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(54) SYSTEM IN WHICH CONSUMABLE CARTRIDGE IS MOUNTABLE TO MOUNTING PORTION

(57) A system includes a mounting portion and a consumable cartridge. The consumable cartridge includes an electrical interface positioned on a board, a first guide surface, and a second guide surface. The mounting portion includes a contact configured to contact the electrical interface, a first wall, and a second wall. When the consumable cartridge is inserted into the mounting portion, the first wall is received in a first space defined by the first guide surface, and the second wall is received in a second space defined by the second guide surface.

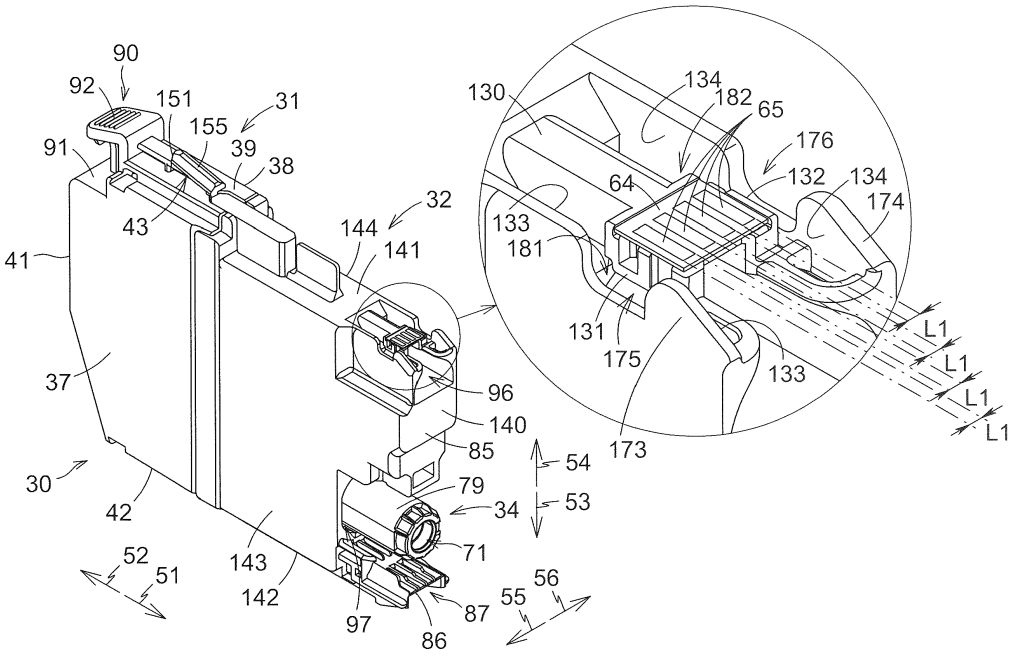

Fig.3

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a system in which a consumable cartridge is mountable to a mounting portion.

2. Description of Related Art

[0002] A known ink-jet printer, as described in U.S. Patent Number 7,703,902, has an ink cartridge and a holder to which the ink cartridge is mountable. The ink cartridge has an electrical connection terminal portion, and the holder has a connector configured to contact the electrical connection terminal portion. By correctly determining a relative position between the ink cartridge and the holder, an electrical connection between the electrical connection terminal portion and the connector is secured.

[0003] Nevertheless, provided that the electrical connection terminal portion is supported on the ink cartridge at a wrong position, even if the relative position between the ink cartridge and the holder is correctly determined, the electrical connection between the electrical connection terminal portion and the connector may not be secured. In particular, the electrical connection terminal portion may contact the connector right after the ink cartridge is mounted to the holder, but may separate from the connector by shock and vibration when the ink-jet printer is used.

SUMMARY OF THE INVENTION

[0004] Therefore, a need has arisen for a system which overcomes these and other shortcomings of the related art. A technical advantage of the present invention is that an electrical interface of a consumable cartridge and a contact of a mounting portion may securely contact each other.

[0005] According to an aspect of the present invention, a system comprises: a mounting portion; a consumable cartridge configured to store a consumable, wherein the consumable cartridge is configured to be inserted into the mounting portion in a first direction and thereby to be mounted to the mounting portion, and configured to be removed from the mounting portion in a second direction opposite the first direction; and a consuming portion configured to consume the consumable to be supplied from the consumable cartridge when mounting of the consumable cartridge to the mounting portion is completed. The consumable cartridge comprises: a consumable chamber configured to store a consumable; a board; a board supporting portion configured to support the board; an electrical interface positioned on the board and facing a third direction which is perpendicular to the first direction and the second direction; a first guide surface positioned further in a fourth direction opposite the third direction than the board, wherein the first guide surface faces a fifth direction which is perpendicular to the first, second, third, and fourth directions; and a second guide surface positioned further in the fourth direction than the board, wherein the second guide surface faces a sixth direction opposite the fifth direction. The mounting portion comprises: a contact configured to contact the electrical interface when the mounting of the consumable cartridge to the mounting portion is completed; a first wall positioned further in the fifth direction than the contact and comprising a portion positioned to overlap a moving path of the board when viewed in the fifth direction, wherein the board moves in the moving path when the consumable cartridge is inserted into the mounting portion; and a second wall positioned further in the sixth direction than the contact and comprising a portion positioned to overlap the moving path of the board when viewed in the sixth direction, wherein when the consumable cartridge is inserted into the mounting portion; a first space is formed, wherein an end of the first space in the sixth direction is defined by the first guide surface, and the first space is opened in the first direction and the third direction, wherein the first space receives the first wall; and a second space is formed, wherein and end of the second space in the fifth direction is defined by the second guide surface, and the second space is opened in the first direction and the third direction, wherein the second space receives the second wall.

[0006] With this configuration, the consumable cartridge is inserted into the mounting portion and mounted to the mounting portion while the first guide surface is guided by the first wall and the second guide surface is guided by the second wall. As a result, the electrical interface on the board of the consumable cartridge contacts the contact of the mounting portion properly.

[0007] If the board is positioned offset from the board supporting portion in the fifth direction, the board contacts the first wall during the insertion of the consumable cartridge into the mounting portion. Similarly, if the board is positioned offset from the board supporting portion in the sixth direction, the board contacts the second wall during the insertion of the consumable cartridge into the mounting portion. Therefore, if the board is offset from the board supporting portion in the fifth direction or the sixth direction, the consumable cartridge cannot be mounted to the mounting portion.

[0008] An electrical interface of the board which is supported on the board supporting portion at an accurate position can contact the contact of the mounting portion while an electrical interface of the board which is offset from the board supporting portion in the fifth direction or the sixth direction cannot contact the contact of the mounting portion. As a result, the electrical interface of the consumable cartridge and the contact of the mounting portion can securely contact each other.

[0009] Incidentally, when the mounting of the consumable cartridge to the mounting portion is completed, the

board may overlap the first wall and the second wall when viewed in the fifth direction or the sixth direction, or may be positioned further in the first direction than the first wall and the second wall.

[0010] Optionally, the first guide surface is positioned further in the fifth direction than the board, or positioned at the same position as an end of the board in the fifth direction, wherein the second guide surface is positioned further in the sixth direction than the board, or positioned at the same position as an end of the board in the sixth direction.

[0011] With this configuration, the first wall is guided by the first guide surface and the second wall is guided by the second guide surface while the board is not damaged by the first wall and the second wall.

[0012] Optionally, the consumable cartridge comprises: a third wall comprising a third guide surface positioned further in the fifth direction than the first guide surface and facing the sixth direction, wherein the third guide surface defines an end of the first space in the fifth direction when the consumable cartridge is inserted into the mounting portion; and a fourth wall comprising a fourth guide surface positioned further in the sixth direction than the second guide surface and facing the fifth direction, wherein the fourth guide surface defines an end of the second space in the sixth direction when the consumable cartridge is inserted into the mounting portion.

[0013] With this configuration, the consumable cartridge is inserted into the mounting portion and mounted to the mounting portion while the first guide surface and the third guide surface are guided by the first wall and the second guide surface and the fourth guide surface are guided by the second wall. As a result, the electrical interface on the board of the consumable cartridge contacts the contact of the mounting portion properly.

[0014] Optionally, the third wall and the fourth wall extend beyond the electrical interface in the third direction.

[0015] With this configuration, when the liquid cartridge contacts something, the board is protected by the third wall and the fourth wall. A likelihood that the board is damaged can be reduced.

[0016] Optionally, the first guide surface and the third guide surface are staggered along the first direction and the second direction, and the second guide surface and the fourth guide surface are staggered along the first direction and the second direction. Optionally, when viewed in the fifth direction or the sixth direction, at least a portion of the third wall does not overlap a portion of the board, which portion contacts the board supporting portion, and at least a portion of the fourth wall does not overlap the portion of the board.

[0017] With this configuration, if the board contacts the board supporting portion via ultraviolet curable adhesive, the optical path of the ultraviolet light directed toward the ultraviolet curable adhesive applied between the board and the board supporting portion in the fifth direction or the sixth direction is not blocked when the consumable cartridge is manufactured. Therefore, the manufacture of the consumable cartridge becomes easy.

[0018] Optionally, a dimension of the electrical interface along the fifth direction and the sixth direction is greater than a sum of a gap along the fifth direction and the sixth direction between the first guide surface and the first wall received in the first space and a gap along the fifth direction and the sixth direction between the third guide surface and the first wall received in the first space, wherein the dimension of the electrical interface is also greater than a sum of a gap along the fifth direction and the sixth direction between the second guide surface and the second wall received in the second space and a gap along the fifth direction and the sixth direction between the fourth guide surface and the second wall received in the second space.

[0019] With this configuration, when the first wall moves in the first space and the second wall moves in the second space in the fifth direction and the sixth direction, the electrical interface still remains in contact with the contact of the mounting portion.

[0020] Optionally, the consumable cartridge comprises a first protrusion and a second protrusion positioned away from each other in the fifth direction and the sixth direction, wherein the first protrusion and the second protrusion protrude in the fourth direction, and contact the mounting portion when the mounting of the consumable cartridge to the mounting portion is completed. Alternatively or at the same time, the mounting portion comprises a third protrusion and a fourth protrusion positioned away from each other in the fifth direction and the sixth direction, wherein the third protrusion and the fourth protrusion protrude in the third direction, and contact the consumable cartridge when the mounting of the consumable cartridge to the mounting portion is completed. Optionally, when the consumable cartridge comprises the first protrusion and the second protrusion, and the mounting portion comprises the third protrusion and the fourth protrusion, the first protrusion contacts the third protrusion and the second protrusion contacts the fourth protrusion when the mounting of the consumable cartridge to the mounting portion is completed.

[0021] With this configuration, a likelihood is reduced that the consumable cartridge rotates around an axis extending in the first direction when the mounting of the consumable cartridge to the mounting portion is completed. Therefore, the electrical interface contacts the contact of the mounting portion further securely.

[0022] Optionally, the first protrusion or the third protrusion is positioned further in the fifth direction than the board, and the second protrusion or the fourth protrusion is positioned further in the sixth direction than the board when the mounting of the consumable cartridge to the mounting portion is completed.

[0023] With this configuration, the distance between the first protrusion and the second protrusion or between the third protrusion and the fourth protrusion becomes larger, and therefore the rotation of the consumable cartridge is further suppressed.

[0024] Optionally, when viewed in the third direction or the fourth direction, the first protrusion or the third protrusion at least partly overlaps the first space, and the second protrusion or the fourth protrusion at least partly overlaps the second space when the mounting of the consumable cartridge to the mounting portion is completed.

[0025] Optionally, the system further comprises a controller, wherein the consumable cartridge comprises an integrated circuit electrically connected to the electrical interface, and the controller is configured to access the integrated circuit via the electrical interface.

[0026] When the controller accesses the integrated circuit, the controller can read date out of the integrated circuit, or write data in the integrated circuit, or both.

[0027] Optionally, the third direction is an upward direction and the fourth direction is a downward direction.

[0028] According to another aspect of the invention, a consumable cartridge is configured to be inserted into a mounting portion in a first direction and thereby to be mounted to the mounting portion, and configured to be removed from the mounting portion in a second direction opposite the first direction. The consumable cartridge comprises: a consumable chamber configured to store a consumable; a board; a board supporting portion configured to support the board; an electrical interface positioned on the board and facing a third direction which is perpendicular to the first direction and the second direction; a first guide surface positioned further in a fourth direction opposite the third direction than the board, wherein the first guide surface faces a fifth direction which is perpendicular to the first, second, third, and fourth directions; a second guide surface positioned further in the fourth direction than the board, wherein the second guide surface faces a sixth direction opposite the fifth direction; a third guide surface positioned further in the fifth direction than the first guide surface and facing the sixth direction; and a fourth guide surface positioned further in the sixth direction than the second guide surface and facing the fifth direction, wherein the first guide surface and the third guide surface define ends of a first space in the sixth direction and the fifth direction, respectively, and the first space is opened in the first direction and the third direction, and wherein the second guide surface and the fourth guide surface define ends of a second space in the fifth direction and the sixth direction, respectively, and the second space is opened in the first direction and the third direction.

[0029] With this configuration, the consumable cartridge is inserted into the mounting portion and mounted to the mounting portion while the first guide surface and the third guide surface are guided by a first wall and the second guide surface and the fourth guide surface are guided by a second wall. As a result, the electrical interface on the board of the consumable cartridge contacts a contact of the mounting portion properly.

[0030] If the board is positioned offset from the board supporting portion in the fifth direction, the board contacts the first wall during the insertion of the consumable cartridge into the mounting portion. Similarly, if the board is positioned offset from the board supporting portion in the sixth direction, the board contacts the second wall during the insertion of the consumable cartridge into the mounting portion. Therefore, if the board is offset from the board supporting portion in the fifth direction or the sixth direction, the consumable cartridge cannot be mounted to the mounting portion.

[0031] An electrical interface of the board which is supported on the board supporting portion at a right position can contact the contact of the mounting portion while an electrical interface of the board which is offset from the board in the fifth direction and the sixth direction cannot contact the contact of the mounting portion. As a result, the electrical interface of the consumable cartridge and the contact of the mounting portion can securely contact each other.

[0032] Optionally, the first guide surface is positioned further in the fifth direction than the board, or positioned at the same position as an end of the board in the fifth direction, wherein the second guide surface is positioned further in the sixth direction than the board, or positioned at the same position as an end of the board in the sixth direction.

[0033] The first wall is guided by the first guide surface and the second wall is guided by the second guide surface while the board is not damaged by the first wall and the second wall.

[0034] Optionally, the third guide surface and the fourth guide surface extend beyond the electrical interface in the third direction.

[0035] With this configuration, when the liquid cartridge contacts something, the board is protected by the third guide surface and the fourth guide surface. A likelihood that the board is damaged can be reduced.

[0036] Optionally, the first guide surface and the third guide surface are staggered along the first direction and the second direction, and the second guide surface and the fourth guide surface are staggered along the first direction and the second direction. Optionally, when viewed in the fifth direction or the sixth direction, at least a portion of the third guide surface does not overlap a portion of the board, which portion contacts the board supporting portion, and at least a portion of the fourth guide surface does not overlap the portion of the board.

[0037] With this configuration, if the board contacts the board supporting portion via ultraviolet curable adhesive, the optical path of the ultraviolet light directed toward the ultraviolet curable adhesive applied between the board and the board supporting portion cannot be blocked when the consumable cartridge is manufactured. Therefore, the manufacture of the consumable cartridge becomes easy.

[0038] Optionally, the consumable cartridge further comprises a first protrusion and a second protrusion positioned away from each other in the fifth direction and the sixth direction, wherein the first protrusion and the

second protrusion protrude in the fourth direction.

[0039] With this configuration, a likelihood is reduced that the consumable cartridge rotates around an axis extending in the first direction when the mounting of the consumable cartridge to the mounting portion is completed. Therefore, the electrical interface contacts the contact of the mounting portion further securely.

[0040] Optionally, the first protrusion is positioned further in the fifth direction than the board, and the second protrusion is positioned further in the sixth direction than the board.

[0041] With this configuration, the distance between the first protrusion and the second protrusion becomes larger, and therefore the rotation of the consumable cartridge is further suppressed.

[0042] Optionally, when viewed in the third direction or the fourth direction, the first protrusion at least partly overlaps the first space, and the second protrusion at least partly overlaps the second space.

[0043] Other objects, features, and advantages will be apparent to persons of ordinary skill in the art from the following detailed description of the invention and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0044] For a more complete understanding of the present invention, needs satisfied thereby, and the objects, features, and advantages thereof, reference now is made to the following description taken in connection with the accompanying drawings.

Fig. 1 is a schematic, cross-sectional view of a printer comprising a cartridge mounting portion and an ink cartridge, according to an embodiment of the present invention.

Fig. 2 is a perspective view of the cartridge mounting portion in which two ink cartridges are mounted.

Fig. 3 is a perspective view of the ink cartridge.

Fig. 4 is a vertical cross-sectional view of the ink cartridge, showing the inside of the ink cartridge.

Fig. 5 is a vertical cross-sectional view of the ink cartridge and the cartridge mounting portion, in which the ink cartridge has started to be inserted into the cartridge mounting portion.

Fig. 6 is a vertical cross-sectional view of the ink cartridge and the cartridge mounting portion, in which a second protrusion contacts a slider.

Fig. 7 is a vertical cross-sectional view of the ink cartridge and the cartridge mounting portion, in which an ink supply portion has started to enter a guide portion, and a rod has started to enter a recess of a front cover.

Fig. 8 is a vertical cross-sectional view of the ink cartridge and the cartridge mounting portion, in which an ink supply tube is inserted through an ink supply opening of the ink supply portion.

Fig. 9 is a vertical cross-sectional view of the ink cartridge and the cartridge mounting portion, in which the ink cartridge is locked in the cartridge mounting portion.

Fig. 10 is a perspective view of the ink cartridge and a contact unit when mounting of the ink cartridge to the cartridge mounting portion is completed.

Fig. 11 is a perspective view of the contact unit.

Fig. 12 is a cross-sectional view of the cartridge mounting portion taken along a plane parallel to a downward direction, an upward direction, a right direction, and a left direction when two ink cartridges are mounted to the cartridge mounting portion.

Fig. 13A is a schematic, cross-sectional view of the cartridge mounting portion taken along a plane parallel to an insertion direction, a removal direction, the right direction, and the left direction, when the ink cartridge is inserted into the cartridge mounting portion, and an IC board is positioned offset from a board supporting portion in the right direction.

Fig. 13B is a schematic, cross-sectional view of the cartridge mounting portion taken along a plane parallel to the insertion direction, the removal direction, the right direction, and the left direction, when the ink cartridge is inserted into the cartridge mounting portion, and the IC board is positioned offset from the board supporting portion in the left direction.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0045] Embodiments of the present invention, and their features and advantages, may be understood by referring to **Figs. 1-13B**, like numerals being used for like corresponding parts in the various drawings.

[0046] In the following embodiments, an ink cartridge 30 is inserted into a cartridge mounting portion 110 in an insertion direction 51, as an example of a first direction, and the ink cartridge 30 is removed from the cartridge mounting portion 110 in a removal direction 52, as an example of a second direction, which is oppose to the insertion direction 51. In the following embodiments, the insertion direction 51 is a horizontal direction, and the removal direction 52 is also a horizontal direction. Nevertheless, in another embodiment, the insertion direction 51 and the removal direction 52 may not be a horizontal direction.

[0047] In the following embodiments, an upward direction 54, as an example of a third direction, is perpendicular to the insertion direction 51 and the removal direction 52, and a downward direction 53, as an example of a fourth direction, is opposite to the upward direction 54 and perpendicular to the insertion direction 51 and the removal direction 52. In the following embodiments, the downward direction 53 as an example of the fourth direction is the gravitational direction. Nevertheless, in another embodiment, the fourth direction may not be the gravitational direction.

[0048] Moreover, in the following embodiments, a right

direction 55, as an example of a fifth direction, is perpendicular to the insertion direction 51 and the downward direction 53, and a left direction 56, as an example of a sixth direction, is opposite to the right direction 55 and perpendicular to the insertion direction 51 and the downward direction 53. More specifically, the right direction 55 extends rightward and the left direction 56 extends leftward when the ink cartridge 30 is viewed in the insertion direction 51 when the ink cartridge 30 is in a mounted attitude, as an example of a first attitude. The mounted attitude is an attitude that the ink cartridge 30 takes when the ink cartridge 30 has been inserted into the cartridge mounting portion 110 up to a mounted position and is locked in the cartridge mounting portion 110. In the following embodiments, the right direction 55 as an example of the fifth direction is a horizontal direction, and the left direction 56 as an example of the sixth direction is also a horizontal direction. Nevertheless, in another embodiment, the fifth direction and the sixth direction may not be a horizontal direction.

[Printer 10]

[0049] Referring to **Fig. 1**, a printer 10, as an example of a system, is an inkjet printer configured to record an image on a sheet of recording paper by ejecting ink droplets selectively on the sheet of recording paper. The printer 10 comprises a consuming portion, e.g., a recording head 21, an ink supply device 100, and an ink tube 20 connecting the recording head 21 and the ink supply device 100. The ink supply device 100 comprises the cartridge mounting portion 110. The cartridge mounting portion 110 is configured to allow a liquid cartridge, e.g., the ink cartridge 30 to be mounted therein. The cartridge mounting portion 110 has an opening 112 and the interior of the cartridge mounting portion 110 is exposed to the exterior of the cartridge mounting portion 110 via opening 112. The ink cartridge 30 is configured to be inserted into the cartridge mounting portion 110 via the opening 112 in the insertion direction 51, and to be removed from the cartridge mounting portion 110 via the opening 112 in the removal direction 52.

[0050] The ink cartridge 30 is configured to store ink, as an example of a consumable, which is consumed by the printer 10. The ink cartridge 30 and the recording head 21 are fluidically connected via the ink tube 20 when mounting of the ink cartridge 30 to the cartridge mounting portion 110 has been completed. The recording head 21 comprises a sub tank 28. The sub tank 28 is configured to temporarily store ink supplied via the ink tube 20 from the ink cartridge 30. The recording head 21 comprises nozzles 29 and is configured to selectively eject ink supplied from the sub tank 28 through the nozzles 29. More specifically, the recording head 21 comprises a head control board (not shown) and piezoelectric actuators 29A corresponding to the nozzles 29, and the head control board is configured to selectively apply driving voltage to the piezoelectric actuators 29A. As such, ink is ejected from the nozzles 29.

[0051] The printer 10 comprises a paper feed tray 15, a paper feed roller 23, a conveying roller pair 25, a platen 26, a discharge roller pair 27, and a discharge tray 16. A conveying path 24 is formed from the paper feed tray 15 up to the discharge tray 16 via the conveying roller pair 25, the platen 26, and the discharge roller pair 27. The paper feed roller 23 is configured to feed a sheet of recording paper from the paper feed tray 15 to the conveying path 24. The conveying roller pair 25 is configured to convey the sheet of recording paper fed from the paper feed tray 15 onto the platen 26. The recording head 21 is configured to selectively eject ink onto the sheet of recording paper passing over the platen 26. In other words, the recording head 21 is configured to consume ink supplied from the ink cartridge 30 mounted to the cartridge mounting portion 110. Accordingly, an image is recorded on the sheet of recording paper. The sheet of recording paper having passed over the platen 26 is discharged by the discharge roller pair 27 to the paper discharge tray 16 disposed at the most downstream side of the conveying path 24.

[Ink supply device 100]

[0052] Referring to **Fig. 1**, the printer 10 comprises the ink supply device 100. The ink supply device 100 is configured to supply ink to the recording head 21. The ink supply device 100 comprises the cartridge mounting portion 110 to which the ink cartridge 30 is mountable. In **Fig. 1**, mounting of the ink cartridge 30 to the cartridge mounting portion 110 has been completed, in other words, the ink cartridge 30 is in the mounted attitude (first attitude).

[Cartridge mounting portion 110]

[0053] Referring to **Figs. 2, 5 and 10**, the cartridge mounting portion 110 is configured to receive four ink cartridges 30 storing cyan, magenta, yellow, and black inks, respectively. Two ink cartridges 30 are mounted in the cartridge mounting portion 110 in **Fig. 2**. The cartridge mounting portion 110 comprises a case 101, and four ink supply tubes 102, four contact units 160, four sliders 107, four rods 125, and four support plates 126, corresponding to the four ink cartridges 30, respectively. The cartridge mounting portion 110 also comprises a lock portion 145. One common lock portion 145 is used for the four ink cartridges 30. The number of the ink cartridges 30 is not limited to four. For instance, in another embodiment, the cartridge mounting portion 110 may be configured to receive only one ink cartridge 30, six ink cartridges 30, or eight ink cartridges 30.

[Case 101]

[0054] Referring to **Fig. 2**, the case 101 has a box shape and forms the outer shape of the cartridge mount-

ing portion 110. The case 101 has an inner space formed therein. The case 101 comprises an upper portion defining the upper end of the inner space, a lower portion defining the lower end of the inner space, and an end surface connected to the upper portion and the lower portion. The case 101 has the opening 112 formed opposite from the end surface in the insertion direction 51 and the removal direction 52. The opening 112 can be exposed to the outside of the printer 10 through a user-interface surface of the printer 10. The user-interface surface is a surface that a user faces and touches when the user uses the printer 10. The ink cartridge 30 is configured to be inserted into and removed from the case 101 through the opening 112. Each of the upper portion and the lower portion of the case 101 has a guide groove 109 formed therein, and the guide groove 109 extends in the insertion direction 51 from the opening 112. When the ink cartridge 30 is inserted into and removed from the case 101, an upper end portion of the ink cartridge 30 is in the guide groove 109 of the upper portion of the case 101, and a lower end portion of the ink cartridge 30 is in the guide groove 109 of the lower portion of the case 101, such that the movement of the ink cartridge 30 is guided in the insertion direction 51 and the removal direction 52. The case 101 comprises three plates 104 extending in the upward direction 54 and the downward direction 53, and the three plates 104 divide the inner space of the case 101 into four vertically-elongated spaces. Each of the four spaces receives the corresponding one of the ink cartridges 30.

[Ink supply tube 102]

[0055] Referring to **Figs. 1 and 5**, the ink supply tube 102 is made of synthetic resin and positioned at a lower portion of the end surface of the case 101 at a position corresponding to an ink supply portion 34 of the ink cartridge 30 mounted to the cartridge mounting portion 110. The ink supply tube 102 extends from the end surface of the case 101 in the removal direction 52.

[0056] A cylindrical guide portion 105 is provided to surround the ink supply tube 102. The guide portion 105 extends from the end surface of the case 101 in the removal direction 52, and has an inner space which is open at the distal end of the guide portion 105. The ink supply tube 102 is positioned at the center of the inner space of the guide portion 105. The guide portion 105 has such a shape that it can receive the ink supply portion 34 of the ink cartridge 30 in the inner space of the guide portion 105.

[0057] Referring to **Fig. 8**, during the insertion of the ink cartridge 30 into the cartridge mounting portion 110 in the insertion direction 51, i.e., while the ink cartridge 30 moves toward the mounted position, the ink supply portion 34 of the ink cartridge 30 enters the inner space of the guide portion 105. When the ink cartridge 30 is further inserted into the cartridge mounting portion 110 in the insertion direction 51, the ink supply tube 102 is inserted through an ink supply opening 71 formed in the ink supply portion 34. When this occurs, a valve 77 provided in the ink supply portion 34 moves to open the ink supply opening 71. As a result, the ink supply tube 102 and the ink supply portion 34 are connected to each other. Ink stored in an ink chamber 36 of the ink cartridge 30 flows into ink tube 20 connected to the ink supply tube 102 via an inner space of a cylindrical wall 73 of the ink supply portion 34 and an inner space of the ink supply tube 102. The ink supply tube 102 may have a flat end surface or pointed end.

[Slider 107]

[0058] Referring to **Fig. 5**, the lower portion of the case 101 comprises a groove bottom wall defining the bottom end of the guide groove 109. The groove bottom wall has an opening 111 formed therethrough in the upward direction 54 and the downward direction 53 at a positon adjacent to the end surface of the case 101, and the opening 111 extends in the insertion direction 51 and the removal direction 52. The slider 107 is positioned in the opening 111. The slider 107 extends from a space below the groove bottom wall to a space above the groove bottom wall through the opening 111. The case 101 comprises a guide rail 113 extending in the insertion direction 51 and the removal direction 52, and the slider 107 is configured to slide on the guide rail 113 in the insertion direction 51 and the removal direction 52 in the opening 111. A pulling spring 114 is connected to the case 101 at one end and to the slider 107 at the other end. The pulling spring 114 pulls the slider 107 in the removal direction 52. Therefore, when an external force is not applied to the slider 107, the slider 107 is positioned at the end of the guide rail 113 in the removal direction 52. When an external force is applied to the slider 107 in the insertion direction 51, the slider 107 moves from the end of the guide rail 113 in the insertion direction 51 along the guide rail 113 in the opening 111.

[0059] Referring to **Fig. 6**, during the insertion of the ink cartridge 30 into the cartridge mounting portion 110 in the insertion direction 51, i.e., while the ink cartridge 30 moves toward the mounted position, a second protrusion 86 of the ink cartridge 30 moves in the guide groove 109 in the insertion direction 51 and contact the slider 107. When the ink cartridge 30 is further inserted into the cartridge mounting portion 110 in the insertion direction 51, the second protrusion 86 pushes the slider 107 in the insertion direction 51, and the slider 107 moves in the insertion direction 51 against an urging force of the pulling spring 114. The second protrusion 86 of the ink cartridge 30 receives the urging force in the removal direction 52 from the slider 107.

[Lock portion 145]

[0060] Referring to **Fig. 5**, the lock portion 145 is positioned adjacent to the upper portion of the case 101

and the opening 112. The lock portion 145 has an elongated shape extending in the left direction 56 and the right direction 55 in the case 101. For instance, the lock portion 145 is a metal circular cylinder. The lock portion 145 has a left end in the left direction 56 and a right end in the right direction 55, and the case 101 has a left end wall defining the end of the inner space of the case 101 in the left direction 56 and a right end wall defining the end of the inner space of the case 101 in the right direction 55. The left end of the lock portion 145 is fixed at the left end wall of the case 101, and the right end of the lock portion 145 is fixed at the right end wall of the case 101. The lock portion 145 does not move relative to the case 101, e.g., does not pivot relative to the case 101. The lock portion 145 extends over the four spaces into which the four cartridges 30 are mountable, respectively. A space is formed around the lock portion 145 in each of the four spaces. Therefore, the lock portion 145 is accessible in the upward direction 54 and in the removal direction 52.

[0061] The lock portion 145 is used for locking the ink cartridge 30 in the mounted position when the ink cartridge 30 is mounted to the cartridge mounting portion 110. When the ink cartridge 30 is inserted into the cartridge mounting portion 110 and pivots to the mounted attitude as an example of the first attitude, the ink cartridge 30 contacts the lock portion 145 in the removal direction 52, and the lock portion 145 locks or retains the ink cartridge 30 against the urging force from the slider 107, which urging force urges the ink cartridge 30 in the removal direction 52, and against an urging force of a coil spring 78 of the ink cartridge 30, which urging force also urges the ink cartridge 30 in the removal direction 52.

[Contact unit 160]

[0062] Referring to **Figs. 5 and 10**, the contact unit 160 is positioned at the upper portion of the case 101 adjacent to the end surface of the case 101 and above the rod 125. When the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed, the contact unit 160 is positioned above a board supporting portion 130 and an IC board 64 of the ink cartridge 30 and faces the board supporting portion 130 and the IC board 64.

[0063] Referring to **Fig. 11**, the contact unit 160 comprises a main body 163 having substantially a rectangular parallelepiped shape and four contacts 106 supported by the main body 163.

[0064] The main body 163 comprises a lower surface 163A and has four cut-outs 164 formed in the lower surface 163A. The four cut-outs 164 are provided corresponding to four electrodes 65 of the ink cartridge 30, and are aligned and spaced away from each other in the right direction 55 and the left direction 56. Each cut-out 164 extends in the insertion direction 51 and the removal direction 52.

[0065] Each contact 106 has a portion protruding to the outside of the main body 163 through a corresponding one of the cut-outs 164. The four contacts 106 are provided corresponding to four electrodes 65 of the ink cartridge 30, and are aligned and spaced away from each other in the right direction 55 and the left direction 56. Each contact 106 is made of a material having electric conductivity and elasticity and can be elastically deformed in the upward direction 54. In this embodiment, each contact 106 is made of copper plated with nickel and gold. The number of contacts 106 in one contact unit 160 is not limited to four, but may be two, three or more than four, and the number of electrodes 65 of one ink cartridge 30 is not limited to four, but may be two, three or more than four.

[0066] Each contact 106 is electrically connected to a controller 1 (see **Fig. 1**) of the printer 10 via an electric circuit. The controller 1 may comprise a CPU, a ROM, and a RAM, and may be used for controlling the operations of the printer 10. When the contacts 106 and the corresponding electrodes 65 contact, voltage may be applied to one of the electrodes 65 from the printer 10, or one of the electrode 65 may be grounded. When the contacts 106 and the corresponding electrodes 65 contact, data stored in an IC (Integrated Circuit) of the ink cartridge 30 becomes accessible from the controller 1 and the data can be transmitted to the controller 1 via the electric circuit of the printer 10.

[0067] Referring to **Fig. 11**, the main body 163 comprises a first wall 161 and a second wall 162 extending in the downward direction 53 from the lower surface 163A of the main body 163.

[0068] The first wall 161 is positioned to the right of the contacts 106. In other words, the first wall 161 is positioned further in the right direction 55 than the contacts 106. The first wall 161 is spaced away from the contacts 106. The first wall 161 has an end in the insertion direction 51, which end is positioned further in the insertion direction 51 than the IC board 64 of the ink cartridge 30 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. The first wall 161 has an end in the removal direction 52, which end is positioned further in the removal direction 52 than the IC board 64 of the ink cartridge 30 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. The first wall 161 has a lower end, which is positioned below the upper end of the IC board 64 of the ink cartridge 30 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed.

[0069] More specifically, the first wall 161 comprises a portion positioned to overlap a moving path of the IC board 64 when viewed in the right direction 55. The IC board 64 moves in the moving path when the ink cartridge 30 is inserted into the cartridge mounting portion 110. The portion of the first wall 161 is positioned below the upper end of the IC board 64 and positioned between both ends of the IC board 64 in the insertion direction 51 and the removal direction 52 when the ink cartridge 30 is inserted and mounted to the cartridge mounting portion 110 and when the IC board 64 is positioned between the

first wall 161 and the second wall 162 in the right direction 55 and the left direction 56.

[0070] In another embodiment, the first wall 161 may have an end in the insertion direction 51, which end is positioned further in the insertion direction 51 than the IC board 64 and have another end in the removal direction 52, which end is positioned between the both ends of the IC board 64 in the insertion direction 51 and the removal direction 52 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. Alternatively, the first wall 161 may have an end in the insertion direction 51, which end is positioned between the both ends of the IC board 64 in the insertion direction 51 and the removal direction 52, and have another end in the removal direction 52, which end is positioned further in the removal direction 52 than the IC board 64 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. Alternatively, the first wall 161 may have ends in the insertion direction 51 and the removal direction 52, which ends are positioned between the both ends of the IC board 64 in the insertion direction 51 and the removal direction 52 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. Alternatively, the entirety of the first wall 161 may be positioned further in the removal direction 52 than the IC board 64. That is, the portion of the first wall 161 may overlap the IC board 64 when viewed in the right direction 55 only during insertion of the ink cartridge 30 to the cartridge mounting portion 110 and may not overlap when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed.

[0071] The second wall 162 is positioned to the left of the contacts 106. In other words, the second wall 162 is positioned further in the left direction 56 than the contacts 106. The second wall 162 is spaced away from the contacts 106. The second wall 162 has an end in the insertion direction 51, which end is positioned further in the insertion direction 51 than the IC board 64 of the ink cartridge 30 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. The second wall 162 has an end in the removal direction 52, which end is positioned further in the removal direction 52 than the IC board 64 of the ink cartridge 30 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. The second wall 162 has a lower end, which is positioned below the upper end of the IC board 64 of the ink cartridge 30 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed.

[0072] More specifically, the second wall 162 comprises a portion positioned to overlap the moving path of the IC board 64 when viewed in the left direction 56. The portion of the second wall 162 is positioned below the upper end of the IC board 64 and positioned between both ends of the IC board 64 in the insertion direction 51 and the removal direction 52 when the ink cartridge 30 is inserted and mounted to the cartridge mounting portion 110 and when the IC board 64 is positioned between the first wall 161 and the second wall 162 in the right direction 55 and the left direction 56.

[0073] In another embodiment, the second wall 162 may have an end in the insertion direction 51, which end is positioned further in the insertion direction 51 than the IC board 64, and have another end in the removal direction 52, which end is positioned between the both ends of the IC board 64 in the insertion direction 51 and the removal direction 52 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. Alternatively, the second wall 162 may have an end in the insertion direction 51, which end is positioned between the both ends of the IC board 64 in the insertion direction 51 and the removal direction 52, and have another end in the removal direction 52, which end is positioned further in the removal direction 52 than the IC board 64 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. Alternatively, the second wall 162 may have ends in the insertion direction 51 and the removal direction 52, which ends are positioned between the both ends of the IC board 64 in the insertion direction 51 and the removal direction 52 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. Alternatively, the entirety of the second wall 162 may be positioned further in the removal direction 52 than the IC board 64. That is, the portion of the second wall 162 may overlap the IC board 64 when viewed in the left direction 56 only during the insertion of the ink cartridge 30 to the cartridge mounting portion 110 and may not overlap when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed.

[Rod 125]

[0074] Referring to **Figs. 2 and 5**, the rod 125 is positioned at the end surface of the case 101 above the ink supply tube 102. The rod 125 extends from the end surface in the removal direction 52. The rod 125 has a cross-sectional shape taken along a plane perpendicular to the removal direction 52, and the cross-sectional shape of the rod 125 is substantially an inversed U-shape, like an upper half of a circle. The rod 125 has a rib extending from the uppermost part of the U-shaped portion, and the rib extends in the removal direction 52. The rod 125 is inserted into a recess 96 formed in the ink cartridge 30 when the ink cartridge 30 is mounted to the cartridge mounting portion 110, i.e., when the ink cartridge 30 is in the mounted position.

[Support plate 126]

[0075] Referring to **Figs. 2 and 5**, the support plate 126 is positioned at the end surface of the case above the ink supply tube 102 and below the rod 125. The support plate 126 extends in the right direction 55 and the left direction 56 and is connected to the end surface of

the case 101 and the plates 104. The support plate 126 is positioned below a first protrusion 85 of the ink cartridge 30 and above the ink supply portion 34 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed.

[0076] The support plate 126 comprises two protrusions 127, 128 at its upper surface, and the two protrusion 127, 128 are spaced away from each other in the right direction 55 and the left direction 56. Each protrusion 127, 128 protrudes from the upper surface of the support plate 126 in the upward direction 54 and extends in the insertion direction 51 and the removal direction 52. The protrusion 127 is positioned further in the right direction 55 than the protrusion 128. Referring to **Fig. 12**, the protrusions 127, 128 contact the first protrusion 85 of the ink cartridge 30 from below when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. The protrusion 127 is an example of a third protrusion, and the protrusion 128 is an example of a fourth protrusion.

[Ink cartridge 30]

[0077] Referring to **Figs. 3 and 4**, the ink cartridge 30 is a container configured to store ink. The ink cartridge 30 has an inner space formed therein, and the inner space is the ink chamber 36, as an example of a consumable chamber, configured to store ink, as an example of a consumable. The ink cartridge 30 comprises an inner frame 35, a rear cover 31, and a front cover 32. The rear cover 31 and the front cover 32 are attached to each other, and the inner frame 35 is enclosed by the rear cover 31 and the front cover 32. The rear cover 31 and the front cover 32 forms the outer shape of the ink cartridge 30. The ink chamber 36 is formed in the inner frame 35. In another embodiment, the ink cartridge 35 may not have the inner frame 35, and the rear cover 31 and the front cover 32 may define the ink chamber 36.

[0078] The attitude of the ink cartridge 30 shown in **Figs. 1, 3 and 4** is the mounted attitude, as an example of the first attitude. As described below, the ink cartridge 30 comprises a front face 140, a rear face 41, an upper face 39, 141, a lower face 42, 142, a side face 37, 143, and a side face 38, 144, as outer faces of the ink cartridge 30. When the ink cartridge 30 takes the attitude shown in **Figs. 1, 3 and 4**, the direction extending from the rear face 41 to front face 140 coincides with the insertion direction 51, the direction extending from the front face 140 to the rear face 41 coincides with the removal direction 52, the direction extending from the upper face 39, 141 to the lower face 42, 142 coincides with the downward direction 53, the direction extending from the lower face 42, 142 to the upper face 39, 141 coincides with the upward direction 54. When the ink cartridge 30 is inserted into and mounted to the cartridge mounting portion 110, the front face 140 faces the insertion direction 51, the rear face 41 faces the removal direction 52, the lower face 42, 142 faces the downward direction 53, and the upper face 39, 141 faces the upward direction 54.

[0079] Referring to **Figs. 3 and 4**, the ink cartridge 30 has a width dimension along the right direction 55 and the left direction 56, a height dimension along the downward direction 53 and the upward direction 54, a depth dimension along the insertion direction 51 and the removal direction 52. The width dimension is less than each of the height dimension and the depth dimension. The front cover 32 comprises the front face 140, which faces the insertion direction 51 when the ink cartridge 30 is inserted into the cartridge mounting portion 110, and the rear cover 31 comprises the rear face 41, which faces the removal direction 52 when the ink cartridge 30 is inserted into the cartridge mounting portion 110. The ink chamber 36 is positioned between the front face 140 and the rear face 41.

[Rear cover 31]

[0080] Referring to **Figs. 3 and 4**, the rear cover 31 has a box shape having side faces 37, 38 spaced apart from each other in the right direction 55 and the left direction 56, the upper face 39 and the lower face 42 spaced apart from each other in the downward direction 53 and the upward direction 54, and the rear face 41. The side faces 37, 38 face the right direction 55 and the left direction 56, respectively, the upper face 39 faces the upward direction 54, and the lower face 42 faces the downward direction 53. The side faces 37, 38, the upper face 39, and the lower face 42 extend from the rear face 41 in the insertion direction 51, and the inner space of the rear cover 31 is opened toward the insertion direction 51. The inner frame 35 is inserted into the inner space of the rear cover 31 from the opening, i.e., the rear cover 31 covers a rear portion of the inner frame 35. The ink chamber 36 is positioned between the upper face 39 and the lower face 42.

[0081] Referring to **Figs. 3 and 4**, the rear cover 31 comprises a protrusion 43 extending from the upper face 39. The protrusion 43 is positioned at about the center of the upper face 39 in the right direction 55 and the left direction 56, and extends in the insertion direction 51 and the removal direction 52. The protrusion 43 comprises a lock surface 151 facing the removal direction 52. The lock surface 151 extends in the upward direction 54 and the downward direction 53. The lock surface 151 is configured to contact the lock portion 145 of the cartridge mounting portion 110 in the removal direction 52 when the ink cartridge is mounted to the cartridge mounting portion 110. By the lock surface 151 contacting the lock portion 145 in the removal direction 52, the ink cartridge 30 is locked or retained in the cartridge mounting portion 110 against the urging force of the pulling spring 114 transmitted via the slider 107 and the urging force of the coil spring 78.

[0082] The protrusion 43 comprises an inclined surface 155 in front of the lock surface 151, i.e., positioned further in the insertion direction 51 than the lock surface

151. The inclined surface 155 faces the upward direction 54 and the insertion direction 51. Therefore, the inclined surface 155 is viewable when the ink cartridge 30 is viewed in the downward direction 53 and is viewable when the ink cartridge is viewed in the removal direction 52. During the insertion of the ink cartridge 30 into the cartridge mounting portion 110, the lock portion 145 of the cartridge mounting portion 145 slides on the inclined surface 155 and therefore is smoothly guided to a position more rearward than the lock surface 151, i.e., a position further in the removal direction 52 than the lock surface 151.

[0083] The rear cover 31 comprises an operation portion 90 at the upper face 39, and the operation portion 90 is positioned more rearward than the lock surface 151, i.e., positioned further in the removal direction 52 than the lock surface 151. The upper face 39 comprises a sub upper face 91 positioned at the rear end of the upper face 39. The sub upper face 91 is positioned below the rest of the upper face 39, i.e., the sub upper face 91 is positioned further in the downward direction 53 than the rest of the upper face 39. The operation portion 90 is positioned above the sub upper face 91, i.e., the operation portion 90 is positioned further in the upward direction 54 than the sub upper face 91, with a space formed therebetween. The operation portion 90 extends in the upward direction 54 beyond the protrusion 43 from a position adjacent to the boundary between the sub upper face 91 and the rest of the upper face 39, and then extends obliquely downward, i.e., in the removal direction 52 and the downward direction 53.

[0084] The operation portion 90 comprises an operation surface 92 facing the upward direction 54 and the removal direction 52. The position of the operation surface 92 and the position of the sub upper face 91 along the insertion direction 51 and the removal direction 52 at least partly overlap. In other words, the operation surface 92 and the sub upper face 91 at least partly overlap in the downward direction 53 and the upward direction 54. In other words, at least a portion of the operation surface 92 is aligned with at least a portion of the sub upper face 91 in the downward direction 53 and the upward direction 54. The operation surface 92 comprises a plurality of protrusions, i.e., a plurality of elongated protrusions, each extending in the right direction 55 and the left direction 56. The elongated protrusions are spaced apart from each other in the insertion direction 51 and the rearward direction 52. With the elongated protrusions, the operation surface 92 becomes recognizable to a user, and the operation surface 92 becomes nonskid when the user operates the operation surface 92 with his/her finger.

[0085] The operation surface 92 is viewable when the ink cartridge 30 is viewed in the downward direction 53 and when the ink cartridge 30 is viewed in the insertion direction 51. In other words, the operation surface 92 is viewable when the ink cartridge 30 is viewed in the direction extending from the upper face 39 toward the lower face 42 and when the ink cartridge 30 is viewed in the direction extending from the rear face 41 toward the front face 140. The operation surface 92 is a surface a user operates for unlocking or releasing the ink cartridge 30 from the locked state in the cartridge mounting portion 110. The operation portion 90 is fixed to the rear cover 31, e.g., the operation portion 90 is integrally molded with the rear cover 31, and therefore the operation portion 90 does not move relative to the rear cover 31, e.g., does not pivot relative to the rear cover 31. Therefore, a force applied to the operation surface 92 from a user is directly transmitted to the rear cover 31, without changing its direction. In this embodiment, the operation portion 90 also does not move relative to the inner frame 35 or ink chamber 36, e.g., does not pivot relative to the inner frame 35 or ink chamber 36.

[0086] At least a portion of the operation surface 92 protrudes further in the upward direction 54 than the lock surface 151.

[Front cover 32]

[0087] Referring to **Figs. 3 and 4**, the front cover 32 has a box shape having side faces 143, 144 spaced apart from each other in the right direction 55 and the left direction 56, the upper face 141 and the lower face 142 spaced apart from each other in the downward direction 53 and the upward direction 54, and the front face 140. The side faces 143, 144 face the right direction 55 and the left direction 56, respectively, the upper face 141 faces the upward direction 54, and the lower face 142 faces the downward direction 53. The side faces 143, 144, the upper face 141, and the lower face 142 extend from the front face 140 in the removal direction 52, and the inner space of the front cover 32 is opened toward the removal direction 52. The inner frame 35 is inserted into the inner space of the front cover 32 from the opening. The front cover 32 covers a front portion of the inner frame 35, which is not covered by the rear cover 31. The ink chamber 36 is positioned between the upper face 141 and the lower face 142.

[0088] The upper face 141 of the front cover 32 and the upper face 39 of the rear cover 31 constitute the upper face of the ink cartridge 30. The lower face 142 of the front cover 32 and the lower face 42 of the rear cover 31 constitute the lower face of the ink cartridge 30. The side faces 143, 144 of the front cover 32 and the side faces 37, 38 of the rear cover 31 constitute the side faces of the ink cartridge 30. The front face 140 of the front cover 32 constitutes the front face of the ink cartridge 30, and the rear face 41 of the rear cover 31 constitutes the rear face of the ink cartridge 30.

[0089] Each of the front face, the rear face, the upper face, the lower face, and the side faces of the ink cartridge 30 may not need to form a single flat surface. The front face of the ink cartridge 30 is a face that is viewable when the ink cartridge 30 in the first attitude is viewed in the removal direction 52 and positioned more forward than the center of the ink cartridge 30 in the first attitude with

respect to the insertion direction 51 and the removal direction 52, i.e., positioned further in the insertion direction 51 than the center of the ink cartridge 30 in the first attitude with respect to the insertion direction 51 and the removal direction 52. The rear face of the ink cartridge 30 is a face that is viewable when the ink cartridge in the first attitude is viewed in the insertion direction 51 and positioned more rearward than the center of the ink cartridge 30 in the first attitude with respect to the insertion direction 51 and the removal direction 52, i.e., positioned further in the removal direction 52 than the center of the ink cartridge 30 in the first attitude with respect to the insertion direction 51 and the removal direction 52. The upper face of the ink cartridge 30 is a face that is viewable when the ink cartridge 30 in the first attitude is viewed in the downward direction 53 and positioned above the center of the ink cartridge 30 with respect to the downward direction 53 and the upward direction 54, i.e., positioned further in the upward direction 54 than the center of the ink cartridge 30 with respect to the downward direction 53 and the upward direction 54. The lower face of the ink cartridge 30 is a face that is viewable when the ink cartridge 30 in the first attitude is viewed in the upward direction 54 and positioned below the center of the ink cartridge 30 with respect to the downward direction 53 and the upward direction 54, i.e., positioned further in the downward direction 53 than the center of the ink cartridge 30 with respect to the downward direction 53 and the upward direction 54. One of the side faces of the ink cartridge 30 is a face that is viewable when the ink cartridge 30 in the first attitude is viewed in the left direction 56 and positioned to the right of the center of the ink cartridge 30 with respect to the right direction 55 and the left direction 56, i.e., positioned further in the right direction 55 than the center of the ink cartridge 30 with respect to the right direction 55 and the left direction 56. The other one of the side faces of the ink cartridge 30 is a face that is viewable when the ink cartridge 30 in the first attitude is viewed in the right direction 55 and positioned to the left of the center of the ink cartridge 30 with respect to the right direction 55 and the left direction 56, i.e., positioned further in the left direction 56 than the center of the ink cartridge 30 with respect to the right direction 55 and the left direction 56.

[0090] The front cover 32 has the recess 96 formed in an upper portion of the front face 140. The recess 96 extends from the front face 140 in the removal direction 52. The recess 96 is configured to receive the rod 125 when the ink cartridge 30 is mounted to the cartridge mounting portion 110. The recess 96 has a cross-sectional shape taken along a plane perpendicular to the insertion direction 51 and the removal direction 52, and the cross-sectional shape of the recess 96 corresponds to the cross-sectional shape of the rod 125.

[0091] The front cover 32 has an opening 97 formed through a lower portion of the front face 140 in the removal direction 52. The opening 97 is configured to allow the ink supply portion 34 to extend therethrough when the inner frame 35 is inserted into the front cover 32, such that the ink supply portion 34 is positioned outside of the front cover 32. The position, dimension, and shape of the opening 97 correspond to those of the ink supply portion 34.

[0092] The front cover 32 comprises the first protrusion 85 and the second protrusion 86 positioned at the front face 140. The first protrusion 85 extends in the insertion direction 51 at the upper end of the front cover 32. The recess 96 is formed in the distal end of the first protrusion 85 facing the insertion direction 51. The distal end of the first protrusion 85 facing the insertion direction 51 is a part of the front face 140.

[0093] The second protrusion 86 extends in the insertion direction 51 at the lower end of the front cover 32. The second protrusion 86 is positioned below the ink supply portion 34, i.e., positioned further in the downward direction 53 than the ink supply portion 34. The protrusion 86 has a recess 87 formed in its lower face, and the recess 87 opens in the insertion direction 51 and the downward direction 53. A portion of the second protrusion 86 defining the recess 87 extends beyond the lower face 142 of the front cover 32 in the downward direction 53. During the insertion of the ink cartridge 30 into the cartridge mounting portion 110, the slider 107 enters the recess 87 and contacts the portion of the second protrusion 86 defining the recess 87.

[Inner frame 35]

[0094] Although not shown in the drawings in detail, the inner frame 35 comprises an annular or loop shaped wall, and the inner space surrounded by the wall opens in the right direction 55 and the left direction 56 at the right and left ends of the inner frame 35, respectively. Films (not shown) are attached to the right and left ends of the inner frame 35, such that the inner space of the inner frame 35 is closed, and the inner space becomes the ink chamber 36 configured to store ink therein. The inner frame 35 comprises a front face 40, and the ink supply portion 34 is positioned at the front face 40. The front face 40 of the inner frame 35 is positioned adjacent to the front face 140 of the front cover 32, when the inner frame 35 is inserted into the front cover 32.

[Ink supply portion 34]

[0095] Referring to **Fig. 4**, the ink supply portion 34 extends from the front face 40 of the inner frame 35 in the insertion direction 51 to the outside of the front cover 32 through the opening 97 formed through the front face 140 of the front cover 32. The ink supply portion 34 has a circular cylindrical outer shape. The ink supply portion 34 comprises the cylindrical wall 73 having a circular cylindrical shape having an inner space, a seal member 76, and a cap 79. The seal member 76 and the cap 79 are attached to the cylindrical wall 73.

[0096] The cylindrical wall 73 extends from the inside

of the ink chamber 36 to the outside of the ink chamber 36. The inner space of the cylindrical wall 73 opens to the ink chamber 36 at the rear end of the cylindrical wall 73. The inner space of the cylindrical wall 73 opens to the outside of the ink cartridge 30 at the front end of the cylindrical wall 73. Communication between the ink chamber 36 and the outside of the ink cartridge 30 is allowed via the inner space of the cylindrical wall 73. The ink supply portion 34 is configured to supply ink stored in the ink chamber 36 to the outside of the ink cartridge 30 through the inner space of the cylindrical wall 73. The seal member 76 and the cap 79 are attached to the front end of the cylindrical wall 73.

[0097] The ink supply portion 34 comprises the valve 77 and the coil spring 78 positioned in the inner space of the cylindrical wall 73. The valve 77 and the coil spring 78 are configured to switch the state of the ink supply portion 34 between a state in which ink is allowed to flow out of the ink chamber 30 through the inner space of the cylindrical wall 73 to the outside of the ink cartridge 30 (see **Figs. 8 and 9**) and a state in which ink is prevented from flowing out of the inner space of the cylindrical wall 73 to the outside of the ink cartridge 30 (see **Figs. 6 and 7**).

[0098] The valve 77 is configured to move in the insertion direction 51 and the removal direction 52 to selectively open and close the ink supply opening 71 formed through the center of the seal member 76. The coil spring 78 is configured to urge the valve 77 in the insertion direction 51, such that the valve 77 contacts the seal member 76 and close the ink supply opening 71 when an external force is not applied to the valve 77.

[0099] The seal member 76 is positioned at the front end of the cylindrical wall 73. The seal member 76 has substantially a disc shape having the ink supply opening 71 formed therethrough in the insertion direction 51 and the removal direction 52. The seal member 76 is made of an elastic material such as rubber, elastomer, etc. The diameter of the ink supply opening 71 is slightly less than the outer diameter of the ink supply tube 102. The seal member 76 liquid-tightly contacts the front end of the cylindrical wall 73 while being pressed by the cap 79 which is attached to and covers the outside of the cylindrical wall 73.

[0100] Before the ink cartridge 30 is inserted into the cartridge mounting portion 110, the valve 77 closes the ink supply opening 71. When the ink cartridge 30 is inserted into the cartridge mounting portion 110, the ink supply tube 102 enters the ink supply opening 71. When this occur, the inner surface of the seal member 76 defining the ink supply opening 71 liquid-tightly contacts the outer surface of the ink supply tube 102 while the seal member 76 is elastically deformed by the outer surface of the ink supply tube 102. When the ink cartridge 30 is further inserted, the end of the ink supply tube 102 passes through the ink supply opening 71 and contacts the valve 77. When the ink cartridge 30 is further inserted, the ink supply tube 102 pushes and moves the valve 77 in the removal direction 52 against the urging force of the coil spring 78. When this occurs, ink is allowed to flow from the ink chamber 36 to the ink supply tube 102 through the inner space of the cylindrical wall 73. Although not shown in the drawings, the ink supply tube 102 has an opening at or adjacent to the end of the ink supply tube 102, and the opening extends from the outer surface of the ink supply tube 102 to the inner space of the ink supply tube 102. Ink flows from the inner space of the cylindrical wall 73 to the inner space of the ink supply tube 102 via the opening of the ink supply tube 102. Ink flows from the ink chamber 36 to the outside of the ink cartridge 30 through the inner space of the cylindrical wall 73 and the inner space of the ink supply tube 102.

[0101] The ink supply portion 34 may not necessarily comprise the valve 77 and the coil spring 78. For instance, in another embodiment, the ink supply opening 71 may be closed by a film. In such an embodiment, when the ink cartridge 30 is inserted into the cartridge mounting portion 110, the ink supply tube 102 penetrates through the film and passes through the ink supply opening 71, such that the end of the ink supply tube 102 is positioned in the inner space of the cylindrical wall 73. In yet another embodiment, the ink supply opening 71 may be closed by the elasticity of the seal member 76. In such an embodiment, when the ink cartridge 30 is inserted into the cartridge mounting portion 110, the outer surface of the ink supply tube 102 pushes the inner surface of the seal member 76 defining the ink supply opening 71 radially, and thereby opens the ink supply opening 71.

[Board supporting portion 130 and IC board 64]

[0102] Referring to **Fig. 3**, the front cover 32 comprises the board supporting portion 130 positioned above the recess 96. The board supporting portion 130 defines the upper end of the recess 96. The board supporting portion 130 is connected to the upper face 141 at an end of the board supporting portion 130 in the removal direction 52.

[0103] The board supporting portion 130 supports the IC board 64. The IC board 64 is attached to the upper face of the board supporting portion 130. In this embodiment, the IC board 64 is attached to the upper face of the board supporting portion 130 via ultraviolet curable adhesive. The dimension of the IC board 64 is preferably less than or equal to the dimension of the board supporting portion 130 in the insertion direction 51 and the removal direction 52. In this embodiment, the dimension of the IC board 64 is less than the dimension of the board supporting portion 130 in the insertion direction 51 and the removal direction 52.

[0104] Four electrodes 65 are formed on the upper face of the IC board 64, i.e., a face of the IC board 64 facing the upward direction 54. The four electrodes 65 are exposed and face the upward direction 54. Each electrode 65 is an example of an electrical interface. Each electrode 65 is elongated in the insertion direction 51 and the removal direction 52. The for electrodes 65 are aligned with

and spaced apart from each other in the right direction 55 and the left direction 56. The four electrodes 65 are a clock signal electrode, a data signal electrode, a power supply electrode, and a ground electrode, respectively, for instance. The IC board 64 also comprises an IC (Integrated Circuit, not shown), and the four electrodes 65 are electrically connected to the IC. The IC stores data/information about the ink cartridge 30, such as the lot number, the manufactured date, the color of ink, etc. The data/information can be read out from the outside.

[First guide surface 131 and second guide surface 132]

[0105] Referring to **Fig. 3**, the ink cartridge 30 comprises a first guide surface 131 and a second guide surface 132 positioned below the IC board 64, i.e., positioned further in the downward direction 53 than the IC board 64. The first guide surface 131 faces the right direction 55. The first guide surface 131 is positioned to the right of the IC board 64, i.e., positioned further in the right direction 55 than the IC board 64. The second guide surface 132 faces the left direction 56. The second guide surface 132 is positioned to the left of the IC board 64, i.e., positioned further in the left direction 56 than the IC board 64. The first guide surface 131 is a part of the board supporting portion 130 and the second guide surface 132 is a part of the board supporting portion 130.

[0106] In another embodiment, the first guide surface 131 may be positioned at the same position as an end of the IC board 64 in the right direction 55, and the second guide surface 132 may be positioned at the same position as an end of the IC board 64 in the left direction 56. The first guide surface 131 and the second guide surface 132 may be provided at different positions than the positions shown in **Fig. 3** in the insertion direction 51 and the removal direction 52. The first guide surface 131 and the second guide surface 132 may be formed on a portion other than the board supporting portion 130. The first guide surface 131 and the second guide surface 132 may extend from positions below the IC board 64 in the upward direction 54 beyond the IC board 64.

[Third guide surface 133 and fourth guide surface 134]

[0107] Referring to **Fig. 3**, the ink cartridge 30 comprises a third wall 173 positioned to the right of the board supporting portion 130, i.e., positioned further in the right direction 55 than the board supporting portion 130. The third wall 173 is positioned further in the right direction 55 than the first guide surface 131, and spaced away from the first guide surface 131 in the right direction 55. The ink cartridge 30 comprises a fourth wall 174 positioned to the left of the board supporting portion 130, i.e., positioned further in the left direction 56 than the board supporting portion 130. The fourth wall 174 is positioned further in the left direction 56 than the second guide surface 132, and spaced away from the second guide surface 132 in the left direction 56.

[0108] The third wall 173 extends from the first protrusion 85 in the upward direction 54. The third wall 173 extends from a position below the IC board 64 in the upward direction 54 beyond the IC board 64. The fourth wall 174 extends from the first protrusion 85 in the upward direction 54. The fourth wall 174 extends from a position below the IC board 64 in the upward direction 54 beyond the IC board 64.

[0109] The third wall 173 comprises a third guide surface 133. The third guide surface 133 is positioned further in the right direction 55 than the first guide surface 131, and spaced away from the first guide surface 131 in the right direction 55. The third guide surface 133 faces the left direction 56. The third guide surface 133 extends from a position below the IC board 64 in the upward direction 54 beyond the IC board 64. The fourth wall 174 comprises a fourth guide surface 134. The fourth guide surface 134 is positioned further in the left direction 56 than the second guide surface 132, and spaced away from the second guide surface 132 in the left direction 56. The fourth guide surface 134 faces the right direction 55. The fourth guide surface 134 extends from a position below the IC board 64 in the upward direction 54 beyond the IC board 64.

[0110] The first wall 161 of the cartridge mounting portion 110 has a dimension along the right direction 55 and the left direction 56, which dimension is less than a gap between the first guide surface 131 and the third guide surface 133 along the right direction 55 and the left direction 56. The second wall 162 of the cartridge mounting portion 110 has a dimension along the right direction 55 and the left direction 56, which dimension is less than a gap between the second guide surface 132 and the fourth guide surface 134 along the right direction 55 and the left direction 56.

[0111] The third wall 173 has a recess 175 formed therein. The recess 175 is formed from the upper end of the third wall 173 in the downward direction 53. The recess 175 is positioned further in the right direction 55 than the first guide surface 131, and aligned with the first guide surface 131 in the right direction 55 and the left direction 56. That is, at least a portion of the first guide surface 131 is not aligned with the third guide surface 133 in the right direction 55 and the left direction 56. A portion of the third guide surface 133 is positioned further in the insertion direction 51 than the first guide surface 131, and another portion of the third guide surface 133 is positioned further in the removal direction 52 than the first guide surface 131. In other words, the first guide surface 131 and the third guide surface 133 are staggered along the insertion direction 51 and the removal direction 52.

[0112] The IC board 64 comprises a contact portion contacting the board supporting portion 130, in this embodiment, via the ultraviolet curable adhesive. The recess 175 is aligned with the contact portion of the IC board 64 in the right direction 55 and the left direction 56. Therefore, when viewed in the left direction 56, at least a portion of the third wall 173 does not overlap the

contact portion of the IC board 64. In other words, the contact portion of the IC board 64 is viewable through the recess 175 when the ink cartridge 30 is viewed in the left direction 56.

[0113] The fourth wall 174 has a recess 176 formed therein. The recess 176 is formed from the upper end of the fourth wall 174 in the downward direction 53. The recess 176 is positioned further in the left direction 56 than the second guide surface 132, and aligned with the second guide surface 132 in the right direction 55 and the left direction 56. That is, at least a portion of the second guide surface 132 is not aligned with the fourth guide surface 134 in the right direction 55 and the left direction 56. A portion of the fourth guide surface 134 is positioned further in the insertion direction 51 than the second guide surface 132, and another portion of the fourth guide surface 134 is positioned further in the removal direction 52 than the second guide surface 133. In other words, the second guide surface 132 and the fourth guide surface 134 are staggered along the insertion direction 51 and the removal direction 52.

[0114] The recess 176 is aligned with the contact portion of the IC board 64 in the right direction 55 and the left direction 56. Therefore, when viewed in the right direction 55, at least a portion of the fourth wall 174 does not overlap the contact portion of the IC board 64. In other words, the contact portion of the IC board 64 is viewable through the recess 176 when the ink cartridge 30 is viewed in the right direction 55.

[0115] In another embodiment, the third wall 173 may be positioned further in the insertion direction 51 than the first guide surface 131, and the fourth wall 174 may be positioned further in the insertion direction 51 than the second guide surface 132. Alternatively, the third wall 173 may be positioned further in the removal direction 52 than the first guide surface 131, and the fourth wall 174 may be positioned further in the removal direction 52 than the second guide surface 132. Alternatively, the third wall 173 may be positioned further in the insertion direction 51 than the first guide surface 131, and the fourth wall 174 may be positioned further in the removal direction 52 than the second guide surface 132.

[First space 181 and second space 182]

[0116] The third wall 173 is spaced away from the board supporting portion 130 in the right direction 55 and the fourth wall 174 is spaced away from the board supporting portion 130 in the left direction 56. Therefore, when the ink cartridge 30 is inserted into the cartridge mounting portion 110, a first space 181 is formed between the third wall 173 and the board supporting portion 130 and a second space 182 is formed between the fourth wall 174 and the board supporting portion 130. The first space 181 receives the first wall 161 of the cartridge mounting portion 110 and the second space 182 receives the second wall 162 of the cartridge mounting portion 110.

[0117] The right end of the first space 181 is defined by the third guide surface 133, and the left end of the first space 181 is defined by the first guide surface 131. The first space 181 is opened in the insertion direction 51 and the upward direction 54. The first space 181 extends up to a position further in the removal direction 52 than the IC board 64. The first space 181 is large enough to receive the first wall 161.

[0118] When the ink cartridge 30 is inserted into and mounted to the cartridge mounting portion 110, the first wall 161 enters the first space 181 from the upper end and the front end of the first space 181. The front end of the first space 181 is the end of the first space 181 in the insertion direction 51. Referring to **Fig. 12**, the first wall 161 extends from the lower surface 163A of the main body 163 of the contact unit 160 in the downward direction 53 into the first space 181. That is, the first wall 161 is received in the first space 181.

[0119] The left end of the second space 182 is defined by the fourth guide surface 134, and the right end of the second space 182 is defined by the second guide surface 132. The second space 182 is opened in the insertion direction 51 and the upward direction 54. The second space 182 extends up to a position further in the removal direction 52 than the IC board 64. The second space 182 is large enough to receive the second wall 162.

[0120] When the ink cartridge 30 is inserted into and mounted to the cartridge mounting portion 110, the second wall 162 enters the second space 182 from the upper end and the front end of the second space 182. The front end of the second space 182 is the end of the second space 182 in the insertion direction 51. Referring to **Fig. 12**, the second wall 162 extends from the lower surface 163A of the main body 163 of the contact unit 160 in the downward direction 53 into the second space 182. That is, the second wall 162 is received in the second space 182.

[0121] Referring to **Fig. 3**, each electrode 65 has a dimension L1 along the right direction 55 and the left direction 56. Referring to **Fig. 12**, there is a gap L2 along the right direction 55 and the left direction 56 between the first guide surface 131 and the first wall 161 received in the first space 181, and there is a gap L3 along the right direction 55 and the left direction 56 between the third guide surface 133 and the first wall 161 received in the first space 181. The dimension I1 is greater than the sum of L2 and L3. There is a gap L4 along the right direction 55 and the left direction 56 between the second guide surface 132 and the second wall 162 received in the second space 182, and there is a gap L5 along the right direction 55 and the left direction 56 between the fourth guide surface 134 and the second wall 162 received in the second space 182. The dimension L1 is greater than the sum of L4 and L5. In this embodiment, the four electrodes 65 have the same dimension L1. In another embodiment, the four electrodes 65 may have different dimensions along the right direction 55 and the left direction 56. In such a case, the smallest dimension

of the different dimensions is greater than the sum of L2 and L3 and greater than the sum of L4 and L5.

[Protrusions 137, 138]

[0122] Referring to **Figs. 4 and 10**, the ink cartridge 30 comprises two protrusions 137, 138 positioned on the lower surface of the first protrusion 85. The protrusion 137 is an example of a first protrusion and the protrusion 138 is an example of a second protrusion. The protrusions 137, 138 are positioned away from each other in the right direction 55 and the left direction 56. Each protrusion 137, 138 protrudes from the lower surface of the first protrusion 85 in the downward direction 53 and extends in the insertion direction 51 and the removal direction 52. The protrusion 137 is positioned further in the right direction 55 than the protrusion 138.

[0123] The protrusion 137 is positioned further in the right direction 55 than the IC board 64. The protrusion 138 is positioned further in the left direction 56 than the IC board 64.

[0124] The protrusion 137 is positioned between the board supporting portion 130 and the third wall 173. The protrusion 137 is positioned between both ends of the third wall 173 in the insertion direction 51 and the removal direction 52. Therefore, the protrusion 137 overlaps the first space 181 when viewed in the upward direction 54 or the downward direction 53. In this embodiment, the protrusion 137 entirely overlaps the first space 181. In another embodiment, the protrusion 137 partly overlaps the first space 181.

[0125] The protrusion 138 is positioned between the board supporting portion 130 and the fourth wall 174. The protrusion 138 is positioned between both ends of the fourth wall 174 in the insertion direction 51 and the removal direction 52. Therefore, the protrusion 1387 overlaps the second space 182 when viewed in the upward direction 54 or the downward direction 53. In this embodiment, the protrusion 138 entirely overlaps the second space 182. In another embodiment, the protrusion 138 partly overlaps the second space 182.

[0126] Referring to Fig. 12, the protrusions 137, 138 contact the support plate 126 of the cartridge mounting portion 110 from above when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed. More specifically, the protrusion 137 contacts the protrusion 127 of the support plate 126, and the protrusion 138 contacts the protrusion 128 of the support plate 126.

[0127] The protrusions 137, 138 are optional. When the protrusions 137, 138 are not provided, the protrusions 127, 128 contact the lower surface of the first protrusion 85 from below. The protrusions 127, 128 are also optional. When the protrusions 127, 128 are not provided, the protrusions 137, 138 contact the upper surface of the support plate 126. When both the protrusions 137, 138 and the protrusions 127, 128 are not provided, the lower surface of the first protrusion 85 contacts the upper surface of the support plate 126.

[Insertion of ink cartridge 30 into cartridge mounting portion 110]

[0128] Referring to **Fig. 4**, before the ink cartridge 30 is inserted into the cartridge mounting portion 110, the valve 77 closes the ink supply opening 71. The flow of ink from the ink chamber 36 to the outside of the ink cartridge 30 is blocked.

[0129] Referring to **Fig. 5**, the ink cartridge 30 is inserted into the case 101 via the opening 112 of the cartridge mounting portion 110. A user pushes the rear face 41 of the rear cover 31 to insert the ink cartridge 30 in the insertion direction 51 into the cartridge mounting portion 110. A lower portion of the front cover 32 is positioned in the guide groove 109 of the lower portion of the case 101.

[0130] Referring to **Fig. 6**, when the ink cartridge 30 is further inserted into the cartridge mounting portion 110, the slider 107 enters the recess 87 and contacts the second protrusion 86 of the ink cartridge 30.

[0131] Referring to **Fig. 7**, when the ink cartridge 30 is further inserted in the insertion direction 51 against the urging force of the pulling spring 114 urging the slider 107 in the removal direction 52, the cap 79 of the ink supply portion 34 starts to enter the guide portion 105, and the rod 125 starts to enter the recess 96.

[0132] Referring to **Fig. 8**, when the ink cartridge 30 is further inserted in the insertion direction 51 against the urging force of the pulling spring 114 urging the slider 107 in the removal direction 52, the ink supply tube 102 enters the ink supply opening 71 and pushes the valve 77 away from the seal member 76 against the urging force of the coil spring 78. The urging force of the pulling spring 114 is applied to the ink cartridge 30 via the slider 107 in the removal direction 52, and the urging force of the coil spring 78 is applied to the ink cartridge 30 in the removal direction 52.

[0133] The rod 125 is further inserted into the recess 96. The protrusion 137 contacts the protrusion 127 and the protrusion 138 contacts the protrusion 128. With this contact, the movement of the first protrusion 85 in the downward direction 53 is restricted.

[0134] The first wall 161 and the second wall 162 of the main body 163 of the contact unit 160 enter the first space 181 and the second space 182, respectively. While the first guide surface 131 and the third guide surface 133 are guided by the first wall 161 and the second guide surface 132 and the fourth guide surface 134 are guided by the second wall 162, the IC board 64 reaches a position directly below the contacts 106. Until the IC board 64 reaches the position below the contacts 106, the lower ends of the contacts 106 are positioned further in the downward direction 53 than the upper surface of the electrodes 65. When the IC board 64 reaches the position below the contacts 106, IC board 65 pushes up the contacts 106 in the upward direction 54, and the contacts 106 are elastically deformed in the upward direction 54.

As such, the electrodes 65 contact the corresponding contacts 106. When this occurs, electrical connection between the IC (not shown) of the IC board 64 and the controller 1 is established, and the controller 1 becomes able to access the IC.

[0135] When the electrodes 65 contact the contacts 106, the IC board 64 is urged in the downward direction 53 by the elastically deformed contacts 106. Nevertheless, because the protrusions 137, 138 of the first protrusion 85 contact the protrusions 127, 128 of support plate 126, respectively, the movement of the first protrusion 85 in the downward direction 53 is restricted. Therefore, the IC board 64 is accurately positioned relative to the contacts 106 in the downward direction 53 and the upward direction 54.

[0136] The protrusion 43 of the rear cover 31 reaches the lock portion 145, and the inclined surface 155 slides on the lock portion 145. The sliding contact between the inclined surface 155 and the lock portion 145 causes the ink cartridge 30 to pivot clockwise in **Fig. 8** about a pivot center which is the center of the ink supply opening 71 through which the ink supply tube 102 is inserted. The attitude of the ink cartridge 30 in **Fig. 8** is an example of a second attitude. When the ink cartridge 30 is in the second attitude, the lock surface 151 of the protrusion 43 is positioned below the lock portion 145, i.e., positioned further in the downward direction 53 than the lock portion 145.

[0137] Referring to **Fig. 9**, when the ink cartridge 30 is further inserted in the insertion direction 51 against the urging force of the pulling spring 114 urging the slider 107 in the removal direction 52 and against urging force of the coil spring 78, the inclined surface 155 is positioned further in the insertion direction 51 than the lock portion 145. When the inclined surface 155 does not contact the lock portion 145, the ink cartridge 30 pivots counterclockwise in **Fig. 9** about the pivot center which is the center of the ink supply opening 71 through which the ink supply tube 102 is inserted.

[0138] When the ink cartridge 30 pivots counterclockwise, the lock surface 151 reaches a position in which the lock surface 151 and the lock portion 145 face each other in the insertion direction 51 and the removal direction 52. Moreover, when the ink cartridge 30 pivots counterclockwise, the rear cover 31 contacts the lock portion 145. When this occurs, the impact of the contact tells the user that the insertion of the ink cartridge 30 is completed. When the user stops pushing the ink cartridge 30, the ink cartridge 30 is moved in the removal direction 52 by the urging force of the pulling spring 114 applied via the slider 107 and the urging force of the coil spring 78. When this occurs, the lock surface 151 contacts the lock portion 145 in the removal direction 52 and the movement of the ink cartridge 30 relative to the cartridge mounting portion 110 in the removal direction 52 is restricted, as shown in **Fig. 9**. The attitude of the ink cartridge 30 in **Fig. 9** is an example of the first attitude. The mounting of the ink cartridge 30 to the cartridge mounting portion 110 is thus completed. The ink cartridge 30 is locked or retained in the cartridge mounting portion 110 with the lock surface 151 contacting the lock portion 145 in the removal direction 52 against the urging force of the pulling spring 114 and the urging force of the coil spring 78 in the removal direction 52.

[0139] When the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed, the protrusion 127 is positioned further in the right direction 55 than the IC board 64. The protrusion 128 is positioned further in the left direction 56 than the IC board 64.

[0140] When the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed, the protrusion 127 is positioned between the board supporting portion 130 and the third wall 173. The protrusion 127 is positioned between both ends of the third wall 173 in the insertion direction 51 and the removal direction 52. Therefore, the protrusion 127 overlaps the first space 181 when viewed in the upward direction 54 or the downward direction 53. In this embodiment, the protrusion 127 entirely overlaps the first space 181. In another embodiment, the protrusion 127 partly overlaps the first space 181.

[0141] When the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed, the protrusion 128 is positioned between the board supporting portion 130 and the fourth wall 174. The protrusion 128 is positioned between both ends of the fourth wall 174 in the insertion direction 51 and the removal direction 52. Therefore, the protrusion 128 overlaps the second space 182 when viewed in the upward direction 54 or the downward direction 53. In this embodiment, the protrusion 128 entirely overlaps the second space 182. In another embodiment, the protrusion 128 partly overlaps the second space 182.

[0142] When a user wishes to remove the ink cartridge 30 from the cartridge mounting portion 110, the user pushes down the operation surface 92. When the ink cartridge 30 is in the first attitude, the operation surface 92 is viewable when the ink cartridge 30 is viewed in the downward direction 53 and is viewable when the ink cartridge 30 is viewed in the insertion direction 51. In other words, when the ink cartridge 30 is in the first attitude, the operation surface 92 faces the upward direction 54 and the removal direction 52. Therefore, when the user pushes the operation surface 92 when the ink cartridge 30 is in the first attitude to release the ink cartridge 30, the user's force is directed toward the downward direction 53 and the insertion direction 51. Due to the force directed toward the insertion direction 51, the lock surface 151 separates from the lock portion 145. Due to the force directed toward the downward direction 53, the ink cartridge 30 pivots from the first attitude to the second attitude. Therefore, compared to a situation in which the ink cartridge 30 pivots from the first attitude to the second attitude while the lock surface 151 slides on the lock portion 145, the force needed to be applied to the operation surface 92 to cause the ink cartridge 30 to pivot from the

first attitude to the second attitude becomes smaller, and the user can readily release the ink cartridge 30.

[0143] When the ink cartridge 30 pivots from the first attitude to the second attitude, the lock surface 151 is positioned below the lock portion 145, i.e., positioned further in the downward direction 53 than the lock portion 145. The urging force of the pulling spring 114 and the coil spring 78 moves the ink cartridge 30 in the removal direction 52. When the ink cartridge 30 separates from the slider 107, the urging force is no longer applied to the ink cartridge 30, and the ink cartridge 30 stops moving in the removal direction 52. When this occurs, at least the rear cover 31 of the ink cartridge 30 is positioned outside of the case 101, the user can take the ink cartridge 30 out of the cartridge mounting portion 110.

[Advantages]

[0144] According to the above-described embodiment, the ink cartridge 30 is inserted into the cartridge mounting portion 110 and mounted to the cartridge mounting portion 110 while the first guide surface 131 is guided by the first wall 161 and the second guide surface 132 is guided by the second wall 162. As a result, the electrodes 65 of the IC board 64 of the ink cartridge 30 contact the contacts 106 of the cartridge mounting portion 110, respectively.

[0145] Referring to **Fig. 13A**, if the IC board 64 is positioned offset from the board supporting portion 130 in the right direction 55, the IC board 64 contacts the first wall 161 during the insertion of the ink cartridge 30 into the cartridge mounting portion 110. Similarly, referring to **Fig. 13B**, if the IC board 64 is positioned offset from the board supporting portion 130 in the left direction 56, the IC board 64 contacts the second wall 162 during the insertion of the ink cartridge 30 into the cartridge mounting portion 110. Therefore, if the IC board 64 is offset from the board supporting portion 130 in the right direction 55 or the left direction 56, the ink cartridge 30 cannot be mounted to the cartridge mounting portion 110.

[0146] The electrodes 65 of the IC board 64 which is supported on the board supporting portion 130 at an accurate position can contact the contacts 106 of the cartridge mounting portion 110 while the electrodes 65 of the IC board 64 which is offset from the board supporting portion 130 in the right direction 55 or the left direction 56 cannot contact the contacts 106 of the cartridge mounting portion 110. As a result, the electrodes 65 of the ink cartridge 30 and the contacts 106 of the cartridge mounting portion 110 can securely contact each other.

[0147] Incidentally, when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed, the IC board 64 may overlap the first wall 161 and the second wall 162 when viewed in the right direction 55 or the left direction 56, or may be positioned further in the insertion direction 51 than the first wall 161 and the second wall 162.

[0148] Because the first guide surface 131 is positioned further in the right direction 55 than the IC board 64, or positioned at the same position as the end of the IC board 64 in the right direction 55, and the second guide surface 132 is positioned further in the left direction 56 than the IC board 64, or positioned at the same position as the end of the IC board 64 in the left direction 56, the IC board 64 is not damaged by the first wall 161 and the second wall 162 when the first wall 161 is guided by the first guide surface 131 and the second wall 162 is guided by the second guide surface 132.

[0149] Because the ink cartridge 30 is inserted into the cartridge mounting portion 110 and mounted to the cartridge mounting portion 110 while the first guide surface 131 and the third guide surface 133 are guided by the first wall 161 and the second guide surface 132 and the fourth guide surface 134 are guided by the second wall 162, the electrodes 65 of the ink cartridge 30 contact the contacts 106 of the cartridge mounting portion 110 properly.

[0150] Because the third wall 173 and the fourth wall 174 extend beyond the electrodes 65 in the upward direction 54, when the ink cartridge 30 contacts something, the IC board 64 is protected by the third wall 173 and the fourth wall 174. A likelihood that the IC board 64 is damaged can be reduced.

[0151] The first guide surface 131 and the third guide surface 133 are staggered along the insertion direction 51 and the removal direction 52, and the second guide surface 132 and the fourth guide surface 134 are staggered along the insertion direction 51 and the removal direction 52. When viewed in the right direction 55 or the left direction 56, at least a portion of the third wall 173 does not overlap the contact portion of the IC board 64, and at least a portion of the fourth wall 174 does not overlap the contact portion of the IC board 64. Therefore, if the IC board 64 contacts the board supporting portion 130 via ultraviolet curable adhesive, the optical path of the ultraviolet light directed toward the ultraviolet curable adhesive applied on the contact portion of the IC board 64 in the right direction 55 or the left direction 56 is not blocked when the ink cartridge 30 is manufactured. Therefore, the manufacture of the ink cartridge 30 becomes easy.

[0152] Because the dimension L1 of the electrode 65 is greater than the sum of L2 and L3 and greater than the sum of L4 and L5, when the first wall 161 and the second wall 162 move in the first space 181 and the second space 182 in the right direction 55 and the left direction 56, the electrodes 65 still remains in contact with the contacts 106 of the cartridge mounting portion 110.

[0153] Because the protrusion 137 contacts the protrusion 127 and the protrusion 138 contacts the protrusion 128 when the mounting of the ink cartridge 30 to the cartridge mounting portion 110 is completed, a likelihood is reduced that the ink cartridge 30 rotated around an axis extending in the insertion direction 51. Therefore, the electrodes 65 contact the contacts 106 of the cartridge mounting portion 110 further securely.

[0154] When the distance between the protrusion 127

and the protrusion 128 or between the protrusion 137 and the protrusion 138 in the right direction 55 and the left direction 56 becomes larger, the rotation of the ink cartridge 30 is further suppressed.

[0155] When the controller 1 accesses the IC of the IC board 64 via the electrodes 65 and the contacts 106, the controller 1 can read data out of the IC, or write date in the IC, or both.

[Modified embodiments]

[0156] In the above-described embodiment, the third guide surface 133 and the fourth guide surface 134 are provided to the ink cartridge 30. Nevertheless, the third guide surface 133 and the fourth guide surface 134 are optional. Even if the third guide surface 133 and the fourth guide surface 134 are not provided, the ink cartridge 30 is inserted into the cartridge mounting portion 110 and mounted to the cartridge mounting portion 110 while the first guide surface 131 is guided by the first wall 161 and the second guide surface 132 is guided by the second wall 162. In such a case, the first space 181 is formed to the right of the first guide surface 131, and the first space 181 is opened in the insertion direction 51, the upward direction 54, and the right direction 55. Similarly, the second space 182 is formed to the left of the second guide surface 132, and the second space 182 is opened in the insertion direction 51, the upward direction 54, and the left direction 56.

[0157] In the above-described embodiment, the ink-jet printer 10 is an example of the system, but the system is not limited to an ink-jet printer. The system can be an electrographic or laser printer configured to record an image on a sheet of paper with toner, applying the electrographic printing method. The system also can be a thermal transfer label printer configured to record an image on a label, applying the thermal transfer printing method.

[0158] In the above-described embodiment, ink is an example of the consumable, but the consumable is not limited to the ink. The consumable can be toner or a label used for the electrographic or laser printer and the label printer.

[0159] While the invention has been described in connection with various example structures and illustrative embodiments, it will be understood by those skilled in the art that other variations and modifications of the structures and embodiments described above may be made without departing from the scope of the invention. Other structures and embodiments will be understood by those skilled in the art from a consideration of the specification or practice of the invention disclosed herein. It is intended that the specification and the described examples are merely illustrative and that the scope of the invention is defined by the following claims.

[0160] The present invention also can be defined as follows in order to achieve the object of invention.

[0161] A consumable cartridge configured to be inserted into a mounting portion in a first direction (51) and thereby to be mounted to the mounting portion, and configured to be removed from the mounting portion in a second direction (52) opposite the first direction, comprising: a consumable chamber (36) configured to store a consumable; a board (64); a board supporting portion (130) configured to support the board; an electrical interface (65) positioned on the board and facing a third direction (54) which is perpendicular to the first direction and the second direction; a first guide surface (131) positioned further in a fourth direction (53) opposite the third direction than the board, wherein the first guide surface faces a fifth direction (55) which is perpendicular to the first, second, third, and fourth directions; a second guide surface (132) positioned further in the fourth direction (53) than the board, wherein the second guide surface faces a sixth direction (56) opposite the fifth direction; a third guide surface (133) positioned further in the fifth direction (55) than the first guide surface (131) and facing the sixth direction (56); and a fourth guide surface (134) positioned further in the sixth direction (56) than the second guide surface (132) and facing the fifth direction (55), wherein the first guide surface (131) and the third guide surface (133) define ends of a first space (181) in the sixth direction (56) and the fifth direction (55), respectively, and the first space (181) is opened in the first direction (51) and the third direction (54), and wherein the second guide surface (132) and the fourth guide surface (134) define ends of a second space (182) in the fifth direction (55) and the sixth direction (56), respectively, and the second space (182) is opened in the first direction (51) and the third direction (54).

[0162] Optionally, the consumable cartridge of claim 14, wherein the first guide surface (131) is positioned further in the fifth direction (55) than the board (64), or positioned at the same position as an end of the board in the fifth direction, wherein the second guide surface (132) is positioned further in the sixth direction (56) than the board (64), or positioned at the same position as an end of the board in the sixth direction.

[0163] Optionally, the consumable cartridge of claim 14 or 15, wherein the third guide surface (133) and the fourth guide surface (134) extend beyond the electrical interface (65) in the third direction (54).

[0164] Optionally, the consumable cartridge of any one of claims 14 to 16, wherein the first guide surface (131) and the third guide surface (133) are staggered along the first direction (51) and the second direction (52), and the second guide surface (132) and the fourth guide surface (134) are staggered along the first direction (51) and the second direction (52).

[0165] Optionally, the consumable cartridge of any one of claims 14 to 17, when viewed in the fifth direction (55) or the sixth direction (56), at least a portion of the third guide surface (133) does not overlap a portion of the board (64), which portion contacts the board supporting portion (130), and at least a portion of the fourth guide surface (134) does not overlap the portion of the board

(64).

[0166] Optionally, the consumable cartridge of any one of claims 14 to 18, further comprising a first protrusion (137) and a second protrusion (138) positioned away from each other in the fifth direction (55) and the sixth direction (56), wherein the first protrusion and the second protrusion protrude in the fourth direction (53).

[0167] Optionally, the consumable cartridge of claim 19, wherein the first protrusion (137) is positioned further in the fifth direction (55) than the board (64), and the second protrusion (138) is positioned further in the sixth direction (56) than the board (64).

[0168] Optionally, the consumable cartridge of claim 20, wherein when viewed in the third direction (54) or the fourth direction (53), the first protrusion (137) at least partly overlaps the first space (181), and the second protrusion (138) at least partly overlaps the second space (182).

Claims

1. A system (10) comprising:

a mounting portion (110);
a consumable cartridge (30) configured to store a consumable, wherein the consumable cartridge is configured to be inserted into the mounting portion in a first direction (51) and thereby to be mounted to the mounting portion, and configured to be removed from the mounting portion in a second direction (52) opposite the first direction; and
a consuming portion (21) configured to consume the consumable to be supplied from the consumable cartridge when mounting of the consumable cartridge to the mounting portion is completed,
wherein the consumable cartridge comprises:

a consumable chamber (36) configured to store the consumable;
a board (64);
a board supporting portion (130) configured to support the board;
an electrical interface (65) positioned on the board and facing a third direction (54) which is perpendicular to the first direction and the second direction;
a first guide surface (131) positioned further in a fourth direction (53) opposite the third direction than the board, wherein the first guide surface faces a fifth direction (55) which is perpendicular to the first, second, third, and fourth directions; and
a second guide surface (132) positioned further in the fourth direction (53) than the board, wherein the second guide surface faces a sixth direction (56) opposite the fifth direction,

wherein the mounting portion comprises:

a contact (106) configured to contact the electrical interface when the mounting of the consumable cartridge to the mounting portion is completed;
a first wall (161) positioned further in the fifth direction (55) than the contact and comprising a portion positioned to overlap a moving path of the board when viewed in the fifth direction (55), wherein the board moves in the moving path when the consumable cartridge is inserted into the mounting portion; and
a second wall (162) positioned further in the sixth direction (56) than the contact and comprising a portion positioned to overlap the moving path of the board when viewed in the sixth direction (56),

wherein when the consumable cartridge is inserted into the mounting portion;
a first space (181) is formed, wherein an end of the first space in the sixth direction (56) is defined by the first guide surface, and the first space is opened in the first direction (51) and the third direction (54), wherein the first space receives the first wall; and
a second space (182) is formed, wherein and end of the second space in the fifth direction (55) is defined by the second guide surface, and the second space is opened in the first direction (51) and the third direction (54), wherein the second space receives the second wall.

2. The system of claim 1, wherein the first guide surface (131) is positioned further in the fifth direction (55) than the board (64), or positioned at the same position as an end of the board in the fifth direction, wherein the second guide surface (132) is positioned further in the sixth direction (56) than the board (64), or positioned at the same position as an end of the board in the sixth direction.

3. The system of claim 1 or 2, wherein the consumable cartridge comprises:

a third wall (173) comprising a third guide surface (133) positioned further in the fifth direction (55) than the first guide surface (131) and facing the sixth direction (56), wherein the third guide surface defines an end of the first space (181) in the fifth direction (55) when the consumable cartridge is inserted into the mounting portion; and

a fourth wall (174) comprising a fourth guide surface (134) positioned further in the sixth direction (56) than the second guide surface (132) and facing the fifth direction (55), wherein the fourth guide surface defines an end of the second space (182) in the sixth direction (56) when the consumable cartridge is inserted into the mounting portion.

4. The system of claim 3, wherein the third wall (173) and the fourth wall (174) extend beyond the electrical interface (65) in the third direction (54).

5. The system of claim 3 or 4, wherein the first guide surface (131) and the third guide surface (133) are staggered along the first direction (51) and the second direction (52), and the second guide surface (132) and the fourth guide surface (134) are staggered along the first direction (51) and the second direction (52).

6. The system of any one claims 3 to 5, wherein when viewed in the fifth direction (55) or the sixth direction (56), at least a portion of the third wall does not overlap a portion of the board (64), which portion contacts the board supporting portion (130), and at least a portion of the fourth wall does not overlap the portion of the board (64).

7. The system of any one of claims 3 to 6, wherein a dimension of the electrical interface (65) along the fifth direction (55) and the sixth direction (56) is greater than a sum of a gap along the fifth direction (55) and the sixth direction (56) between the first guide surface (131) and the first wall (161) received in the first space (181) and a gap along the fifth direction (55) and the sixth direction (56)between the third guide surface (133) and the first wall (161) received in the first space (181), wherein the dimension of the electrical interface (65) is also greater than a sum of a gap along the fifth direction (55) and the sixth direction (56) between the second guide surface (132) and the second wall (162) received in the second space (182) and a gap along the fifth direction (55) and the sixth direction (56) between the fourth guide surface (134) and the second wall (162) received in the second space (182).

8. The system of any one of claims 1 to 7,
wherein the consumable cartridge comprises a first protrusion (137) and a second protrusion (138) positioned away from each other in the fifth direction (55) and the sixth direction (56), wherein the first protrusion and the second protrusion protrude in the fourth direction (53), and contact the mounting portion when the mounting of the consumable cartridge to the mounting portion is completed, and/or
wherein the mounting portion comprises a third protrusion (127) and a fourth protrusion (128) positioned away from each other in the fifth direction (55) and the sixth direction (56), wherein the third protrusion and the fourth protrusion protrude in the third direction (54), and contact the consumable cartridge when the mounting of the consumable cartridge to the mounting portion is completed.

9. The system of claim 8, wherein when the consumable cartridge comprises the first protrusion and the second protrusion, and the mounting portion comprises the third protrusion and the fourth protrusion, the first protrusion (137) contacts the third protrusion (127) and the second protrusion (138) contacts the fourth protrusion (128) when the mounting of the consumable cartridge to the mounting portion is completed.

10. The system of claim 7 or 8, wherein the first protrusion (137) or the third protrusion (127) is positioned further in the fifth direction (55) than the board (64), and the second protrusion (138) or the fourth protrusion (128) is positioned further in the sixth direction (56) than the board (64) when the mounting of the consumable cartridge to the mounting portion is completed.

11. The system of any one of claims 9, when viewed in the third direction (54) or the fourth direction (53), the first protrusion (137) or the third protrusion (127) at least partly overlaps the first space (181), and the second protrusion (138) or the fourth protrusion (128) at least partly overlaps the second space (182) when the mounting of the consumable cartridge to the mounting portion is completed.

12. The system of any one of claim 1 to 11, further comprising a controller (1), wherein the consumable cartridge comprises an integrated circuit electrically connected to the electrical interface (65), and the controller is configured to access the integrated circuit via the electrical interface.

13. The system of any one of claims 1 to 12, wherein the third direction (54) is an upward direction (54) and the fourth direction (53) is a downward direction (53).

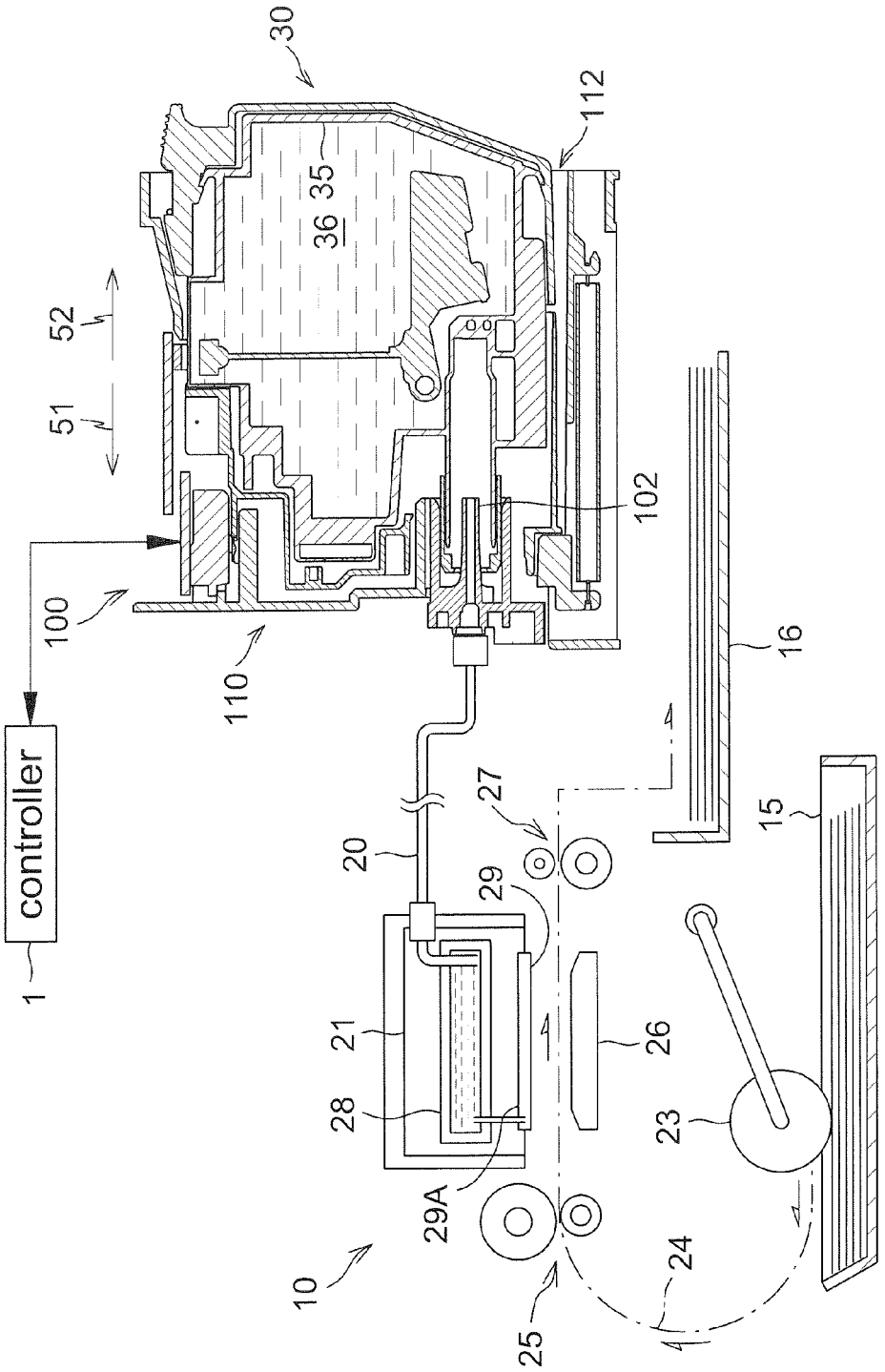
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Fig.1

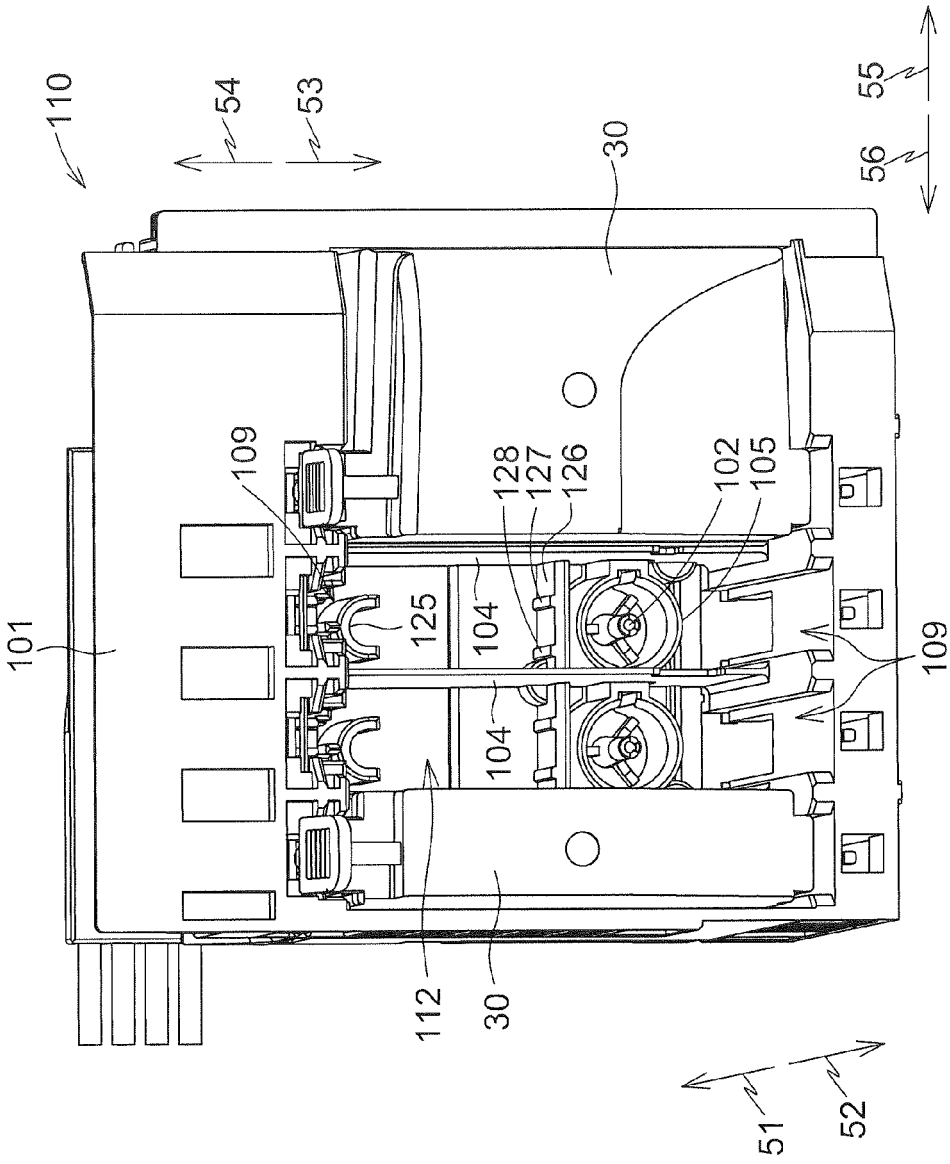
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Fig.2

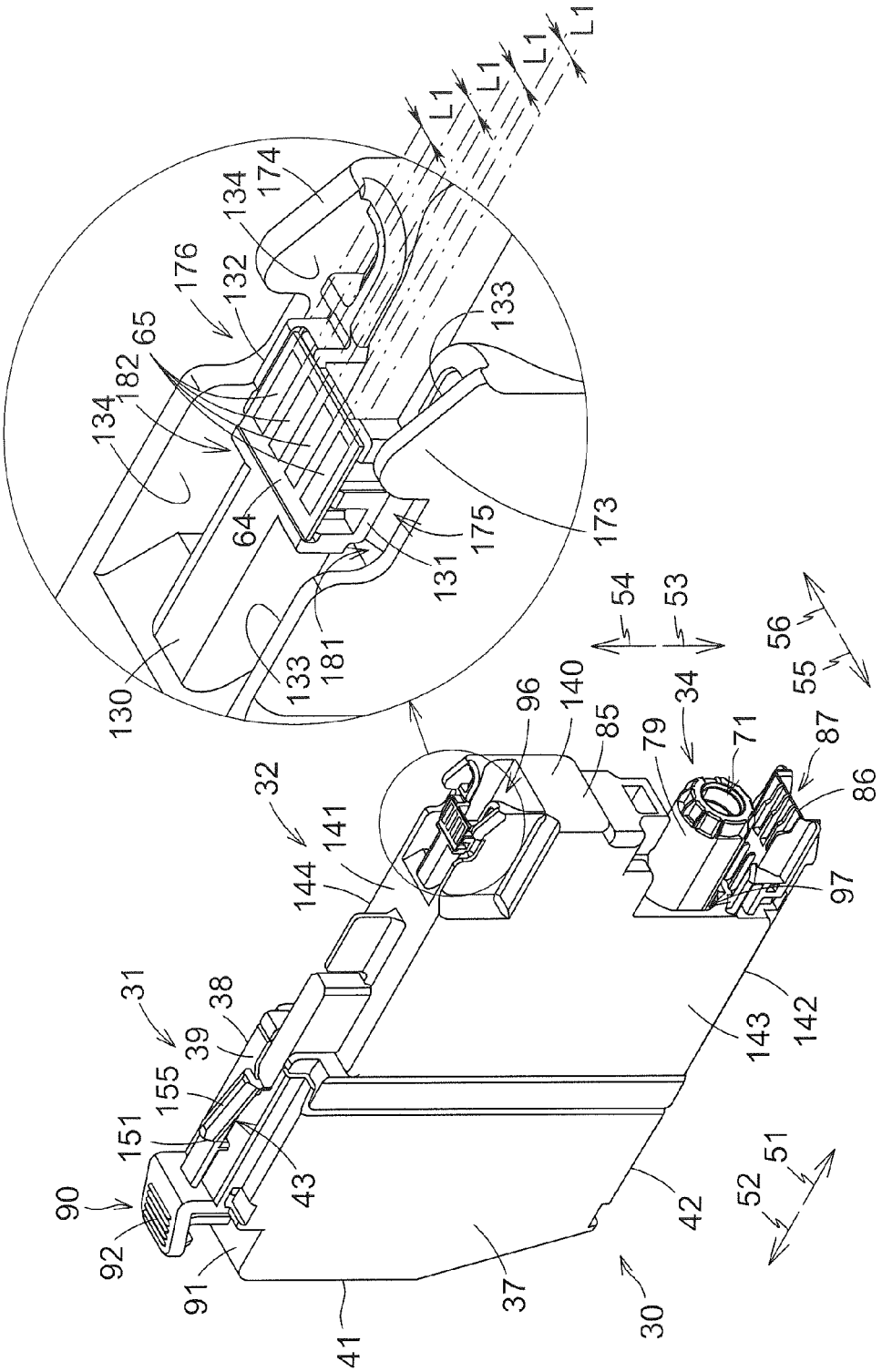
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Fig.3

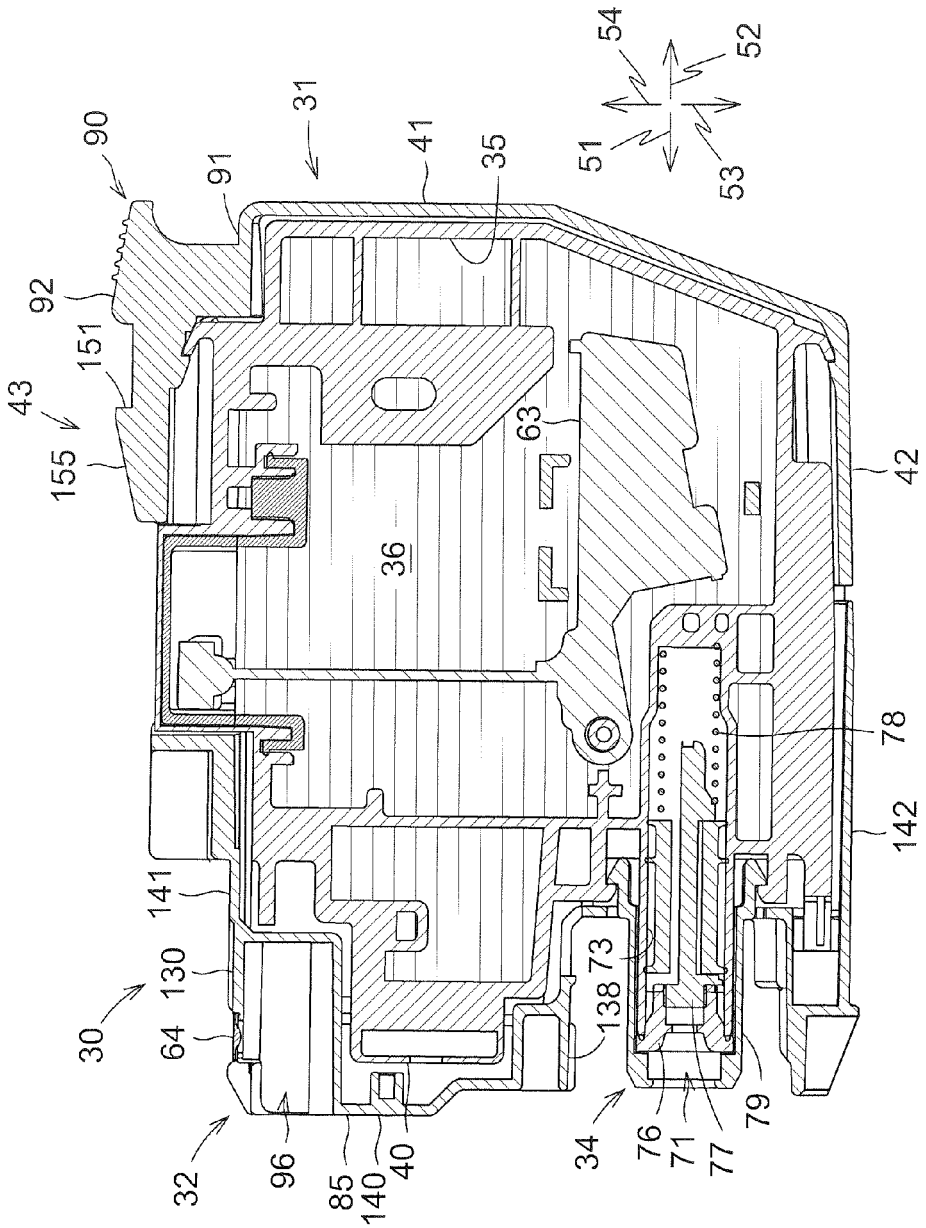
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Fig.4

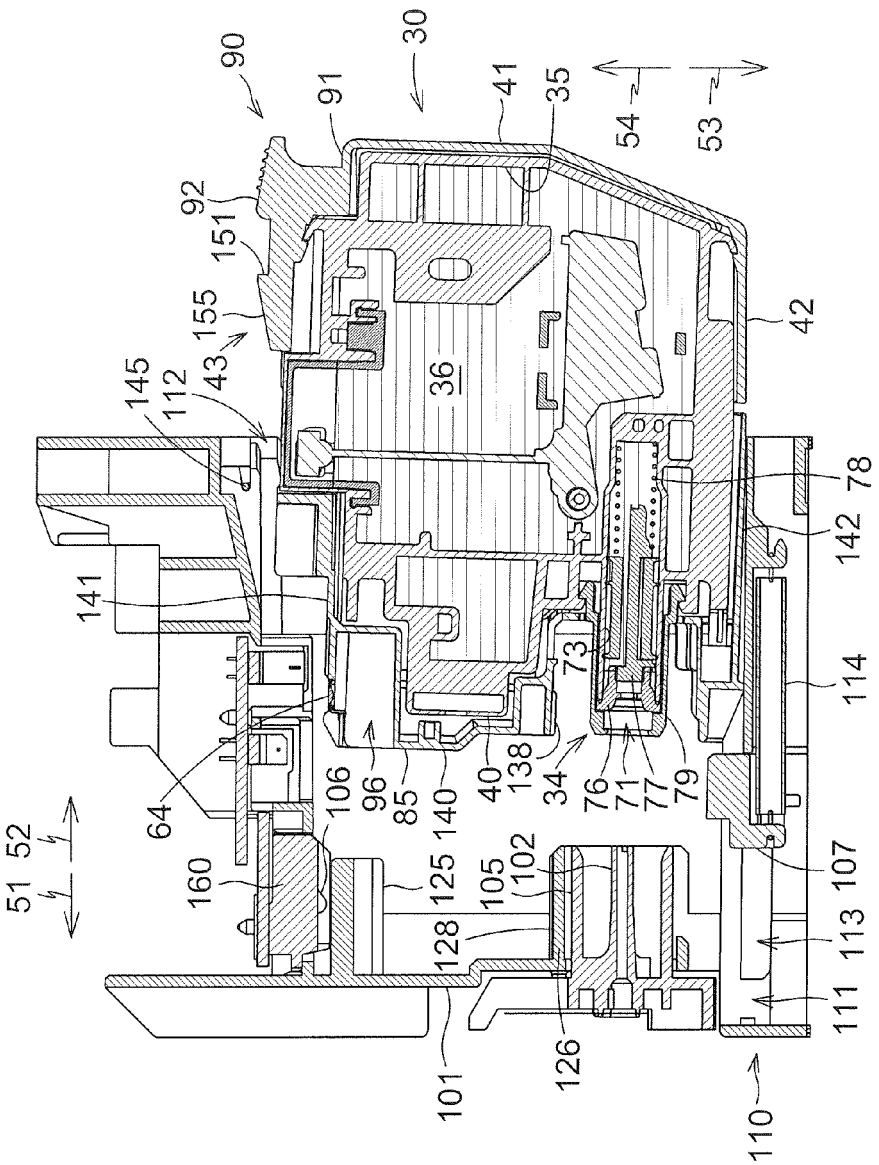
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Fig.5

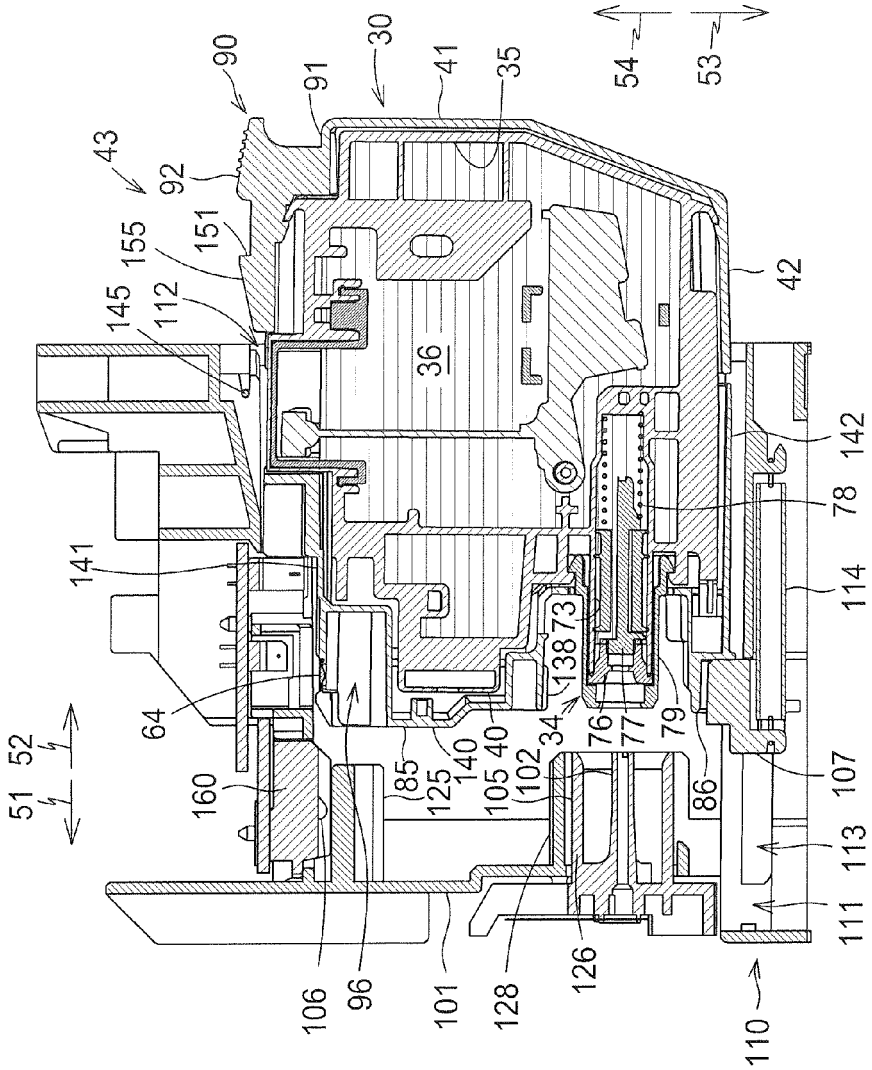
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Fig.6

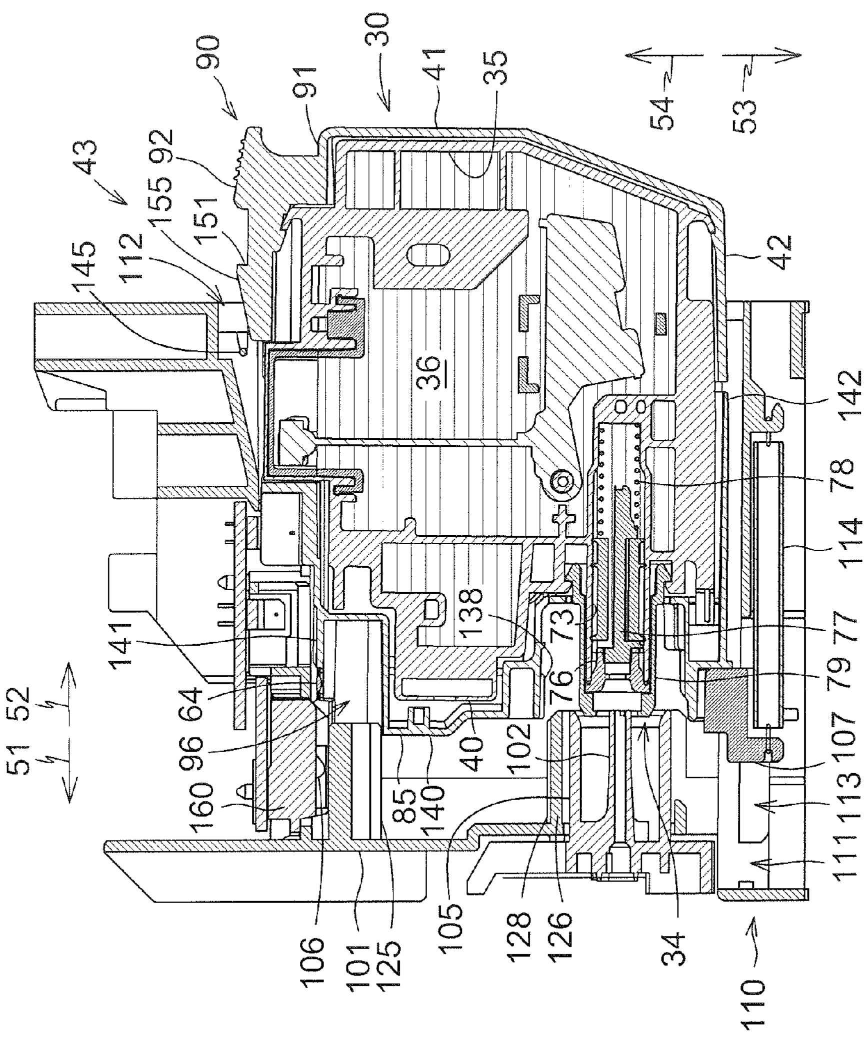
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Fig.7

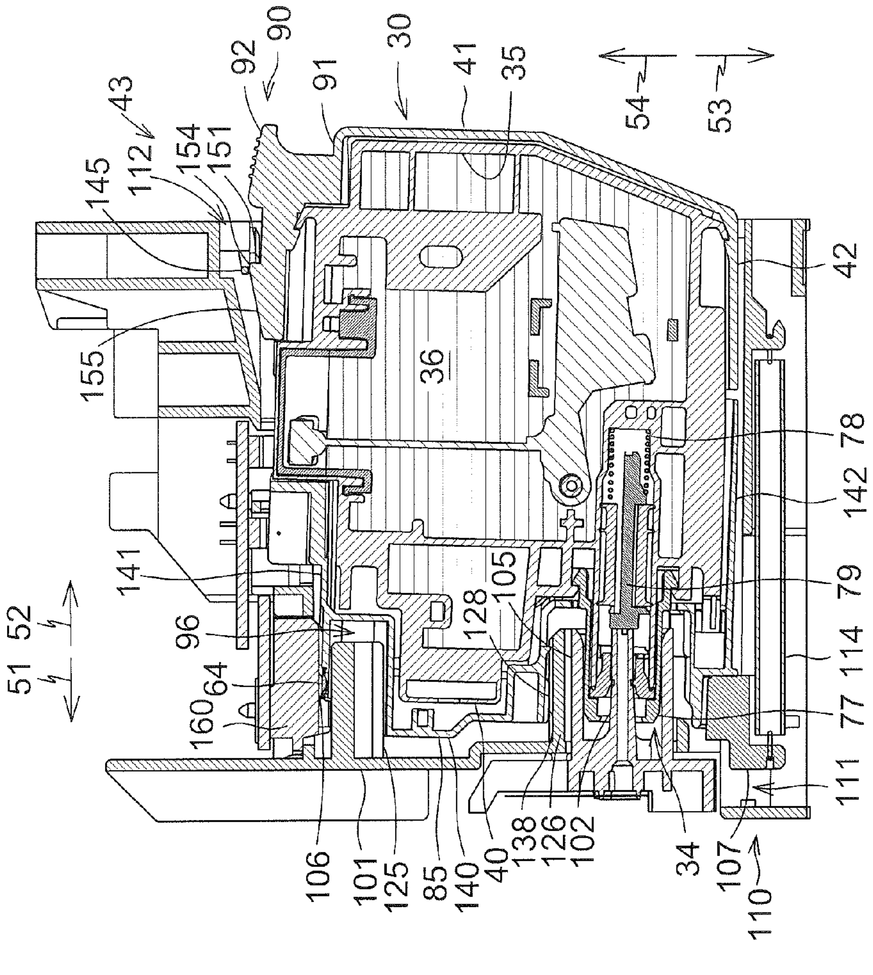
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Fig.8

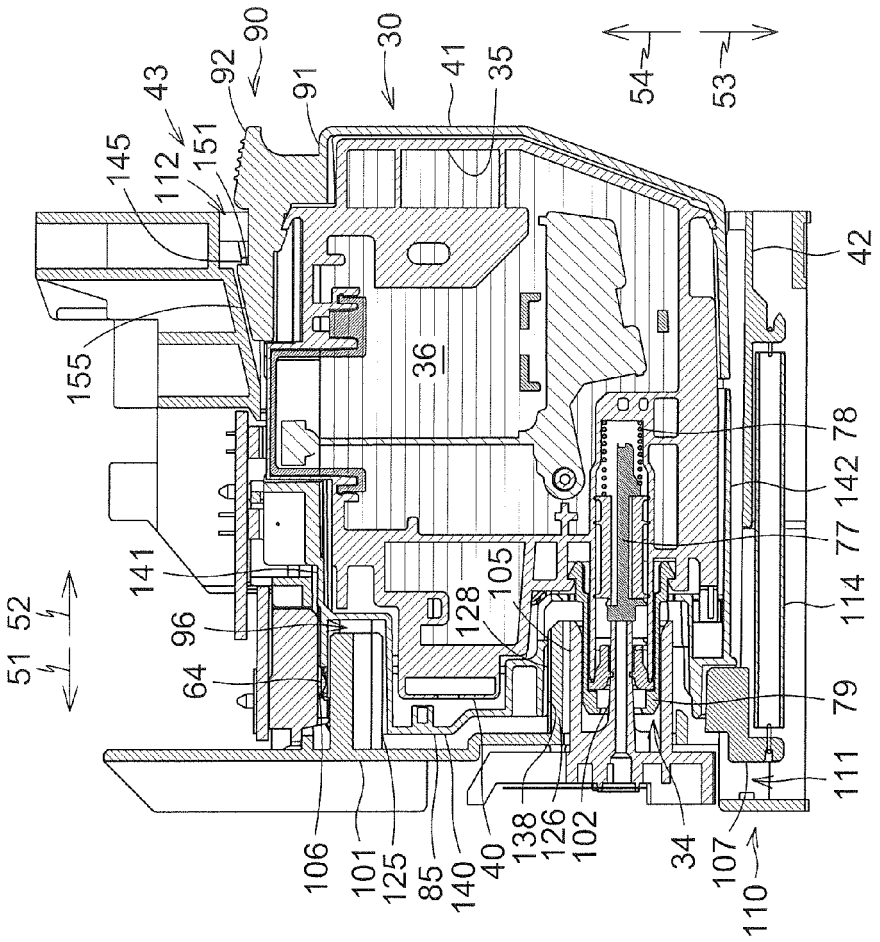
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Fig.9

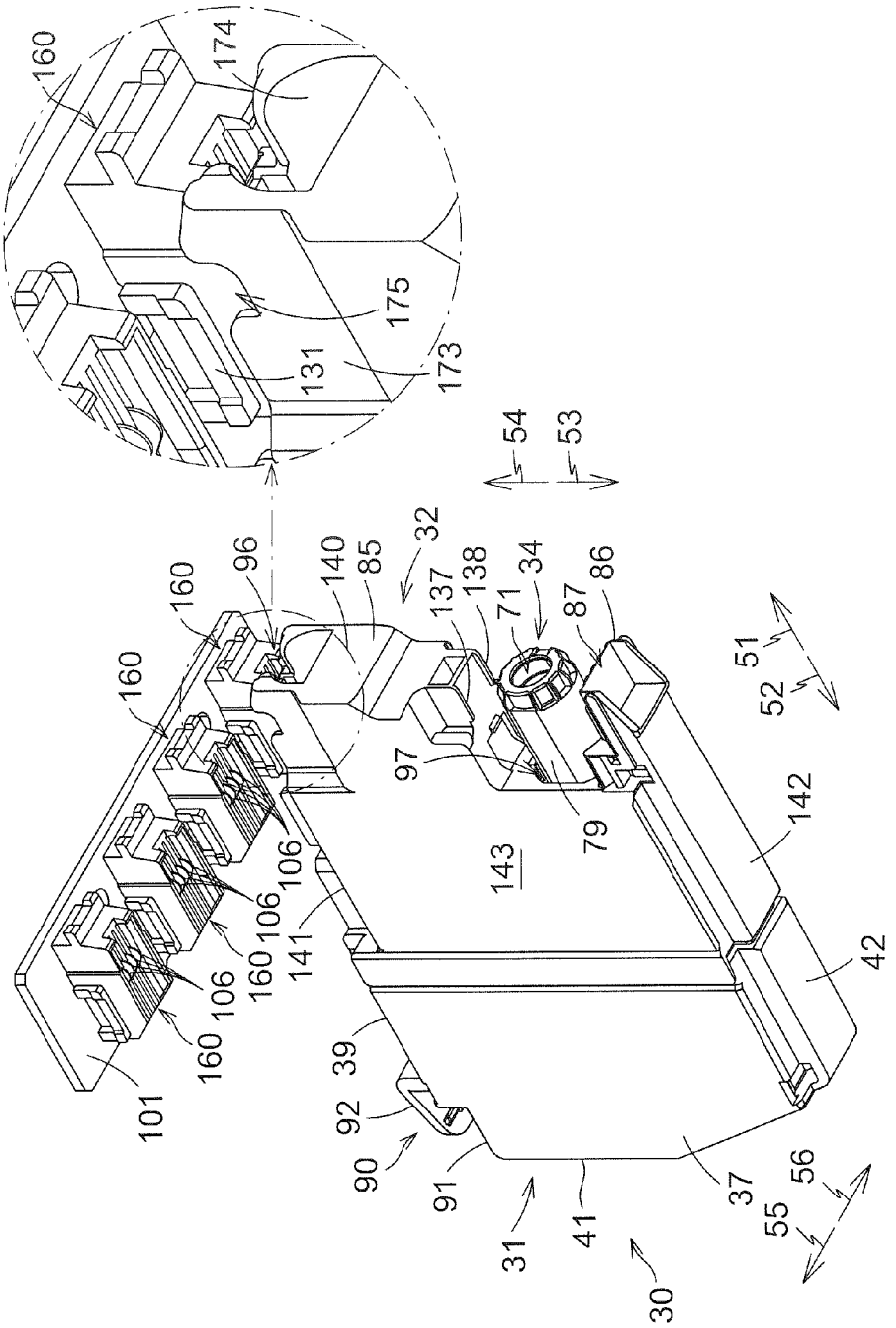
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Fig.10

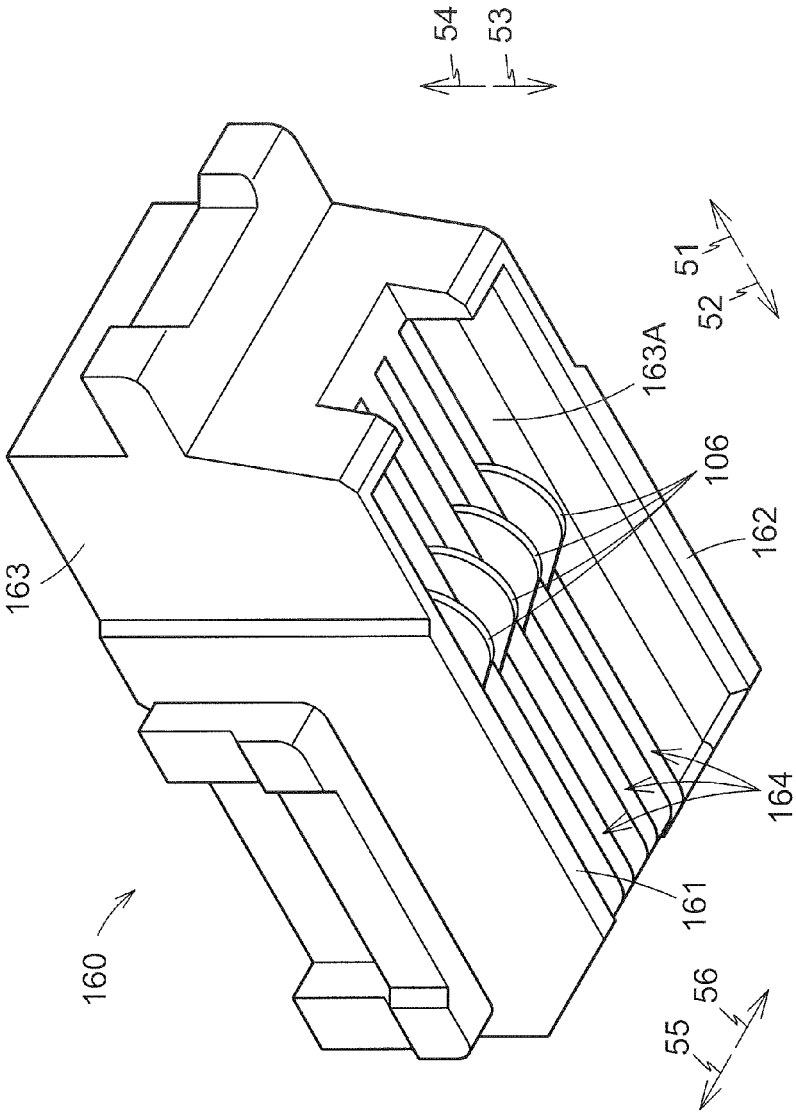

Fig.11

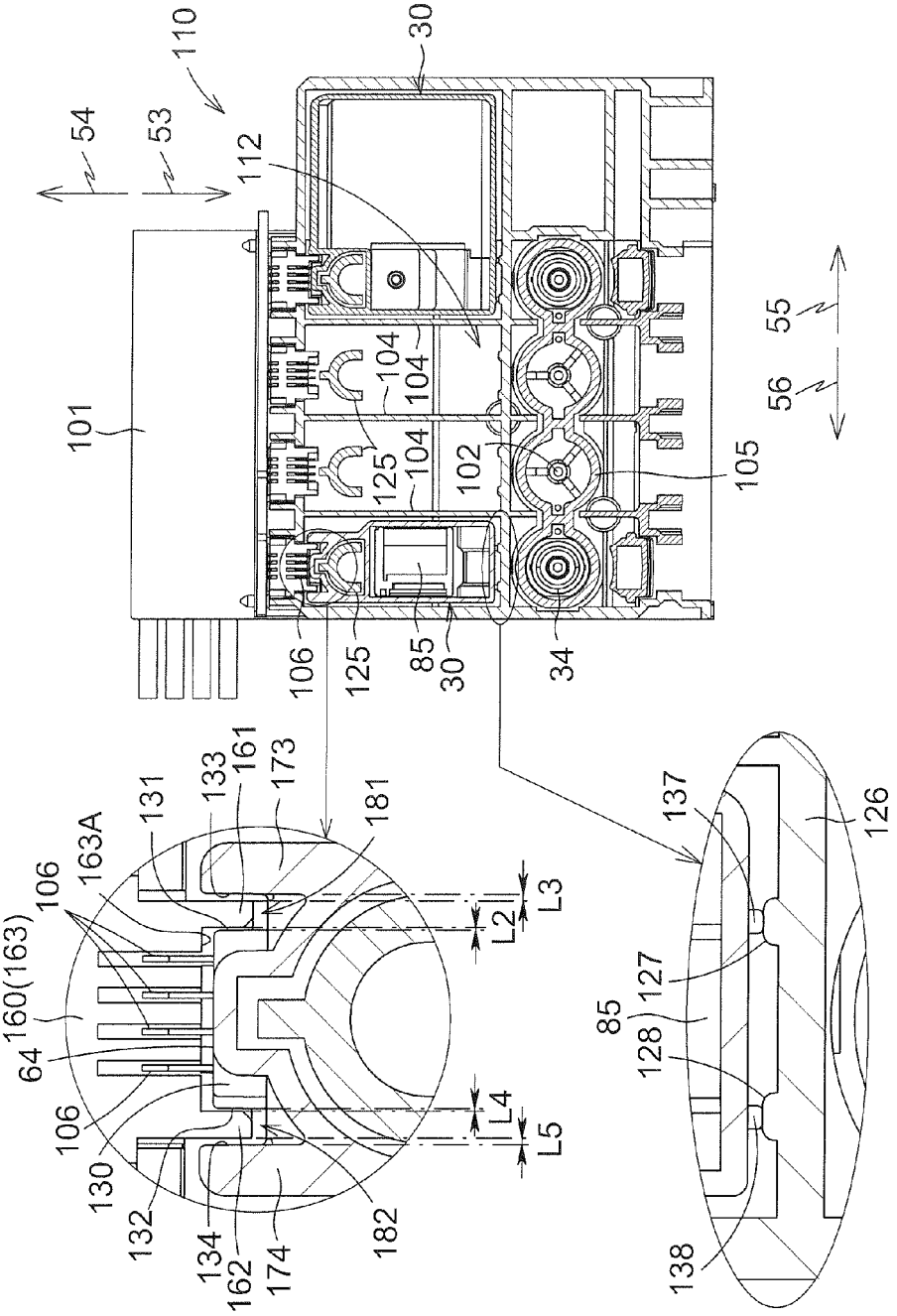
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Fig.12

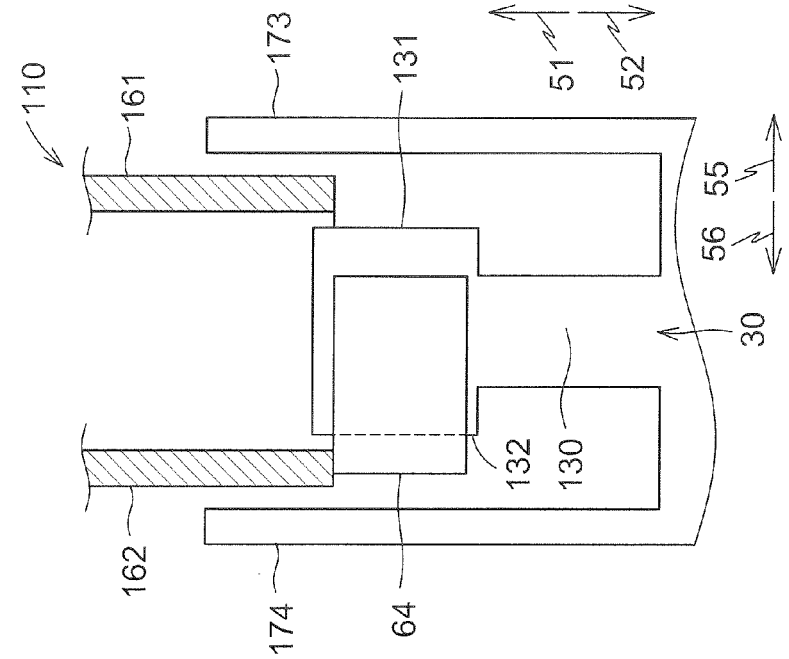

Fig.13B

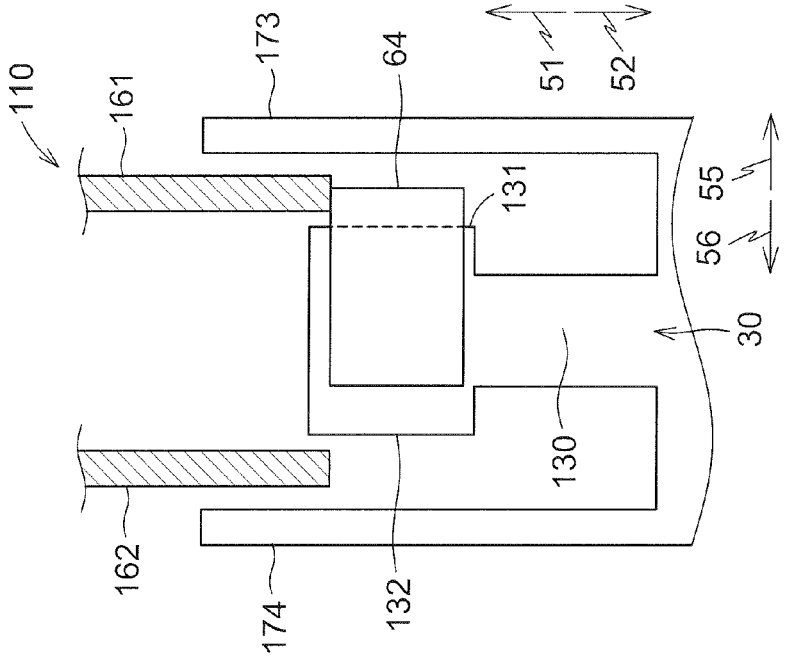

Fig.13A

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EUROPEAN SEARCH REPORT

Application Number
EP 15 17 4898

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2012/056954 A1 (ASAUCHI NOBORU [JP] ET AL) 8 March 2012 (2012-03-08) * paragraph [0123]; figures 1, 2a, 7 *	1-4,6, 8-13 7	INV. B41J2/175
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A,D	US 7 703 902 B2 (NOZAWA IZUMI [JP] ET AL) 27 April 2010 (2010-04-27) * column 16, line 36 - column 17, line 52; figures 6-8 *	1-13	
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B41J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 May 2016	Gavaza, Bogdan

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12-05-2016

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