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(54) **DROPLET DISCHARGE HEAD AND DROPLET DISCHARGE DEVICE**

(57) A liquid droplet discharge head includes a channel member and a reservoir. The channel member includes a plurality of discharge holes through which liquid droplets are discharged. The reservoir is positioned above the channel member and supplies liquid to the channel member. The reservoir includes a reservoir body including a resin material. The reservoir body includes a first groove portion, a second groove portion, and a connector. The first groove portion is positioned on a

side opposite to the channel member, and the liquid flows through the first groove portion. The second groove portion is positioned on a side of the channel member, and the liquid flows through the second groove portion. The connector connects the first groove portion and the second groove portion. At least one of the first groove portion or the second groove portion includes a bent portion that is bent and thus does not overlap at least a part of the other in plan view.

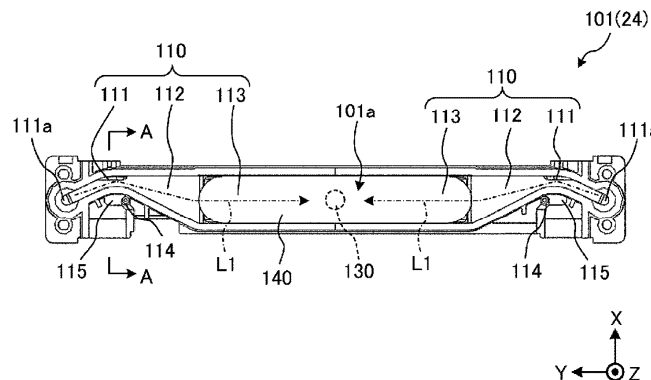


FIG. 5

Description

TECHNICAL FIELD

[0001] The disclosed embodiment relates to a liquid droplet discharge head and a liquid droplet discharge apparatus.

BACKGROUND OF INVENTION

[0002] As a printing head, for example, a known liquid droplet discharge head performs various types of printing by discharging liquid onto a recording medium. Patent Document 1 discloses an inkjet head including a planar layered channel unit provided with a reservoir that guides ink supplied from an ink supply port to an ink outlet.

CITATION LIST

PATENT LITERATURE

[0003] Patent Document 1: JP 2004-114404 A

SUMMARY

[0004] A liquid droplet discharge head of the present disclosure includes a channel member and a reservoir. The channel member includes a plurality of discharge holes through which liquid droplets are discharged. The reservoir is positioned above the channel member and supplies liquid to the channel member. The reservoir includes a reservoir body including a resin material. The reservoir body includes a first groove portion, a second groove portion, and a connector. The first groove portion is positioned on a side opposite to the channel member, and the liquid flows through the first groove portion. The second groove portion is positioned on a side of the channel member, and the liquid flows through the second groove portion. The connector connects the first groove portion and the second groove portion. At least one of the first groove portion or the second groove portion includes a bent portion that is bent and thus does not overlap at least a part of the other in plan view.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005]

FIG. 1 is a schematic side view of a printer according to an embodiment.

FIG. 2 is a schematic plan view of the printer according to the embodiment.

FIG. 3 is an exploded perspective view illustrating an overall configuration of a liquid droplet discharge head according to the embodiment.

FIG. 4 is a perspective view illustrating an example of the configuration of a reservoir according to the embodiment.

FIG. 5 is a top view illustrating an example of the configuration of a reservoir body according to the embodiment.

FIG. 6 is a bottom view illustrating an example of the configuration of the reservoir body according to the embodiment.

FIG. 7 is a diagram for describing a function of a curved portion according to the embodiment.

FIG. 8 is a cross-sectional perspective view illustrating an example of the configuration of the reservoir body, an upper lid, and a pressing member according to the embodiment.

DESCRIPTION OF EMBODIMENTS

[0006] Hereinafter, embodiments for implementing a liquid droplet discharge head and a liquid droplet discharge apparatus according to the present disclosure (hereinafter referred to as "embodiment") are elaborated with reference to the accompanying drawings. Note that the present disclosure is not limited by the embodiments. The embodiments can be appropriately combined within a range that does not cause inconsistencies in the processing content. In the following embodiments, the same portions are denoted by the same reference signs, and redundant descriptions are omitted.

[0007] In the following embodiments, expressions such as "equal", "orthogonal", "perpendicular", and "parallel" may be used, but these expressions need not mean exactly "equal", "orthogonal", "perpendicular", and "parallel". That is, each of the expressions mentioned above allows for deviations in, for example, manufacturing accuracy or installation accuracy.

[0008] In the drawings to be referenced below, to facilitate understanding, an orthogonal coordinate system may be defined, in which the X-axis direction, Y-axis direction, and Z-axis direction mutually orthogonal are specified, and the Z-axis positive direction is set as the vertically upward direction.

[0009] As a printing head, for example, a known liquid droplet discharge head performs various types of printing by discharging liquid onto a recording medium. Patent Document 1 discloses an inkjet head including a planar layered channel unit provided with a reservoir that guides ink supplied from an ink supply port to an ink outlet.

[0010] However, in the above-described related technique, when the reservoir made of a metal material is changed to a resin material to simplify the manufacturing process, the thickness of the resin positioned in a bottom portion of the channel may become uneven, and thus molding defects such as sink marks may occur. This may reduce yield in the manufacturing process of the reservoir.

[0011] In view of the foregoing, a technique that can solve the above problems and improve yield in the manufacturing process of a reservoir is desired to be implemented.

Configuration of Printer

[0012] First, an outline of a printer 1, which is an example of a liquid droplet discharge apparatus according to an embodiment, will be described with reference to FIGs. 1 and 2. FIG. 1 is a schematic side view of the printer 1 according to the embodiment. FIG. 2 is a schematic plan view of the printer 1 according to the embodiment. The printer 1 according to the embodiment is, for example, a color inkjet printer.

[0013] As illustrated in FIG. 1, the printer 1 includes a paper feed roller 2, a guide roller 3, an applicator 4, a head case 5, a plurality of transport rollers 6, a plurality of frames 7, a plurality of liquid droplet discharge heads 8, a transport roller 9, a dryer 10, a transport roller 11, a sensor unit 12, and a collection roller 13.

[0014] The printer 1 further includes a controller 14 that controls the paper feed roller 2, the guide roller 3, the applicator 4, the head case 5, the plurality of transport rollers 6, the plurality of frames 7, the plurality of liquid droplet discharge heads 8, the transport roller 9, the dryer 10, the transport roller 11, the sensor unit 12, and the collection roller 13.

[0015] The printer 1 records images and characters on printing paper P by causing liquid droplets to land on the printing paper P. The printing paper P is an example of the recording medium. The printing paper P is wound around the paper feed roller 2 before use. The printer 1 transports the printing paper P from the paper feed roller 2 to the inside of the head case 5 via the guide roller 3 and the applicator 4.

[0016] The applicator 4 uniformly applies a coating agent to the printing paper P. Thus, since the printing paper P can undergo surface treatment, the printing quality of the printer 1 can be improved.

[0017] The head case 5 accommodates therein the plurality of transport rollers 6, the plurality of frames 7, and the plurality of liquid droplet discharge heads 8. The inside of the head case 5 forms a space isolated from the outside except for parts connected to the outside, such as portions where the printing paper P enters and leaves.

[0018] In the internal space of the head case 5, at least one of the controlling factors such as temperature, humidity, and air pressure is controlled by the controller 14 as required. The transport roller 6 transports the printing paper P to the vicinity of the liquid droplet discharge heads 8 inside the head case 5.

[0019] The frame 7 is a rectangular flat plate and positioned above and in close proximity to the printing paper P transported by the transport roller 6. As illustrated in FIG. 2, the frame 7 is positioned such that the longitudinal direction thereof is orthogonal to a transport direction of the printing paper P. A plurality of (e.g., four) frames 7 is positioned inside the head case 5 along the transport direction of the printing paper P.

[0020] Note that in the following description, a direction in which the printing paper P is transported is also referred to as a "sub-scanning direction," and a direction

orthogonal to the sub-scanning direction and parallel to the printing paper P is also referred to as a "main-scanning direction".

[0021] A liquid, such as ink, is supplied from a liquid tank (not illustrated) to the liquid droplet discharge head 8. That is, the ink is an example of the liquid. The liquid droplet discharge head 8 discharges the liquid supplied from the liquid tank as liquid droplets.

[0022] The controller 14 controls the liquid droplet discharge head 8 based on data such as images and characters to discharge liquid droplets toward the printing paper P. A distance between the liquid droplet discharge head 8 and the printing paper P is, for example, about 0.5 mm to 20 mm.

[0023] The liquid droplet discharge head 8 is fixed to the frame 7. The liquid droplet discharge head 8 is fixed to the frame 7 at both end portions in the longitudinal direction, for example. The liquid droplet discharge head 8 is positioned such that the longitudinal direction thereof is orthogonal to the transport direction of the printing paper P.

[0024] That is, the printer 1 according to the embodiment is a so-called line printer in which the liquid droplet discharge head 8 is fixed inside the printer 1. Note that the printer 1 according to the embodiment is not limited to a line printer, and may be a so-called serial printer.

[0025] A serial printer is a printer that employs a method of alternately performing an operation of recording while moving the liquid droplet discharge head 8 back and forth, for example, in a direction intersecting the transport direction of the printing paper P such as a direction substantially orthogonal to the transport direction of the printing paper P, and an operation of transporting the printing paper P.

[0026] As illustrated in FIG. 2, a plurality of (e.g., five) liquid droplet discharge heads 8 is fixed on one frame 7. FIG. 2 illustrates an example in which three of the liquid droplet discharge heads 8 are positioned on the front side and two of the liquid droplet discharge heads 8 are positioned on the rear side in the transport direction of the printing paper P. The liquid droplet discharge heads 8 are positioned such that the centers thereof do not overlap each other in the transport direction of the printing paper P.

[0027] The plurality of liquid droplet discharge heads 8 positioned on one frame 7 constitutes a head group 8A. Four head groups 8A are positioned along the transport direction of the printing paper P. The same color ink is supplied to the liquid droplet discharge heads 8 belonging to the same head group 8A. Accordingly, the printer 1 can perform printing with inks of four colors by using the four head groups 8A.

[0028] The colors of inks discharged from the head groups 8A are, for example, magenta (M), yellow (Y), cyan (C), and black (K). The controller 14 can print a color image on the printing paper P by controlling the head groups 8A to discharge inks of a plurality of colors onto the printing paper P.

[0029] Note that in order that the printing paper P undergoes surface treatment, the liquid droplet discharge head 8 may discharge a coating agent onto the printing paper P.

[0030] The number of liquid droplet discharge heads 8 included in one head group 8A, and the number of head groups 8A mounted on the printer 1 can be appropriately changed depending on the printing object and printing conditions. For example, when the printing color on the printing paper P is a single color, and the printing range can be covered by one liquid droplet discharge head 8, the number of liquid droplet discharge heads 8 mounted on the printer 1 may be one.

[0031] The printing paper P that has been subjected to print processing inside the head case 5 is transported to the outside of the head case 5 by the transport roller 9, and passes through the inside of the dryer 10. The dryer 10 dries the printing paper P that has been subjected to print processing. The printing paper P dried by the dryer 10 is transported by the transport roller 11 and collected by the collection roller 13.

[0032] In the printer 1, drying the printing paper P with the dryer 10 can reduce adhesion of the printing paper P overlapping one another to be wound, and reduce rubbing of undried liquid at the collection roller 13.

[0033] The sensor unit 12 includes a position sensor, a speed sensor, and a temperature sensor. Based on information from the sensor unit 12, the controller 14 can determine the state of each unit of the printer 1 and control each unit of the printer 1.

[0034] The printer 1 described above uses the printing paper P as a printing target (i.e., recording medium). However, the printing target in the printer 1 is not limited to the printing paper P. For example, the printing target may be a rolled cloth.

[0035] Instead of directly transporting the printing paper P, the printer 1 may transport the printing paper P placed on a transport belt. By using the transport belt, the printer 1 can print on sheet paper, cut cloth, wood, or tile, as a printing object.

[0036] The printer 1 may print a wiring pattern or the like of an electronic device by discharging liquid droplets containing electrically conductive particles from the liquid droplet discharge head 8. The printer 1 may also discharge a predetermined amount of liquid chemical agent or liquid droplets containing the chemical agent from the liquid droplet discharge head 8 toward a reaction container or the like to produce chemicals.

[0037] The printer 1 may also include a cleaning unit that cleans the liquid droplet discharge head 8. The cleaning unit cleans the liquid droplet discharge head 8 by performing, for example, wiping processing or capping processing.

[0038] The wiping processing is processing for removing liquid adhering to the liquid droplet discharge head 8 by wiping a surface of a portion from which the liquid droplets are discharged, for example, using a flexible wiper.

[0039] The capping processing is performed, for example, as follows. First, a cap is placed to cover the surface of the portion from which the liquid droplets are discharged (this is called capping). This creates a substantially hermetically sealed space between the cap and the surface of the portion from which the liquid droplets are discharged.

[0040] Subsequently, the discharge of the liquid droplets is repeated in the hermetically sealed space. As a result, liquid having a viscosity higher than that in a normal state, foreign matter, or the like clogging up discharge holes (nozzles) for discharging the liquid droplets can be removed.

15 Configuration of Liquid Droplet Discharge Head

[0041] Next, a configuration of the liquid droplet discharge head 8 according to the embodiment will be described with reference to FIG. 3. FIG. 3 is an exploded perspective view illustrating an overall configuration of the liquid droplet discharge head 8 according to the embodiment.

[0042] As illustrated in FIG. 3, the liquid droplet discharge head 8 includes a head body 20, a wiring portion 30, a head cover 40, and two heat dissipation plates 45. The head body 20 includes a channel member 21, a piezoelectric actuator substrate (not illustrated), a branched channel member 23, and a reservoir 24.

[0043] In the following description, for convenience, a direction in which the head body 20 is provided in the liquid droplet discharge head 8 may be referred to as "lower", and a direction in which the head cover 40 is provided relative to the head body 20 may be referred to as "upper".

[0044] The channel member 21 of the head body 20 has a substantially flat plate shape, and includes a first surface which is one main surface positioned on the branched channel member 23 side (Z-axis positive direction side in FIG. 3), and a second surface positioned on the opposite side (Z-axis negative direction side in FIG. 3) to the first surface. The first surface includes an opening (not illustrated), and liquid is supplied from the reservoir 24 to the inside of the channel member 21 through the opening. Two openings through which the liquid is supplied are disposed at each of both end portions of the channel member 21 in the longitudinal direction. The two openings at each end portion are arranged side by side along the lateral direction.

[0045] A plurality of discharge holes (not illustrated) through which the liquid droplets are discharged onto the printing paper P is positioned in the second surface. The channel member 21 includes therein a channel through which the liquid flows from the first surface to the second surface.

[0046] The channel member 21 includes the piezoelectric actuator substrate, and the piezoelectric actuator substrate is positioned on the first surface of the channel member 21. The piezoelectric actuator substrate in-

cludes a plurality of displacement elements (not illustrated). The piezoelectric actuator substrate is electrically connected to a flexible substrate 31 of the wiring portion 30.

[0047] The branched channel member 23, which is a connection channel member, is positioned on the channel member 21. The branched channel member 23 includes therein a branched channel (not illustrated) which is a connection channel connected to the channel of the channel member 21.

[0048] Note that the branched channel member 23 may be a member having a box shape elongated in the main-scanning direction (Y-axis direction) and having an open upper surface. The branched channel member 23 has a box shape, and thus the rigidity of the branched channel member 23 can be increased in comparison with a case where the branched channel member 23 has a flat plate shape. As a result, the amount of deflection of a nozzle surface of the channel member 21 bonded to the branched channel member 23 can be reduced.

[0049] The reservoir 24 is positioned on the branched channel member 23. The reservoir 24 is provided with openings 24a at both end portions in the main-scanning direction (Y-axis direction in FIG. 3). The reservoir 24 includes therein a channel, and liquid is supplied from the outside through the opening 24a. The reservoir 24 supplies liquid to the channel member 21. The reservoir 24 also stores the liquid to be supplied to the channel member 21. The configuration of the reservoir 24 will be described in detail later.

[0050] The reservoir 24 may further include a heater substrate (not illustrated) and a heat generating resistor (not illustrated). The heater substrate brings the temperature of the liquid flowing through the head body 20 closer to a predetermined temperature. A hole 24b for accommodating a fixing member (not illustrated) such as a screw or a bolt is formed in a side surface of the reservoir 24 facing the heat dissipation plate 45.

[0051] The wiring portion 30 includes the flexible substrate 31, a wiring board 32, a plurality of driver ICs 33, and a pressing member 34. The flexible substrate 31 is a flexible wiring board, and transmits, to the head body 20, a predetermined signal transmitted from the outside. Note that as illustrated in FIG. 3, the liquid droplet discharge head 8 according to the embodiment includes two flexible substrates 31.

[0052] One end portion of the flexible substrate 31 is electrically connected to the piezoelectric actuator substrate of the channel member 21 in the head body 20. The other end portion of the flexible substrate 31 is drawn out above the reservoir 24 and electrically connected to the wiring board 32. As a result, the piezoelectric actuator substrate of the channel member 21 in the head body 20 can be electrically connected to the outside.

[0053] The wiring board 32 is positioned above the head body 20. The wiring board 32 distributes signals to the plurality of driver ICs 33.

[0054] The plurality of driver ICs 33 is positioned on

one main surface of the flexible substrate 31. As illustrated in FIG. 3, in the liquid droplet discharge head 8 according to the embodiment, two driver ICs 33 are provided on one flexible substrate 31. Note that the number of driver ICs 33 provided on one flexible substrate 31 is not limited to two.

[0055] The driver IC 33 drives each displacement element in the piezoelectric actuator substrate of the head body 20 based on a driving signal transmitted from the controller 14 (see FIG. 1). In this way, the driver IC 33 drives the liquid droplet discharge head 8.

[0056] The pressing member 34 is, for example, a plate spring having a substantially U shape in cross-sectional view. The pressing member 34 is positioned between the two flexible substrates 31, and presses the driver ICs 33 on the flexible substrates 31 toward the heat dissipation plates 45. As a result, the driver IC 33 is brought into close contact with the heat dissipation plate 45, allowing heat generated when the driver IC 33 is driven to be efficiently dissipated to the heat dissipation plate 45.

[0057] Note that the pressing force need not be directly generated by the pressing member 34. For example, a force generated by another member may press the driver IC 33 via the pressing member 34.

[0058] The head cover 40 is mounted to the head body 20, and is disposed to cover the wiring portion 30 positioned on the head body 20 such as the flexible substrates 31, the wiring board 32, and the pressing member 34. As a result, the head cover 40 can seal the wiring portion 30. The head cover 40 is made of, for example, resin or metal.

[0059] The head cover 40 has a box shape elongated in the main-scanning direction, and includes a first opening 40a and a second opening 40b on two side surfaces facing each other along the sub-scanning direction (X-axis direction in FIG. 3). In the example of FIG. 3, the first opening 40a is provided on the side surface positioned on the X-axis positive direction side, and the second opening 40b is provided on the side surface positioned on the X-axis negative direction side. The head cover 40 also includes a third opening 40c on a lower surface thereof, and a fourth opening 40d on an upper surface thereof.

[0060] The two heat dissipation plates 45 are mounted to the head cover 40. One of the two heat dissipation plates 45 is disposed to close the first opening 40a, and the other is disposed to close the second opening 40b.

[0061] The heat dissipation plate 45 is a plate-like member elongated in the longitudinal direction of the liquid droplet discharge head 8, and is made of metal or an alloy with high heat dissipation properties, for example. The heat dissipation plate 45 is provided in contact with the driver ICs 33 to dissipate heat generated in the driver ICs 33.

[0062] Each of the two heat dissipation plates 45 includes a plurality of through holes 46 that accommodates fixing members. The head cover 40 includes a plurality of through holes 41 that accommodates the fixing members.

[0063] Each of the two heat dissipation plates 45 is fixed to the head cover 40 with the fixing members. The head cover 40 with the heat dissipation plate 45 mounted thereon has a box shape in which the first opening 40a and the second opening 40b are closed, and the third opening 40c and the fourth opening 40d are open.

[0064] The third opening 40c is positioned to face the reservoir 24. The flexible substrates 31 and the pressing member 34 are inserted into the third opening 40c.

[0065] The fourth opening 40d is provided to allow a connector (not illustrated) provided on the wiring board 32 to be inserted therein. When a region between the connector and the fourth opening 40d is sealed with resin or the like, liquid, dust, or the like is less likely to enter the head cover 40.

[0066] The head cover 40 may also include a thermal insulating portion (not illustrated) between the heat dissipation plates 45 and the head body 20. By providing the thermal insulating portion in the head cover 40, heat generated by the driver ICs 33 is less likely to be transferred to the head body 20 via the heat dissipation plates 45.

[0067] Note that FIG. 3 illustrates an example of the configuration of the liquid droplet discharge head 8, and the liquid droplet discharge head 8 may further include members other than those illustrated in FIG. 3.

Configuration of Reservoir

[0068] Next, the configuration of the reservoir 24 according to the embodiment will be described in detail with reference to FIGs. 4 to 8. FIG. 4 is a perspective view illustrating an example of the configuration of the reservoir 24 according to the embodiment.

[0069] As illustrated in FIG. 4, the reservoir 24 is a member having a box shape elongated in the main-scanning direction (Y-axis direction). An ink supply tube 24c to which ink is supplied from the outside is positioned on an upper surface (surface on the Z-axis positive direction side) of the reservoir 24. The ink supply tube 24c is connected to the opening 24a illustrated in FIG. 3, and a pair of the ink supply tubes 24c is provided at both end portions of the reservoir 24 in the main-scanning direction.

[0070] An ink outlet 24d for guiding the ink flowing through the reservoir 24 to the branched channel member 23 (see FIG. 3) is positioned on a lower surface (surface on the Z-axis negative direction side) of the reservoir 24. A pair of the ink outlets 24d is provided at both end portions of the reservoir 24 in the main-scanning direction.

[0071] The reservoir 24 also includes a reservoir body 101, an upper lid 102, and a lower lid 103. The reservoir body 101 includes a resin material. The reservoir body 101 is, for example, formed as one unit. The reservoir body 101 is formed by, for example, an injection molding method.

[0072] The upper lid 102 is positioned to cover a first

surface 101a (see FIG. 5) of the reservoir body 101. The first surface 101a is a surface of the reservoir body 101 which is positioned on a side opposite to the channel member 21 (i.e., the Z-axis positive direction side) (see FIG. 3). The upper lid 102 includes, for example, the above-described pair of ink supply tubes 24c, and is made of resin, for example.

[0073] The lower lid 103 is positioned to cover a second surface 101b (see FIG. 6) of the reservoir body 101. The second surface 101b is a surface of the reservoir body 101 which is positioned on the channel member 21 side (i.e., the Z-axis negative direction side). The lower lid 103 includes, for example, the above-described pair of ink outlets 24d, and is made of resin, for example.

[0074] FIG. 5 is a top view illustrating an example of the configuration of the reservoir body 101 according to the embodiment. As illustrated in FIG. 5, a pair of first groove portions 110 is positioned in the first surface 101a of the reservoir body 101, that is, on a side of the reservoir body 101 opposite to the channel member 21 (see FIG. 3). The first groove portion 110 has a groove shape, and serves as a first channel 104 (see FIG. 8) through which ink flows when the upper lid 102 (see FIG. 4) covers the first surface 101a.

[0075] The first groove portion 110 includes a curved portion 111, a tapered portion 112, and a widened portion 113 in this order from the upstream side (the ink supply tube 24c (see FIG. 4) side). The curved portion 111 is an example of the bent portion.

[0076] The curved portion 111 is a narrow portion that is connected to the ink supply tube 24c and extends from a connector 111a with the ink supply tube 24c toward a center portion of the reservoir body 101 in the longitudinal direction (Y-axis direction). The curved portion 111 is curved with respect to the longitudinal direction.

[0077] The tapered portion 112 is a portion that is connected to the downstream side of the curved portion 111 and has a width gradually increasing toward the center portion in the longitudinal direction. The widened portion 113 is a portion that is connected to the downstream side of the tapered portion 112, has a substantially uniform width, and is wider than the curved portion 111.

[0078] In the first groove portion 110 which becomes the first channel 104 by being covered with the upper lid 102, the ink supplied from the ink supply tube 24c flows toward the center portion of the reservoir body 101 in the longitudinal direction as a flow L1.

[0079] Then, the ink having reached the center portion from both end portions of the reservoir 24 in the first channel 104 flows through a connector 130 formed in the center portion of the reservoir body 101, and flows into a second channel 105 (see FIG. 8) provided on the second surface 101b (see FIG. 6) side of the reservoir 24.

[0080] The connector 130 is provided to penetrate between the first channel 104 (first groove portion 110) and the second channel 105 (second groove portion 120) in the vertical direction (Z-axis direction). The connector 130 is a channel connecting the first groove portion 110

and the second groove portion 120 with a fluid flowing through the channel.

[0081] FIG. 6 is a bottom view illustrating an example of the configuration of the reservoir body 101 according to the embodiment. As illustrated in FIG. 6, the second groove portion 120 is positioned in the second surface 101b of the reservoir body 101, that is, on the channel member 21 (see FIG. 3) side of the reservoir body 101. The second groove portion 120 has a groove shape, and serves as the second channel 105 (see FIG. 8) through which ink flows when the lower lid 103 (see FIG. 4) covers the second surface 101b.

[0082] The second groove portion 120 has a substantially uniform width from the upstream side connected to the connector 130 to a connector 120a on the downstream side connected to the ink outlet 24d (see FIG. 4), and extends substantially parallel to the longitudinal direction (Y-axis direction).

[0083] In the second groove portion 120 which becomes the second channel 105 by being covered with the lower lid 103, the ink supplied from the connector 130 flows toward both end portions of the reservoir body 101 in the longitudinal direction as flows L2. Then, the ink having reached the connector 120a is guided from the reservoir 24 to the branched channel member 23 (see FIG. 3) via the ink outlet 24d.

[0084] The ink is supplied through the ink outlet 24d to the branched channel member 23 at both end portions in the longitudinal direction. The ink introduced into the branched channel member 23 is split into two in the lateral direction by branched channels in the branched channel member 23 at both end portions in the longitudinal direction, and is supplied to the four openings in the channel member 21.

[0085] Note that the branched channel in the branched channel member 23 only needs to be a connection channel connecting the reservoir 24 and the channel member 21, and need not be branched in the middle. The ink outlet 24d and the opening of the channel member 21 may be directly connected to each other without providing the branched channel member 23.

[0086] As described above, in the reservoir 24 according to the embodiment, one ink supply tube 24c is positioned at each of both end portions in the longitudinal direction. The reservoir 24 has a structure in which ink can be supplied into the reservoir 24 from both the two ink supply tubes 24c.

[0087] With this structure, by supplying ink from only one ink supply tube 24c at first, air remaining inside or a liquid different from the ink to be supplied, which has been already contained, can be easily removed from the other ink supply tube 24c. The ink used for actual printing may be supplied from only one ink supply tube 24c or from two ink supply tubes 24c.

[0088] Also during printing, ink may be supplied from one ink supply tube 24c, and ink in the reservoir 24 (first channel 104) may be collected to the outside using the other ink supply tube 24c. The collected liquid may be

supplied from the one ink supply tube 24c again through a filter (not illustrated), for example. That is, in the liquid droplet discharge head 8 according to the embodiment, ink may be circulated.

[0089] The reservoir 24 according to the embodiment has a structure in which the ink supplied from a pair of first channels 104 once merges at the connector 130 and branches into the pair of second channels 105 again from the connector 130.

[0090] With this structure, when the ink is guided from the pair of ink outlets 24d positioned at both ends to the branched channel member 23, the ink can be guided uniformly in both the ink outlets 24d.

[0091] In the embodiment, as described above, at least one of the first groove portion 110 or the second groove portion 120 has a bent portion (e.g., the curved portion 111) that is bent so as not to overlap at least a part of the other in plan view.

[0092] For example, in the present disclosure, the first groove portion 110 has the curved portion 111 that is curved so as not to overlap at least a part of the second groove portion 120 in plan view. Note that the first groove portion 110 and the second groove portion 120 may not overlap each other at all in plan view.

[0093] The curved portion 111 may be provided in both the first groove portion 110 and the second groove portion 120, but is preferably provided in one of the groove portions because a channel having a linear shape is basically desirable. Note that in the present disclosure, the term "plan view" refers to a viewpoint when viewed from a direction perpendicular to the first surface 101a or the second surface 101b.

[0094] FIG. 7 is a diagram for describing the function of the curved portion 111 according to the embodiment, and is a cross-sectional perspective view corresponding to the cross-section taken along the line A-A in FIG. 5.

[0095] As illustrated in FIG. 7, in the embodiment, the first groove portion 110 formed in the first surface 101a of the reservoir body 101 includes the curved portion 111, so that a recessed portion 115 can be formed at a position overlapping the second groove portion 120 in plan view in the first surface 101a.

[0096] As a result, a thickness T of a bottom portion of the second groove portion 120 can be set to a desired value by controlling the depth of the recessed portion 115. Therefore, in the embodiment, the thickness of the bottom portion of the first groove portion 110, and the thickness T of the bottom portion of the second groove portion 120 can become substantially equal to each other.

[0097] As a result, according to the embodiment, when the reservoir body 101 including a resin material is molded, occurrence of molding defects such as sink marks can be reduced, and thus yield in the manufacturing process of the reservoir 24 can be improved.

[0098] Note that in the embodiment, in a portion of the second groove portion 120 overlapping the tapered portion 112 in plan view, the thickness of the bottom portion can become substantially equal to that of the other por-

tions by thinning the side surface of the reservoir body 101.

[0099] In the embodiment, in a portion of the second groove portion 120 overlapping the widened portion 113 in plan view, the thickness of the bottom portion can become substantially equal to that of the other portions by increasing the groove depth of the widened portion 113 for thinning thereof.

[0100] The second channel 105 may have a structure symmetrical in the lateral direction and be short in order to supply ink to the channel member 21 in a stable state. That is, the second channel 105 may be disposed in a straight-line shape at the center portion in the lateral direction. In order to form the second channel 105 in such a shape, the curved portion 111 may be provided in the first groove portion 110 which becomes the first channel 104, instead of being provided in the second groove portion 120 which becomes the second channel 105.

[0101] The connector 130 may be disposed in a center portion of the reservoir body 101 in the longitudinal direction and a center portion of the reservoir body 101 in the lateral direction. The second channel 105 may extend from the connector 130 toward both end portions.

[0102] With this configuration, the second channel 105 can supply ink uniformly to the openings at both end portions of the channel member 21 in the longitudinal direction in a stable state. The second channel 105 may have a structure symmetrical in the longitudinal direction and the lateral direction so that the ink can be supplied more uniformly and stably.

[0103] In the embodiment, the reservoir body 101 may have a fitting portion that is positioned in the vicinity of the curved portion 111 and is used to position another member. As such a fitting portion, for example, a protruding portion 114 may be provided, or a recessed portion may be provided. When the protruding portion 114 is provided, the shape of the object to be fitted does not need to be complicated. For example, a flat plate-shaped member having a hole or the like formed therein can be fitted to the protruding portion 114.

[0104] FIG. 8 is a cross-sectional perspective view illustrating an example of the configuration of the reservoir body 101, the upper lid 102, and the pressing member 34 according to the embodiment. As illustrated in FIG. 8, in the embodiment, the reservoir body 101 has the protruding portion 114, and thus can facilitate positioning of other members adjacent to the first surface 101a where the protruding portion 114 is positioned.

[0105] For example, in the example of FIG. 8, through holes are formed in the upper lid 102 that is in direct contact with the first surface 101a of the reservoir body 101 and in the pressing member 34 that is in contact with an upper surface of the upper lid 102. With this configuration, the upper lid 102 and the pressing member 34 can be easily positioned by inserting the protruding portion 114 into the through holes.

[0106] Thus, according to the embodiment, the man-

ufacturing cost of the liquid droplet discharge head 8 can be reduced.

[0107] In the embodiment, as illustrated in FIG. 5, the protruding portion 114 may be positioned at a center portion of the reservoir body 101 in the lateral direction (X-axis direction). This improves the positioning stability of other members positioned by the protruding portion 114.

[0108] Note that in the present disclosure, the expression "positioned at a center portion in the lateral direction" means that the center of the protruding portion 114 is located within the central one-third region, further within the central one-fifth region of the reservoir body 101 in the lateral direction, and particularly at substantially the center.

[0109] In the embodiment, the first groove portion 110 may include one curved portion 111 at each of both end portions in the longitudinal direction (Y-axis direction). This improves the molding accuracy of the periphery of the second groove portion 120 at both end portions of the reservoir body 101.

[0110] The protruding portion 114 may be positioned in the vicinity of each of the two curved portions 111, and a line connecting the two protruding portions 114 may be parallel to the longitudinal direction. This can further improve the positioning stability of other members positioned by the protruding portion 114.

[0111] The position of the protruding portion 114 may be in a range where the curved portion 111 is present in the longitudinal direction of the channel member 21. The distance between the protruding portion 114 and the curved portion 111 in the lateral direction of the channel member 21 may be one-half or less, or may be one-fourth or less, of the distance in the lateral direction of the channel member 21.

[0112] In the embodiment, as described above, the upper lid 102 may be positioned by the protruding portion 114 provided on the reservoir body 101. The pressing member 34 may be positioned by the protruding portion 114. This can increase the positioning accuracy of the upper lid 102 and the pressing member 34.

[0113] In the above-described positioning, the upper lid 102 and the pressing member 34 may be positioned with respect to the same protruding portion 114. This improves the positional accuracy between the upper lid 102 and the pressing member 34, and thus can minimize the cumulative tolerance of the plurality of members assembled on the reservoir body 101.

[0114] In the embodiment, as illustrated in FIG. 5, the filter member 140 may be positioned to cover an opening portion of the connector 130 in the widened portion 113 of the first groove portion 110. As a result, all the ink flowing inside the reservoir 24 can be filtered by a single filter member 140.

[0115] The filter member 140 may be disposed to cover the opening of the connector 130 on the first channel 104 side from the first channel 104 side. The filter member 140 disposed in this manner is less likely to be separated

from the opening portion of the connector 130.

[0116] In the embodiment, the filter member 140 is disposed in the widened portion 113 formed deeper than other portions for thinning the bottom portion, so that the space inside the reservoir 24 can be effectively utilized.

[0117] Although the embodiments of the present disclosure have been described above, the present disclosure is not limited to the embodiments described above, and various changes can be made without departing from the spirit of the present disclosure.

[0118] For example, the above embodiment illustrates an example in which the curved portion 111 is provided in the first groove portion 110 positioned in the first surface 101a of the reservoir body 101. However, the present disclosure is not limited to such an example, and a curved portion may be provided in the second groove portion 120 positioned in the second surface 101b, or may be provided in both the first groove portion 110 and the second groove portion 120.

[0119] This also allows the thickness of the bottom portion of the first groove portion 110 and the second groove portion 120 to be set to a desired value, thereby improving yield in the manufacturing process of the reservoir 24.

[0120] In the above embodiment, as long as the first groove portion 110 and the second groove portion 120 do not overlap in plan view, the bent portion need not be provided in both the first groove portion 110 and the second groove portion 120.

[0121] This also allows the thickness of the bottom portion of the first groove portion 110 and the second groove portion 120 to be set to a desired value, thereby improving yield in the manufacturing process of the reservoir 24.

[0122] In the present disclosure, when the second groove portion 120 of the second surface 101b is provided with a curved portion, a protruding portion may be provided in the vicinity of the curved portion. This can facilitate positioning of other members (e.g., lower lid 103) adjacent to the second surface 101b of the reservoir body 101.

[0123] In the embodiment, a mode has been described in which ink is supplied to the reservoir 24 from the outside during printing, and a mode has been described in which ink is supplied to the reservoir 24 from the outside and also the ink is collected from the reservoir 24 to the outside during printing. In the latter mode, the ink may be supplied to the channel member 21 from the reservoir 24, and also the ink may be collected in the reservoir 24 from the channel member 21.

[0124] In the channel member 21, ink may be supplied to and collected from the channel facing the nozzle (discharge hole) so that the ink is less likely to remain in the nozzle and the periphery thereof. In such a mode, on the whole, the ink is supplied to the liquid droplet discharge head 8 from the outside, the ink is partly discharged, and the ink not having been discharged is collected to the outside.

[0125] The ink collected to the outside may be supplied to the liquid droplet discharge head 8 again. That is, the ink may be circulated. The controller 14 may control the supply and collection of ink to and from the liquid droplet discharge head 8 or the circulation of the ink.

[0126] Additional effects and other aspects can be easily derived by one skilled in the art. For this reason, broader aspects of the present disclosure are not limited to the specific details and representative embodiments illustrated and described above. Accordingly, various changes can be made without departing from the spirit or scope of the general inventive concepts defined by the appended claims and their equivalents.

[0127] Note that the present technique can also have the following configurations.

(1) A liquid droplet discharge head including:

a channel member including a plurality of discharge holes through which liquid droplets are discharged; and
a reservoir positioned above the channel member and configured to supply liquid to the channel member, in which
the reservoir includes a reservoir body including a resin material,
the reservoir body includes a first groove portion that is positioned on a side opposite to the channel member and through which the liquid flows, a second groove portion that is positioned on a side of the channel member and through which the liquid flows, and a connector connecting the first groove portion and the second groove portion, and
at least one of the first groove portion or the second groove portion includes a bent portion that is bent and thus does not overlap at least a part of the other in plan view.

(2) The liquid droplet discharge head according to (1) above, in which

the first groove portion includes the bent portion.

(3) The liquid droplet discharge head according to (2) above, in which

the first groove portion includes the one bent portion at each of both end portions in a longitudinal direction in which the second groove portion extends.

(4) The liquid droplet discharge head according to any one of (1) to (3) above, in which

the reservoir body includes a fitting portion positioned in a vicinity of the bent portion to position another member.

(5) The liquid droplet discharge head according to (4) above, in which

the reservoir body has a longitudinal direction in which the second groove portion extends and a lateral direction perpendicular to the longitudinal direction in plan view, and the fitting portion is posi-

tioned at a center portion of the reservoir body in the lateral direction.

(6) The liquid droplet discharge head according to (5) above, in which

the first groove portion includes the one bent portion at each of both end portions in the longitudinal direction,
the fitting portion is positioned in a vicinity of the one bent portion located at each of both end portions in the longitudinal direction, and
a line connecting the two fitting portions is parallel to the longitudinal direction.

(7) The liquid droplet discharge head according to any one of (4) to (6) above, in which

the reservoir further includes an upper lid covering a side of the reservoir body opposite to the channel member, and
the upper lid is positioned with respect to the reservoir body by the fitting portion.

(8) The liquid droplet discharge head according to any one of (4) to (7) above, further including:

a flexible substrate electrically connected to the channel member;
a heat dissipation plate; and
a pressing member configured to press the flexible substrate toward the heat dissipation plate, in which
the pressing member is positioned with respect to the reservoir body by the fitting portion.

(9) The liquid droplet discharge head according to (7) above, further including:

a flexible substrate electrically connected to the channel member;
a heat dissipation plate; and
a pressing member configured to press the flexible substrate toward the heat dissipation plate, in which
the upper lid and the pressing member are positioned with respect to the reservoir body by the same fitting portion.

(10) The liquid droplet discharge head according to any one of (1) to (9) above, in which the reservoir includes a filter member positioned while covering an opening portion of the connector.

(11) A liquid droplet discharge apparatus including:

the liquid droplet discharge head according to any one of (1) to (10) above; and
a controller configured to control the liquid droplet discharge head.

REFERENCE SIGNS

[0128]

- | | |
|----|---|
| 5 | 1 Printer (example of liquid droplet discharge apparatus) |
| | 8 Liquid droplet discharge head |
| | 14 Controller |
| | 21 Channel member |
| 10 | 24 Reservoir |
| | 31 Flexible substrate |
| | 45 Heat dissipation plate |
| | 101 Reservoir body |
| | 101a First surface |
| | 101b Second surface |
| 15 | 102 Upper lid |
| | 103 Lower lid |
| | 104 First channel |
| | 105 Second channel |
| 20 | 110 First groove portion |
| | 111 Curved portion (example of bent portion) |
| | 114 Protruding portion (example of fitting portion) |
| | 120 Second groove portion |
| | 130 Connector |
| 25 | 140 Filter member |

Claims

- | | |
|----|---|
| 30 | 1. A liquid droplet discharge head comprising: |
| | a channel member comprising a plurality of discharge holes through which liquid droplets are discharged; and |
| | a reservoir positioned above the channel member and configured to supply liquid to the channel member, wherein |
| 35 | the reservoir comprises a reservoir body comprising a resin material, |
| | the reservoir body comprises a first groove portion that is positioned on a side opposite to the channel member and through which the liquid flows, a second groove portion that is positioned on a side of the channel member and through which the liquid flows, and a connector connecting the first groove portion and the second groove portion, and |
| | at least one of the first groove portion or the second groove portion comprises a bent portion that is bent and thus does not overlap at least a part of the other in plan view. |
| 40 | |
| 45 | |
| 50 | 2. The liquid droplet discharge head according to claim 1, wherein |
| | the first groove portion comprises the bent portion. |
| 55 | 3. The liquid droplet discharge head according to claim 2, wherein |

the first groove portion comprises the one bent portion at each of both end portions in a longitudinal direction in which the second groove portion extends.

4. The liquid droplet discharge head according to any one of claims 1 to 3, wherein the reservoir body comprises a fitting portion positioned in a vicinity of the bent portion to position another member.

5. The liquid droplet discharge head according to claim 4, wherein

the reservoir body has a longitudinal direction in which the second groove portion extends and a lateral direction perpendicular to the longitudinal direction in plan view, and the fitting portion is positioned at a center portion of the reservoir body in the lateral direction.

6. The liquid droplet discharge head according to claim 5, wherein

the first groove portion comprises the one bent portion at each of both end portions in the longitudinal direction, the fitting portion is positioned in a vicinity of the one bent portion located at each of both end portions in the longitudinal direction, and a line connecting the two fitting portions is parallel to the longitudinal direction.

7. The liquid droplet discharge head according to any one of claims 4 to 6, wherein

the reservoir further comprises an upper lid covering a side of the reservoir body opposite to the channel member, and the upper lid is positioned with respect to the reservoir body by the fitting portion.

8. The liquid droplet discharge head according to any one of claims 4 to 7, further comprising:

a flexible substrate electrically connected to the channel member;
a heat dissipation plate; and
a pressing member configured to press the flexible substrate toward the heat dissipation plate, wherein the pressing member is positioned with respect to the reservoir body by the fitting portion.

9. The liquid droplet discharge head according to claim 7, further comprising:

a flexible substrate electrically connected to the

channel member;
a heat dissipation plate; and
a pressing member configured to press the flexible substrate toward the heat dissipation plate, wherein the upper lid and the pressing member are positioned with respect to the reservoir body by the same fitting portion.

10. The liquid droplet discharge head according to any one of claims 1 to 9, wherein the reservoir comprises a filter member positioned while covering an opening portion of the connector.

11. A liquid droplet discharge apparatus comprising:

the liquid droplet discharge head according to any one of claims 1 to 10; and
a controller configured to control the liquid droplet discharge head.

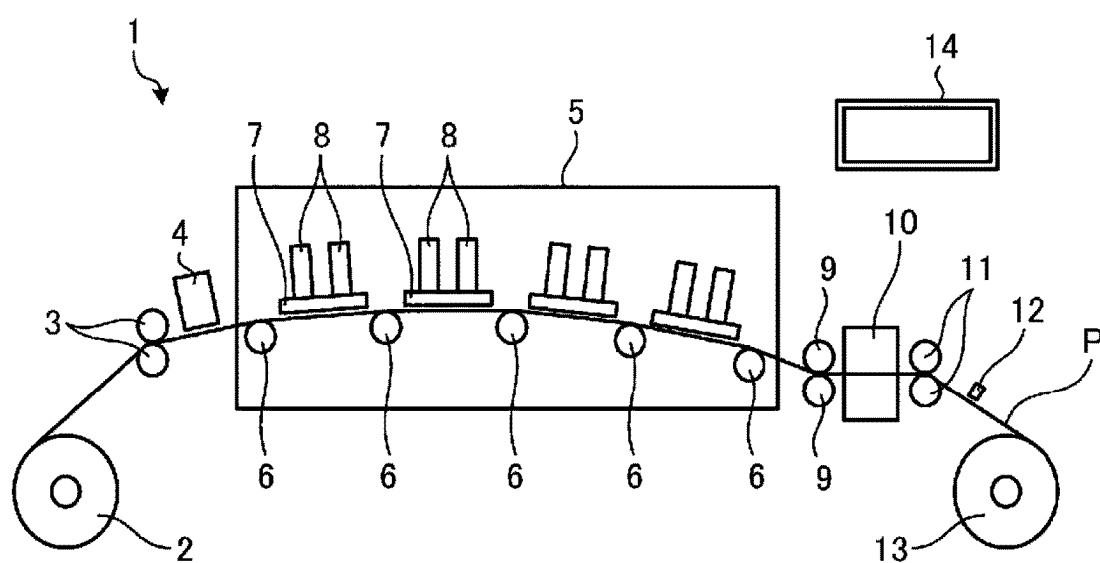


FIG. 1

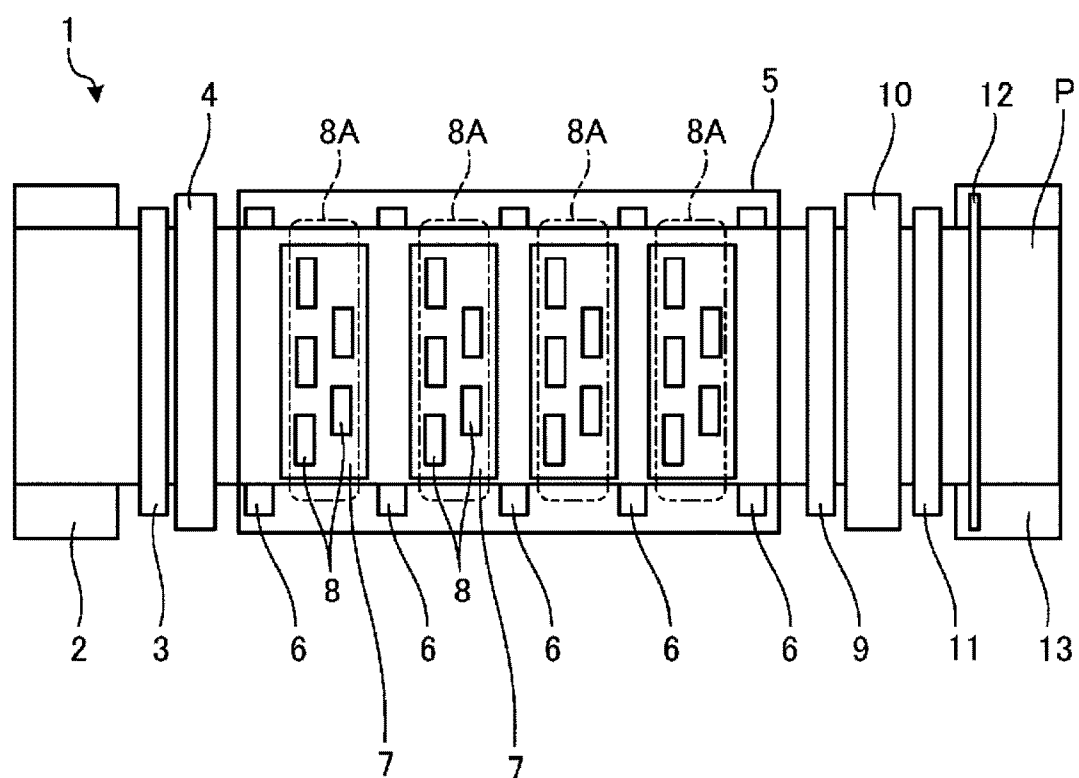


FIG. 2

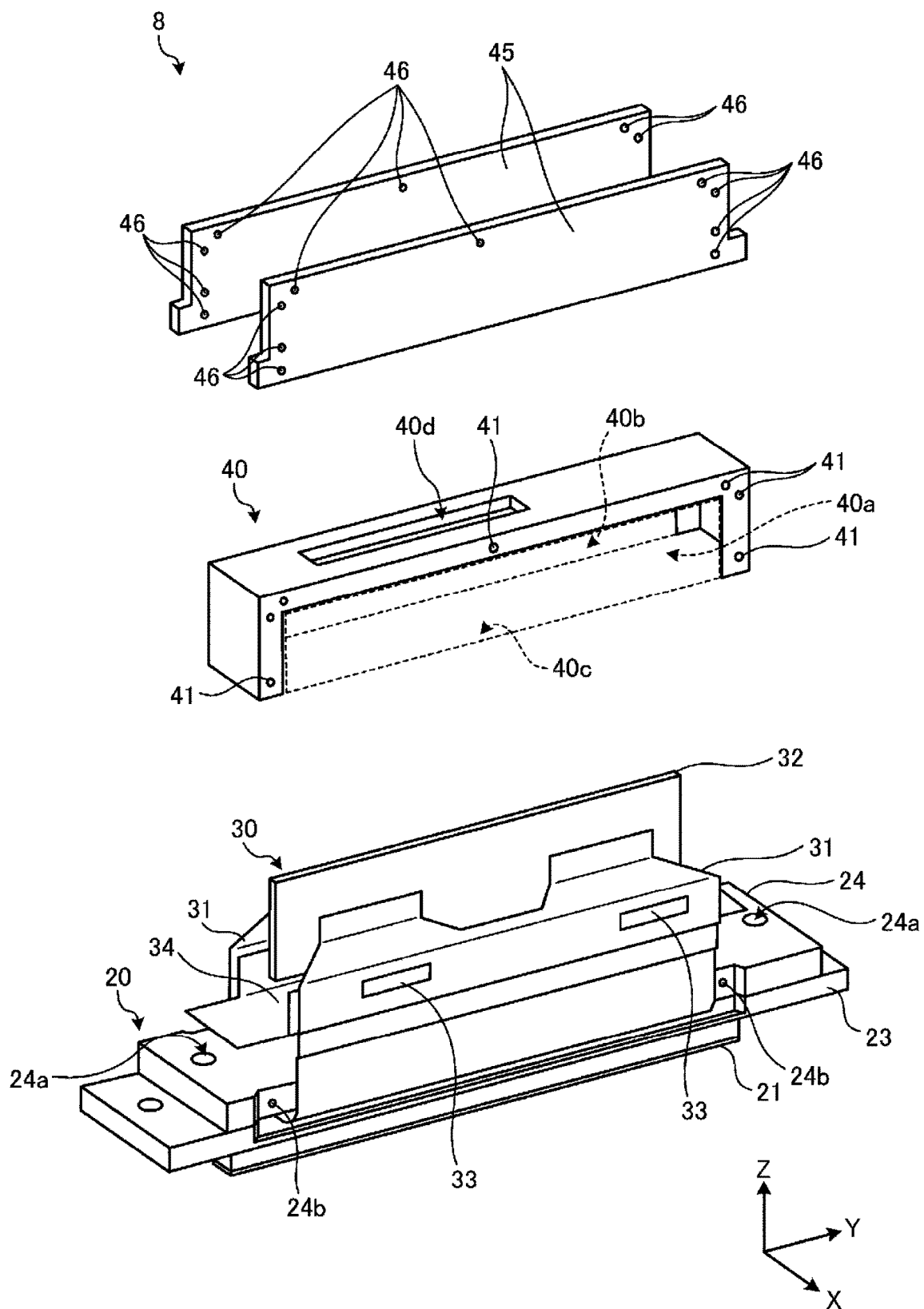


FIG. 3

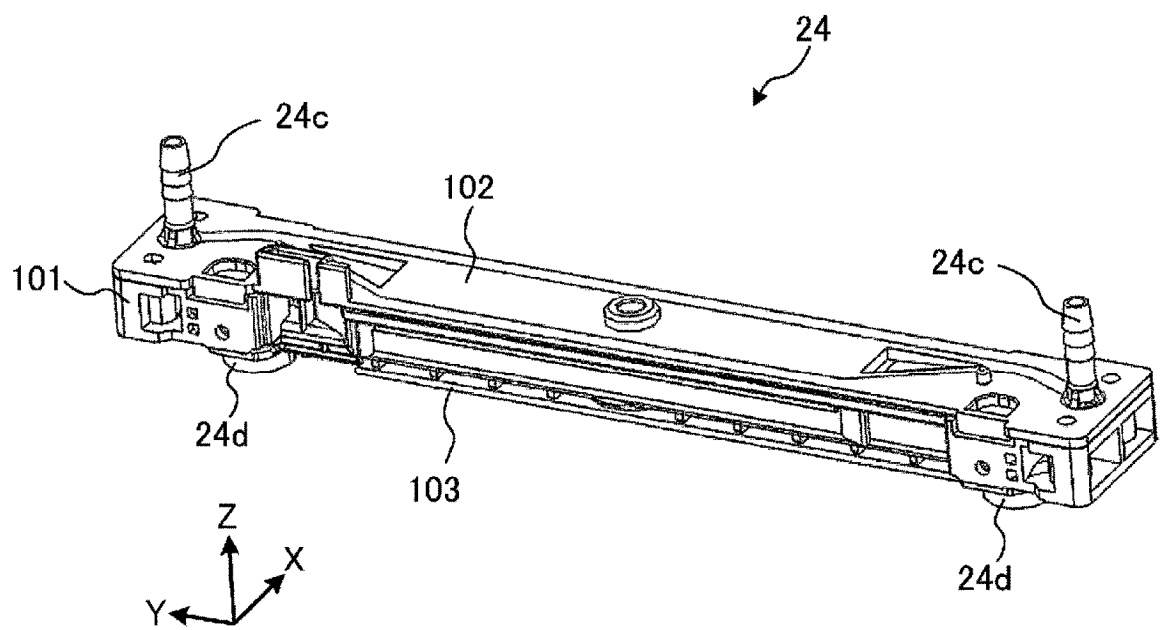


FIG. 4

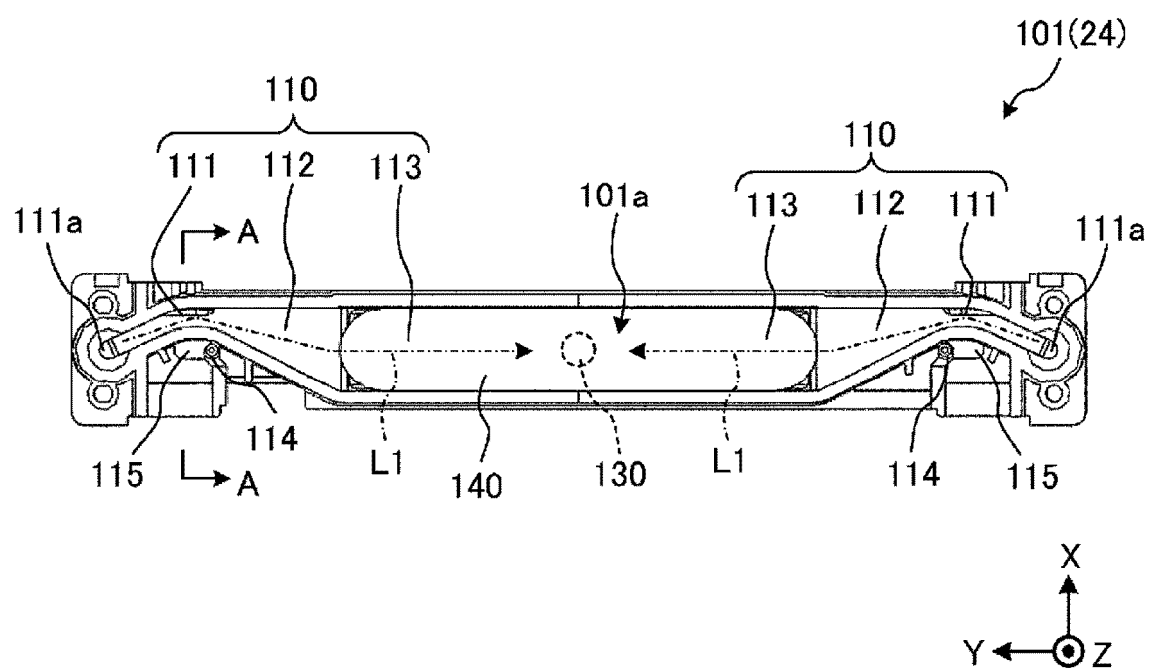


FIG. 5

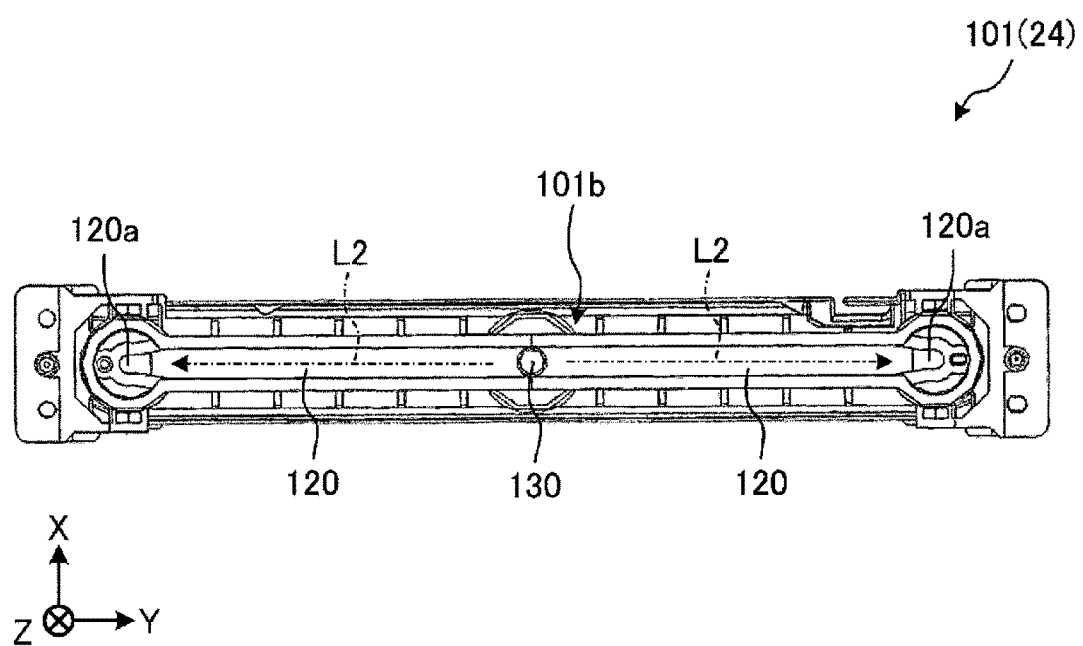


FIG. 6

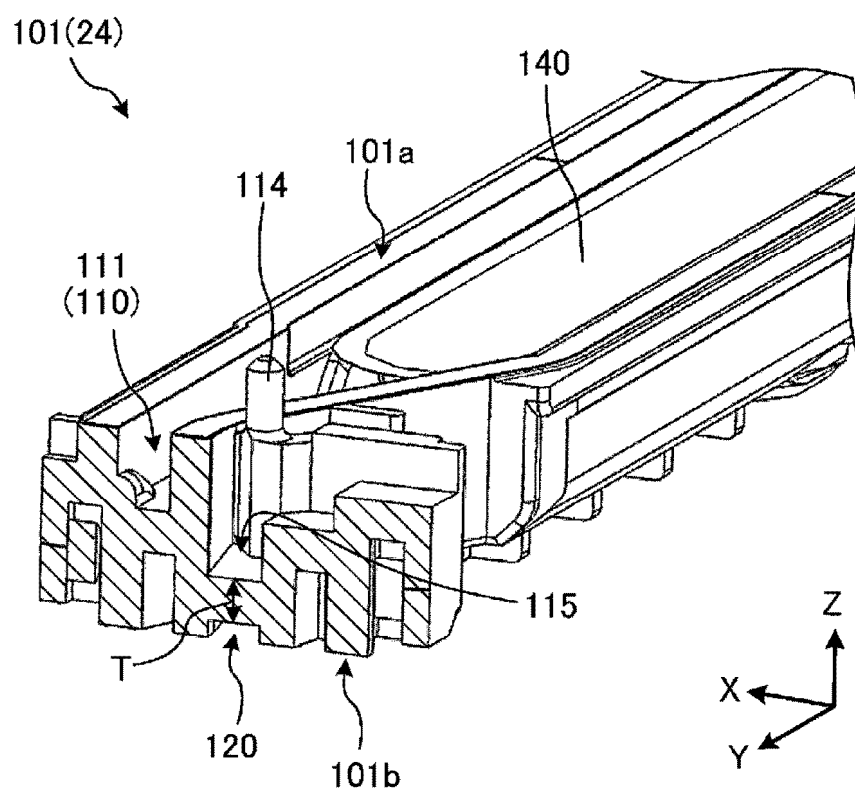


FIG. 7

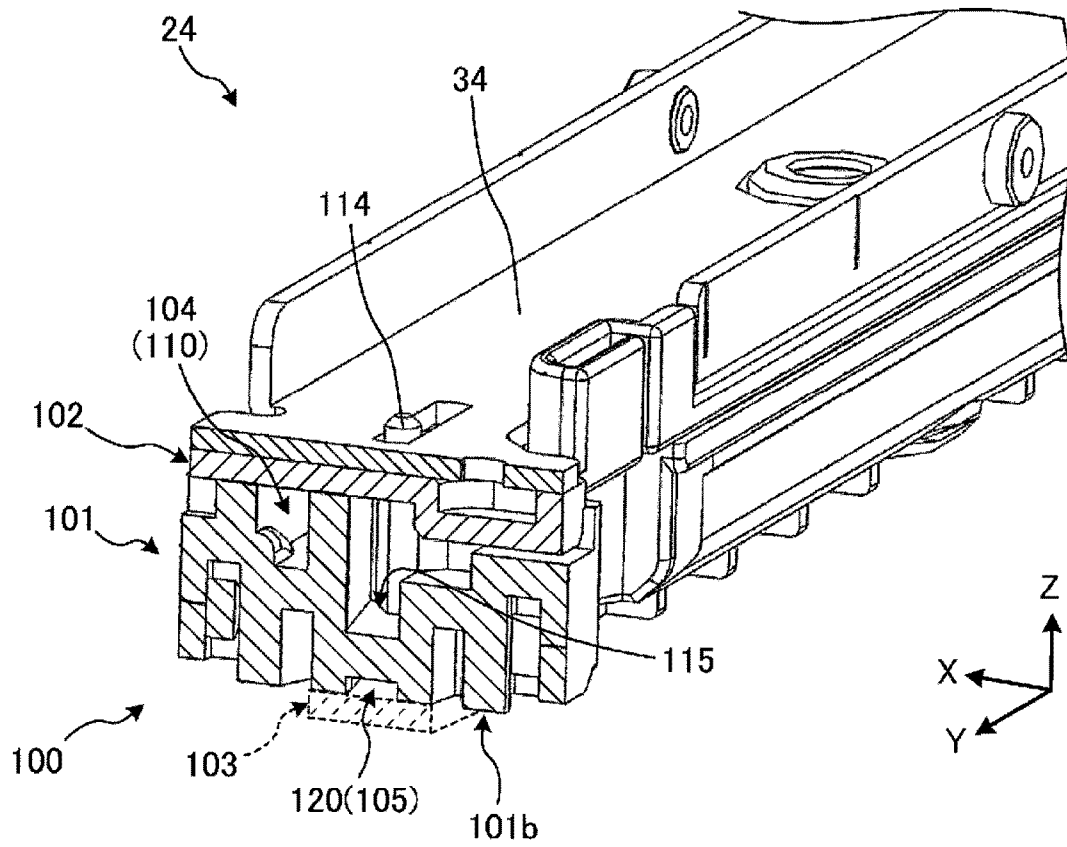


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2024/030744

A. CLASSIFICATION OF SUBJECT MATTER**B41J 2/175**(2006.01)i; **B41J 2/01**(2006.01)i

FI: B41J2/175 503; B41J2/175 201; B41J2/01 301

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B41J2/175; B41J2/01

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2024

Registered utility model specifications of Japan 1996-2024

Published registered utility model applications of Japan 1994-2024

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2014-97661 A (KYOCERA CORPORATION) 29 May 2014 (2014-05-29) paragraphs [0023]-[0024], [0036], [0042]-[0048], fig. 1, 6, 8-9	1-3, 10-11
A	entire text, all drawings	4-9
X	JP 2014-28452 A (KYOCERA CORPORATION) 13 February 2014 (2014-02-13) paragraphs [0013]-[0016], [0019], [0059]-[0060], fig. 1-3, 9	1, 10-11
A	entire text, all drawings	2-9
A	WO 2014/119604 A1 (KYOCERA CORPORATION) 07 August 2014 (2014-08-07) entire text, all drawings	1-7, 10-11
A	JP 2021-104665 A (KYOCERA CORPORATION) 26 July 2021 (2021-07-26) entire text, all drawings	8-9
A	JP 2010-76176 A (BROTHER KOGYO KABUSHIKI KAISHA) 08 April 2010 (2010-04-08) entire text, all drawings	1-11

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

05 November 2024

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Japan Patent Office (ISA/JP)

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Japan

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Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2024/030744

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2007-268868 A (BROTHER KOGYO KABUSHIKI KAISHA) 18 October 2007 (2007-10-18) entire text, all drawings	1-7, 10-11

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2024/030744

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2014-97661 A	29 May 2014	(Family: none)	
JP 2014-28452 A	13 February 2014	(Family: none)	
WO 2014/119604 A1	07 August 2014	US 2015/0360467 A1 entire text, all drawings EP 2952349 A1 CN 104936786 A JP 14-119604 A1	
JP 2021-104665 A	26 July 2021	(Family: none)	
JP 2010-76176 A	08 April 2010	US 2010/0073433 A1	
JP 2007-268868 A	18 October 2007	US 2007/0229602 A1 entire text, all drawings EP 1839881 A2 CN 101045380 A	

REFERENCES CITED IN THE DESCRIPTION

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