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(54) LIQUID EJECTION HEAD AND RECORDING DEVICE

(57) A liquid discharge head (8) includes a channel member (20), a pressurizing portion (42), a heat equalizing member (45), a reservoir (40), and a thermally conductive resin (46). The channel member (20) includes a discharge hole (21) for discharging liquid and a pressure chamber (22) connected to the discharge hole (21). The pressurizing portion (42) applies pressure to the pressure chamber (22). The heat equalizing member (45) is positioned above the pressurizing portion (42). The reservoir (40) is positioned above the channel member (22) and stores the liquid to be supplied to the channel member (22). The thermally conductive resin (46) is positioned between the heat equalizing member (45) and the reservoir (40).

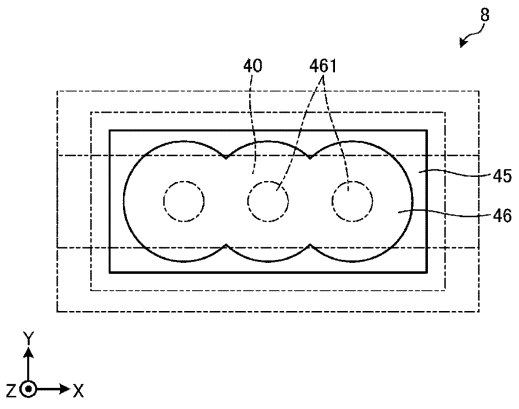

FIG. 8

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Description

TECHNICAL FIELD

[0001] The disclosed embodiments relate to a liquid discharge head and a recording device.

BACKGROUND OF INVENTION

[0002] Inkjet printers and inkjet plotters utilizing an inkjet recording method are known as printing devices. A liquid discharge head for discharging a liquid is mounted in such a printing apparatus using an inkjet method.

[0003] For such a liquid discharge head, a technique to, for example, introduce a liquid in a reservoir into a pressure chamber and operate a pressurizing portion to discharge the liquid in the pressure chamber from a discharge hole has been proposed.

CITATION LIST

PATENT LITERATURE

[0004]

Patent Document 1: JP 2006-181975 A
Patent Document 2: JP 2010-120202 A

SUMMARY

PROBLEM TO BE SOLVED

[0005] A liquid discharge head according to an aspect of an embodiment includes a channel member, a pressurizing portion, a heat equalizing member, a reservoir, and a thermally conductive resin. The channel member includes a discharge hole for discharging liquid and a pressure chamber connected to the discharge hole. The pressurizing portion applies pressure to the pressure chamber. The heat equalizing member is positioned above the pressurizing portion. The reservoir is positioned above the channel member and stores a liquid to be supplied to the channel member. The thermally conductive resin is positioned between the heat equalizing member and the reservoir.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

FIG. 1 is a front view schematically illustrating an overall front of a printer according to an embodiment.
FIG. 2 is a plan view schematically illustrating an overall plan of a printer according to an embodiment.
FIG. 3 is a cross-sectional view illustrating an example of a schematic configuration of a liquid discharge head according to a first embodiment.
FIG. 4 is a cross-sectional view illustrating an example of a schematic configuration of a channel configuration of the liquid discharge head according to the first embodiment.
FIG. 5 is a cross-sectional view illustrating an example of a schematic configuration of a liquid discharge head according to a second embodiment.
FIG. 6 is a cross-sectional view illustrating an example of a schematic configuration of a liquid discharge head according to a third embodiment.
FIG. 7 is a plan view illustrating an example of a schematic configuration of a liquid discharge head according to a fourth embodiment.
FIG. 8 is a plan view illustrating an example of a schematic configuration of a liquid discharge head according to a fifth embodiment.

DESCRIPTION OF EMBODIMENTS

[0007] In the liquid discharge head mentioned above, there is a case, for example, in which the temperature of the nozzle surface on which the discharge hole is positioned varies due to heat transmitted from the pressurizing portion, which is a heat generation source, and there is room for improvement in discharge performance particularly during high-speed driving.

[0008] Therefore, it is desired to provide a liquid discharge head and a recording device that can improve discharge performance.

[0009] Embodiments of a liquid discharge head and a recording device disclosed in the present application will be described in detail below with reference to the accompanying drawings. The present disclosure is not limited by the following embodiments. Note that the drawings are schematic and that the dimensional relationships between elements, the proportions of the elements, and the like may differ from the actual ones. There may be differences between the drawings in terms of dimensional relationships, proportions, and the like.

[0010] In the embodiments described below, expressions such as "constant", "orthogonal", "perpendicular", and "parallel" may be used, but these expressions do not mean exactly "constant", "orthogonal", "perpendicular", and "parallel". In other words, it is assumed that the above expressions allow for deviations in manufacturing accuracy, installation accuracy, or the like.

[0011] Embodiments can be appropriately combined so as not to contradict each other in terms of processing content. In the following embodiments, the same portions are denoted by the same reference signs, and redundant explanations are omitted.

Embodiment

Printer Configuration

[0012] With reference to FIGs. 1 and 2, an overview of a printer is described as an example of a recording device

according to an embodiment. FIG. 1 is a front view schematically illustrating an overall front of the printer according to the embodiment. FIG. 2 is a plan view schematically illustrating an overall plan of the printer according to the embodiment. The printer 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, guide rollers 3, an applicator 4, a head case 5, a plurality of transport rollers 6, a plurality of frames 7, a plurality of liquid discharge heads 8, transport rollers 9, a dryer 10, transport rollers 11, a sensor portion 12, and a collection roller 13. The transport roller 6 is an example of a transporter.

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

[0015] By landing droplets on a printing sheet P, the printer 1 records images and characters on the printing sheet P. The printing sheet P is an example of a recording medium. The printing sheet P is rolled on the paper feed roller 2 prior to use. The printer 1 conveys the printing sheet P from the paper feed roller 2 to the inside of the head case 5 via the guide rollers 3 and the applicator 4.

[0016] The applicator 4 uniformly applies a coating agent over the printing sheet P. This can perform surface treatment on the printing sheet P, improving the printing quality of the printer 1.

[0017] The head case 5 houses the plurality of transport rollers 6, the plurality of frames 7, and the plurality of liquid discharge heads 8. The inside of the head case 5 is formed with a space separated from the outside except for a part connected to the outside such as parts where the printing sheet P enters and exits.

[0018] As required, the controller 14 controls at least one of controllable factors of the internal space of the head case 5, such as temperature, humidity, and air pressure. The transport rollers 6 convey the printing sheet P near the liquid discharge heads 8 inside the head case 5.

[0019] The frames 7 are rectangular flat plates and are positioned above and close to the printing sheet P to be conveyed by the transport rollers 6. As illustrated in FIG. 2, the frames 7 are positioned having the longitudinal direction orthogonal to a conveyance direction of the printing sheet P. Inside the head case 5, the plurality of (e.g., 4) frames 7 are located at predetermined intervals along the conveyance direction of the printing sheet P.

[0020] A liquid, for example, ink, is supplied to the liquid discharge heads 8 from a liquid tank (not illustrated). The liquid discharge heads 8 discharge the liquid supplied from the liquid tank.

[0021] The controller 14 controls the liquid discharge heads 8 based on data of an image, characters, or the like to discharge the liquid toward the printing sheet P. The distance between each liquid discharge head 8 and the printing sheet P is, for example, approximately 0.5 mm to 20 mm.

[0022] Each of the liquid discharge heads 8 is fixed to the frame 7. The liquid discharge heads 8 are positioned having the longitudinal direction orthogonal to the conveyance direction of the printing sheet P.

[0023] That is, the printer 1 according to the present embodiment is a so-called line printer in which the liquid discharge heads 8 are fixed inside the printer 1. Note that the printer 1 according to the present embodiment is not limited to the line printer, and may also be a so-called serial printer.

[0024] The serial printer is a printer employing a method of alternately performing operations of recording while moving the liquid discharge heads 8 in a manner such as reciprocation in a direction intersecting (e.g., substantially orthogonal to) the conveyance direction of the printing sheet P, and conveying the printing sheet P.

[0025] As illustrated in FIG. 2, a plurality of (e.g., five) liquid discharge heads 8 are fixed to one frame 7. FIG. 2 illustrates an example in which three liquid discharge heads 8 are located on the forward side and two liquid discharge heads 8 are located on the rear side, in the conveyance direction of the printing sheet P. Further, the liquid discharge heads 8 are positioned without their centers overlapping in the conveyance direction of the printing sheet.

[0026] The plurality of liquid discharge heads 8 positioned in one frame 7 form a head group 8A. Four head groups 8A are positioned along the conveyance direction of the printing sheet P. The liquid discharge heads 8 that belong to the same head group 8A are supplied with four colors of ink. As a result, the printer 1 can perform printing with four colors of ink using the four head groups 8A.

[0027] The colors of the ink discharged from the respective liquid discharge heads 8 are, for example, magenta (M), yellow (Y), cyan (C), and black (K). The controller 14 can print a color image on the printing sheet P by controlling the respective liquid discharge heads 8 to discharge the plurality of colors of ink onto the printing sheet P.

[0028] Note that a surface treatment may be performed on the printing sheet P, by discharging a coating agent from the liquid discharge head 8 onto the printing sheet P.

[0029] Furthermore, the number of the liquid discharge heads 8 included in one head group 8A and the number of the head groups 8A mounted in the printer 1 can be changed as appropriate in accordance with printing targets and printing conditions. For example, the number of the liquid discharge heads 8 in the printer 1 may be one in a case in which it is desired to print a printable area that can be printed with one liquid discharge head 8.

[0030] The printing sheet P printed inside the head case 5 is conveyed to the outside of the head case 5 by the transport rollers 9 and passes through the inside of the dryer 10. The dryer 10 dries the printing sheet P

printed. The printing sheet P dried by the dryer 10 is transported by the transport rollers 11 and then collected by the collection roller 13.

[0031] In the printer 1, by drying the printing sheet P with the dryer 10, it makes it possible to suppress bonding, or rubbing of an undried liquid, between the printing sheets P overlapped with each other and rolled at the collection roller 13.

[0032] The sensor portion 12 includes a position sensor, a speed sensor, or a temperature sensor. Based on information from the sensor portion 12, the controller 14 can determine the state of each part of the printer 1 and control each part of the printer 1.

[0033] In the printer 1 described above, the printing sheet P is the printing target (i.e., the recording medium), but the printing target in the printer 1 is not limited to the printing sheet P, and a roll type fabric or the like may be the printing target.

[0034] The printer 1 may convey the printing sheet P put on a conveyor belt instead of directly conveying it. By using the conveyor belt, the printer 1 can perform printing on a sheet of paper, a cut cloth, wood, a tile, or the like as a printing target.

[0035] The printer 1 may discharge a liquid containing electrically conductive particles from the liquid discharge heads 8, to print a wiring pattern or the like of an electronic device. Furthermore, the printer 1 may discharge a liquid containing a predetermined amount of a liquid chemical agent or a liquid containing the chemical agent from the liquid discharge heads 8 onto a reaction vessel or the like to produce chemicals.

[0036] The printer 1 may also include a cleaner for cleaning the liquid discharge heads 8. The cleaner cleans the liquid discharge heads 8 by, for example, a wiping process or a capping process.

[0037] The wiping process is, for example, a process of wiping a surface of a portion from which a liquid is discharged using a flexible wiper, thereby removing the liquid attached to the liquid discharge head 8.

[0038] The capping process is performed as follows, for example. First, a cap is placed over the surface of the area where the liquid is to be discharged (this is called capping). This creates a substantially hermetically sealed space between the surface of the area where the liquid is discharged and the cap. The discharge of liquid is then repeated in such a hermetically sealed space. This removes liquids with higher viscosity than the normal state and foreign matters that have clogged the discharge hole 21 (see FIG. 3).

[0039] Configuration of Liquid Discharge Head

First Embodiment

[0040] The configuration of the liquid discharge head 8 according to a first embodiment will be described with reference to FIG. 3. FIG. 3 is a cross-sectional view illustrating an example of a schematic configuration of the liquid discharge head according to the first embodiment.

[0041] For the sake of clarity, FIG. 3 illustrates a three-dimensional orthogonal coordinate system including the Z-axis in which a vertically upward direction is a positive direction. In addition, for the sake of convenience, a direction in which the discharge hole 21 is positioned in the liquid discharge head 8, that is, the negative direction side of the Z-axis may be referred to as "under" or "below", and the positive direction side of the Z-axis may be referred to as "on" or "above" in the following description.

[0042] As illustrated in FIG. 3, the liquid discharge head 8 includes a channel member 20, a diaphragm 30, and a reservoir 40. The liquid discharge head 8 is elongate in the X-axis direction (hereinafter referred to as a longitudinal direction) and has a rectangular parallelepiped shape.

[0043] The channel member 20 includes a discharge hole 21 and a pressure chamber 22. The discharge hole 21 is positioned on a bottom surface 23 side of the liquid discharge head 8 that faces the printing sheet P (see FIG. 1). The discharge hole 21 is configured to discharge the liquid stored in the liquid discharge head 8 to the outside.

[0044] The material of the channel member 20 may be, for example, stainless steel or a resin material having heat resistance.

[0045] The pressure chamber 22 is positioned above the discharge hole 21. The pressure chamber 22 is connected to the discharge hole 21. A liquid is supplied into the pressure chamber 22 from the reservoir 40.

[0046] The diaphragm 30 is positioned on the pressure chamber 22. The diaphragm 30 applies pressure to the inside of the pressure chamber 22.

[0047] The reservoir 40 is positioned above the diaphragm 30. The reservoir 40 is positioned above the channel member 20 and stores the liquid to be supplied to the channel member 20.

[0048] The material of the reservoir 40 may be, for example, stainless steel or a resin material having heat resistance.

[0049] The reservoir 40 has a space 41 positioned between the reservoir 40 and the diaphragm 30. The space 41 houses a pressurizing portion 42, a flexible substrate 43, a bonding material 44, a heat equalizing member 45, and a thermally conductive resin 46.

[0050] The pressurizing portion 42 applies pressure to the pressure chamber 22. The pressurizing portion 42 includes a piezoelectric element that is displaced by energizing. The pressurizing portion 42 causes the diaphragm 30 to vibrate by displacing the piezoelectric element in response to a drive signal. The internal pressure of the pressure chamber 22 changes by the vibration of the diaphragm 30, causing the discharge of the liquid stored in the pressure chamber 22 from the discharge hole 21. The pressurizing portion 42 is elongate in the X-axis direction (hereinafter referred to as a longitudinal direction) and has a flat plate shape.

[0051] The flexible substrate 43 is positioned on the

upper side of the pressurizing portion 42. The flexible substrate 43 is a wiring board having flexibility and configured to transmit a drive signal supplied from the outside to the pressurizing portion 42. One end of the flexible substrate 43 is electrically connected to the piezoelectric element of the pressurizing portion 42, and the other end thereof is drawn upward from the end on the positive direction side and/or negative direction side of the Y-axis and is electrically connected to a wiring substrate (not illustrated).

[0052] The flexible substrate 43 and the heat equalizing member 45 are bonded with the bonding material 44. The bonding material 44 may be, for example, an adhesive, or may be a double-sided tape on which the adhesive is applied to both surfaces of the base member. The material of such an adhesive may be, for example, an adhesive made of an acrylic adhesive.

[0053] The heat equalizing member 45 is positioned above the pressurizing portion 42. The heat equalizing member 45 is bonded to the flexible substrate 43 via the bonding material 44. The heat equalizing member 45 receives heat transmitted from the pressurizing portion 42 via the flexible substrate 43 and the bonding material 44, and dissipates heat from the pressurizing portion 42. The heat equalizing member 45 and the pressurizing portion 42 are elongate in the X-axis direction (hereinafter referred to as a longitudinal direction), have a flat plate shape, and have lengths equal to or longer than the length of the pressurizing portion 42.

[0054] The heat equalizing member 45 is, for example, a metal plate-like member. The material of such a heat equalizing member 45 may be, for example, copper or aluminum.

[0055] The thermally conductive resin 46 is positioned on the heat equalizing member 45. The thermally conductive resin 46 is positioned between the heat equalizing member 45 and the reservoir 40. The thermally conductive resin 46 transfers heat transmitted from the heat equalizing member 45 to the reservoir 40.

[0056] The thermally conductive resin 46 may be a resin material, such as an adhesive containing acrylic resin, having a higher thermal conductivity than the bonding material 44. The material of the thermally conductive resin 46 may be in the form of a sheet, paste, or grease, for example. The thermally conductive resin 46 may be, for example, a material whose properties change before and after the assembly work of the liquid discharge head 8. The thermally conductive resin 46 may be, for example, a thermal interface material (TIM). The TIM may be, for example, thermal grease, a thermal pad, a phase change material, or thermal putty. Note that the thermal conductivity is measured by, for example, a steady method or an unsteady method. Examples of the unsteady method include a laser flash method and a hot disk method. Alternatively, for example, a measurement method specified in JISA1412-1:2016 may be used for measurement.

[0057] As described above, the heat generated in the pressurizing portion 42, which serves as a heat generation source, is transmitted to the reservoir 40 via the pressurizing portion 42, the flexible substrate 43, the bonding material 44, the heat equalizing member 45, and the thermally conductive resin 46 which are housed in the space 41. This allows dissipation of heat generated in the pressurizing portion 42 by the heat equalizing member 45 and the reservoir 40, and decreases the temperature distribution on the bottom surface 23 where the discharge hole 21 is positioned. Thus, the variations in the discharge properties of the liquid supplied to the channel member 20 via the reservoir 40 can be reduced, whereby the discharge performance of the liquid discharge head 8 can be improved.

[0058] The thermally conductive resin 46 can be positioned so as to fill the gap between the heat equalizing member 45 and the reservoir 40. This increases the contact area between the heat equalizing member 45 and the thermally conductive resin 46 and the contact area between the reservoir 40 and the thermally conductive resin 46, and improves the heat dissipation performance compared to the case in which the heat equalizing member 45 and the reservoir 40 are brought into contact with each other without the thermally conductive resin 46 interposed therebetween. This can improve the discharge performance of the liquid discharge head 8. The thermally conductive resin 46 is provided only in the gap between the heat equalizing member 45 and the reservoir 40, and does not fill the space 41. This suppresses the application of stress generated by filling the thermally conductive resin 46 to the pressurizing portion 42, causing it less likely to suppress the displacement of the pressurizing portion 42.

[0059] Furthermore, the thermally conductive resin 46 may be positioned so as to overlap the entire surface of the heat equalizing member 45 in a plan view. This increases the contact area between the heat equalizing member 45 and the thermally conductive resin 46, and improves the heat dissipation properties as compared with the case in which the heat equalizing member 45 and the thermally conductive resin 46 are positioned in a partially overlapping manner in the plan view. This further improves the discharge performance of the liquid discharge head 8.

[0060] Furthermore, the thermally conductive resin 46 may be thicker than the bonding material 44. Increasing the thickness of the thermally conductive resin 46 having a higher thermal conductivity than the bonding material 44 can facilitate the dissipation of heat generated in the pressurizing portion 42, and decreases the temperature distribution on the bottom surface 23 where the discharge hole 21 is positioned. This can improve the discharge performance of the liquid discharge head 8. The thickness of the thermally conductive resin 46 can be, for example, from 50 μm to 350 μm. The thickness of the bonding material 44 can be, for example, from 30 μm to 100 μm. The thickness of the heat equalizing member 45 can be, for example, from 450 μm to 750 μm.

[0061] The heat equalizing member 45 may have a higher thermal conductivity than the channel member 20 and/or the reservoir 40. This facilitates the transmission of heat generated in the pressurizing portion 42 to the heat equalizing member 45, thus improving the discharge performance of the liquid discharge head 8. In order to obtain the above-described configuration, for example, the heat equalizing member 45 may be made of a copper plate, and the channel member 20 and/or the reservoir 40 may be made of an SUS plate.

[0062] The heat equalizing member 45 may have a higher thermal conductivity than the thermally conductive resin 46. The heat equalizing member 45 may be thicker than the thermally conductive resin 46. This facilitates the transmission of heat generated in the pressurizing portion 42 to the heat equalizing member 45, and reduces the temperature variations on the bottom surface 23 where the discharge hole 21 is positioned, whereby the discharge performance of the liquid discharge head 8 can be improved. In order to obtain the above configuration, for example, the heat equalizing member 45 may be made of a copper plate, and the thermally conductive resin 46 may be made of a thermally conductive acrylic adhesive sheet.

[0063] The heat equalizing member 45 is positioned away from the channel member 20. This suppresses the dissipation of heat transmitted to the heat equalizing member 45 to the channel member 20. Accordingly, the heat transmitted to the heat equalizing member 45 is directly transmitted to the channel member 20, and the temperature variations on the bottom surface 23 where the discharge hole 21 is positioned is reduced, whereby the discharge performance of the liquid discharge head 8 can be improved.

[0064] With reference to FIG. 4, an example of the channel configuration of the liquid discharge head 8 according to the present embodiment will be described. FIG. 4 is a cross-sectional view illustrating an example of the schematic channel configuration of the liquid discharge head according to the first embodiment. In FIG. 4, only the common channels having a large flow rate are schematically illustrated, and the individual channels corresponding to the respective discharge holes 21 are not illustrated. In FIG. 4, some of the members illustrated in FIG. 3, such as the diaphragm 30, are omitted.

[0065] As illustrated in FIG. 4, each of the liquid discharge heads 8 includes channels 401 to 412. The channels 401 to 406 are supply channels for supplying a liquid to the channel member 20 from the reservoir 40.

[0066] The channel 401 is a channel for supplying a liquid to the inside of the reservoir 40 and, in the example illustrated in FIG. 4, is positioned at an end portion on the negative direction side of the X-axis. The channels 402, 403 are positioned above the space 41, serving as branch channels for distributing the liquid flowing through the channel 401. The channels 402, 403 are connected to the channels 404, 405, respectively, which are positioned along the side surfaces of the space 41. Then, the channels 404, 405 merge with the channel 406 positioned above the space 41. The liquid flowing through the channel 406 is discharged to the outside from the discharge hole 21 (see FIG. 3).

[0067] On the other hand, the channels 407 to 412 are recovery channels for recovering the liquid from the channel member 20 to the reservoir 40.

[0068] The channel 407 is connected to the channel 406 via the pressure chamber 22 (see FIG. 3). A part of the liquid flowing through the channel 406 which remains without being discharged to the outside from the discharge hole 21 (see FIG. 3) flows into the channel 407. The channels 408, 409 are positioned along the side surfaces of the space 41, serving as branch channels for distributing the liquid flowing through the channel 407. The channels 408, 409 are connected respectively to the channels 410, 411 positioned above the space 41. Then, the channels 410, 411 merge with the channel 412 extending upward from the channels 410, 411, and the liquid flowing through the channel 412 is recovered from the end portion on the positive direction side of the X-axis. The liquid recovered from the channel 412 may be supplied to the channel 401 through, for example, a filter which is not illustrated. Thus, the liquid discharge head 8 has a circulation channel for supplying and recovering the liquid, allowing reuse of the liquid that remains without being discharged from the discharge hole 21 (see FIG. 3).

[0069] The channels 402, 403 serving as the supply channels may be positioned, for example, between the thermally conductive resin 46 and the channels 410, 411 serving as the recovery channels. This can make the temperature of the liquid flowing through the supply channels to be closer to the temperature of the liquid flowing through the recovery channels, thus achieving a stable discharge performance.

[0070] The channels 404, 405 serving as the supply channels may be positioned, for example, between the heat equalizing member 45 and the channels 408, 409 serving as the recovery channels. This can make the temperature of the liquid flowing through the supply channels to be closer to the temperature of the liquid flowing through the recovery channels, thus achieving a stable discharge performance.

[0071] The liquid flowing through the liquid discharge head 8 is supplied from the central portion in the longitudinal direction to flow toward both end portions in the longitudinal direction and toward the central portion again in the longitudinal direction, and then the flowing liquid is partially discharged. The liquid not discharged from the liquid discharge head 8 flows toward both end portions in the longitudinal direction and toward the central portion in the longitudinal direction, and is recovered from the central portion in the longitudinal direction. Thus, the liquid flowing along the longitudinal direction and the heat equalizing member 45 which is elongate in the longitudinal direction are next to each other a plurality of times allows for efficient heat exchange.

[0072] Furthermore, the liquid flowing through the li-

quid discharge head 8 is supplied from the central portion in the longitudinal direction, allowing cooling of the central portion in the longitudinal direction of the pressurizing portion 42 which is likely to have a high temperature.

Second Embodiment

[0073] FIG. 5 is a cross-sectional view illustrating an example of the schematic configuration of a liquid discharge head according to a second embodiment. The liquid discharge head 8 illustrated in FIG. 5 is different from the liquid discharge head 8 according to the first embodiment in that the heat equalizing member 45 has leg portions 45a. The leg portions 45a are positioned between the space 41 and the pressurizing portion 42, the flexible substrate 43, and the bonding material 44. The leg portions 45a are bonded to the channel member 20 through a bonding material 47.

[0074] By having the leg portions 45a in the heat equalizing member 45 in a plan view, the heat equalizing member 45 can be larger than the pressurizing portion 42. This can further improve heat dissipation properties, and further improves the discharge performance of the liquid discharge head 8.

[0075] The bonding material 47 may be, for example, an adhesive, or may be a double-sided tape on which the adhesive is applied to both surfaces of the base member. The material of such an adhesive may be, for example, an adhesive made of an acrylic adhesive. The bonding material 47 may or may not be the same as the bonding material 44.

[0076] The bonding material 47 may have a lower thermal conductivity than the thermally conductive resin 46. This suppresses the dissipation of heat transmitted to the heat equalizing member 45 to the channel member 20 side, thus reducing the temperature variations on the bottom surface 23 where the discharge hole 21 is positioned. This can improve the discharge performance of the liquid discharge head 8.

Third Embodiment

[0077] FIG. 6 is a cross-sectional view illustrating an example of the schematic configuration of the liquid discharge head according to a third embodiment. The liquid discharge head 8 illustrated in FIG. 6 is different from the liquid discharge head 8 according to the second embodiment in that a thermally conductive resin 48 is provided instead of the bonding material 47.

[0078] The thermally conductive resin 48 may be a resin material, such as an adhesive containing an acrylic resin, having a higher thermal conductivity than the bonding material 44. The thermally conductive resin 48 may be a TIM. The thermally conductive resin 48 may or may not be the same material as the material of the thermally conductive resin 46.

[0079] The heat equalizing member 45 is bonded to the channel member 20 via the thermally conductive resin 48 which is a resin material having thermal conductivity, which reduces the occurrence of positional deviation compared to the case in which the heat equalizing member 45 is bonded to the channel member 20 via the bonding material 47. This increases the durability of the liquid discharge head 8.

[0080] The thermally conductive resin 48 may be thicker than the thermally conductive resin 46. By making the thermally conductive resin 48, which is in contact with the channel member 20, to be thicker than the thermally conductive resin 46, the transmission of heat generated in the pressurizing portion 42 to the channel member 20 via the thermally conductive resin 48 can be suppressed, and the temperature distribution on the bottom surface 23 where the discharge hole 21 is positioned can be decreased. This can improve the discharge performance of the liquid discharge head 8. The thickness of the thermally conductive resin 46 can be, for example, from 50 μm to 350 μm. The thickness of the thermally conductive resin 48 can be, for example, from 30 μm to 100 μm.

Fourth and Fifth Embodiments

[0081] FIG. 7 is a plan view illustrating an example of the schematic configuration of the liquid discharge head according to a fourth embodiment. FIG. 8 is a plan view illustrating an example of the schematic configuration of the liquid discharge head according to a fifth embodiment. FIGs. 7 and 8 are plan views seen from the positive direction side of the Z-axis along the discharge direction of the liquid to be discharged from the liquid discharge head 8.

[0082] As illustrated in FIGs. 7 and 8, the liquid discharge head 8 includes the heat equalizing member 45, the thermally conductive resin 46, and the reservoir 40. To facilitate understanding, members other than the heat equalizing member 45, the thermally conductive resin 46, and the reservoir 40 are not illustrated in FIGs. 7 and 8. In addition, in FIGs. 7 and 8, the outline of the liquid discharge head 8 and the reservoir 40 are indicated by double-dashed lines.

[0083] The thermally conductive resin 46 is positioned between the heat equalizing member 45 and the reservoir 40. As illustrated in FIGs. 7 and 8, the thermally conductive resin 46 is positioned in a region where the heat equalizing member 45 and the reservoir 40 overlap in a plan view, and the thermally conductive resin 46 may be positioned in a range narrower than this region. This improves, for example, the efficiency of the assembly work of the liquid discharge head 8. For example, when a material in the form of a sheet (sheet material) is used as the thermally conductive resin 46, a separator attached to the sheet material can easily be detached. When the material in the form of paste or grease is used as the thermally conductive resin 46, for example, an amount to be applied onto the heat equalizing member 45 can easily be adjusted.

[0084] As illustrated in FIGs. 7 and 8, the thermally

conductive resin 46 may have a smaller area than the heat equalizing member 45 in the plan view. This improves, for example, the efficiency of the assembly work of the liquid discharge head 8. For example, when a material in the form of a sheet (sheet material) is used as the thermally conductive resin 46, a separator attached to the sheet material can easily be detached. When the material in the form of paste or grease is used as the thermally conductive resin 46, for example, an amount to be applied onto the heat equalizing member 45 can easily be adjusted. Here, the area of the thermally conductive resin 46 in the plan view as illustrated in FIGs. 7 and 8 can be set to, for example, from 50% to 90% of the area of the heat equalizing member 45.

[0085] When the thermally conductive resin 46 is in the form of a sheet, as illustrated in FIG. 7, the thermally conductive resin 46 may be positioned up to both ends of the heat equalizing member 45 in the lateral direction (Y-axis direction), and need not be positioned at both ends of the heat equalizing member 45 in the longitudinal direction (X-axis direction) in the region where the heat equalizing member 45 and the reservoir 40 overlap in the plan view.

[0086] For example, the temperature on a nozzle surface (the bottom surface 23 of the liquid discharge head 8, see FIG. 3, for example) tends to be higher at the center portion in the longitudinal direction (X-axis direction) of the liquid discharge head 8 than at the end portions thereof. At this time, by more actively dissipating heat in the central portion in the longitudinal direction (X-axis direction) of the liquid discharge head 8 than in the end portions thereof, the temperature can be uniformed, for example, over the entire nozzle surface.

[0087] As illustrated in FIG. 8, when a material 461 of the thermally conductive resin 46 is in the form of paste or grease, the thermally conductive resin 46 may be provided so as not to protrude from the heat equalizing member 45 in the plan view. This can make it less likely to cause, for example, the flaw of externally protruding the material 461 and/or the thermally conductive resin 46 from the heat equalizing member 45 and staining other parts of the liquid discharge head 8. In addition, by bringing the material 461 of the thermally conductive resin 46 into close contact with the heat equalizing member 45 and the reservoir 40, the heat equalizing member 45 and the reservoir 40 can be made, for example, to be in contact more reliably with the thermally conductive resin 46, whereby the heat dissipation property is improved. Note that the shapes of the material 461 and the thermally conductive resin 46 illustrated in FIG. 8 are merely examples, and not limited thereto.

Other Embodiments

[0088] In each of the above-described embodiments, the flexible substrate 43 is positioned on the pressurizing portion 42, but the flexible substrate 43 may be positioned under the pressurizing portion 42.

[0089] The second and third embodiments described above include the bonding material 44 for bonding the flexible substrate 43 with the reservoir 40, but the flexible substrate 43 and the reservoir 40 may be brought into contact without the bonding material 44. Instead of the bonding material 44, the thermally conductive resin 46 or the thermally conductive resin 48 may be provided.

[0090] As described above, the liquid discharge head 8 according to the embodiments includes the channel member 20, the pressurizing portion 42, the heat equalizing member 45, the reservoir 40, and the thermally conductive resin 46. The channel member 20 includes the discharge hole 21 for discharging the liquid and the pressure chamber 22 connected to the discharge hole 21. The pressurizing portion 42 applies pressure to the pressure chamber 22. The heat equalizing member 45 is positioned above the pressurizing portion 42. The reservoir 40 is positioned above the channel member 20 and stores the liquid to be supplied to the channel member 20. The thermally conductive resin 46 is positioned between the heat equalizing member 45 and the reservoir 40. Thus, the liquid discharge head 8 according to the embodiments can improve the discharge performance.

[0091] Further effects and variations can be readily derived by those skilled in the art. Thus, a wide variety of aspects of the present invention are not limited to the specific details and representative embodiments represented 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.

REFERENCE SIGNS

[0092]

1 Printer
8 Liquid discharge head
20 Channel member
21 Discharge hole
22 Pressure chamber
30 Diaphragm
40 Reservoir
42 Pressurizing portion
43 Flexible substrate
44 Bonding material
45 Heat equalizing member
46 Thermally conductive resin

Claims

1. A liquid discharge head, comprising:

a channel member comprising a discharge hole configured to discharge liquid and a pressure chamber connected to the discharge hole;
a pressurizing portion configured to apply pres-

sure to the pressure chamber;
a heat equalizing member positioned above the pressurizing portion;
a reservoir positioned above the channel member and configured to store a liquid to be supplied to the channel member; and
a thermally conductive resin positioned between the heat equalizing member and the reservoir.

2. The liquid discharge head according to claim 1, wherein the heat equalizing member has a higher thermal conductivity than the channel member and/or the reservoir.

3. The liquid discharge head according to claim 2, wherein

the heat equalizing member has a higher thermal conductivity than the thermally conductive resin, and
the heat equalizing member is thicker than the thermally conductive resin.

4. The liquid discharge head according to any one of claims 1 to 3, wherein the heat equalizing member is positioned away from the channel member.

5. The liquid discharge head according to any one of claims 1 to 4, wherein the heat equalizing member is bonded to the channel member via a bonding material having a lower thermal conductivity than the thermally conductive resin.

6. The liquid discharge head according to claim 5, wherein the thermally conductive resin is thicker than the bonding material.

7. The liquid discharge head according to any one of claims 1 to 4, wherein the heat equalizing member is bonded to the channel member via a resin material having thermal conductivity.

8. The liquid discharge head according to any one of claims 1 to 7, further comprising:

a supply channel configured to supply the liquid from the reservoir to the channel member; and
a recovery channel configured to recover the liquid from the channel member to the reservoir,
wherein the supply channel is positioned between the thermally conductive resin and the recovery channel.

9. The liquid discharge head according to claim 8, wherein the supply channel is positioned between the heat equalizing member and the recovery channel.

10. A liquid discharge head, comprising:

a heat equalizing member;
a reservoir configured to store a liquid; and
a thermally conductive resin positioned between the heat equalizing member and the reservoir,
wherein the thermally conductive resin is positioned in a range narrower than a region in which the heat equalizing member and the reservoir overlap in a plan view along a discharge direction of the liquid.

11. The liquid discharge head according to claim 10, wherein the thermally conductive resin has an area smaller than an area of the heat equalizing member in the plan view.

12. The liquid discharge head according to claim 10 or 11, wherein

a material of the thermally conductive resin is in the form of a sheet, and
in the region, the thermally conductive resin is positioned up to both ends of the heat equalizing member in a lateral direction, and the thermally conductive resin is not positioned at both ends of the heat equalizing member in a longitudinal direction.

13. The liquid discharge head according to claim 10 or 11, wherein

a material of the thermally conductive resin is in the form of a paste or grease, and
the thermally conductive resin is positioned to not protrude from the heat equalizing member in the plan view.

14. A recording device, comprising the liquid discharge head according to any one of claims 1 to 13.

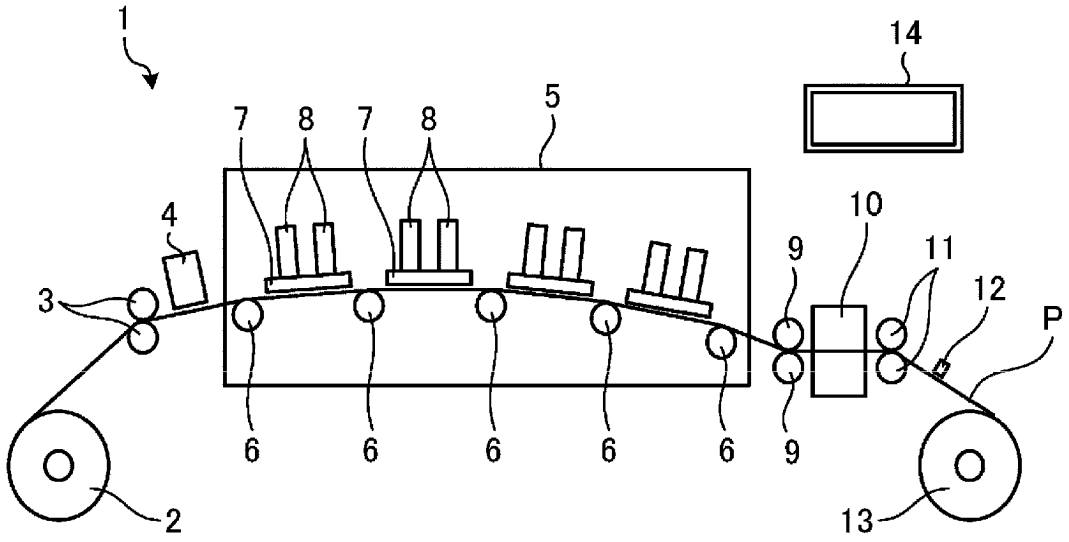
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FIG. 1

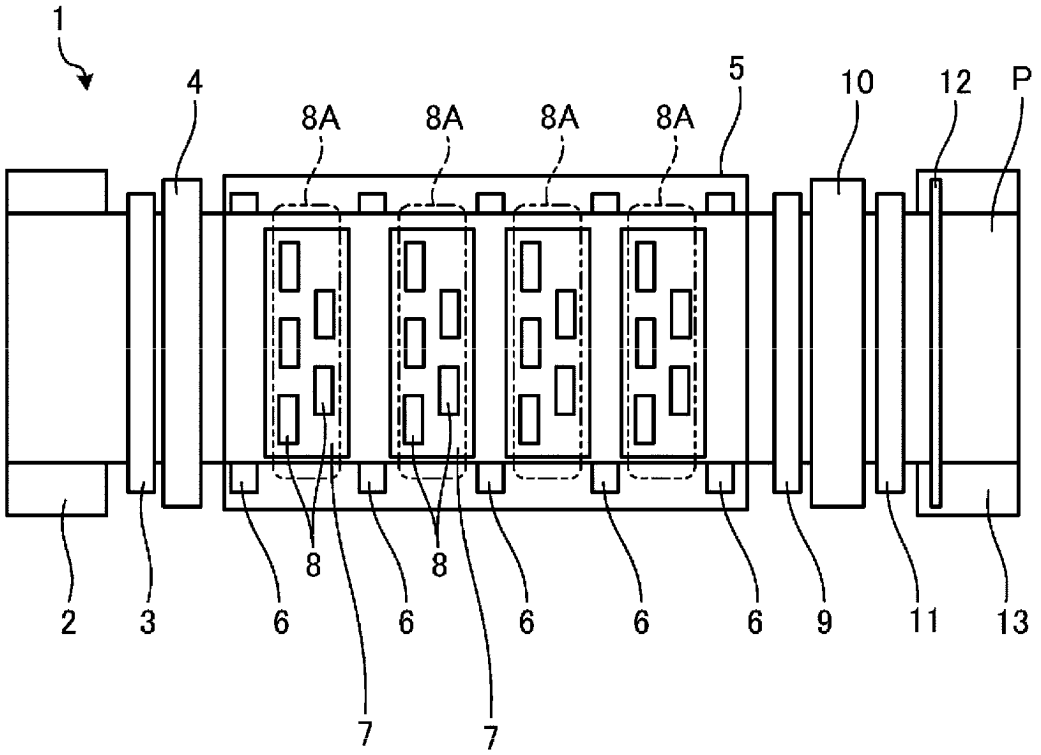
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FIG. 2

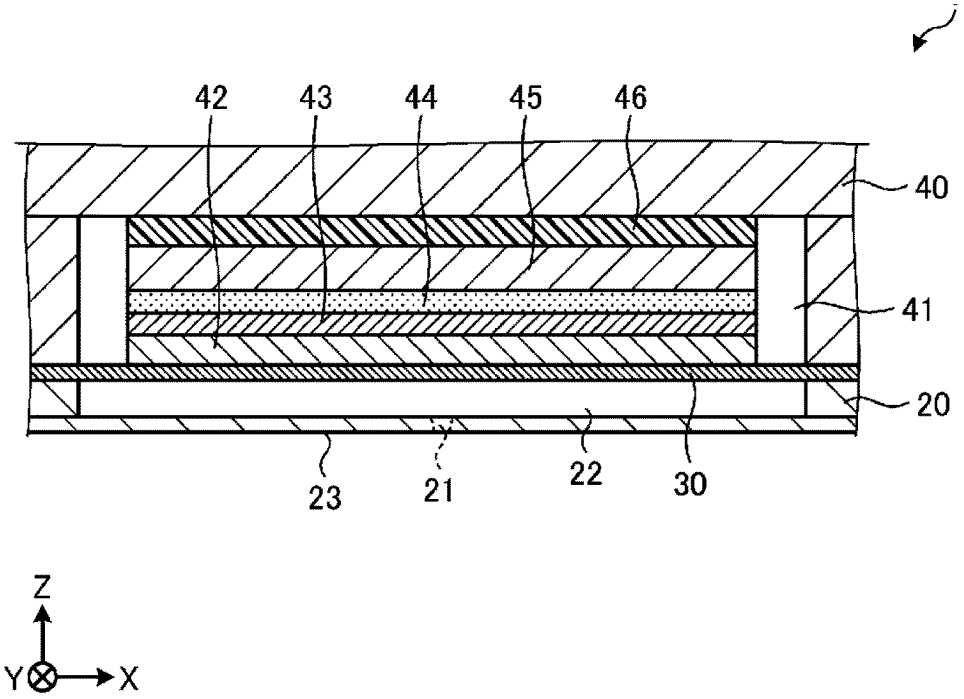
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FIG. 3

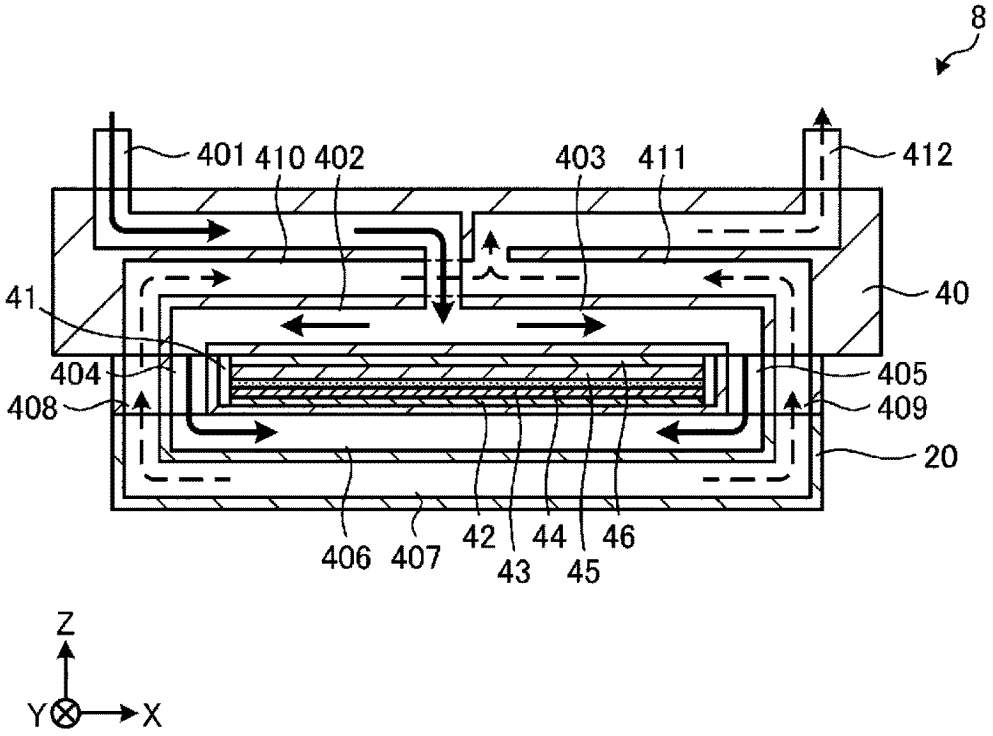
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FIG. 4

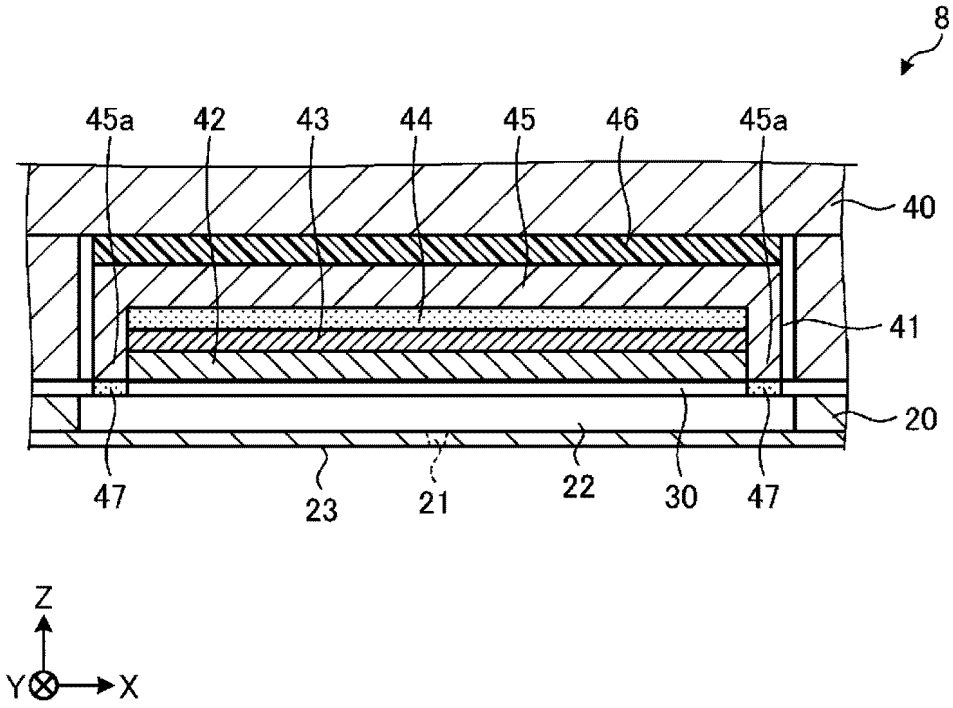
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FIG. 5

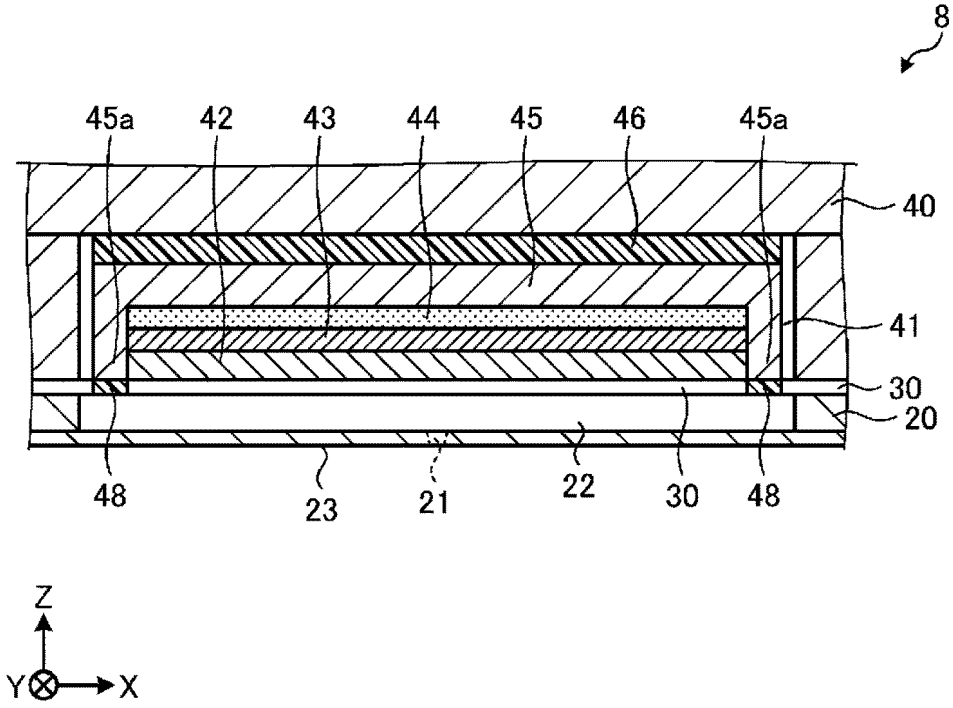
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FIG. 6

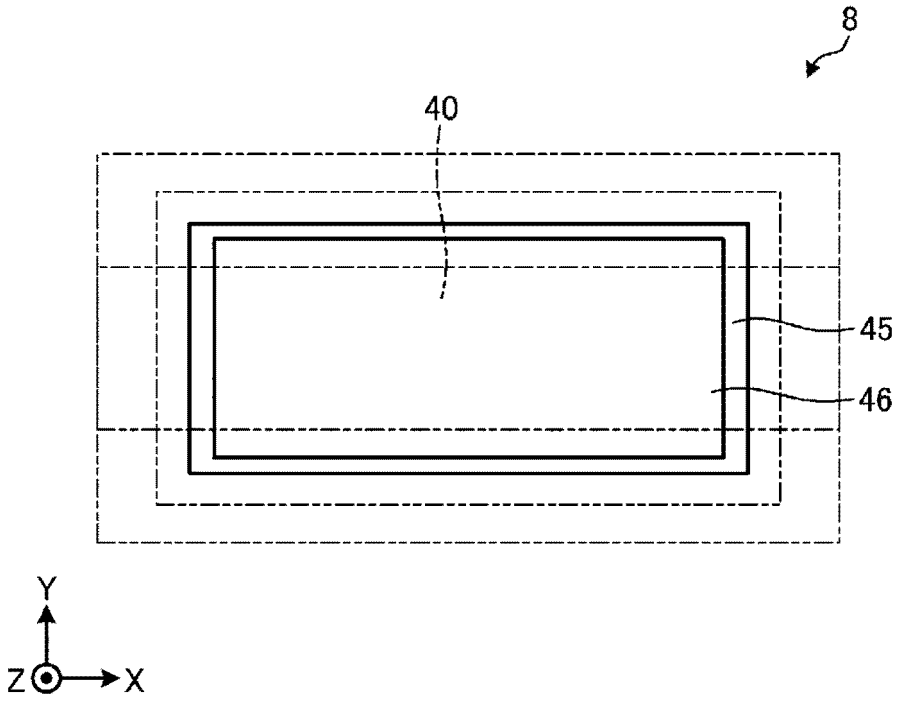

FIG. 7

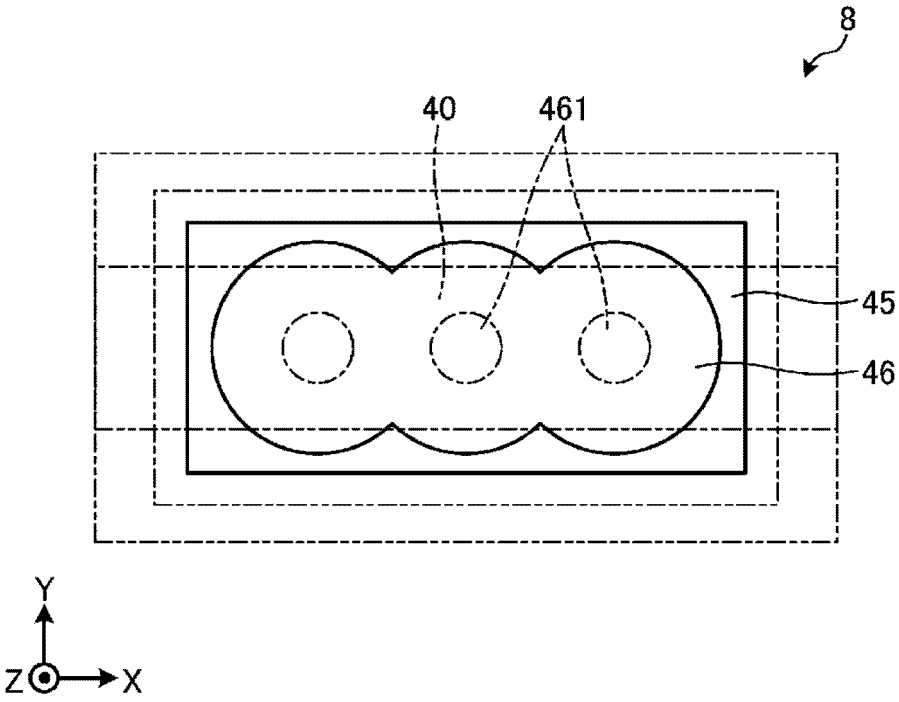

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/013423

A. CLASSIFICATION OF SUBJECT MATTER

B41J 2/14(2006.01)i; ***B41J 2/16***(2006.01)i; ***B41J 2/18***(2006.01)i
FI: B41J2/14 305; B41J2/14 603; B41J2/14 613; B41J2/16 503; B41J2/18

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)

B41J2/14; B41J2/16; B41J2/18

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 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

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 2019-147368 A (RICOH CO LTD) 05 September 2019 (2019-09-05) paragraphs [0023], [0035]-[0042], fig. 1-3, 5-8, 11	1-3, 5-7, 10-14
A		4, 8-9
A	JP 2019-018406 A (SII PRINTEK INC) 07 February 2019 (2019-02-07) paragraphs [0065]-[0066], [0073], [0093]-[0095], fig. 4-8	1-14
A	JP 2017-077639 A (RICOH CO LTD) 27 April 2017 (2017-04-27) paragraphs [0017]-[0019], fig. 3-5	8-9
A	JP 2007-203528 A (FUJI XEROX CO LTD) 16 August 2007 (2007-08-16) paragraphs [0034]-[0043], fig. 6	1-14
A	US 2012/0281044 A1 (ANDREWS et al.) 08 November 2012 (2012-11-08) paragraphs [0030]-[0037], fig. 1-8	1-14

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

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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	Date of mailing of the international search report
21 April 2023	**16 May 2023**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/013423

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2019-147368 A	05 September 2019	US 2019/0263157 A1 paragraphs [0039], [0052]-[0059], fig. 1-3, 5-8, 11	
JP 2019-018406 A	07 February 2019	(Family: none)	
JP 2017-077639 A	27 April 2017	(Family: none)	
JP 2007-203528 A	16 August 2007	(Family: none)	
US 2012/0281044 A1	08 November 2012	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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- JP 2010120202 A **[0004]**