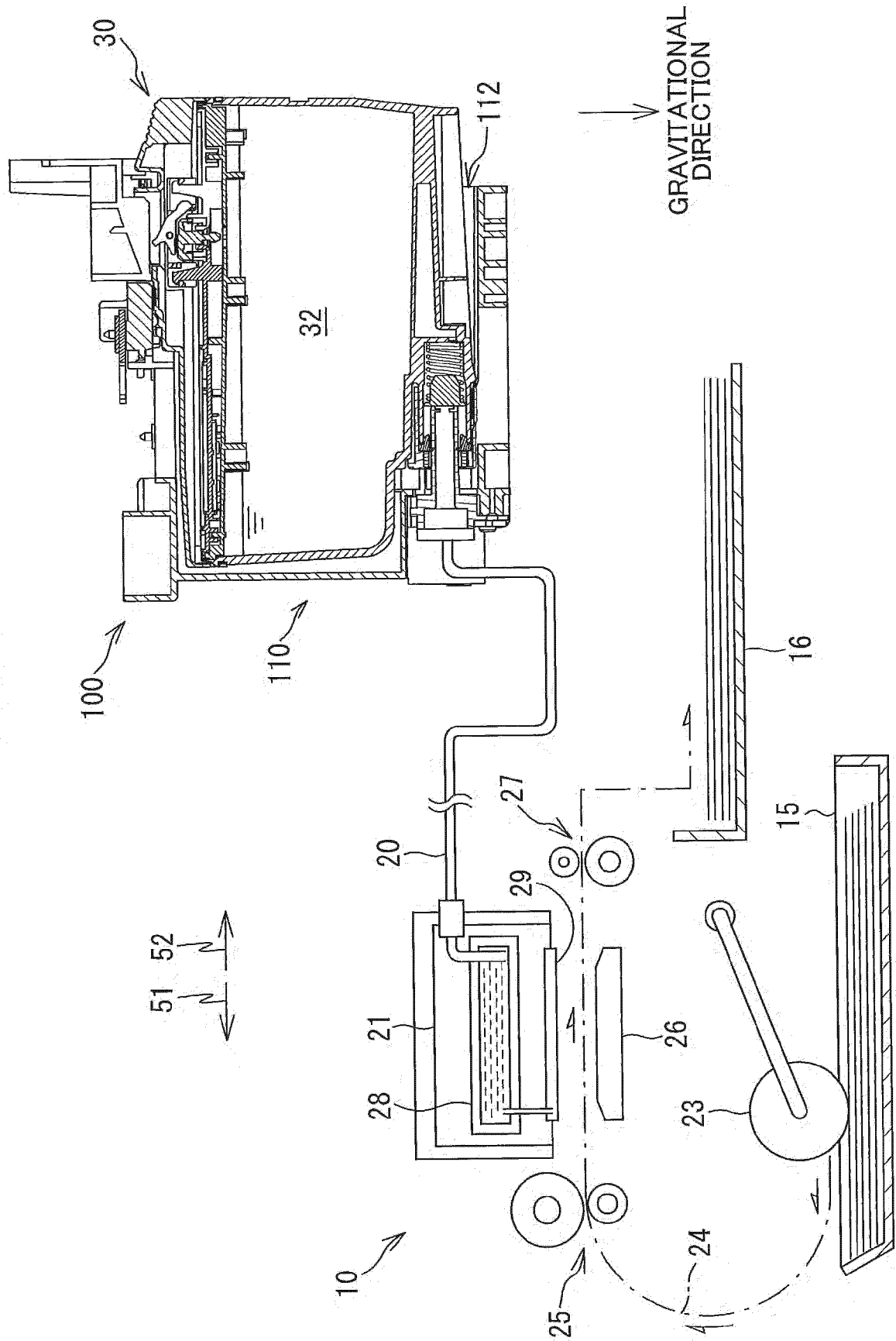


FIG. 2

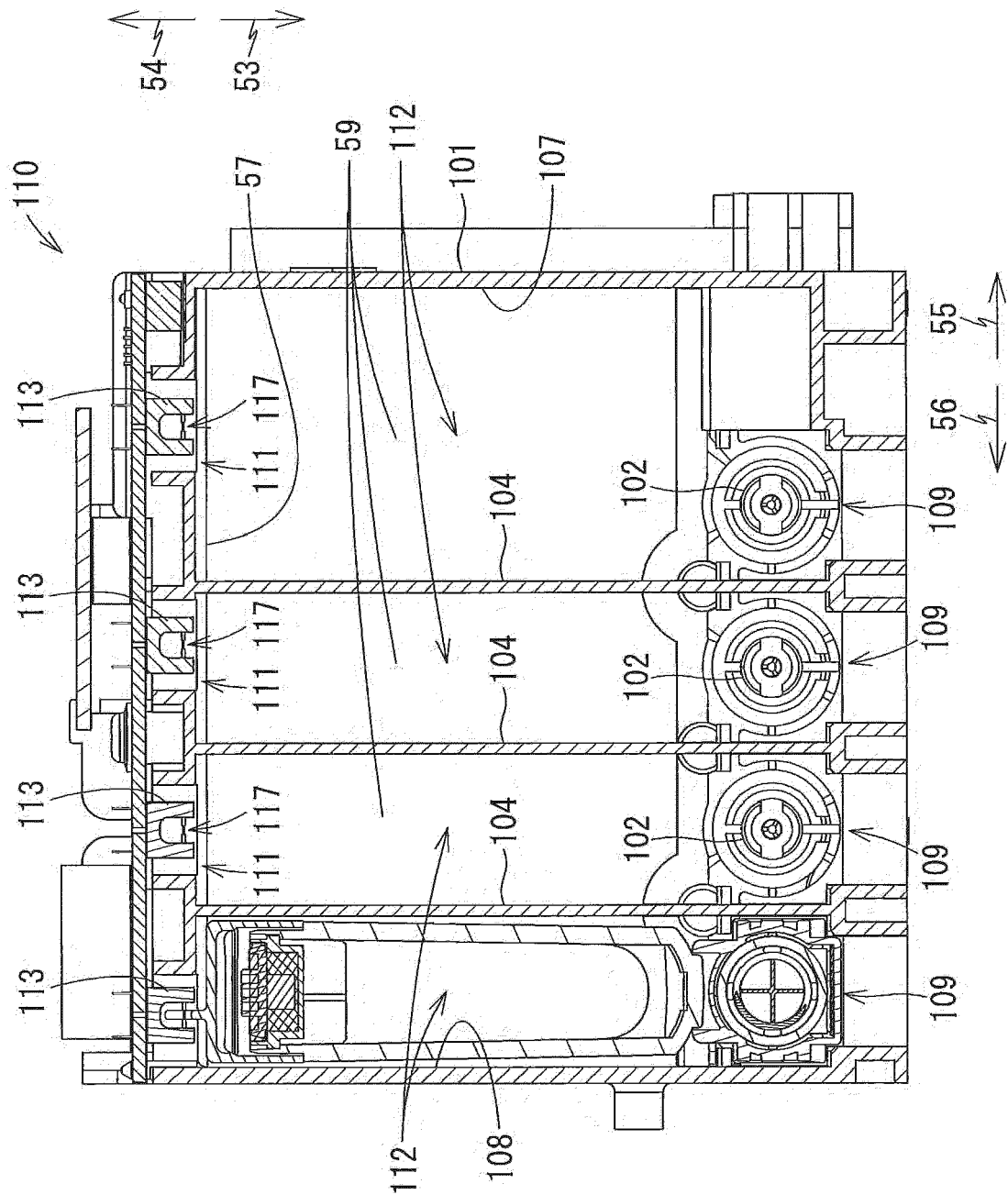


FIG. 3

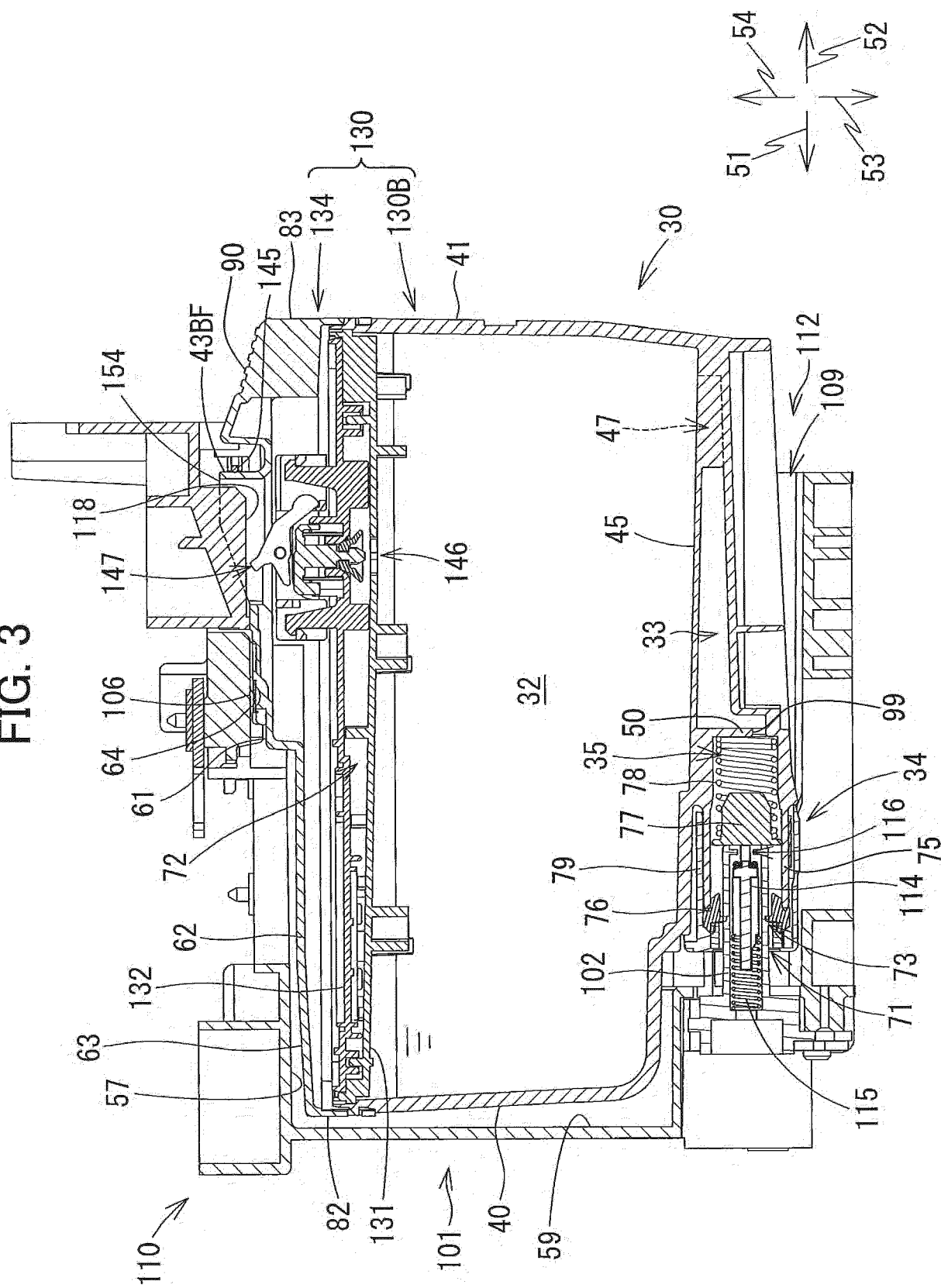


FIG. 4

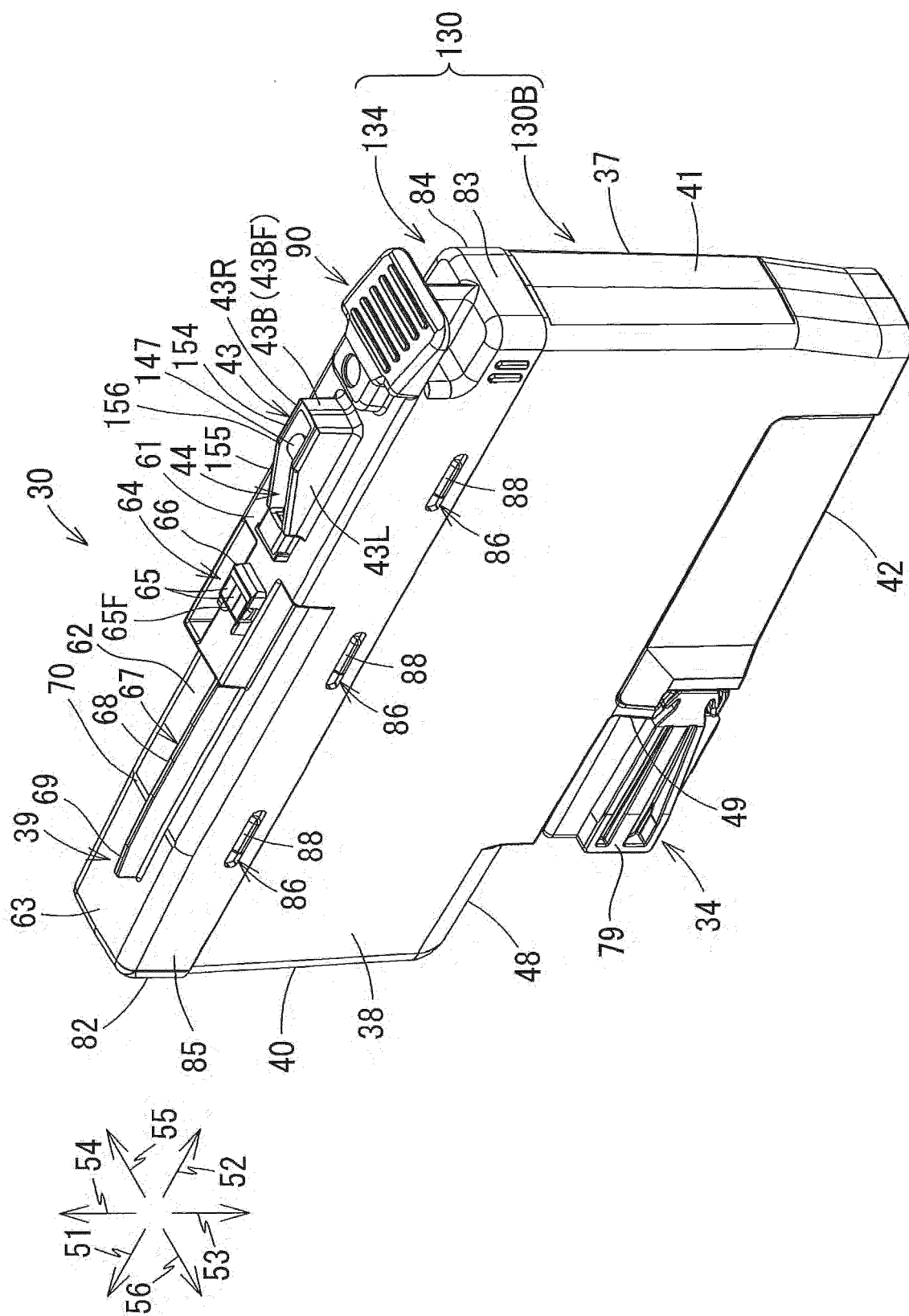


FIG. 5

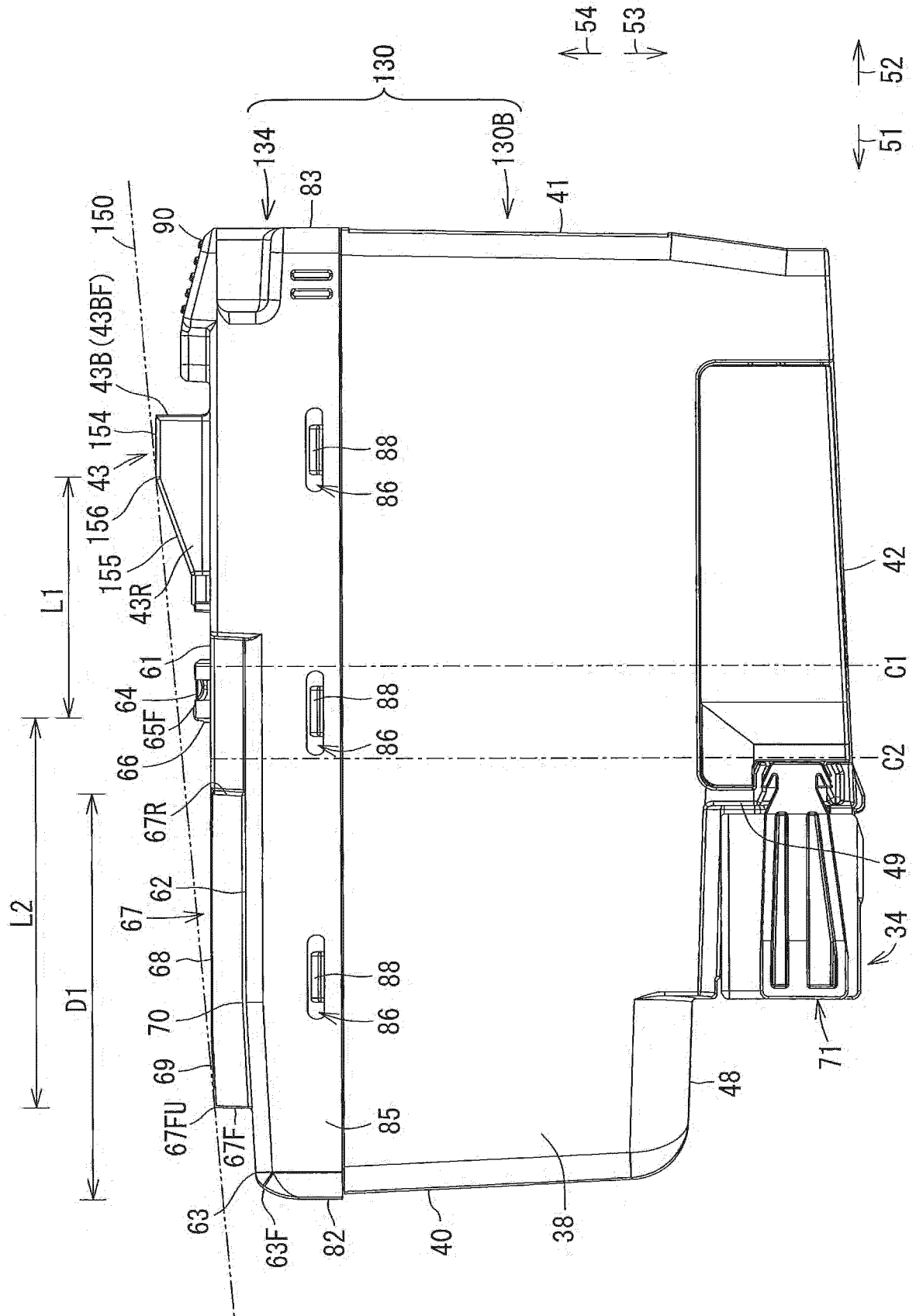


FIG. 6

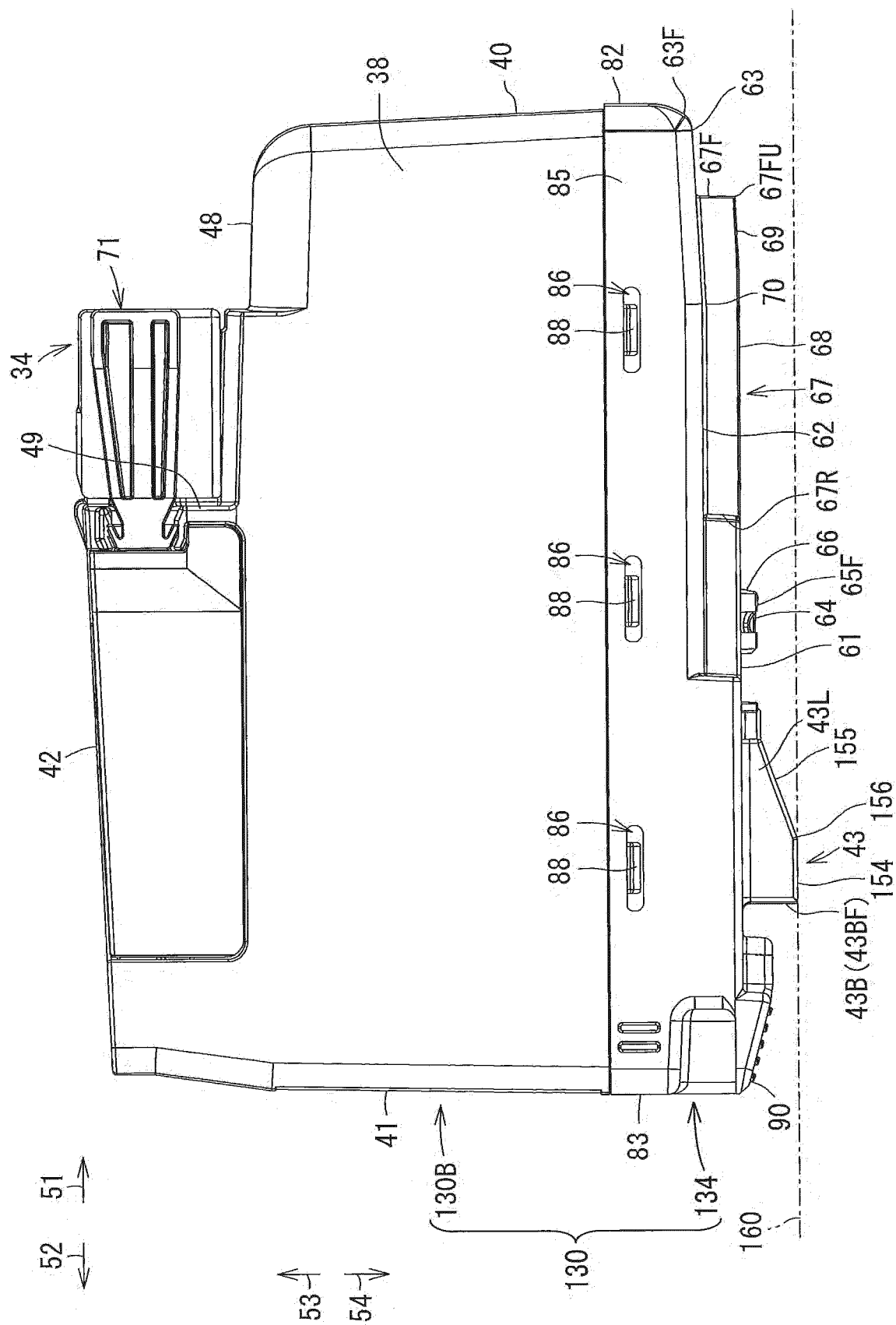


FIG. 7

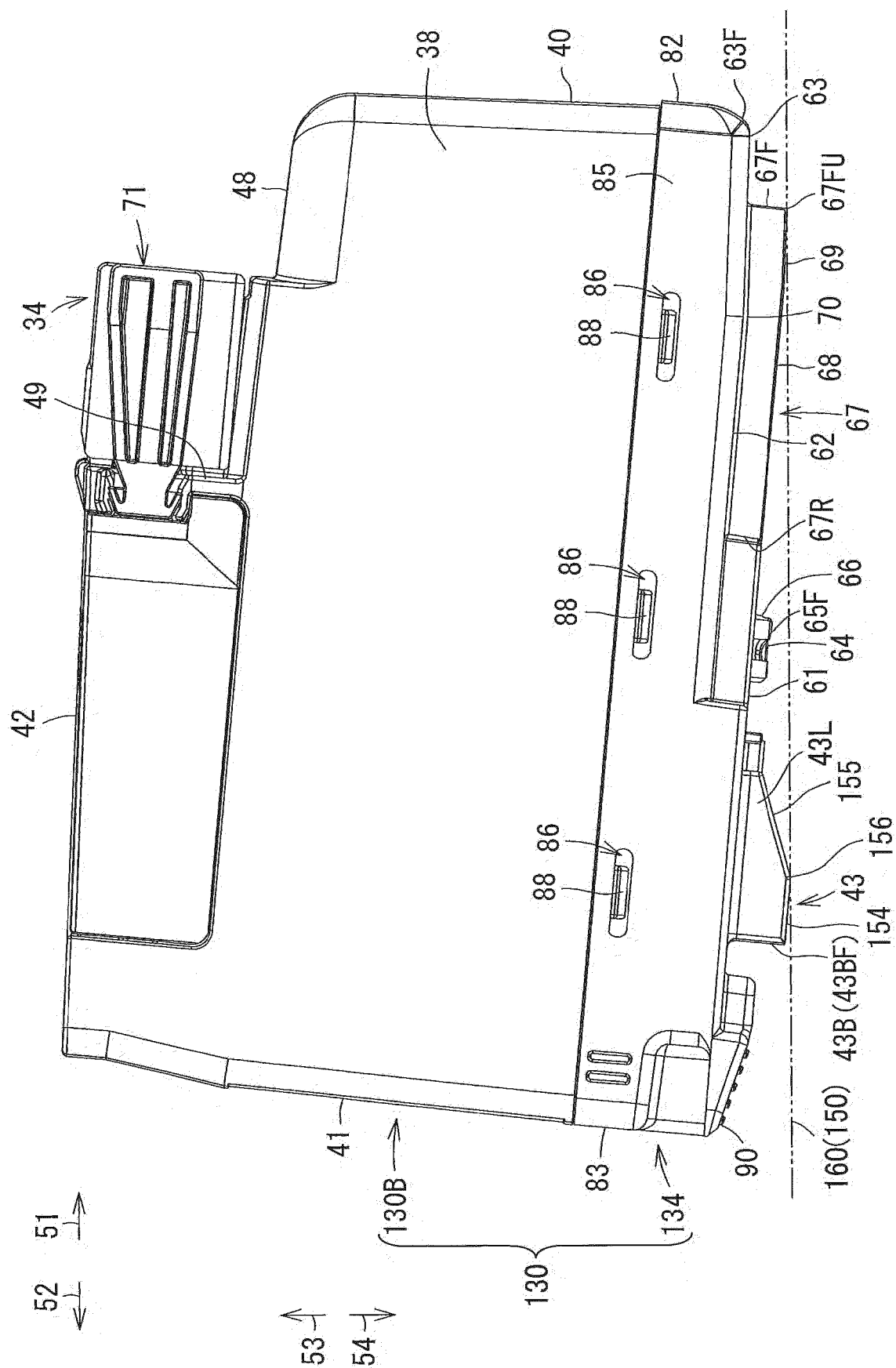




FIG. 8

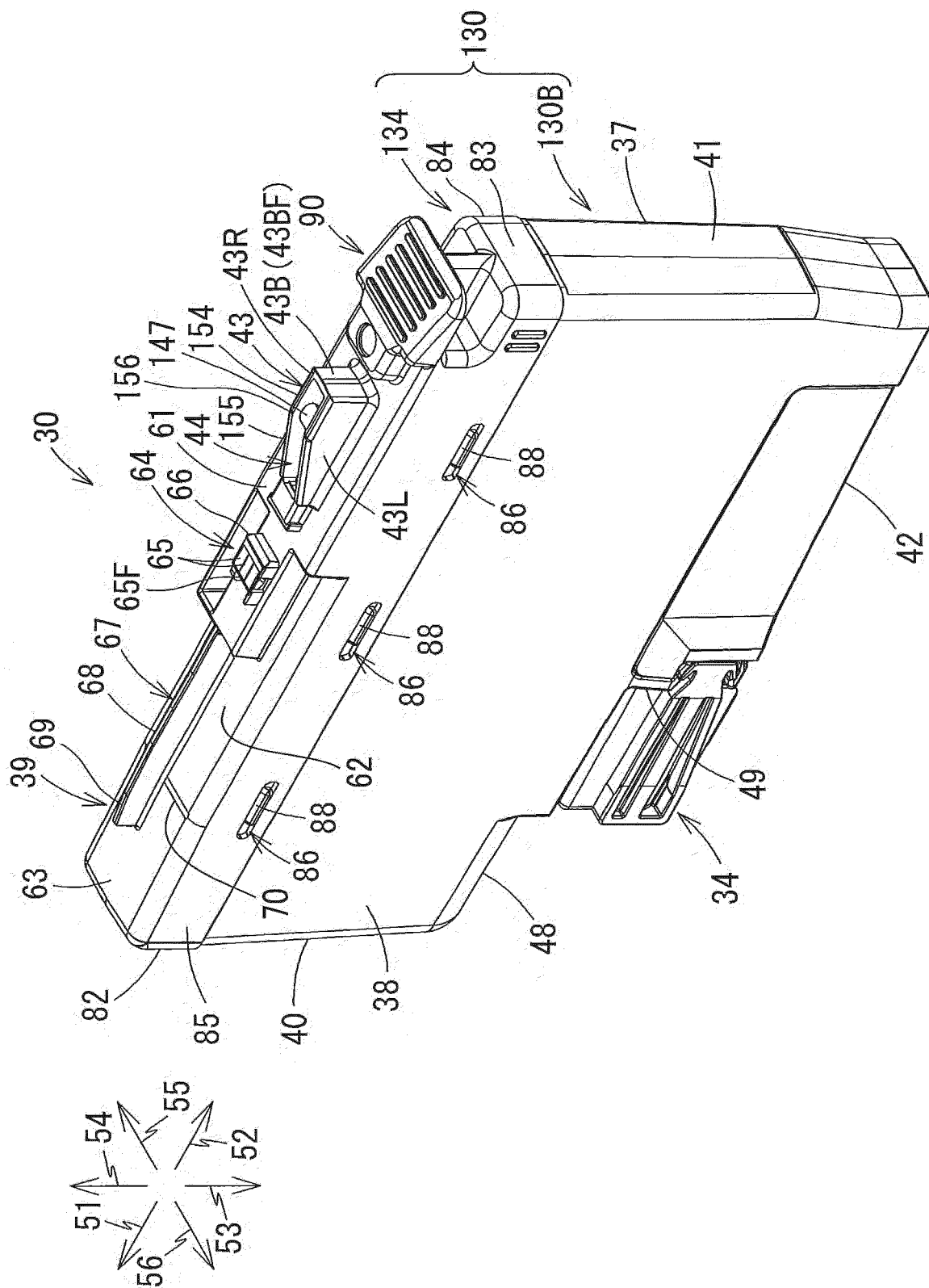
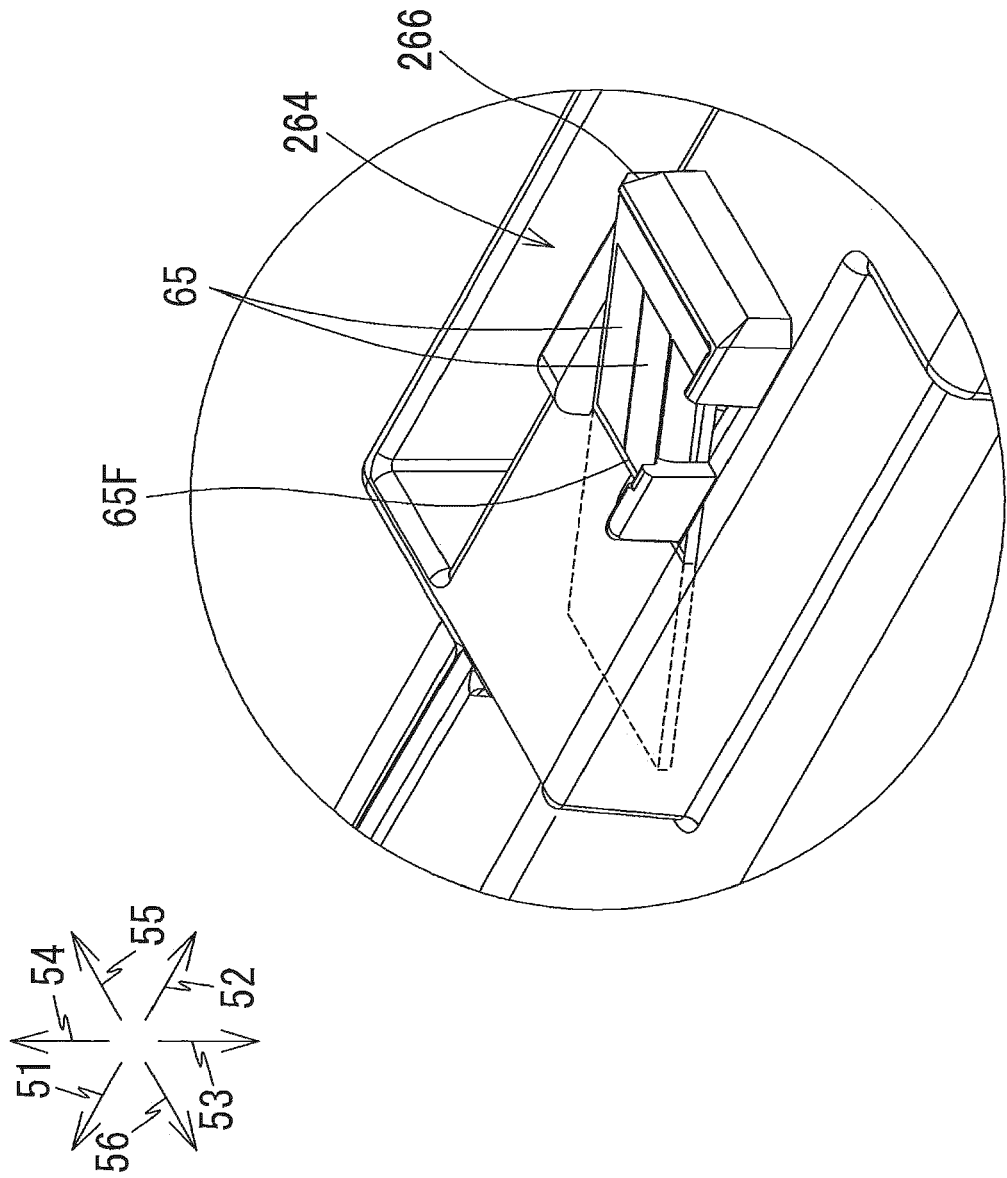


FIG. 9





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Place of search The Hague		Date of completion of the search 22 January 2021	Examiner Cavia Del Olmo, D
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