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(54) LIQUID EJECTION HEAD AND RECORDING DEVICE

(57) A liquid discharge head includes a first channel member, a second channel member, a drive IC, and a heat dissipation plate. The first channel member is configured to discharge a liquid. The second channel member is configured to supply the liquid to the first channel member. The drive IC is configured to control discharge of the liquid. The heat dissipation plate is in contact with the drive IC. The second channel member includes a cutout portion in which the heat dissipation plate is accommodated.

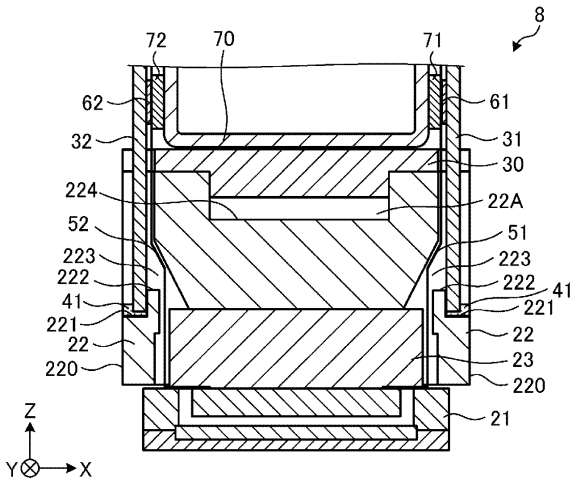

FIG. 6

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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 device that uses an inkjet method.

[0003] An example of such a liquid discharge head is a known liquid discharge head configured such that a heat dissipation plate is in contact with a drive IC which is a heat generation source and heat transmitted from the drive IC is released through the heat dissipation plate.

CITATION LIST

PATENT LITERATURE

[0004]

Patent Document 1: JP 2014-97661 A
Patent Document 2: JP 2008-87231 A

SUMMARY

[0005] A liquid discharge head according to an aspect of an embodiment includes a first channel member, a second channel member, a drive IC, and a heat dissipation plate. The first channel member is configured to discharge a liquid. The second channel member is configured to supply the liquid to the first channel member. The drive IC is configured to control discharge of the liquid. The heat dissipation plate is in contact with the drive IC. The second channel member includes a cutout portion in which the heat dissipation plate is accommodated.

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 plane of the printer according to the embodiment.
FIG. 3 is a perspective view illustrating an example of a schematic configuration of a liquid discharge head according to a first embodiment.
FIG. 4 is a perspective view illustrating an example of a schematic configuration of a second channel member according to the first embodiment.
FIG. 5 is a partially enlarged perspective view of the liquid discharge head illustrated in FIG. 3.
FIG. 6 is a cross-sectional view illustrating an example of the liquid discharge head according to the first embodiment.
FIG. 7 is a cross-sectional view illustrating another example of the liquid discharge head according to the first embodiment.
FIG. 8 is a plan view illustrating an example of a schematic configuration of a heat dissipation plate included in the liquid discharge head according to a second embodiment.
FIG. 9 is a partially enlarged perspective view illustrating an example of a schematic configuration of the liquid discharge head according to the second embodiment.
FIG. 10 is a plan view illustrating an example of a schematic configuration of the heat dissipation plate and a thermal insulating member that are included in the liquid discharge head according to a third embodiment.
FIG. 11 is a partially enlarged perspective view illustrating an example of a schematic configuration of the liquid discharge head according to the third embodiment.
FIG. 12 is a perspective view illustrating an example of the thermal insulating member included in the liquid discharge head according to the third embodiment.
FIG. 13 is a perspective view illustrating an example of the thermal insulating member included in the liquid discharge head according to the third embodiment.

DESCRIPTION OF EMBODIMENTS

[0007] In the liquid discharge head described above, there is room for further improvement in terms of heat dissipation.

[0008] Therefore, provision of a liquid discharge head and a recording device that provide enhanced heat dissipation is expected.

[0009] Embodiments of a liquid discharge head and a recording device disclosed in the present application will be described below with reference to the accompanying drawings. Note that 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 following embodiments, expressions such as "constant", "orthogonal", "perpendicular", and "parallel" may be used, but these expressions do not necessarily have to strictly mean "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

Configuration of Printer

[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 plane 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, a 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 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 portion 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 12, and the collection roller 13.

[0015] By depositing 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 transports 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. Accordingly, a surface treatment can be performed on the printing sheet P, and the printing quality of the printer 1 can thus be improved.

[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 portions connected to the outside such as portions from which the printing sheet P enters and exits the head case 5.

[0018] 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, as necessary. The transport rollers 6 transport the printing sheet P to the vicinity of the liquid discharge heads 8 inside the head case 5.

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

[0020] A liquid, for example, ink, is supplied to the liquid discharge head 8 from a liquid tank (not illustrated). The liquid discharge head 8 discharges 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 of the liquid discharge heads 8 and the printing sheet P is, for example, approximately 0.5 mm to 20 mm.

[0022] The liquid discharge heads 8 are fixed to the frames 7. The liquid discharge heads 8 are located such that the longitudinal direction is orthogonal to the conveyance direction of the printing sheet P.

[0023] In other words, 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 an operation of recording while moving the liquid discharge heads 8 such that the liquid discharge heads 8 reciprocate in a direction intersecting, for example, substantially orthogonal to the conveyance direction of the printing sheet P, and an operation of conveying the printing sheet P.

[0025] As illustrated in FIG. 2, a plurality of liquid discharge heads 8 (e.g., five liquid discharge heads) 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. The liquid discharge heads 8 are located such that their centers do not overlap in the conveyance direction of the printing sheet P.

[0026] The plurality of liquid discharge heads 8 located in one frame 7 form a head group 8A. Four head groups 8A are located along the conveyance direction of the printing sheet P. The liquid discharge heads 8 belonging 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 by 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 coating agent may be discharged from the liquid discharge heads 8 onto the printing sheet P to perform a surface treatment on the printing sheet P.

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

[0030] The printing sheet P on which the printing has been performed inside the head case 5 is transported 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 on which the printing has been performed. 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, drying the printing sheet P with the dryer 10 helps prevent the printing sheet P taken up in an overlapped manner by the collection roller 13 from adhering to the collection roller 13 and helps prevent undried liquid from rubbing against the collection roller 13.

[0032] The sensor 12 includes a position sensor, a speed sensor, or a temperature sensor. Based on information from the sensor 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, a case where the printing sheet P is used as an object to be printed (i.e., a recording medium) is indicated, but the object to be printed in the printer 1 is not limited to the printing sheet P, and a rolled cloth or the like may be used as the object to be printed.

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

[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. 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, for example, by a wiping process or a capping process.

[0037] The wiping process is, for example, a process of wiping the surface of a portion from which a liquid is discharged, with 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 to which the liquid is to be discharged (this is called capping). This creates a substantially hermetically sealed space between the surface of the area to which the liquid is to be discharged and the cap. Then, discharge of the liquid is repeated in such a hermetically sealed space. Consequently, a liquid having viscosity higher than that in a normal state, foreign matter, or the like that has clogged a nozzle 21A (see FIG. 3) can be removed.

Configuration of Liquid Discharge Head

First Embodiment

[0039] The configuration of the liquid discharge head 8 according to a first embodiment will be described with reference to FIGs. 3 to 6. FIG. 3 is a perspective view illustrating an example of a schematic configuration of the liquid discharge head according to the first embodiment.

[0040] 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. Such an orthogonal coordinate system may also be presented in other drawings used in the description below. For the sake of convenience, a direction in which the nozzle 21A is located 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. **In** FIGs. 3 to 6, the members may be omitted or illustrated in a simplified manner.

[0041] As illustrated in FIG. 3, the liquid discharge head 8 includes a first channel member 21, a second channel member 22, a pressurizer 23, a connector portion 26, a first channel 27, a second channel 28, a head cover 29, and heat dissipation plates 31, 32.

[0042] The first channel member 21 is located on a bottom surface side of the liquid discharge head 8, which faces the printing sheet P (see FIG. 1). The first channel member 21 includes the nozzle 21A. The nozzle 21A opens into the bottom surface of the liquid discharge head 8 and discharges the liquid supplied to the inside of the first channel member 21 to the outside.

[0043] The second channel member 22 is located above the first channel member 21. The second channel member 22 supplies the liquid to the first channel member 21. The second channel member 22 includes a channel 22A connecting to the nozzle 21A. The liquid is supplied from the first channel 27 to the inside of the channel 22A. Details of the second channel member 22 will be described below.

[0044] The pressurizer 23 controls the discharge of the liquid from the first channel member 21 in accordance with a driving signal. The pressurizer 23 includes a piezo-

electric element that is displaced by energization and a pressure chamber whose internal pressure changes in accordance with the displacement of the piezoelectric element. The pressurizer 23 controls the discharge of the liquid from the nozzle 21A included in the first channel member 21 to the outside by changing the internal pressure of the pressurizing chamber.

[0045] The connector portion 26 includes a connector 24. The connector 24 is electrically connected to the pressurizer 23. In response to a control signal output from the controller 14 (see FIG. 1), the connector portion 26 externally receives, for example, a driving signal for driving the piezoelectric element included in the pressurizer 23. The connector portion 26 may include a connector cover 25 located between the connector 24 and the head cover 29.

[0046] The first channel 27 supplies the liquid to the inside of the second channel member 22. The second channel 28 recovers the liquid from the inside of the second channel member 22. The liquid recovered from the second channel 28 is supplied to the first channel 27, for example, through a filter (not illustrated).

[0047] The head cover 29 has a plate shape and is disposed to cover a space located on the opposite side of the first channel member 21 with the second channel member 22 interposed therebetween. The head cover 29 includes a top plate 290, first side plates 291, 292, and second side plates 293, 294, 295.

[0048] The top plate 290 is located at an end portion on the positive direction side of the Z-axis along the XY plane. The first side plates 291, 292 are located at both end portions in the Y-axis direction along the ZX plane. The first side plate 291 is located at an end portion on the negative direction side of the Y-axis. The first side plate 292 is located at an end portion on the positive direction side of the Y-axis. One end of each of the first side plates 291, 292 is connected to the top plate 290, and the other end thereof is located above the second channel member 22.

[0049] The second side plates 293, 294, 295 are located at both end portions in the X-axis direction along the YZ plane. One end of the second side plate 293 is connected to the top plate 290. One end of the second side plate 294 is connected to the first side plate 291. One end of the second side plate 295 is connected to the first side plate 292.

[0050] The head cover 29 can be made of a conductive metal material such as aluminum. The head cover 29 may be made of, for example, a conductive or insulating resin material. Thus, heat is appropriately released from the liquid discharge head 8 via the head cover 29. The thermal conductivity of the head cover 29 may be higher than that of the second channel member 22. Accordingly, heat conduction from the head cover 29 to the second channel member 22 is less likely to occur. Therefore, for example, the probability of occurrence of a defect in discharge performance due to a change in properties of the liquid flowing through the second channel member 22 can be reduced.

[0051] The head cover 29 may be in contact with the second channel member 22 or may be separated from the second channel member 22. The head cover 29 is located separately from the second channel member 22, and thus heat conduction from the head cover 29 to the second channel member 22 is less likely to occur, and heat conduction to the heat dissipation plates 31, 32 is promoted. Therefore, for example, the probability of occurrence of a defect in discharge performance due to a change in the properties of the liquid flowing through the second channel member 22 can be reduced.

[0052] The heat dissipation plates 31, 32 are plate-like members located along the YZ plane. The heat dissipation plates 31, 32 are located to face each other in the X-axis direction with the head cover 29 interposed therebetween. The heat dissipation plates 31, 32 are each connected to the second side plates 293, 294, 295 of the head cover 29 via fixing members 42. For example, when the amount of heat generated by drive ICs 61, 62 is small, the heat dissipation plates 31, 32 receive heat generated inside the liquid discharge head 8 from the head cover 29 and release the heat. For example, when the amount of heat generated by the drive ICs 61, 62 is large, the head cover 29 receives heat generated inside the liquid discharge head 8 from the heat dissipation plates 31, 32 and releases the heat. The fixing members 42 may be, for example, screw members made of metal. The heat dissipation plates 31, 32 are screwed to the head cover 29 by these screw members, and thus the liquid discharge head 8 can ensure a heat release route. The fixing members 42 are an example of second members adapted to connect the heat dissipation plates 31, 32 and the head cover 29.

[0053] The heat dissipation plates 31, 32 can be made of, for example, the same material as the head cover 29. The heat dissipation plates 31, 32 may be made of, for example, a material having higher thermal conductivity than the head cover 29.

[0054] FIG. 4 is a perspective view illustrating an example of a schematic configuration of the second channel member according to the first embodiment. FIG. 5 is a partially enlarged perspective view of the liquid discharge head illustrated in FIG. 3. FIG. 6 is a cross-sectional view illustrating an example of the liquid discharge head according to the first embodiment.

[0055] As illustrated in FIG. 4, the second channel member 22 includes a first cutout portion 221, a second cutout portion 222, and a channel portion 224. The first cutout portion 221, the second cutout portion 222, and the channel portion 224 are on an upper surface (in the Z-axis positive direction) of the second channel member 22.

[0056] The first cutout portion 221 and the second cutout portion 222 are located to cut out a side surface 220 of the second channel member 22. The side surface 220 is located on both end portions in the width direction of the second channel member 22 along the X axis.

[0057] As illustrated in FIGs. 5 and 6, each of the heat

dissipation plates 31, 32 is accommodated in a respective one of the first cutout portions 221. Accordingly, the length of the heat dissipation plates 31, 32 in the Z-axis direction can be increased compared to the head cover 29, and thus, for example, the heat dissipation of the liquid discharge head 8 can be enhanced. The heat dissipation plates 31, 32 are accommodated in the first cutout portion 221, and thus, for example, an increase in the size of the liquid discharge head 8 in the X-axis direction can be avoided. The first cutout portion 221 is located on the side surface 220, and thus, for example, the heat dissipation plates 31, 32 can be easily accommodated.

[0058] As illustrated in FIG. 6, an adhesive 41 may be located between the heat dissipation plates 31, 32 and the first cutout portion 221. In other words, the heat dissipation plates 31, 32 and the first cutout portion 221 may be fixed to each other with the adhesive 41. The adhesive 41 is an example of a first member adapted to connect the heat dissipation plates 31, 32 and the second channel member 22. The adhesive 41 may be, for example, a resin-based adhesive including a thermosetting resin, a photo-curable resin, or the like. The adhesive 41 may be made of, for example, a material having higher thermal conductivity than the fixing member 42. Therefore, for example, heat conduction from the heat dissipation plates 31, 32 to the second channel member 22 via the adhesive 41 can be reduced.

[0059] The second cutout portion 222 is located closer to the center of the second channel member 22 than the first cutout portion 221, and is disposed to cut out the first cutout portion 221. The second cutout portions 222 each include an opening 223. As illustrated in FIG. 6, flexible substrates 51, 52 are each inserted into a respective one of the openings 223. One end and the other end of the flexible substrate 51, 52 are electrically connected respectively to the pressurizer 23 and the connector 24. The drive IC (Integrated Circuit) 61 is mounted on the flexible substrate 51, and the drive IC 62 is mounted on the flexible substrate 52. The drive ICs 61, 62 are each a so-called integrated circuit and a heat generation source configured to generate heat when energized. The drive ICs 61, 62 control the pressurizer 23 in accordance with a driving signal sent from the connector 24, and controls the discharge of the liquid.

[0060] As illustrated in FIG. 6, the drive ICs 61, 62 are pressed against the heat dissipation plates 31, 32 by a pressing member 70 and elastic members 71, 72. The pressing member 70 is made of, for example, a metal member or a resin member, and has predetermined rigidity. The pressing member 70 includes portions facing the drive ICs 61, 62 with the flexible substrates 51, 52 interposed therebetween. The elastic members 71, 72 are located respectively between the pressing member 70 and the drive IC 61 (flexible substrate 51) and between the pressing member 70 and the drive IC 62 (flexible substrate 52). As just described, the drive ICs 61, 62 are pressed against the heat dissipation plates 31, 32 with appropriate pressing force by the pressing member 70 and the elastic members 71, 72. Note that the drive ICs 61, 62 may be fixed to the heat dissipation plates 31, 32, for example, with an adhesive (not illustrated).

[0061] As described above, the second channel member 22 includes the second cutout portion 222, and thus, for example, the other end side of the flexible substrates 51, 52 whose one end is connected to the pressurizer 23 is easily drawn out. Therefore, for example, the workability in assembly work of the liquid discharge head 8 is improved.

[0062] The second channel member 22 includes the first cutout portion 221 and the second cutout portion 222, and thus, for example, a contact area between the heat dissipation plates 31, 32 and the second channel member 22 is reduced. Therefore, for example, heat conduction from the heat dissipation plates 31, 32 to the second channel member 22 can be reduced.

[0063] The channel portion 224 is a recessed portion located at a central portion of the second channel member 22 and extends in the length direction along the Y-axis direction. As illustrated in FIG. 6, the channel portion 224 is sealed by a lid-like member 30 located above the second channel member 22 to form the channel 22A. Note that the lid-like member 30 may be configured integrally with the second channel member 22.

[0064] **In** the embodiment described above, the heat dissipation plates 31, 32 are in contact with the second channel member 22, but may be located separately from the second channel member 22. FIG. 7 is a cross-sectional view illustrating another example of the liquid discharge head according to the first embodiment.

[0065] As illustrated in FIG. 7, an intermediate member 43 located between the heat dissipation plates 31, 32 and the second channel member 22 may be further provided. The intermediate member 43 may be an elastic member such as a resin sponge, which has lower thermal conductivity than the heat dissipation plates 31, 32 and the second channel member 22. The intermediate member 43 can serve as, for example, a buffer material and a spacer between the heat dissipation plates 31, 32 and the second channel member 22. Accordingly, heat conduction from the heat dissipation plates 31, 32 to the second channel member 22 is further less likely to occur. Therefore, for example, the probability of occurrence of a defect in discharge performance due to a change in properties of the liquid flowing through the second channel member 22 can be further reduced. The fact that the heat dissipation plates 31, 32 are located separately from the second channel member 22 means that the heat dissipation plates 31, 32 are not in direct contact with the second channel member 22. **In** other words, another member may be interposed between the heat dissipation plates 31, 32 and the second channel member 22 as illustrated in FIG. 7, or the heat dissipation plates 31, 32 and the second channel member 22 may be separated without another member interposed therebetween.

Second Embodiment

[0066] The configuration of the liquid discharge head 8 according to a second embodiment will be described with reference to FIGs. 8 and 9. FIG. 8 is a plan view illustrating an example of a schematic configuration of the heat dissipation plate included in the liquid discharge head according to the second embodiment.

[0067] As illustrated in FIG. 8, the heat dissipation plate 31 may include a first portion 311 and a second portion 312. The first portion 311 is located closer to the negative direction side of the Z-axis than the second portion 312. The length of the first portion 311 along the Y-axis direction is larger than that of the second portion 312. **In** other words, the first portion 311 of the heat dissipation plate 31 is a first wide portion whose width in the longitudinal direction of the liquid discharge head 8 is larger than other portions.

[0068] As just described, the heat dissipation plate 31 has the first portion 311, and thus, for example, the heat capacity of the heat dissipation plate 31 can be improved, and the heat dissipation of the liquid discharge head 8 is improved.

[0069] FIG. 9 is a partially enlarged perspective view illustrating an example of a schematic configuration of the liquid discharge head according to the second embodiment. As illustrated in FIG. 9, the first portion 311 that is the first wide portion of the heat dissipation plate 31 may be accommodated in the first cutout portion 221.

[0070] The first portion 311 is accommodated in the first cutout portion 221 as just described, and thus, for example, the heat capacity can be improved without increasing the size of the heat dissipation plate 31 and/or the liquid discharge head 8 in the height direction (Z-axis direction), and the heat dissipation of the liquid discharge head 8 is improved. For example, when the heat dissipation plate 31 is fixed to the second channel member 22 with an adhesive, the adhesive can remain on an upper surface of the protruding first portion 311, and thus workability is improved.

[0071] Although the shape and arrangement of the heat dissipation plate 31 are described in FIGs. 8 and 9, the heat dissipation plate 32 can be configured in the same manner as the heat dissipation plate 31.

Third Embodiment

[0072] The configuration of the liquid discharge head 8 according to a third embodiment will be described with reference to FIGs. 10 to 13. FIG. 10 is a plan view illustrating an example of a schematic configuration of the heat dissipation plate and a thermal insulating member that are included in the liquid discharge head according to the third embodiment. FIG. 11 is a partially enlarged perspective view illustrating an example of a schematic configuration of the liquid discharge head according to the third embodiment.

[0073] The liquid discharge head 8 according to the present embodiment is different from the liquid discharge head 8 according to each of the embodiments described above in that the liquid discharge head 8 further includes a thermal insulating member 80 located between the heat dissipation plate 31 and the first channel member 21. Therefore, heat conduction from the heat dissipation plate 31 to the first channel member 21 can be further reduced.

[0074] The thermal insulating member 80 is made of, for example, an epoxide-based resin. The thermal conductivity of the thermal insulating member 80 may be lower than the thermal conductivity of the heat dissipation plate 31. The thermal conductivity of the thermal insulating member 80 is, for example, 0.19 (W/m°C). By providing the thermal insulating member 80, heat generated in the drive IC 61 is less likely to be transmitted to the first channel member 21 via the heat dissipation plate 31.

[0075] As illustrated in FIG. 10, the heat dissipation plate 31 may include a third portion 313 and a fourth portion 314. The third portion 313 is located closer to the negative direction side of the Z-axis than the fourth portion 314. The length of the third portion 313 along the Y-axis direction is smaller than that of the fourth portion 314.

[0076] The thermal insulating member 80 may include a first portion 801, a second portion 802, and a third portion 803. The second portion 802 and the third portion 803 are located at both ends in the Y-axis direction. The third portion 313 of the heat dissipation plate 31 is accommodated between the second portion 802 and the third portion 803.

[0077] The first portion 801 is located closer to the negative direction side of the Z-axis than the second portion 802 and the third portion 803. The length of the first portion 801 along the Y-axis direction is larger than those of the second portion 802 and the third portion 803. In other words, the first portion 801 of the thermal insulating member 80 is a second wide portion whose width in the longitudinal direction of the liquid discharge head 8 is larger than other portions.

[0078] As just described, the heat dissipation plate 31 includes the first portion 801, and thus, for example, the bonding area between the heat dissipation plate 31 and the second channel member 22 can be increased, and the bonding strength is improved.

[0079] As illustrated in FIG. 11, the first portion 801 that is the second wide portion of the thermal insulating member 80 may be accommodated in the first cutout portion 221.

[0080] As described above, the first portion 801 of the thermal insulating member 80 is accommodated in the first cutout portion 221 to be bonded to the second channel member 22, and thus, for example, the liquid discharge head 8 compact in outer appearance can be obtained. For example, in fixing the thermal insulating member 80 to the second channel member 22 with an adhesive, the adhesive can remain on an upper surface of the protruding first portion 801, and thus workability is improved.

[0081] An example of the configuration of the thermal insulating member included in the liquid discharge head according to the present embodiment will be described with reference to FIGs. 12 and 13. FIGs. 12 and 13 are each a perspective view illustrating an example of the thermal insulating member included in the liquid discharge head according to the third embodiment.

[0082] As illustrated in FIGs. 12 and 13, the thermal insulating member 80 is an elongated member extending in the longitudinal direction (Y-axis direction) of the liquid discharge head 8. The thermal insulating member 80 includes a first portion 81, a second portion 82, and a third portion 83 connecting the first portion 81 and the second portion 82. The thermal insulating member 80 has a substantially S-shape in a cross-sectional view. The first portion 81 and the second portion 82 are located to be shifted from each other in the X-axis direction. The first portion 81 has a surface 811 facing the inside of the liquid discharge head 8. The second portion 82 has a surface 821 facing the outside of the liquid discharge head 8. The third portion 53 connects a lower portion of the first portion 81 and an upper portion of the second portion 82 and accommodates the third portion 313 of the heat dissipation plate 31.

[0083] The thermal insulating member 80 may include protruding portions 84 protruding from the first portion 81 toward the outside of the liquid discharge head 8. The protruding portions 84 are accommodated in through holes 315 (see FIG. 11) included in the heat dissipation plate 31, and thus a relative position shift between the heat dissipation plate 31 and the thermal insulating member 80 is less likely to occur. Note that instead of the through holes 315, the heat dissipation plate 31 may include recessed portions in which the protruding portions 84 can be accommodated.

[0084] Although the shape and arrangement of the heat dissipation plate 31 and the thermal insulating member 80 located near the heat dissipation plate 31 are described in FIGs. 10 to 13, the heat dissipation plate 32 and a thermal insulating member located near the heat dissipation plate 32 can be configured in the same manner as the heat dissipation plate 31 and the thermal insulating member 80.

Other Embodiments

[0085] In each of the embodiments described above, the heat dissipation plates 31, 32 are each connected to the second side plates 293, 294, 295 of the head cover 29 via the fixing members 42. However, the adhesive 41 may be located between the heat dissipation plates 31, 32 and the second side plates 293, 294, 295, and the heat dissipation plates 31, 32 and the second side plates 293, 294, 295 may be connected with the use of the adhesive 41 and the fixing members 42. Thus, the heat dissipation plates 31, 32 and the head cover 29 can be more firmly fixed to each other.

[0086] The second side plates 293, 294, 295 of the head cover 29 are located independently as described in the aforementioned embodiments; however, two or more of the second side plates 293 to 295 may be located to be continuous with each other.

[0087] The liquid discharge head 8 includes the heat dissipation plates 31, 32 as described in the aforementioned embodiments, but may include only one of the heat dissipation plates 31, 32. In such a case, the second channel member 22 may include only the first cutout portion 221 corresponding to the heat dissipation plate included in the liquid discharge head 8.

[0088] As described above, the liquid discharge head 8 according to the embodiment includes the first channel member 21, the second channel member 22, the drive ICs 61, 62, and the heat dissipation plates 31, 32. The first channel member 21 is configured to discharge a liquid. The second channel member 22 supplies the liquid to the first channel member 21. The drive ICs 61, 62 are configured to control the discharge of the liquid. The heat dissipation plates 31, 32 are respectively in contact with the drive ICs 61, 62. The second channel member 22 includes the cutout portion (first cutout portion 221) in which the heat dissipation plates 31, 32 are accommodated. As a result, according to the liquid discharge head 8 of the embodiment, high heat dissipation can be attained.

[0089] 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

[0090]

1 Printer
8 Liquid discharge head
14 Controller
21 First channel member
21A Nozzle
22 Second channel member
23 Pressurizer
29 Head cover
31, 32 Heat dissipation plate
41 Adhesive
42 Fixing member
51, 52 Flexible substrate
61, 62 Drive IC
80 Thermal insulating member
220 Side surface
221 First cutout portion
222 Second cutout portion
223 Opening

Claims

1. A liquid discharge head, comprising:

   a first channel member configured to discharge a liquid;
   a second channel member configured to supply the liquid to the first channel member;
   a drive IC configured to control discharge of the liquid; and
   a heat dissipation plate in contact with the drive IC, wherein
   the second channel member comprises a cutout portion in which the heat dissipation plate is accommodated.

2. The liquid discharge head according to claim 1, wherein
   the cutout portion is located on a side surface of the second channel member.

3. The liquid discharge head according to claim 1 or 2, wherein
   the heat dissipation plate is located separately from the second channel member.

4. The liquid discharge head according to any one of claims 1 to 3, further comprising:
   an adhesive located between the heat dissipation plate and the second channel member.

5. The liquid discharge head according to any one of claims 1 to 4, wherein
   the heat dissipation plate is connected to the second channel member via a first member, and is connected to a head cover via the first member and a second member having higher thermal conductivity than the first member.

6. The liquid discharge head according to claim 5, wherein
   the head cover is located separately from the second channel member.

7. The liquid discharge head according to claim 5 or 6, wherein
   the head cover has a higher thermal conductivity than the second channel member.

8. The liquid discharge head according to any one of claims 1 to 7, wherein
   the second channel member comprises a first cutout portion in which the heat dissipation plate is accommodated and a second cutout portion located closer to a center of the second channel member than the first cutout portion.

9. The liquid discharge head according to claim 8, further comprising:

   a flexible substrate on which the drive IC is mounted, wherein
   the second cutout portion has an opening through which the flexible substrate is inserted.

10. The liquid discharge head according to any one of claims 1 to 9, wherein
    the heat dissipation plate has a first wide portion whose width in a longitudinal direction of the liquid discharge head is larger than other portions.

11. The liquid discharge head according to claim 10, wherein
    the first wide portion is accommodated in the cutout portion.

12. A liquid discharge head, comprising:

    a first channel member configured to discharge a liquid;
    a second channel member configured to supply the liquid to the first channel member;
    a drive IC configured to control discharge of the liquid;
    a heat dissipation plate in contact with the drive IC; and
    a thermal insulating member located between the heat dissipation plate and the first channel member, wherein
    the second channel member comprises a cutout portion in which the thermal insulating member is accommodated.

13. The liquid discharge head according to claim 12, wherein
    the thermal insulating member has a second wide portion whose width in a longitudinal direction of the liquid discharge head is larger than other portions.

14. The liquid discharge head according to claim 13, wherein
    the second wide portion is accommodated in the cutout portion.

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

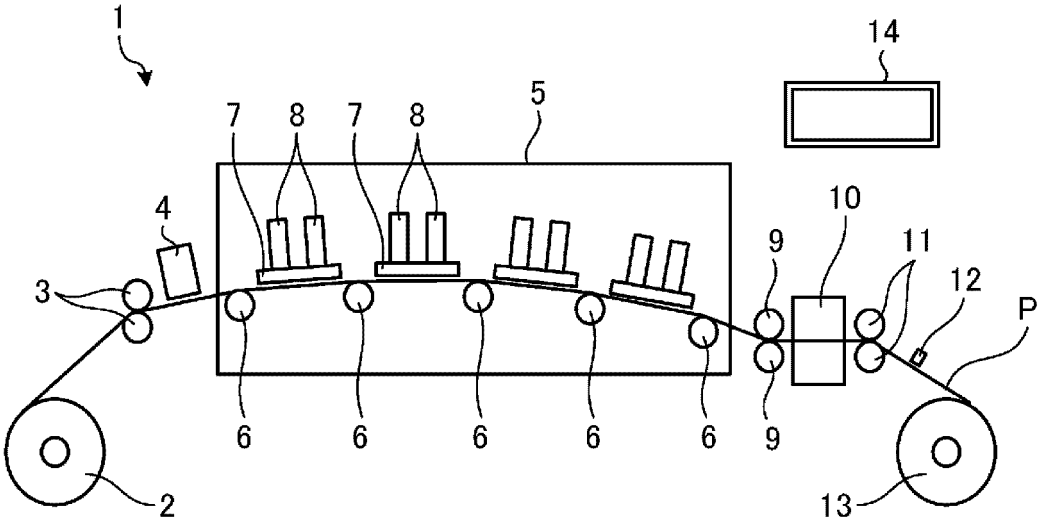
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FIG. 1

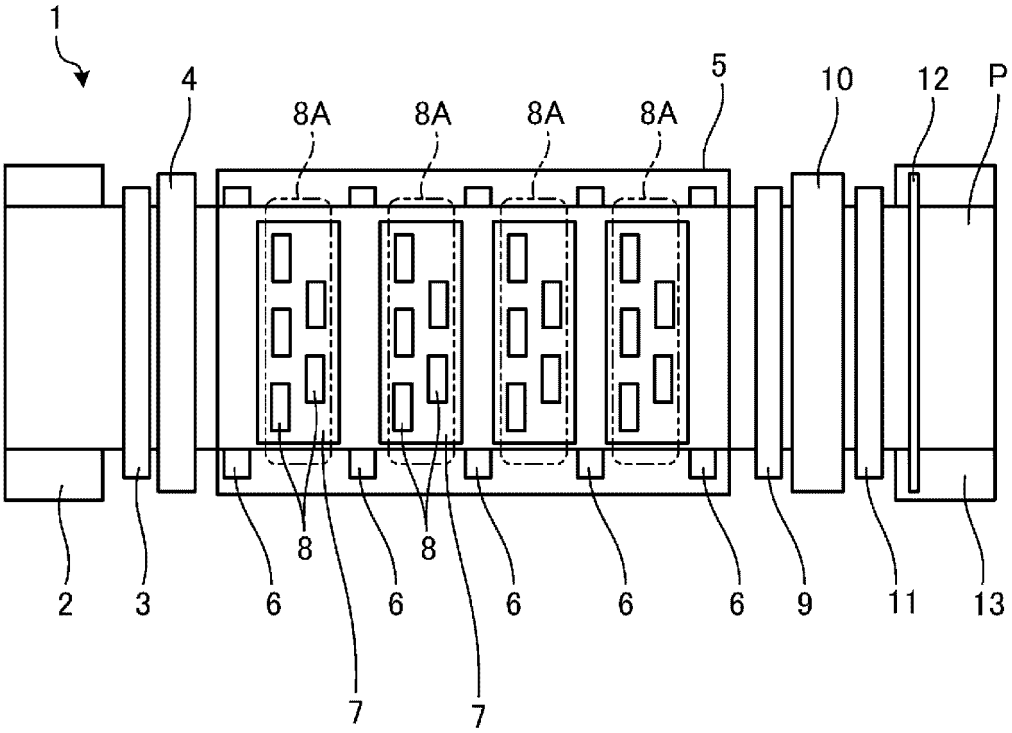
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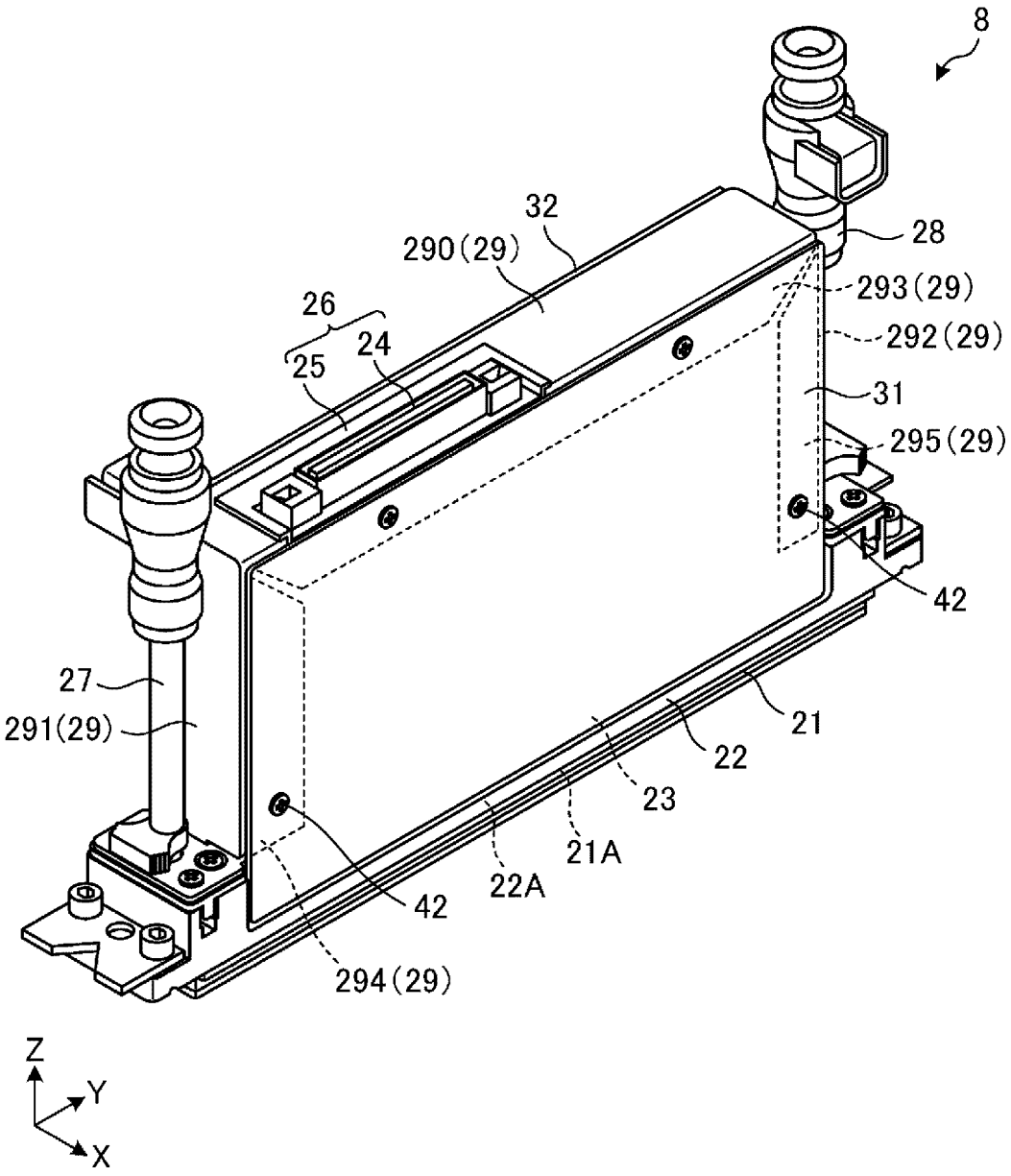
FIG. 2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32
290(29)
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293(29)
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292(29)
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21A
22A
42
294(29)
Z
Y
X

FIG. 3

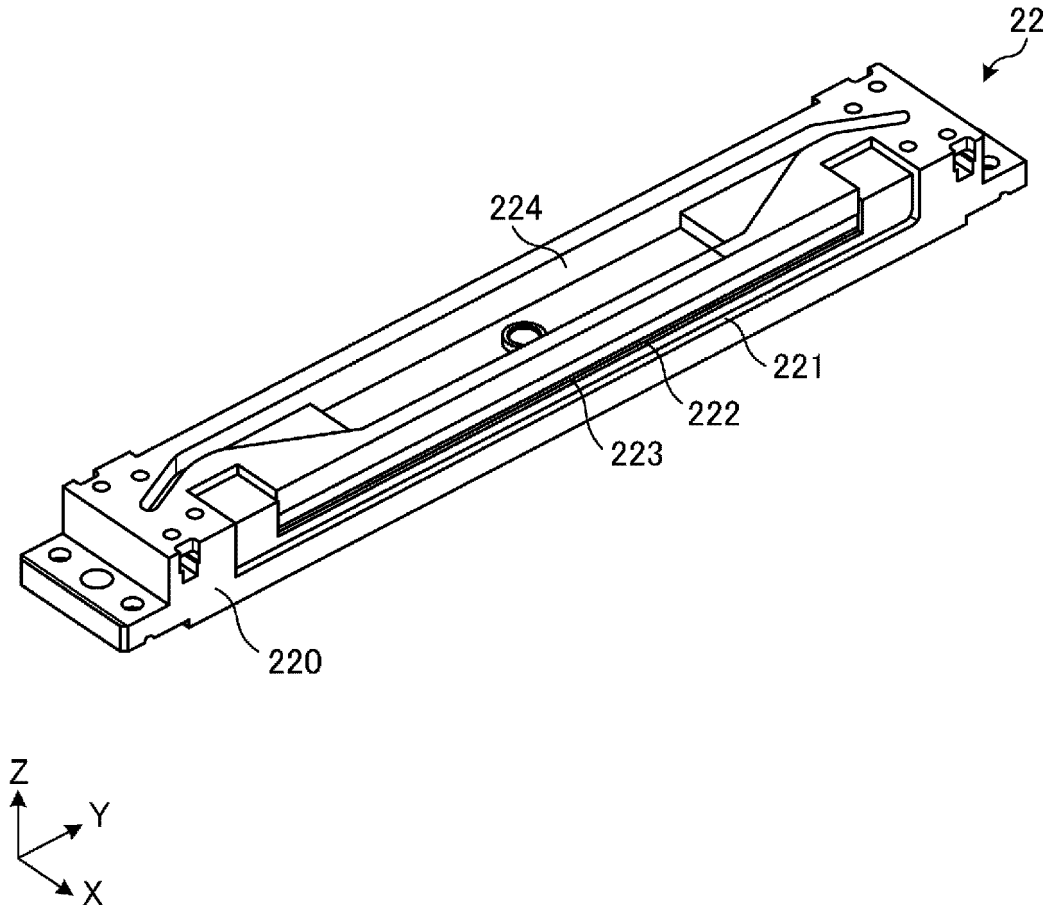
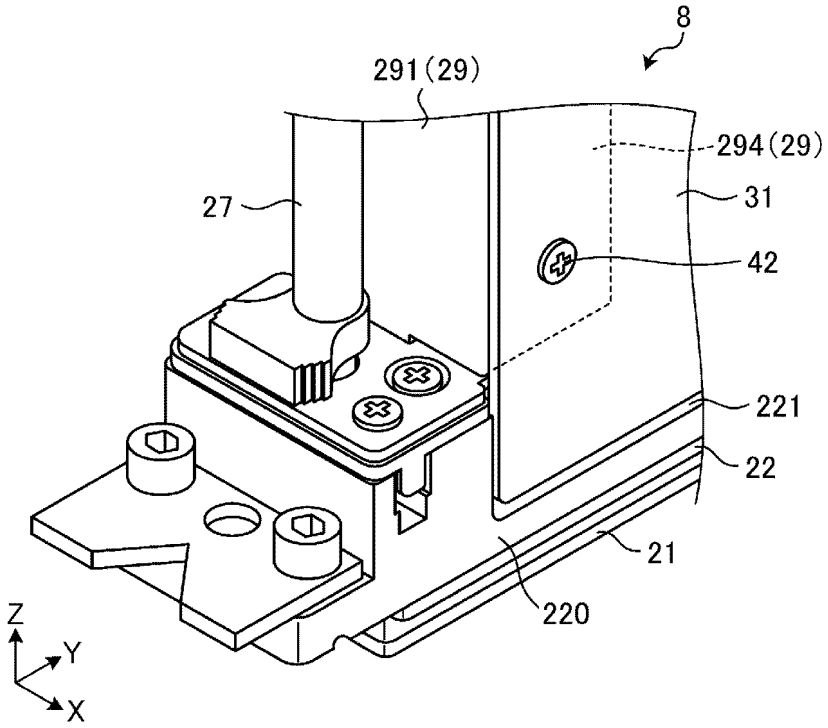


FIG. 4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291(29)
294(29)
27
31
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221
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FIG. 5

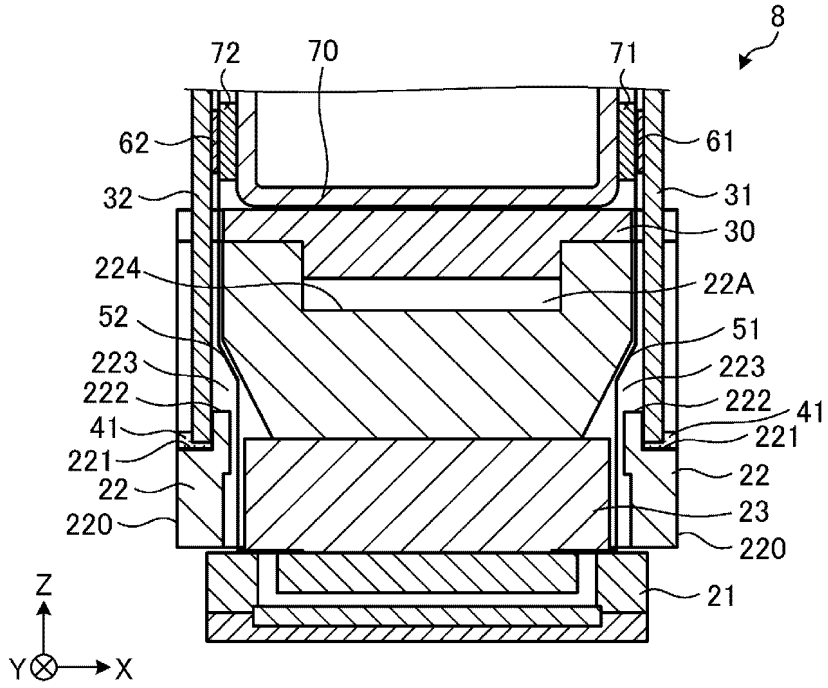
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FIG. 6

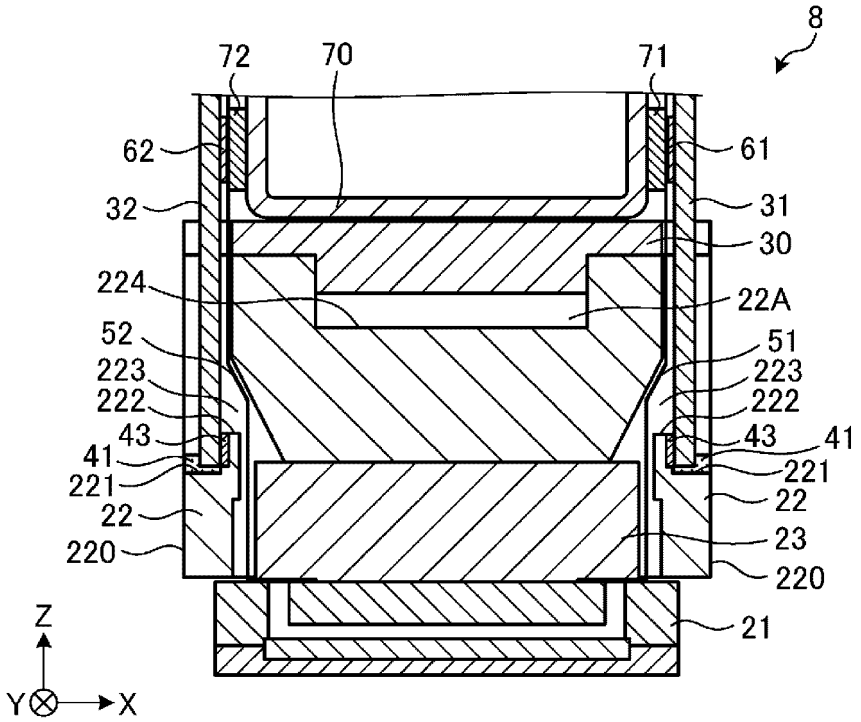
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FIG. 7

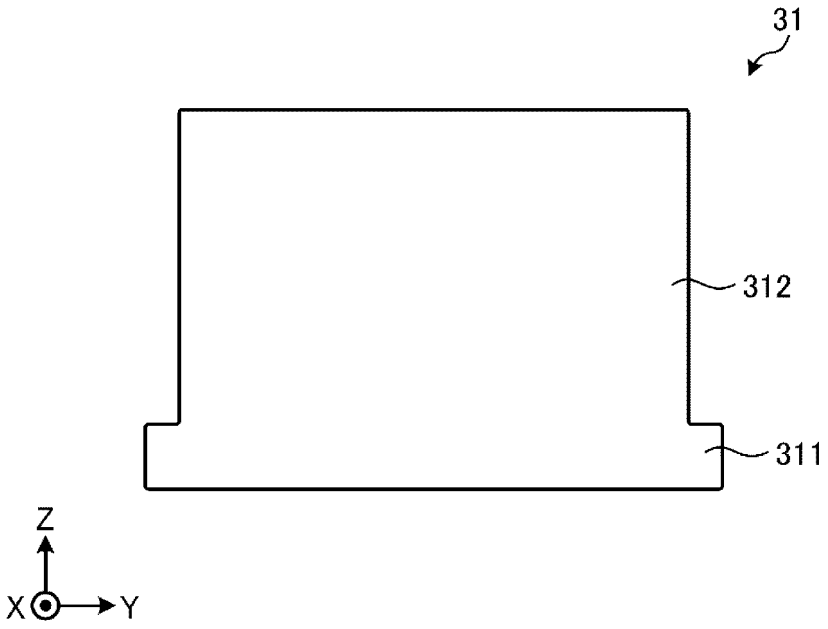
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FIG. 8

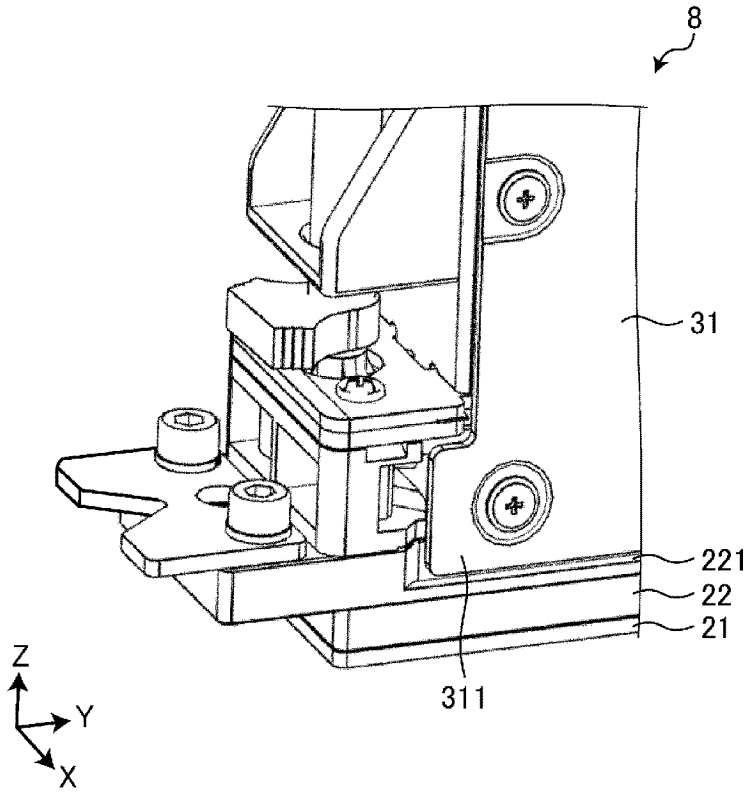

FIG. 9

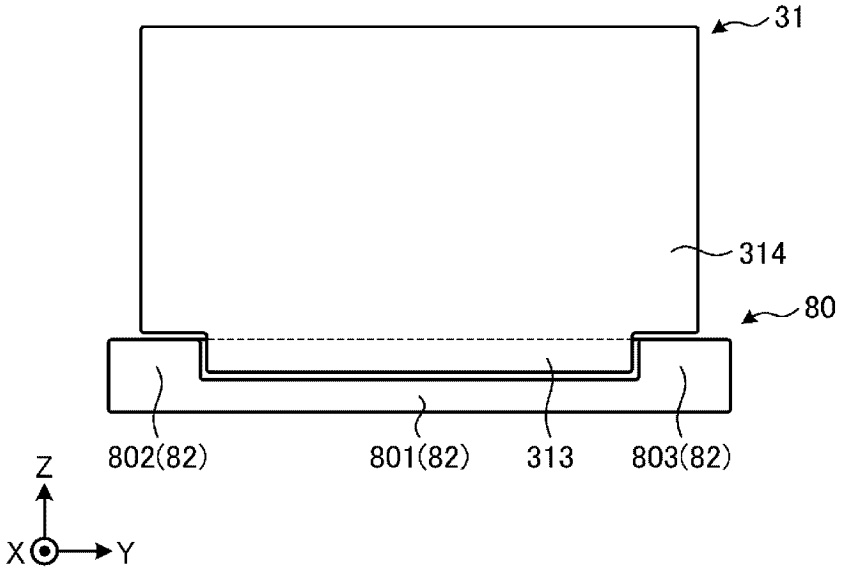

FIG. 10

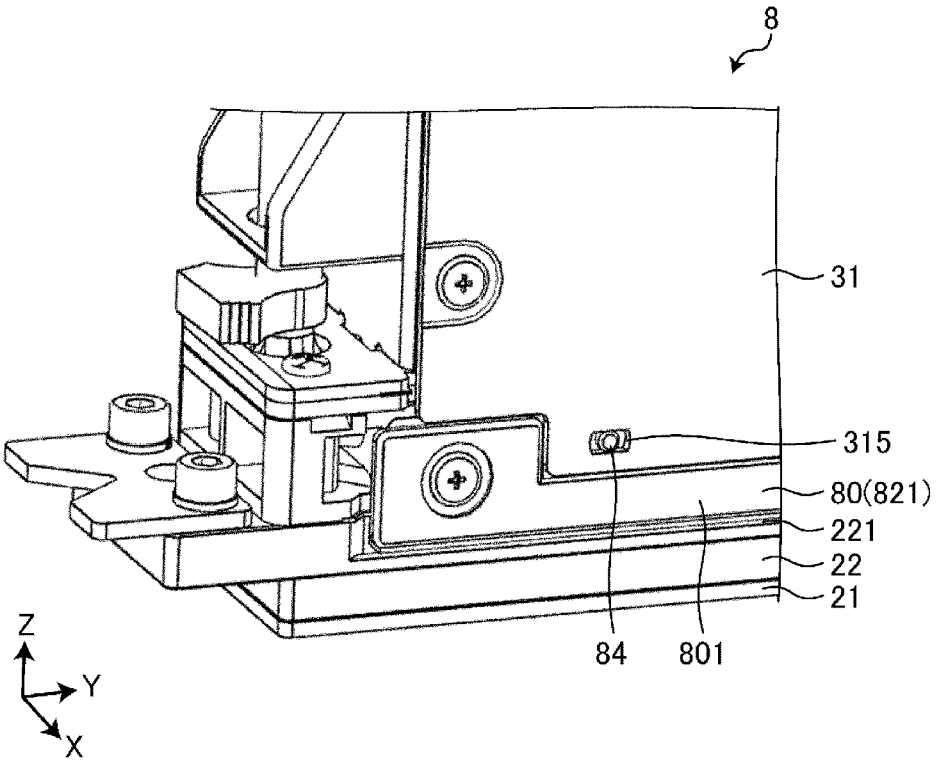

FIG. 11

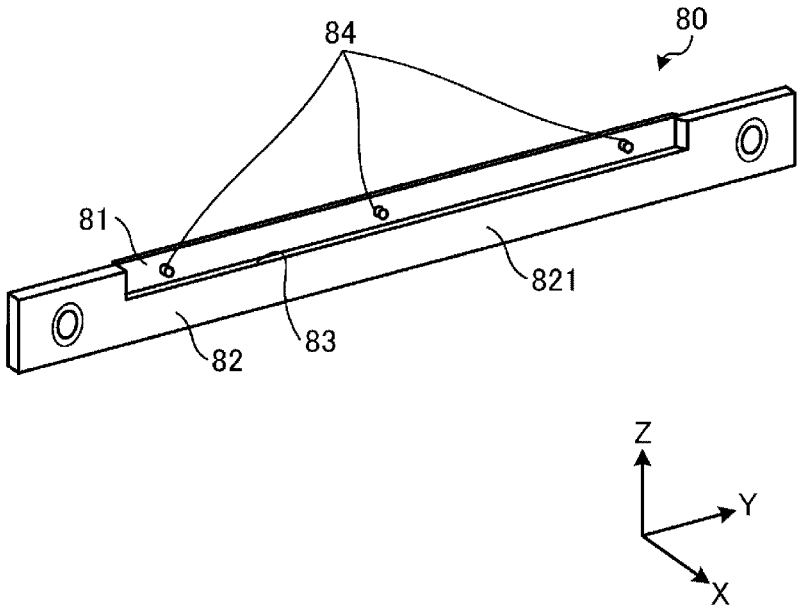

FIG. 12

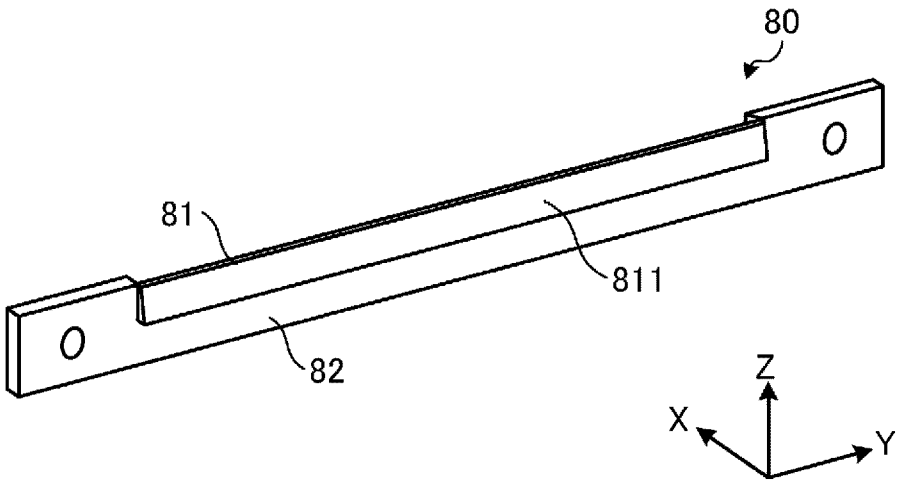

FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/013287

A. CLASSIFICATION OF SUBJECT MATTER

B41J 2/01(2006.01)i; ***B41J 2/16***(2006.01)i
FI: B41J2/01 301; B41J2/16 503

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)

B41J2/01; B41J2/16

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	WO 2016/190413 A1 (KYOCERA CORPORATION) 01 December 2016 (2016-12-01) paragraphs [0021]-[0025], [0035], fig. 1-4	1-9, 12, 15
Y		10-11, 13-14
X	JP 2007-268850 A (BROTHER IND LTD) 18 October 2007 (2007-10-18) paragraphs [0020], [0026]-[0031], fig. 1-4	1-11, 15
Y		10-11, 13-14
A	WO 2020/158905 A1 (KYOCERA CORPORATION) 06 August 2020 (2020-08-06) paragraphs [0062], [0081], [0097], fig. 6, 11B	1-15
A	WO 2020/250873 A1 (KYOCERA CORPORATION) 17 December 2020 (2020-12-17) paragraphs [0062], [0135], fig. 7-10	1-15
A	JP 2020-189404 A (TOSHIBA TEC KK) 26 November 2020 (2020-11-26) fig. 2-3	1-15

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

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"P" document published prior to the international filing date but later than the priority date claimed
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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	Date of mailing of the international search report
19 April 2023	**09 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/JP2023/013287

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
WO 2016/190413 A1	01 December 2016	US 2018/0147846 A1 paragraphs [0031]-[0035], [0045], fig. 1-4 US 2019/0263118 A1 US 2021/0070045 A1 US 2022/0332114 A1 EP 3290209 A1 CN 107683208 A CN 110356114 A	
JP 2007-268850 A	18 October 2007	US 2007/0242109 A1 paragraphs [0027], [0033]-[0038], fig. 1-4	
WO 2020/158905 A1	06 August 2020	US 2022/0118764 A1 paragraphs [0084], [0103], [0119], fig. 6, 11B EP 3919274 A1	
WO 2020/250873 A1	17 December 2020	US 2022/0258467 A1 paragraphs [0079], [0154], fig. 7-10 EP 3984751 A1 CN 113939405 A	
JP 2020-189404 A	26 November 2020	(Family: none)	

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

REFERENCES CITED IN THE DESCRIPTION

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- JP 2014097661 A **[0004]**
- JP 2008087231 A **[0004]**