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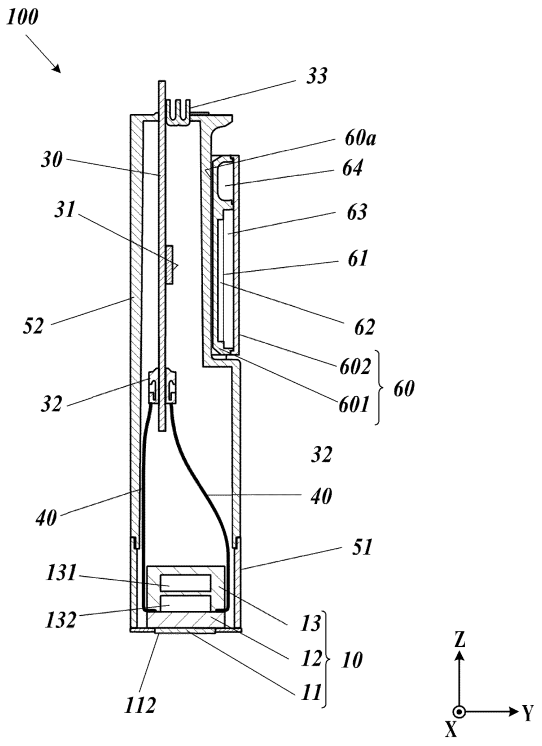
(54) INKJET HEAD AND INKJET RECORDING DEVICE

(57) Provided are an inkjet head and an inkjet recording device with which it is possible to effectively suppress image quality reduction caused by the heat of a drive substrate. The inkjet head comprises: an ink discharge unit in which the opening of a nozzle that discharges ink is provided to an ink discharge surface, the ink discharge unit having an operation element that performs an operation for discharging ink from the opening of the nozzle; a drive substrate in which a drive circuit is provided for driving the operation element; and an ink tank in which ink supplied to the ink discharge unit is stored, the ink tank being provided in an aspect in which a prescribed surface of the outer surface of the ink tank is provided along the drive substrate, and the heat of the drive substrate is propagated to the prescribed surface.

FIG. 4



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Description

Technical Field

[0001] The present invention relates to an inkjet head and an inkjet recording device.

Background Art

[0002] Conventionally, there is an inkjet recording device in which ink is ejected from an opening of a nozzle provided on an ink ejecting surface of an inkjet head, and the ink is landed on a desired position to form an image. The inkjet head of the inkjet recording device includes an ink ejector which ejects the ink from the opening of the nozzle in response to operation of the operation element such as the piezoelectric element in which pressure in an ink storage in communication with the nozzle is changed. The inkjet head usually includes a driving substrate provided with a driving circuit to drive an operation element. (For example, Patent Literature 1).

Citation List

Patent Literature

[0003] Patent Literature 1: JP 2014-004767

Summary

Technical Problem

[0004] However, when the temperature of the driving substrate increases due to operation heat of the driving circuit, the heat of the driving substrate is transmitted to the ink in the ink ejector causing the viscosity of the ink decrease, and with this, ink ejection cannot be performed suitably. Moreover, the ink ejector expands due to the heat of the driving substrate and with this, the position of the nozzle is changed. Therefore, image quality of the recorded image decreases.

[0005] The purpose of the present invention is to provide an inkjet head and an inkjet recording device which can effectively suppress decrease of image quality due to heat of the driving substrate.

Solution to Problem

[0006] In order to solve the above problems, according to aspect 1 of the present invention, an inkjet head includes:

an ink ejector in which an opening of a nozzle which ejects ink is provided in an ink ejecting surface and which includes an operation element which performs an operation to eject ink from the opening of the nozzle;
a driving substrate in which a driving circuit is provided to drive the operation element; and
an ink tank which stores ink supplied to the ink ejector,

wherein, the ink tank is provided with a predetermined surface of the ink tank among outer surfaces of the ink tank positioned along the driving substrate, and
the ink tank is provided in a manner that heat of the driving substrate is transmitted to the predetermined surface.

[0007] According to aspect 2 of the present invention, the inkjet head according to aspect 1, wherein the driving substrate is provided along a direction intersecting with the ink ejecting surface in a side opposite of the ink ejecting surface of the ink ejector.

[0008] According to aspect 3 of the present invention, the inkjet head according to aspect 1 or 2, wherein,
the ink tank is provided with an in-tank flow path in which ink supplied to the ink ejector flows in a predetermined supply direction, and
the ink tank is provided with a first filter which is provided along the predetermined surface inside the in-tank flow path and through which ink flowing in the in-tank flow path passes.

[0009] According to aspect 4 of the present invention, the inkjet head according to aspect 3, wherein,
the in-tank flow path includes an upstream side ink chamber adjacent to the first filter on an upstream side in the supply direction,
the in-tank flow path includes a downstream side ink chamber adjacent to the first filter on a downstream side in the supply direction, and
the upstream side ink chamber is provided on the predetermined surface side of the first filter.

[0010] According to aspect 5 of the present invention, the inkjet head according to aspect 3, wherein,
the in-tank flow path includes an upstream side ink chamber adjacent to the first filter on an upstream side in the supply direction,
the in-tank flow path includes a downstream side ink chamber adjacent to the first filter on a downstream side in the supply direction, and
the downstream side ink chamber is provided on the predetermined surface side of the first filter.

[0011] According to aspect 6 of the present invention, the inkjet head according to any one of aspects 3 to 5, wherein,
the ink ejector includes an outflow opening from which some of the ink flowing in from the in-tank flow path flow out, and
the inkjet head includes an ink discharge flow path which guides the ink flowing out from the outflow opening of the ink ejector outside of the inkjet head.

[0012] According to aspect 7 of the present invention, the inkjet head according to aspect 6, further including,
a bypass flow path which connects the in-tank flow path and the ink discharge flow path without the ink ejector in between,
a second filter which is provided inside the bypass flow

path and through which the ink flowing in the bypass flow path passes, and

a backward flow preventer which is provided between a connecting position with the bypass flow path in the ink discharge flow path and an exit of the ink discharge flow path, and which does not pass ink in a direction reverse from a direction heading to the exit.

[0013] According to aspect 8 of the present invention, the inkjet head according to aspect 7, wherein,

the bypass flow path is provided inside the ink tank, and the first filter and the second filter are provided as one.

[0014] According to aspect 9 of the present invention, the inkjet head according to any one of aspects 3 to 8, further comprising an attaching member which detachably fixes the ink tank.

[0015] According to aspect 10 of the present invention, the inkjet head according to any one of aspects 1 to 9, wherein,

a cover member which covers at least a portion of the driving substrate is provided between the ink tank and the driving substrate, and

a heat dissipating member which comes into contact with the cover member and the ink tank is provided between the cover member and the ink tank.

[0016] According to aspect 11 of the present invention, the inkjet head according to any one of aspects 1 to 10, wherein,

an amount of heat dissipation from one surface of the driving substrate when the driving circuit is operated is larger than the amount of heat dissipation from the other surface of the driving substrate, and

the ink tank is provided in a side of the one surface of the driving substrate.

[0017] According to aspect 12 of the present invention, the inkjet recording device including the inkjet head according to any one of aspects 1 to 11.

Advantageous Effects of Invention

[0018] According to the present invention, the following effect can be achieved, that is, the decrease of the image quality due to the heat of the driving substrate can be effectively suppressed.

Brief Description of Drawings

[0019]

FIG. 1 is a diagram showing a schematic configuration of an inkjet recording device.

FIG. 2 is a schematic diagram showing a configuration of a head unit.

FIG. 3 is a perspective view showing an inkjet head.

FIG. 4 is a diagram showing a cross section along a YZ plane of the inkjet head.

FIG. 5 is an enlarged schematic cross section diagram showing a configuration of an ink ejector.

FIG. 6 is a diagram showing a cross section along a XY plane of the inkjet head.

FIG. 7 is a perspective view of an inkjet head showing an inner configuration of an ink tank.

FIG. 8A is a diagram showing a cross section of the ink tank along a YZ plane in a position X1 shown in FIG. 7.

FIG. 8B is a diagram showing a cross section of the ink tank along the YZ plane in a position X2 shown in FIG. 7.

FIG. 8C is a diagram showing a cross section of the ink tank along the YZ plane in a position X3 shown in FIG. 7.

FIG. 9 is a schematic diagram describing a flow path of ink in an inkjet head.

FIG. 10 is a schematic diagram showing a configuration of an ink circulating mechanism.

FIG. 11 is a block diagram showing a configuration of a main function in the inkjet recording device.

FIG. 12 is a diagram showing a flow direction of ink in a downstream side ink chamber according to a modification.

Description of Embodiments

[0020] Embodiments of the inkjet head and the inkjet recording device according to the present invention is described with reference to the drawings.

[0021] FIG. 1 is a diagram showing a schematic configuration of an inkjet recording device 1 according to an embodiment of the present invention.

[0022] The inkjet recording device 1 includes a conveyor 2 and a head unit 3.

[0023] The conveyor 2 includes a ring shaped conveying belt 2c which is supported from the inner side by two conveying rollers 2a and 2b which rotate around a rotating axis extending in an X direction shown in FIG. 1. In the conveyor 2, the conveying roller 2a rotates in response to operation of a conveying motor (not shown) and the conveying belt 2c rotates in a state with the recording medium M placed on a conveying surface of the conveying belt 2c. With this, the recording medium M is conveyed in a moving direction (conveying direction, Y direction shown in FIG. 1) of the conveying belt 2c.

[0024] The recording medium M can be sheet paper cut in a certain dimension. The recording medium M is supplied on a conveying belt 2c by a sheet feeding device (not shown) and after the ink is ejected from the head unit 3 and the image is recorded, the sheet is discharged from the conveying belt 2c to a predetermined sheet discharger. A rolled sheet can be used as the recording medium M. Alternatively, other than paper such as a normal sheet or a coated sheet, various media which can be used as the recording medium M include media in which ink landed on a surface can be fixed, examples including a cloth or a sheet shaped resin.

[0025] Based on the image data, the head unit 3 ejects ink at a suitable timing to a recording medium M conveyed by the conveyor 2 and records an image. In the inkjet

recording device 1 according to the present embodiment, four head units 3 corresponding to each of the four colors of ink which are yellow (Y), magenta (M), cyan (C), and black (K) are arranged to be aligned with a predetermined interval in between in the order of the color Y, M, C, K from an upstream side in a conveying direction of the recording medium M. The number of head units 3 can be 3 or less or 5 or more.

[0026] FIG. 2 is a schematic diagram showing a configuration of a head unit 3, and the diagram is a plane view viewing the head unit 3 from a side which faces the conveying surface of the conveying belt 2c. The head unit 3 includes a plate shaped supporter 3a and a plurality of inkjet heads 100 (here, 8), fixed to the supporter 3a in a state fitted to a penetrating hole provided in the supporter 3a. The inkjet head 100 is fixed to the supporter 3a in a state in which an ink ejecting surface 112 provided in an opening of a nozzle 111 is exposed in a -Z direction from a penetrating hole of the supporter 3a.

[0027] In the inkjet head 100, the plurality of nozzles 111 are each arranged with an even interval in a direction intersecting with a conveying direction of the recording medium M (width direction orthogonal to the conveying direction in the present embodiment, that is, the X direction). According to the present embodiment, each inkjet head 100 include 4 rows of nozzles 111 (nozzle row) arranged in one dimension with an even interval in the X direction. The 4 nozzle rows are positioned with the positions in the X direction shifted from each other so that the positions of the nozzles 111 in the X direction do not overlap. The number of nozzle rows included in the inkjet head 100 is not limited to 4, and can be 3 or less or 5 or more.

[0028] The 8 inkjet heads 100 in the head unit 3 are positioned in a hound's tooth pattern continuing in a positioning range in the X direction of the nozzle 111. The positioning range of the nozzle 111 in the X direction included in the head unit 3 covers the width in the X direction in the region in which the image can be recorded in the recording medium M conveyed by the conveying belt 2c. The head unit 3 is used with the position fixed when the image is recorded, and the ink is ejected from the nozzle 111 to each position with a predetermined interval (conveying direction interval) in between in the conveying direction in response to the conveying of the recording medium M. With this, the image is recoded in a single pass method.

[0029] FIG. 3 is a perspective view of the inkjet head 100.

[0030] The inkjet head 100 includes an exterior member 51 in which the ink ejector 10 (FIG. 4) including the ink ejecting surface 112 is stored inside, a cover member 52 which fits with the exterior member 51 in an upper edge of the exterior member 51, an ink tank 60 which is attached to a position which covers a portion of the outer side of the cover member 52, an inlet 71 (ink supply opening) in which ink is supplied from outside and an outlet 72 (ink discharge opening) from which ink is discharged outside.

[0031] The exterior member 51 includes an orifice 511 (FIG. 7) in which ink supplied to an ink inflow opening 101 (FIG. 9) of the ink ejector 10 flows and an orifice 512 (FIG. 7) from which ink flown out from an outflow opening 102 (FIG. 9) of the ink ejector 10 is discharged. A plurality of attaching holes 513 are provided in the exterior member 51 to attach the inkjet head 100 to a supporter 3a of the head unit 3.

[0032] The material for the exterior member 51 and the cover member 52 is not limited and various resins such as a PPS resin with high mechanical strength and high medical strength against ink, or metal, alloys and the like can be used.

[0033] The inlet 71 and the outlet 72 are provided on both ends of the cover member 52 in the longitudinal direction. That is, the inlet 71 is provided in the +X direction side of the cover member 52 and the outlet 72 is provided in the -X direction side of the cover member 52.

[0034] The ink tank 60 is connected to the inlet 71 at one end side and connected to the outlet 72 at the other end side. The ink tank 60 stores the ink flowing in from the inlet 71 and supplies the ink to the ink ejector 10 in the exterior member 51. The ink tank 60 is provided so that a plate shaped portion connecting the above one end side and the other end side (portion where the ink is mainly stored) covers the upper half of a surface on a front side of the cover member 52 (surface opposed in +Y direction side).

[0035] The ink tank 60 includes a lid 602 included in the front side of the plate shaped portion (+Y direction side), a base 601 facing the lid 602, and a fixed portion 603 which extends downward from both ends in the X direction of the base 601 and which is fixed to the exterior member 51. Among the above, the fixed portion 603 is fixed detachably to the exterior member 51 with a plurality of attaching screws 54 (attaching members). That is, the ink tank 60 can be detached from the inkjet head 100 and changed.

[0036] FIG. 4 is a diagram showing a cross section along a YZ plane of the inkjet head 100 shown in FIG. 3.

[0037] As shown in FIG. 4, the ink ejector 10 in which the bottom surface is the ink ejecting surface 112, a wiring member 40 connected to the ink ejector 10, and a driving substrate 30 to which the wiring member 40 is connected are stored in the inner space formed by the exterior member 51 and the cover member 52.

[0038] On the front side surface of the cover member 52, a step is provided so that the upper half of the surface is shifted to the -Y direction side than the lower half, and the ink tank 60 is attached to be fit in this step. In detail, the ink tank 60 is provided to be stored within the range to the -Y direction side than the plane of the lower half among the plane on the front side of the cover member 52. According to such configuration, the ink tank 60 can be provided without increasing the width of the inkjet head 100 in the Y direction.

[0039] The driving substrate 30 is provided on the op-

posite side of the ink ejecting surface 112 of the ink ejector 10 (that is, +Z direction side) along the direction intersecting with the ink ejecting surface 112 of the ink ejector 10 (according to the present embodiment, the orthogonal direction orthogonal to the ink ejecting surface 112, that is, +Z direction). In detail, the relative position with relation to the cover member 52 is fixed with the fixing member (not shown) so that the driving substrate 30 is positioned in the above direction and position. The driving substrate 30 is positioned so as to be covered by the cover member 52 with the exception of a portion of the upper end.

[0040] The driving substrate 30 is a rigid substrate in which metal circuit wires are formed on the surface of a base material with insulation properties such as a glass epoxy substrate. The driving substrate 30 includes flexibility in a range so that it is possible to be stably fixed with relation to the cover member 52.

[0041] The ink ejector 10 includes a nozzle substrate 11 (nozzle plate) in which the nozzles 111 are provided and which forms the ink ejecting surface 112, an actuator substrate 12 which is layered to the +Z direction side of the nozzle substrate 11 and in which an actuator (operation element) which performs the operation to eject ink from the opening of the nozzle 111 is provided, and a common ink chamber 13 (common liquid chamber) which temporarily stores ink supplied to the actuator substrate 12. The ink from the ink tank 60 flows in through the orifice 511 to the common ink chamber 13.

[0042] FIG. 5 is an enlarged schematic cross section diagram showing a configuration of the ink ejector 10. FIG. 5 shows a cross section including four nozzles 111 included in each of the four nozzle rows as shown in FIG. 2.

[0043] A head chip HC including the nozzle substrate 11 and the actuator substrate 12 is a configuration to eject ink from the nozzle 111, and a plurality of plate shaped substrates are layered and formed (here, 4 substrates). The substrate at the bottom of the head chip HC is the nozzle substrate 11. A plurality of nozzles 111 are provided in the nozzle substrate 11, and ink can be ejected substantially orthogonal to the exposed surface (ink ejecting surface 112) of the nozzle substrate 11 from the opening of the nozzle 111. On the opposite side of the ink ejecting surface 112 of the nozzle substrate 11, a pressure chamber substrate 12a (chamber plate), a spacer substrate 12b and a wiring forming substrate 12c are formed attached and layered in order upward. The pressure chamber substrate 12a, the spacer substrate 12b and the wiring forming substrate 12c are included in the actuator substrate 12.

[0044] The head chip HC is provided with an ink flow path in communication with the nozzle 111, and the ink flow path is open at the surface on the side where the wiring forming substrate 12c is exposed (upper side). On the exposed surface of the wiring forming substrate 12c, a common ink chamber 13 is provided so as to cover all of the openings. In detail, the common ink chamber 13 includes a first common ink chamber 131 and a second common ink chamber 132 provided in a lower layer (-Z direction side) of the first common ink chamber 131 and from the above, the second common ink chamber 132 is in communication commonly with all of the openings of the ink flow path. The ink in the second common ink chamber 132 is supplied to each nozzle 111 from the opening of the wiring forming substrate 12c.

[0045] A pressure chamber 121 is provided in the middle of the ink flow path. The pressure chamber 121 is provided penetrating the pressure chamber substrate 12a in the vertical direction, and the upper surface of the pressure chamber 121 is formed by a vibrating plate 122 provided between the pressure chamber substrate 12a and the spacer substrate 12b. A change in pressure is applied to the ink in the pressure chamber 121 due to the vibrating plate 122 (pressure chamber 121) deforming by the displacing (deforming) of a piezoelectric element 123 (actuator, operation element) in a housing unit 124 provided adjacent to the pressure chamber 121 with the vibrating plate 122 in between. By applying the suitable change in pressure to the ink in the pressure chamber 121, the ink in the ink flow path is ejected from the nozzle 111 in communication with the pressure chamber 121 as liquid droplets.

[0046] The holding substrate 133 is attached to the upper surface of the head chip HC, and the holding substrate 133 holds the common ink chamber 13. An opening with almost the same size and the same shape as the opening on the lower surface of the second common ink chamber 132 is provided in the holding substrate 133, and the ink in the second common ink chamber 132 is supplied to the upper surface of the head chip HC through the opening on the lower surface of the second common ink chamber 132 and the opening of the holding substrate 133.

[0047] For example, the wiring member 40 is a FPC (flexible printed circuits) and the wiring member 40 is connected to a wiring layer 127 on the surface of the wiring forming substrate 12c. The piezoelectric element 123 is displaced by the driving signal transmitted to the wiring 126 and connection 125 in the housing unit 124 through the wiring layer 127. One wiring member 40 is pulled out from each of the front side (+Y direction side) and back side (-Y direction side) of the head chip HC, penetrating the holding substrate 133. As shown in FIG. 4, the pair of wiring members 40 is connected to the circuit wiring of the front surface of the driving substrate 30 and the circuit wiring of the back surface through the first connector 32 provided in each of the surface in the +Y direction side of the driving substrate 30 (hereinafter also described as the front surface) and the surface in the -Y direction side (hereinafter also described as the back surface).

[0048] As shown in FIG. 4, in addition to the first connector 32, a driving element 31 and a second connector 33 are provided on the front surface of the driving substrate 30.

[0049] The driving element 31 receives the control signal supplied from the controller 20 (FIG. 11) of the inkjet recording device 1 and the driving control circuit 81 (FIG. 11) of the head unit 3 through the second connector 33, and in response to an ink ejecting operation from the nozzles 111 or a non-ejecting operation, the suitable driving signals of the piezoelectric element 123 are output to the wiring on the driving substrate 30. The driving element 31 includes an IC (Integrated Circuit). In addition to the driving element 31, various electronic components which are not shown connected directly or indirectly to the driving element 31 are provided in the driving substrate 30 by the circuit wiring. Such electronic components and driving element 31 are included in the "driving circuit" for driving the piezoelectric element 123 as the operation element.

[0050] Most of the driving elements 31 and electronic components included in the driving circuit are provided on the front surface of the driving substrate 30. Some of the driving signals from the driving circuit are supplied to the first connector 32 on the front surface side through the circuit wiring provided on the front surface of the driving substrate 30. Some of the circuit wiring on the front surface side are conducted to the circuit wiring on the back surface side through the through hole, etc., and some of the driving signals from the driving circuit are supplied to the first connector 32 on the back surface side through the circuit wiring pulled to the back surface side.

[0051] Most of the driving elements 31 and the electronic components are provided on the front surface of the driving substrate 30, and with this, an amount of heat dissipation from the front surface of the driving substrate 30 during operation of the driving circuit becomes larger than the amount of heat dissipation from the back surface.

[0052] FIG. 6 is a diagram showing a cross-section of the inkjet head 100 along an XY flat surface at a position passing the driving element 31.

[0053] As shown in FIG. 6, the cover member 52 includes a flat surface portion 521 which is provided facing the front surface of the driving substrate 30 and which is provided along the front surface, a flat surface portion 522 which is provided facing the back surface of the driving substrate 30 and which is provided along the back surface, and a side surface portion 523 which connects the above flat surface portions 521 and 522 and which covers the side of the driving substrate 30. The cover member 52 covers a large portion of the driving substrate 30 with the exception of the portion near the second connector 33.

[0054] As shown in FIG. 4 and FIG. 6, the ink tank 60 is provided in the portion of the cover member 52 along the flat surface portion 521 which covers the front surface side of the driving substrate 30. That is, a facing surface 60a (surface facing -Y direction) (predetermined surface) which is on the outer surface of the ink tank 60 and which faces the cover member 52 is provided along the driving substrate 30.

[0055] A sheet shaped heat dissipating member 53 in contact with the ink tank 60 and the cover member 52 is provided between the facing surface 60a of the ink tank 60 and the flat surface portion 521 of the cover member 52. As the heat dissipating member 53, any material with a heat conductivity higher than air can be used. Preferably, in order to transmit heat efficiently from the cover member 52 to the ink tank 60, a material including high heat conductivity such as silicone or acrylic resin is used.

[0056] The ink tank 60 is provided so that the heat dissipated from the driving substrate 30 is transmitted to the facing surface 60a through the cover member 52 and the heat dissipating member 53. That is, the ink tank 60 also functions as a heat sink which receives the heat of the driving substrate 30 and discharges the heat outside. Some of the heat transmitted from the driving substrate 30 to the ink tank 60 is discharged from the outer surface of the ink tank 60 to the external space, and is discharged to the supporter 3a of the head unit 3 through the external member 51 from the ink tank 60. Some of the heat transmitted to the ink tank 60 is transmitted to the ink in the ink tank 60 and the heat which passes through the later described ink flow path is discharged with the ink from the outlet 72.

[0057] As shown in FIG. 6, a cylinder shaped penetrating hole is provided at the edge on the +X direction side of the base 601 of the ink tank 60 and is provided extending in the +Z direction. Such penetrating hole is included in an ink supply flow path 711. An edge at one side of the ink supply flow path 711 is connected to the inlet 71 and an edge at the other side is connected to a later-described opening A1 (FIG. 7).

[0058] A cylinder shaped penetrating hole is provided at the edge on the -X direction side of the base 601 of the ink tank 60 and is provided extending in the +Z direction. Such penetrating hole is included in an ink discharge flow path 721. An edge at one side of the ink discharge flow path 721 is connected to the orifice 512 of the external member 51, and an edge at the other side is connected to the outlet 72.

[0059] With reference to FIG. 4, FIG. 6, FIG. 7, and FIG. 8A to FIG. 8C, the internal structure of the ink tank 60 and the flow path of the ink in the internal structure are described.

[0060] FIG. 7 is a perspective view of an inkjet head 100 showing an internal structure of the ink tank 60. FIG. 7 is drawn so that the members included in the outer surface of the ink tank 60 are transparent.

[0061] FIG. 8A is a diagram showing a cross section of the ink tank 60 along the YZ plane at a position X1 shown in FIG. 7.

[0062] FIG. 8B is a diagram showing a cross section of the ink tank 60 along the YZ plane at a position X2 shown in FIG. 7.

[0063] FIG. 8C is a diagram showing a cross section of the ink tank 60 along the YZ plane at a position X3 shown in FIG. 7.

[0064] In FIG. 7, FIG. 8A to FIG. 8C, the flowing direction of the ink is shown with an arrow.

[0065] The following are provided inside the ink tank 60, a plate shaped filter 61 (first filter, second filter) provided along the facing surface 60a, an upstream side ink chamber 62 and a downstream side ink chamber 63 divided by a filter 61, a pulling flow path 64 in communication with the downstream side ink chamber 63, and upstream side auxiliary ink chamber 65 and downstream side auxiliary ink chamber 66 divided by a filter 61 (second filter), a communicating flow path 67 in communication with the downstream side auxiliary ink chamber 66, an ink supply flow path 711 (FIG. 6) in communication with the inlet 71, and an ink discharge flow path 721 in communication with the outlet 72.

[0066] As shown in FIG. 4, FIG. 6, FIG, 7, and FIG. 8, the upstream side ink chamber 62 and the downstream side ink chamber 63 are ink chambers in a flat substantial rectangular parallelepiped shape along the facing surface 60a. The ink is able to move from the upstream side ink chamber 62 to the downstream side ink chamber 63 through the filter 61 provided in between. The upstream side ink chamber 62 is provided adjacent to the filter 61 in the -Y direction side (facing surface 60a side) and the downstream side ink chamber 63 is provided adjacent to the filter 61 in the +Y direction side.

[0067] The filter 61 is a material for capturing foreign substances mixed in the ink and filtering the ink. The material of the filter 61 is not limited as long as a mesh structure with a size which can capture foreign substances is included. Examples such as a material weaved with stainless steel and a non-woven material including resin fiber such as polypropylene can be used.

[0068] The portion in the filter 61 provided between the upstream side ink chamber 62 and the downstream side ink chamber 63 is to be the "first filter".

[0069] As shown in FIG. 7, an opening A1 in communication with the ink supply path 711 is provided at a lower end of the side surface in the +X direction side in the upstream side ink chamber 62. In the upstream side ink chamber 62, ink flows in from the inlet 71 through the ink supply flow path 711 and the opening A1.

[0070] As shown in FIG. 7 and FIG. 8B, an opening A2 in communication with the pulling flow path 64 is provided at an edge on the -X direction side on the upper surface (surface on +Z direction side) of the downstream side ink chamber 63.

[0071] In the upstream side ink chamber 62 and the downstream side ink chamber 63, as shown by the arrows a1 described in FIG. 7, FIG. 8A, and FIG. 8B, the ink flows from the upstream side ink chamber 62, passes the filter 61 and moves to the downstream side ink chamber 63 and the ink flows from the opening A1 toward the opening A2 in the +X direction and the +Z direction.

[0072] As shown in FIG. 7, FIG. 8A and FIG. 8B, the pulling flow path 64 includes a first portion extending in the +X direction above the upstream side ink chamber 62 and the downstream side ink chamber 63, and a second portion extending in a downward direction (-Z direction) at a side on the +X direction side of the upstream side ink chamber 62 and the downstream side ink chamber 63 from an edge in the +X direction side of the first portion. The edge of the second portion is connected to the orifice 511 provided in the exterior member 51. The orifice 511 is in communication with the common ink chamber 13 of the ink ejector 10. As shown above, the pulling flow path 64 pulls the ink flowing from the downstream side ink chamber 63 in the +X direction (arrow a2 shown in FIG. 7, FIG. 8A, and FIG. 8B) and the -Z direction, and guides the ink to the orifice 511.

[0073] An "in-tank flow path F1" (FIG. 9) includes the above-described upstream side ink chamber 62, the downstream side ink chamber 63, and the pulling flow path 64. The ink flow direction in the in-tank flow path F1 from the upstream side ink chamber 62, through the downstream side ink chamber 63 and the pulling flow path 64, and to the orifice 511 corresponds to a "predetermined supplying direction".

[0074] As shown in FIG. 7, the upstream side auxiliary ink chamber 65 and the downstream side auxiliary ink chamber 66 are provided on the -X direction side of the upstream ink chamber 62 and the downstream ink chamber 63. The upstream side auxiliary ink chamber 65 and the downstream side auxiliary ink chamber 66 are ink chambers in a flat substantial rectangular parallelepiped shape along the facing face 60a, include the same thickness (length in Y direction) and the same height (length in Z direction) as the upstream side ink chamber 62 and the downstream side ink chamber 63, and the width (length in X direction) is smaller than the upstream side ink chamber 62 and the downstream side ink chamber 63. The upstream side auxiliary ink chamber 65 is partitioned from the upstream side ink chamber 62 by a first partitioning member 681 provided as one with a base 601. The downstream side auxiliary ink chamber 66 is partitioned from the downstream ink chamber 63 by a second partitioning member 682 provided as one with a lid 602.

[0075] As shown in FIG. 7 and FIG. 8C, an opening A3 is provided in the upper edge of the first partitioning member 681. Therefore, among the ink flowing in the upstream side ink chamber 62, some of the ink flows in the upstream side auxiliary ink chamber 65 through the opening A3 as shown by the arrow a3 in FIG. 7 and FIG. 8C before moving to the downstream side ink chamber 63 side.

[0076] The ink which flows in the upstream side auxiliary ink chamber 65 passes the filter 61 and moves to the downstream side auxiliary ink chamber 66.

[0077] In the filter 61, the portion provided between the upstream side auxiliary ink chamber 65 and the downstream side auxiliary ink chamber 66 is to be a "second filter".

[0078] According to the present embodiment, the "first filter" and the "second filter" provided between the upstream side ink chamber 62 and the downstream side ink chamber 63 compose a single filter 61. That is, the

"first filter" and the "second filter" are provided as one.

[0079] An opening A4 in communication with a communicating flow path 67 is provided in an edge of the -X direction side on the upper surface (surface on the +Z direction side) of the downstream side auxiliary ink chamber 66.

[0080] The communicating flow path 67 is provided in a shape which bends in the -X direction side after extending in the +Z direction from the opening A4, and heads toward the -Z direction while meandering. The edge on the opposite side of the opening A4 of the communicating flow path 67 is connected to the ink discharge flow path 721.

[0081] Therefore, the ink flowing in the upstream side auxiliary ink chamber 65 passes the filter 61, moves to the downstream side auxiliary ink chamber 66, passes the communicating flow path 67, and flows in to the ink discharge flow path 721.

[0082] The upstream side auxiliary ink chamber 65, the downstream side auxiliary ink chamber 66, and the communicating flow path 67 are included in a "bypass flow path F2" (FIG. 9) which connects the in-tank flow path F1 and the ink discharge flow path 721 without passing through the ink ejector 10.

[0083] A check valve 73 is provided between a connecting position with the bypass flow path F2 in the ink discharge flow path 721 and the outlet 72. Such check valve 73 is a section which prevents reverse flow. The ink flows in the discharge direction toward the outlet 72 and does not flow in the direction opposite to the discharge direction.

[0084] Next, the ink flow path in the entire inkjet head 100 including the ink tank 60 is described.

[0085] FIG. 9 is a schematic diagram describing the flow path of the ink in the inkjet head 100. For the purpose of ease of description, FIG. 9 shows the filter 61 in the ink tank 60, the upstream side ink chamber 62, and the downstream side ink chamber 63 as a shape long in the horizontal direction.

[0086] As shown in FIG. 9, the ink flowing into the inlet 71 from outside passes the ink supply flow path 711, and flows into the upstream side ink chamber 62 in the ink tank 60 through the opening A1. Most of the ink flowing in the upstream side ink chamber 62 passes the above-described in-tank flow path F1 and flows into the inflow opening 101 of the ink ejector 10.

[0087] Some of the ink flowing in the inflow opening 101 flows in the first common ink chamber 131 in the common ink chamber 13, and the rest of the ink flows in the second common ink chamber 132. A partitioning wall between the first common ink chamber 131 and the second common ink chamber 132 includes a member through which ink cannot pass (for example, resin).

[0088] The ink flowing in the first common ink chamber 131 is guided as is to the outflow opening 102 of the ink ejector 10.

[0089] Some of the ink flowing in the second common ink chamber 132 flows into the ink flow path of the actuator substrate 12 and is ejected outside as droplets from the nozzle 111 of the nozzle substrate 11. The ink which is not ejected from the nozzle 111 is guided to the outflow opening 102.

[0090] As described above, the ink which is not ejected from the nozzle 111 flows into the first common ink chamber 131 and flows out from the outflow opening 102. With this, the ink can be efficiently recirculated in the inkjet head 100. Therefore, bubbles in the ink can be discharged outside, and the heat transmitted to the ink from the driving substrate 30 can be discharged outside with the ink.

[0091] The volume ratio between the first common ink chamber 131 and the second common ink chamber 132 is set so that the supply amount of ink from the second common ink chamber 132 to the nozzle 111 is secured, and the ink amount recirculated by the first common ink chamber 131 is a predetermined amount.

[0092] The ink flowing out from the outflow opening of the ink ejector 10 passes the ink discharge flow path 721 and is discharged outside from the outlet 72 (exit of ink discharge flow path 721).

[0093] Further, as described above, some of the ink flowing in the in-tank flow path F1 flows into the bypass flow path F2 from the opening A3, and the ink is guided to the ink discharge flow path 721 without passing the ink ejector 10.

[0094] Since the check valve 73 is provided between the connecting position in the ink discharge flow path 721 with the bypass flow path F2 and the outlet 72, the ink flowing reverse from the outlet 72 side to the ink ejector 10 can be prevented.

[0095] The flow of the ink in the ink flowing path as shown in FIG. 9 can be generated by an ink circulating mechanism 9 included in the inkjet recording device 1.

[0096] FIG. 10 is a diagram schematically showing a configuration of the ink circulating mechanism 9.

[0097] The ink circulating mechanism 9 includes a supplying sub-tank 91, a recirculating sub-tank 92, and a main tank 93.

[0098] The supplying sub-tank 91 stores the ink supplied to the ink tank 60 of the inkjet head 100. The supplying sub-tank 91 is connected to the inlet 71 by the ink flow path 94.

[0099] The recirculating sub-tank 92 is connected to the outlet 72 by the ink flow path 95, and the ink discharged from the outlet 72 is stored.

[0100] The supplying sub-tank 91 and the recirculating sub-tank 92 are connected to the ink flow path 96. Then, the ink can be returned from the recirculating sub-tank 92 to the supplying sub-tank 91 using the pump 98 provided in the ink flow path 96.

[0101] The main tank 93 stores the ink supplied to the supplying sub-tank 91. The main tank 93 is connected to the supplying sub-tank 91 by the ink flow path 97. The ink is supplied from the main tank 93 to the supplying sub-tank 91 by using the pump 99 provided in the ink flow path 97.

[0102] The supplying sub-tank 91 is provided so that the liquid surface becomes a position higher than the ink ejecting surface 112 (hereinafter referred to as "position standard surface") of the ink ejector 10. The recirculating sub-tank 92 is provided so that the liquid surface becomes a position lower than the position standard surface. Therefore, pressure PI by a water head difference between the position reference surface and the supplying sub-tank 91, and pressure P2 by a water head difference between the position reference surface and the recirculating sub-tank 92 are generated. As a result, the pressure of the ink in the inlet 71 is higher than the pressure of the ink in the outlet 72. According to such pressure difference, the flow of ink from the inlet 71, passing through the ink tank 60 and the ink ejector 10 and heading to the outlet 72 occurs. With this, the ink supply to the ink ejector 10 and the discharge of ink (recirculating) from the ink ejector 10 is performed. The ink amount in the sub-tanks and the position of the sub-tanks in the vertical direction are changed. With this, the pressure PI and the pressure P2 can be adjusted, and with this, a flow rate of the ink can be adjusted.

[0103] FIG. 11 is a block diagram showing a configuration of the main functions in the inkjet recording device 1.

[0104] The inkjet recording device 1 includes, the above-described head unit 3, a controller 20, a conveying driver 82, an input/output interface 83, and a bus 84. Among the above, the head unit 3 includes a driving control circuit 81, and an inkjet head 100 provided with a driving element 31 and a piezoelectric element 123. The controller 20 includes a CPU 21 (Central Processing Unit), a RAM 22 (Random Access Memory), a ROM 23 (Read Only Memory), and a storage 24.

[0105] The CPU 21 reads programs for various control and setting data stored in the ROM 23 and stores the above in the RAM 22. The CPU 21 executes the above program and performs various calculating processes. The CPU 21 centrally controls the entire operation of the inkjet recording device 1.

[0106] The RAM 22 provides a memory space for work in the CPU 21 and stores temporary data. The RAM 22 may include a nonvolatile memory.

[0107] The ROM 23 stores programs for various control and setting data executed by the CPU 21. Instead of the ROM 23, a rewritable nonvolatile memory such as an EEPROM (electrically erasable Programmable Read Only Memory) or flash memory can be used.

[0108] The storage 24 stores a print job input from an external apparatus 200 through the input/output interface 83 and the image data regarding the print job. As the storage 24, for example, a HDD (Hard Disk Drive) is used or a DRAM (Dynamic Random Access Memory) can be additionally used.

[0109] Based on a control signal from the controller 20, the driving control circuit 81 supplies various control signals and image data at a suitable timing to the driving element 31.

[0110] Based on a control signal supplied from the CPU 21, the conveying driver 82 supplies a driving signal to the motor driving the conveying rollers 2a and 2b of the conveyor 2 and rotates the conveying rollers 2a and 2b at a predetermined speed and timing, and the conveying belt 2c is rotated.

[0111] The input/output interface 83 mediates transmitting and receiving of data between the external apparatus 200 and the controller 20. The input/output interface 83 includes either various serial interfaces, various parallel interfaces, or a combination of the above.

[0112] The bus 84 is a path to transmit and receive a signal between the controller 20 and other structure.

[0113] The external apparatus 200 is a personal computer, for example, and supplies print jobs, image data, and the like to the controller 20 through the input/output interface 83.

[0114] As described above, the inkjet head 100 according to the present embodiment includes, the ink ejector 10 in which the opening of the nozzle 111 which ejects ink is provided in the ink ejecting surface 112, and which includes a piezoelectric element 123 as the operation element which performs the operation to eject ink from the opening of the nozzle 111, the driving substrate 30 in which the driving circuit to drive the piezoelectric element 123 is provided, and an ink tank 60 in which the ink supplied to the ink ejector 10 is stored. The ink tank 60 is provided so that the facing surface 60a of the ink tank 60 is provided along the driving substrate 30 and the heat of the driving substrate 30 is transmitted to the facing surface 60a.

[0115] According to the above configuration, the ink tank 60 is able to function as a heat sink which receives heat from the driving substrate 30 and discharges the heat to the outside. That is, some of the heat transmitted from the driving substrate 30 to the ink tank 60 is discharged from the outer surface of the ink tank 60 to the external space, and the heat can be discharged outside through the exterior member 51 where the ink tank 60 is attached. Some of the heat transmitted to the ink tank 60 is transmitted to the ink in the ink tank 60. Therefore, by guiding the ink outside the inkjet head 100 by a predetermined path, the heat of the driving substrate 30 can be discharged outside with the ink.

[0116] With this, it is possible to suppress problems such as the ink not being able to be suitably ejected from the nozzle 11 due to the heat of the driving substrate 30 transmitting to the ink in the ink ejector 10 and the viscosity of the ink decreasing or the ink ejector 10 expanding by the heat of the driving substrate 30 causing the position of the nozzle 111 to change. As a result, the decrease of the image quality of the recorded image due to the heat of the driving substrate 30 can be effectively suppressed.

[0117] The driving substrate 30 is provided on the opposite side of the ink ejecting surface 112 of the ink ejector 10 along the direction intersecting with the ink ejecting surface 112. According to such configuration, the driving

substrate 30 can be positioned using the space on the side opposite of the ink ejecting surface 112 of the ink ejector 10. Therefore, it is possible to make the size of the inkjet head 100 in the direction parallel to the ink ejecting surface 112 small. Moreover, is possible to provide the driving substrate 30 in the inkjet head 100. By positioning the ink tank 60 so that the facing surface 60a of the ink tank 60 is along the driving substrate 30 positioned as described above, the size of the inkjet head 100 in the direction parallel to the ink ejecting surface 112 can be made small, and the ink tank 60 can be provided in the inkjet head 100.

[0118] The ink tank 60 is provided with the in-tank flow path F1 in which the ink supplied to the ink ejector 10 flows in a predetermined supply direction, and the filter 61 as the first filter 1 which is provided along the facing surface 60a in the in-tank flow path F1 and through which the ink flowing in the in-tank flow path F1 passes. As described above, by providing the filter 61 in the ink tank 60 along the facing surface 60a, the increase in the size of the inkjet head 100 can be suppressed to a minimum and the filter 61 with a large area can be provided. With this, the pressure loss of ink when the ink flowing in the in-tank flow path F1 passes the filter 61 can be made small. Therefore, the back pressure to flow the ink can be made small in the range that the necessary flow rate of ink can be secured or the flow rate of ink can be increased when the back pressure is the same. With this, the impurities mixed in the ink can be captured efficiently with the filter 61. Since the ink can flow efficiently, the heat of the driving substrate 30 and the bubbles in the ink can be easily discharged outside.

[0119] The in-tank flow path F1 includes the upstream side ink chamber 62 adjacent to the filter 61 in the upstream side of the supply direction and the downstream side ink chamber 63 adjacent to the filter 61 in the downstream side of the supply direction. The upstream side ink chamber 62 is provided on the facing surface 60a side of the filter 61.

[0120] According to the above configuration, the upstream side ink chamber 62 is provided on the side closer to the driving substrate 30. The ink flowing in the upstream side ink chamber 62 stays in the upstream side ink chamber 62 until the ink passes the filter 61 and moves to the downstream side ink chamber 62. Therefore, the flow rate of the ink in each portion of the upstream side ink chamber 62 tends to become low entirely. Therefore, the heat from the driving substrate 30 can be transmitted to the ink almost evenly and efficiently in each position of the upstream side ink chamber 62. With this, the heat from the driving substrate 30 can be discharged efficiently through the ink in the ink tank 60.

[0121] The ink ejector 10 includes an outflow opening 102 through which some of the ink flowing in from the in-tank flow path F1 flows out, and the inkjet head 100 includes the ink discharge flow path 721 which guides the ink flowing out from the outflow opening 102 of the ink ejector 10 outside the inkjet head 100. As described above, among the ink supplied from the ink tank 60 to the ink ejector 10, the ink which is not ejected from the nozzle 111 is guided outside and then returned. With this, the amount of ink flowing in the in-tank flow path F1 of the ink tank 60 can be increased. With this, the heat of the driving substrate 30 transmitted to the ink and the bubbles in the ink can flow efficiently with the ink and can be discharged outside.

[0122] The inkjet head 100 includes the bypass flow path F2 which connects the in-tank flow path F1 and the ink discharge flow path 721 without connecting the ink ejector 10 in between, the filter 61 as the second filter which is provided in the bypass flow path F2 and through which ink flowing in the bypass flow path F2 passes, and the check valve 73 which is provided between the connecting position with the bypass flow path F2 in the ink discharge flow path 721 and the exit (outlet 72) of the ink discharge flow path 721, and which does not pass ink in the direction opposite to the direction heading to the outlet 72.

[0123] According to such bypass flow path F2, the heat transmitted from the driving substrate 30 can be discharged outside from the outlet 72 with the ink, and the bubbles in the ink can be discharged outside from the outlet 72. The discharge flow path of the ink passing the bypass flow path F2 has a short flow path length compared to the discharge path of the ink passing the ink ejector 10. With this, the pressure loss can be made small. Therefore, according to the ink discharge path passing the bypass flow path F2, it is possible to more efficiently discharge heat and remove bubbles than the discharge path of the ink passing the ink ejector 10.

[0124] Further, by providing the check valve 73, the reverse flow of the ink to the ink ejector 10 from the outlet 72 side can be prevented. Therefore, it is possible to prevent problems occurring in the nozzle 111 and the ink flow path in communication with the nozzle 111 by the bubbles and the foreign substances mixed by such reverse flow of the ink.

[0125] The bypass flow path F2 is provided in the ink tank 60 and the first filter and the second filter are provided as one. With this, the number of units included in the inkjet head 100 can be reduced and the rise in the manufacturing cost can be suppressed. Further, the inkjet head 100 becoming smaller can be achieved.

[0126] The inkjet head 100 includes an attaching screw 54 as the attaching member to detachably fix the ink tank 60. According to such structure to detachably fix the ink tank 60, when clogging and deterioration over time occurs in the filter 61, the filter 61 can be easily and cheaply be exchanged by exchanging the ink tank 60.

[0127] The cover member 52 covering at least a portion of the driving substrate 30 is provided between the ink tank 60 and the driving substrate 30, and the heat dissipating member 53 in contact with the cover member 52 and the ink tank 60 is provided between the cover member 52 and the ink tank 60. With this, the heat of the driving substrate 30 can be more efficiently transmitted

to the ink tank 60.

[0128] The amount of heat dissipation from the front surface of the driving substrate 30 during operation of the driving circuit is larger than the amount of heat dissipation from the back surface of the driving substrate 30, and the ink tank 60 is provided in a side of the front surface of the driving substrate 30. With this, the heat of the driving substrate 30 can be efficiently transmitted to the ink tank 60 and discharged.

[0129] The inkjet recording device 1 according to the present embodiment includes the inkjet head 100 and the decrease of image quality due to the heat of the driving substrate 30 in the inkjet head 100 can be efficiently suppressed.

(Modification)

[0130] Next, the modification of the above embodiment is described.

[0131] According to the above embodiment, in the ink tank 60, the upstream side ink chamber 62 and the upstream side auxiliary ink chamber 65 are provided in the -Y direction side (facing surface 60a side) with relation to the filter 61, and the downstream side ink chamber 63 and the downstream side auxiliary ink chamber 66 are provided in the +Y direction side with relation to the filter 61. According to the modification, the relation of the positions of the above ink chambers with relation to the filter 61 is opposite. That is, according to the modification, the downstream side ink chamber 63 and the downstream side auxiliary ink chamber 66 are provided in the -Y direction side (facing surface 60a side) with relation to the filter 61, and the upstream side ink chamber 62 and the upstream side auxiliary ink chamber 65 are provided in the +Y direction side with relation to the filter 61.

[0132] According to the above configuration, the downstream side ink chamber 63 is provided in the side close to the facing surface 60a, that is, the side close to the driving substrate 30. Therefore, after the ink moves from the upstream side ink chamber 62, passes the filter 61, and moves to the downstream side ink chamber 63, the ink easily receives the heat of the driving substrate 30.

[0133] As shown in FIG. 12, in the downstream side ink chamber 63, since the ink flows towards the opening A2 provided in the upper right of the drawing, the flow rate of the ink in the region R near the opening A2 is faster than the flow rate of the ink in the other regions.

[0134] Therefore, according to the configuration of the modification with the downstream side ink chamber 63 provided on the facing surface 60a side of the filter 61, the ink which absorbed heat in the region R can be immediately discharged to the pulling flow path 64. Therefore, the heat discharge efficiency in the region R is enhanced (that is, the range of the region R can be intensively cooled). Therefore, by positioning a circuit component (for example, driving element 31) with a large amount of heat generation in the range of the driving substrate 30 overlapping with the region R viewed from the Y direction, the heat emitted from the circuit component can be absorbed efficiently, and the heat can be discharged outside with the ink.

[0135] The present invention is not limited to the above embodiment, and various modifications are possible.

[0136] For example, the shape and the way of setting the ink tank 60 is not limited to the description of the above embodiment, and can be any shape or way of setting as long as the range satisfies the condition of "the facing surface 60a is along the driving substrate 30 and the heat of the driving substrate 30 transmits to the facing surface 60a".

[0137] One example may be, according to the present embodiment, as the ink tank 60, the facing surface 60a and the surface on the opposite side (front surface side) of the facing surface 60a are both flat. The shape is not limited to the above, and the shape of the surface other than the facing surface 60a of the ink tank 60 can be any shape within the range which can be fitted in the head unit 3.

[0138] According to the present embodiment, the driving substrate 30 and the ink tank 60 face each other with the cover member 52 and the heat dissipating member 53 in between. The relation is not limited to the above, and the driving substrate 30 and the ink tank 60 can directly face each other. Specifically, by providing an opening in the portion of the cover member 52 covered by the ink tank 60, the heat of the driving substrate 30 can pass the opening and may be dissipated directly to the ink tank 60.

[0139] In addition to the facing surface 60a and the driving substrate 30 being parallel, the manner in which the facing surface 60a is along the driving substrate 30 can be a tilted manner with the facing surface 60a tilted in a slight angle (about a few degrees to 10 plus a few degrees) with relation to the driving substrate 30.

[0140] Instead of the configuration providing the ink tank 60 detachably, the ink tank 60 can be fixed so as not to be detachable.

[0141] According to the above embodiment, the driving substrate 30 is provided to be vertical with relation to the ink ejecting surface 112 of the ink ejector 10, but the direction is not limited to the above, and the driving substrate 30 can be provided along any direction intersecting with the ink ejecting surface 112. When the space for positioning the driving substrate 30 and the ink tank 60 can be secured, the driving substrate 30 can be provided parallel with the ink ejecting surface 112.

[0142] The amount of heat dissipation from the back surface side of the driving substrate 30 can be larger than the amount of heat dissipation from the front surface side (for example, the driving element 31 can be provided on the back surface side of the driving substrate 30), and the ink tank 60 can be positioned in the side of the back surface of the driving substrate 30.

[0143] The configuration of the in-tank flow path F1 in the ink tank 60 according to the present embodiment is one example, and the in-tank flow path F1 can be any

other configuration which can supply the ink flowing in from the inlet 71 to the ink ejector 10.

[0144] According to the present embodiment, the bypass flow path F2 is provided in the ink tank 60, but the configuration is not limited to the above, and the bypass flow path F2 can be provided outside the ink tank 60. In this case, preferably, the filter (second filter) separate from the filter 61 of the ink tank 60 is provided in the bypass flow path F2.

[0145] According to the present embodiment, the ink supply flow path 711 and the ink discharge flow path 721 are provided in the ink tank 60, but the configuration is not limited to the above and at least one of the ink supply flow path 711 and the ink discharge flow path 721 can be provided outside the ink tank 60.

[0146] According to the present embodiment, the piezoelectric element 123 is deformed and the pressure of the ink in the pressure chamber is changed to eject the ink. This is the inkjet head 100 including the head chip with the vent mode but the configuration is not limited to the above. For example, the piezoelectric member included in a wall of the pressure chamber can repeat displacement in a shear mode to change the pressure of the ink in the pressure chamber and eject ink. Such inkjet head including the head chip in a shear mode can be applied to the present invention.

[0147] According to the present embodiment and the modification, the conveyor 2 including the conveying belt 2c conveys the recording medium M but the structure is not limited to the above. The conveyor 2 can hold the recording medium M on the outer circumferential surface of the rotating conveying drum and convey the recording medium M, for example.

[0148] The present embodiment and the modification include an inkjet recording device 1 in a single pass method, but the present invention can be applied to the inkjet recording device which records the image while scanning the inkjet head 100.

[0149] Various embodiments of the present invention are described above, but the scope of the present invention is not limited by the embodiments described above, and the scope of the present invention includes the range of the invention as described in the attached claims and its equivalents.

Industrial Applicability

[0150] The present invention can be applied to an inkjet head and an inkjet recording device.

Reference Sign List

[0151]

1 inkjet recording device
2 conveyor
3 head unit
9 ink circulating mechanism
10 ink ejector
101 inflow opening
102 outflow opening
11 nozzle substrate
111 nozzle
112 ink ejecting surface
12 actuator substrate
123 piezoelectric element
13 common ink chamber
131 first common ink chamber
132 second common ink chamber
20 controller
30 driving substrate
31 driving element
32 first connector
33 second connector
40 wiring member
51 exterior member
52 cover member
53 heat dissipating member
54 attaching screw
60 ink tank
60a facing surface
601 base
602 lid
603 fixed portion
61 filter
62 upstream side ink chamber
63 downstream side ink chamber
64 pulling flow path
65 upstream side auxiliary ink chamber
66 downstream side auxiliary ink chamber
67 communicating flow path
68 partitioning member
71 inlet
711 ink supply flow path
72 outlet
721 ink discharge flow path
73 check valve
100 inkjet head
F1 in-tank flow path
F2 bypass flow path
HC head chip
M recording medium

Claims

1. An inkjet head comprising:

an ink ejector in which an opening of a nozzle which ejects ink is provided in an ink ejecting surface and which includes an operation element which performs an operation to eject ink from the opening of the nozzle;
a driving substrate in which a driving circuit is provided to drive the operation element; and
an ink tank which stores ink supplied to the ink

ejector,
wherein, the ink tank is provided with a predetermined surface of the ink tank among outer surfaces of the ink tank positioned along the driving substrate, and
the ink tank is provided in a manner that heat of the driving substrate is transmitted to the predetermined surface.

2. The inkjet head according to claim 1, wherein the driving substrate is provided along a direction intersecting with the ink ejecting surface in a side opposite of the ink ejecting surface of the ink ejector.

3. The inkjet head according to claim 1 or 2, wherein,
the ink tank is provided with an in-tank flow path in which ink supplied to the ink ejector flows in a predetermined supply direction, and
the ink tank is provided with a first filter which is provided along the predetermined surface inside the in-tank flow path and through which ink flowing in the in-tank flow path passes.

4. The inkjet head according to claim 3, wherein,
the in-tank flow path includes an upstream side ink chamber adjacent to the first filter on an upstream side in the supply direction,
the in-tank flow path includes a downstream side ink chamber adjacent to the first filter on a downstream side in the supply direction, and
the upstream side ink chamber is provided on the predetermined surface side of the first filter.

5. The inkjet head according to claim 3, wherein,
the in-tank flow path includes an upstream side ink chamber adjacent to the first filter on an upstream side in the supply direction,
the in-tank flow path includes a downstream side ink chamber adjacent to the first filter on a downstream side in the supply direction, and
the downstream side ink chamber is provided on the predetermined surface side of the first filter.

6. The inkjet head according to any one of claims 3 to 5, wherein,
the ink ejector includes an outflow opening from which some of the ink flowing in from the in-tank flow path flow out, and
the inkjet head includes an ink discharge flow path which guides the ink flowing out from the outflow opening of the ink ejector outside of the inkjet head.

7. The inkjet head according to claim 6, further comprising,
a bypass flow path which connects the in-tank flow path and the ink discharge flow path without the ink ejector in between,
a second filter which is provided inside the bypass flow path and through which the ink flowing in the bypass flow path passes, and
a backward flow preventer which is provided between a connecting position with the bypass flow path in the ink discharge flow path and an exit of the ink discharge flow path, and which does not pass ink in a direction reverse from a direction heading to the exit.

8. The inkjet head according to claim 7, wherein,
the bypass flow path is provided inside the ink tank, and
the first filter and the second filter are provided as one.

9. The inkjet head according to any one of claims 3 to 8, further comprising an attaching member which detachably fixes the ink tank.

10. The inkjet head according to any one of claims 1 to 9, wherein,
a cover member which covers at least a portion of the driving substrate is provided between the ink tank and the driving substrate, and
a heat dissipating member which comes into contact with the cover member and the ink tank is provided between the cover member and the ink tank.

11. The inkjet head according to any one of claims 1 to 10, wherein,
an amount of heat dissipation from one surface of the driving substrate when the driving circuit is operated is larger than the amount of heat dissipation from the other surface of the driving substrate, and
the ink tank is provided in a side of the one surface of the driving substrate.

12. An inkjet recording device including the inkjet head according to any one of claims 1 to 11.

FIG. 1

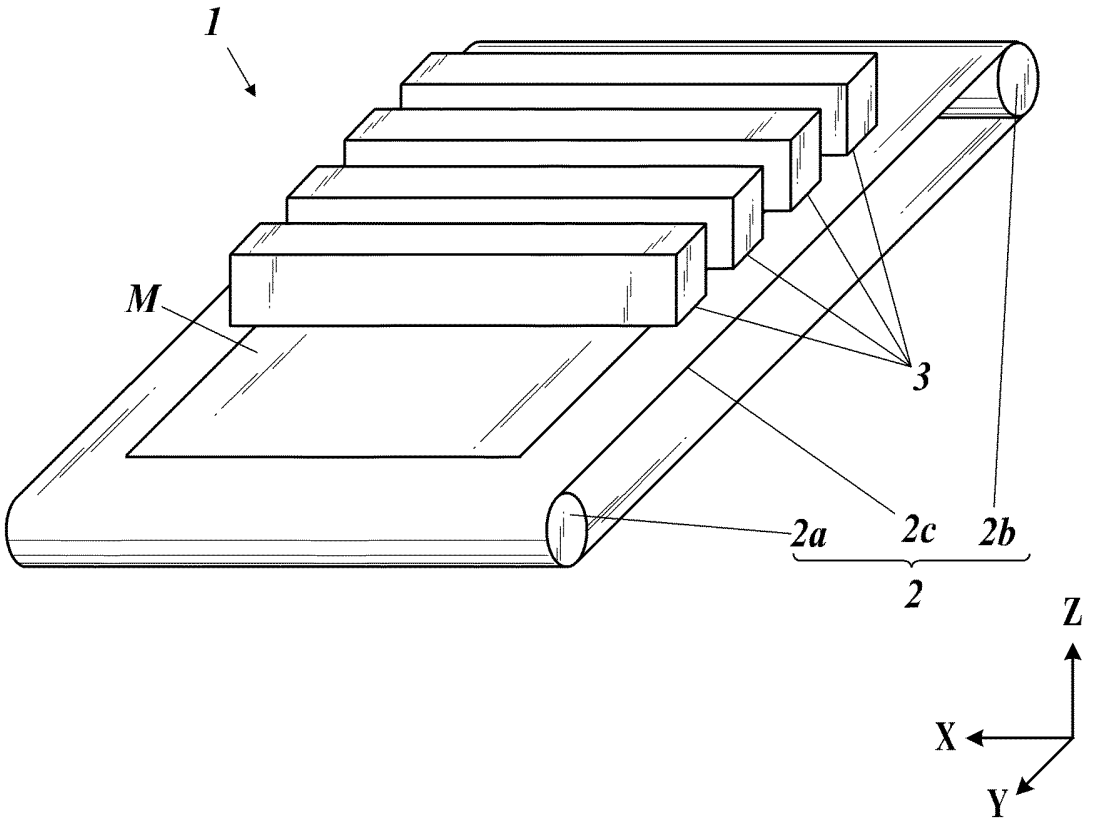
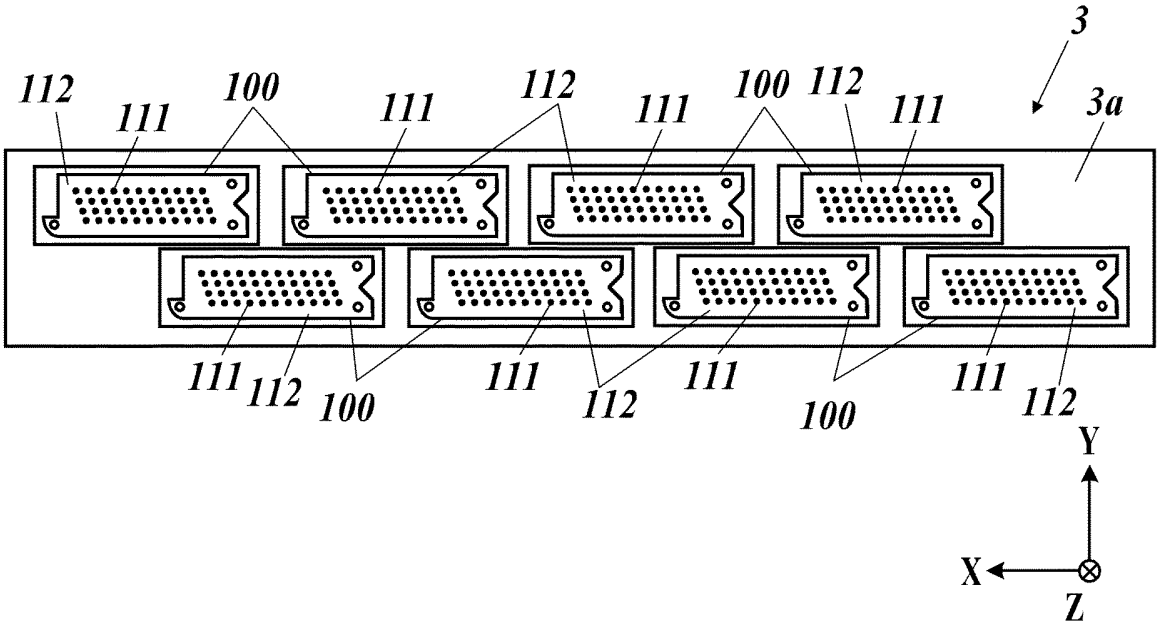

1
M
3
2a
2c
2b
2
Z
X
Y

FIG. 2


3
3a
112
111
100
111
112
111
100
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112
100
111
112
100
111
112
Y
X
Z

FIG. 3

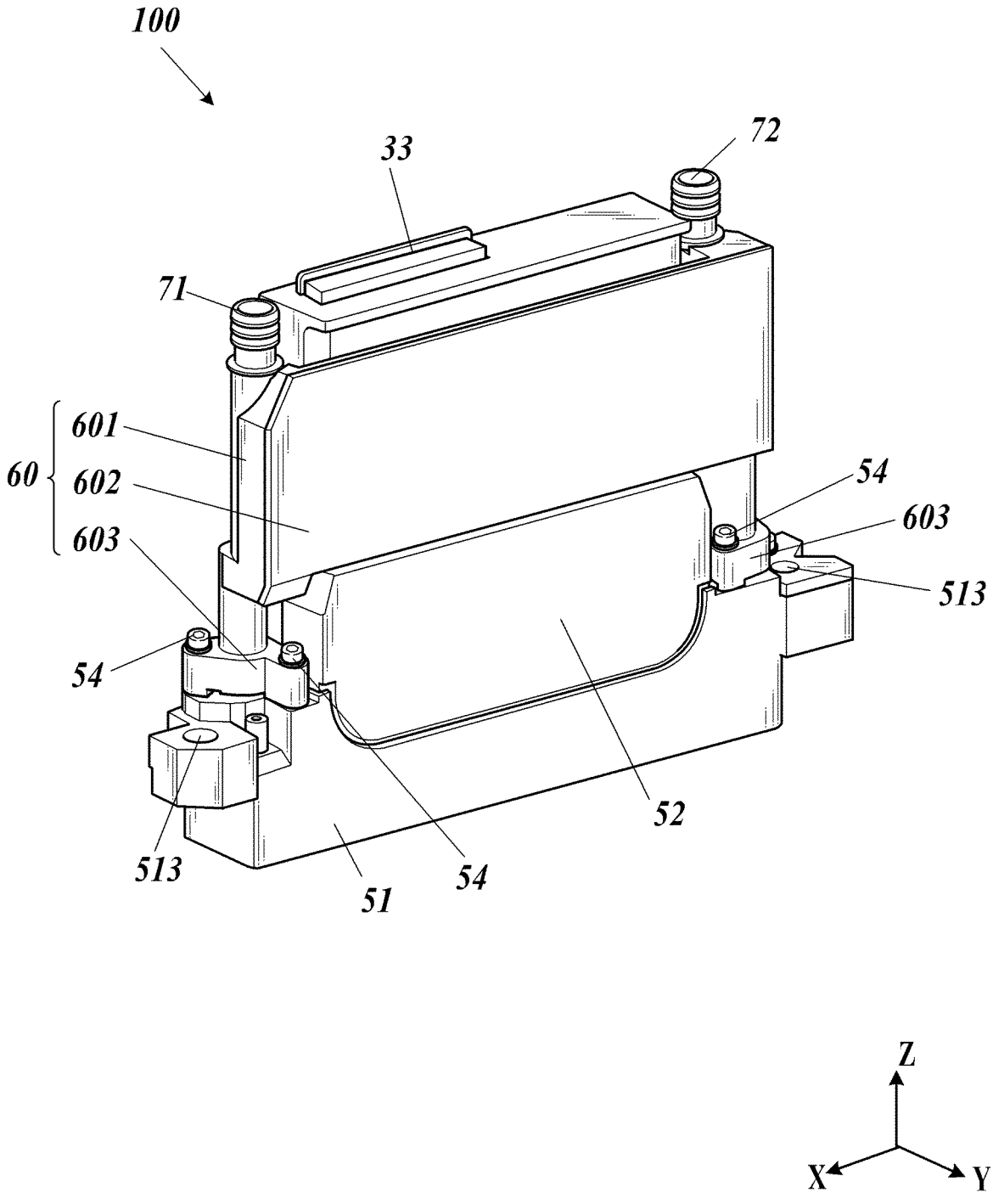


FIG. 4

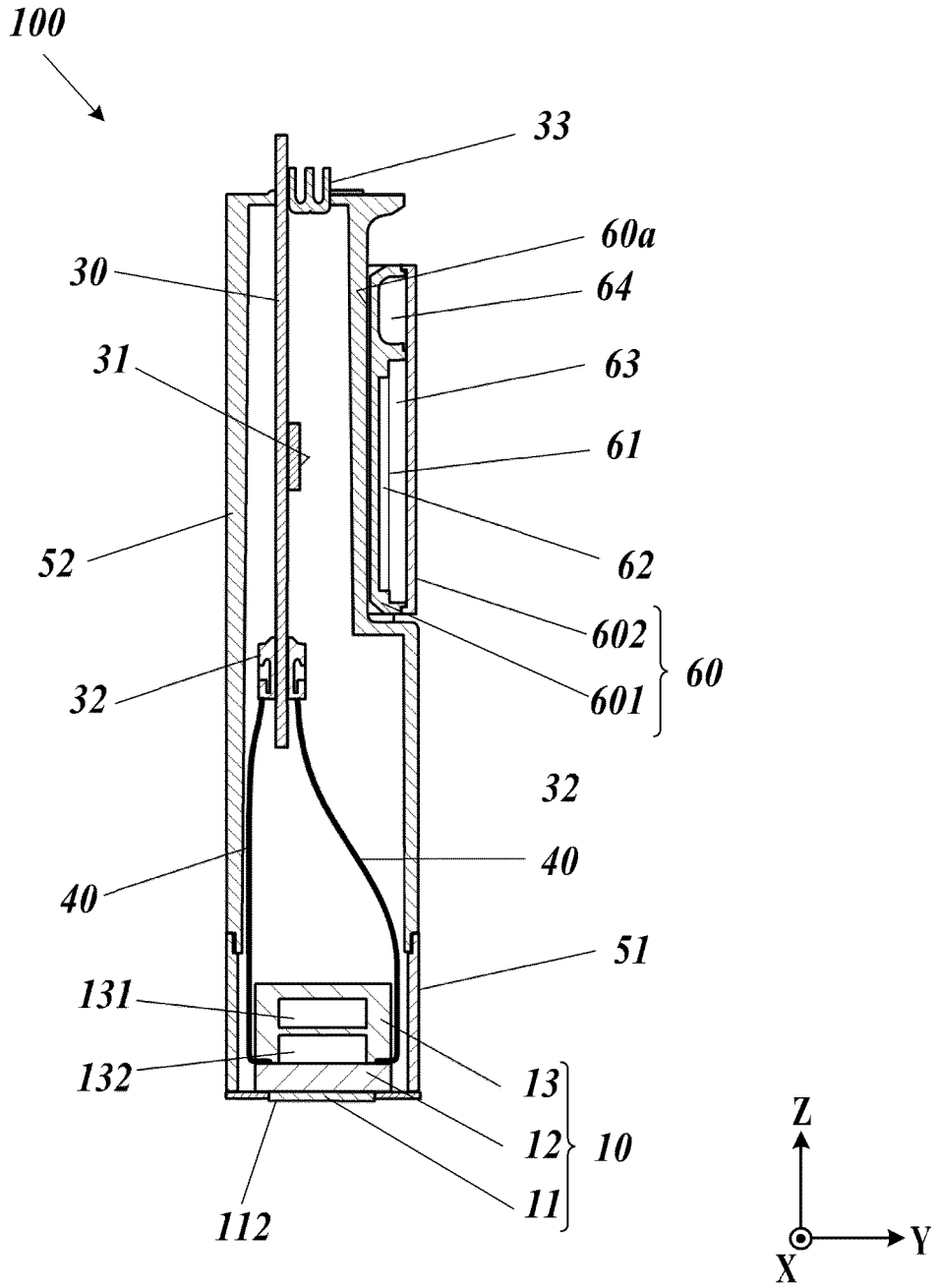

100
33
60a
30
64
31
63
61
52
62
602
60
601
32
32
40
40
51
131
13
132
12
10
11
112
Z
Y
X

FIG. 5

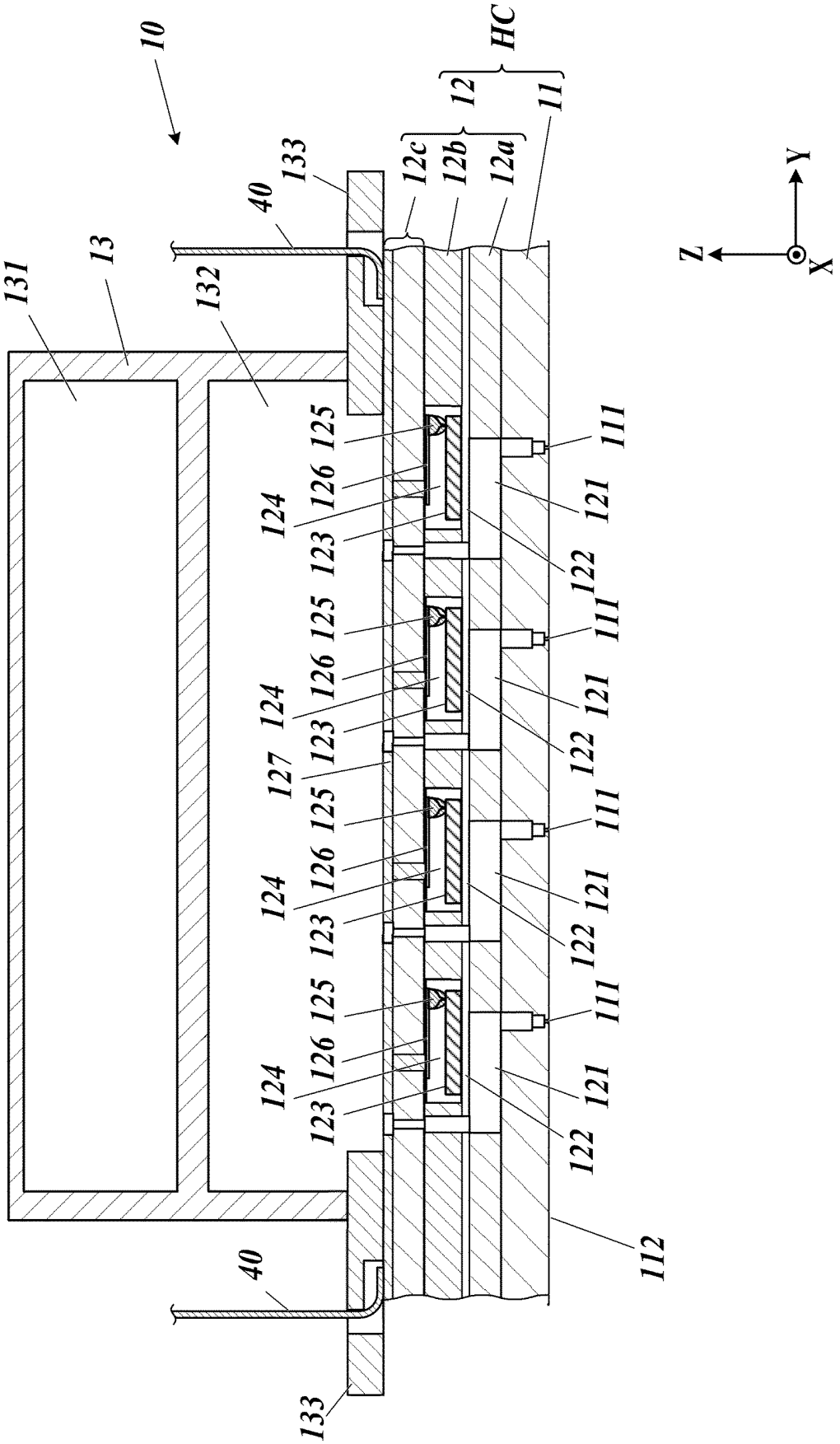
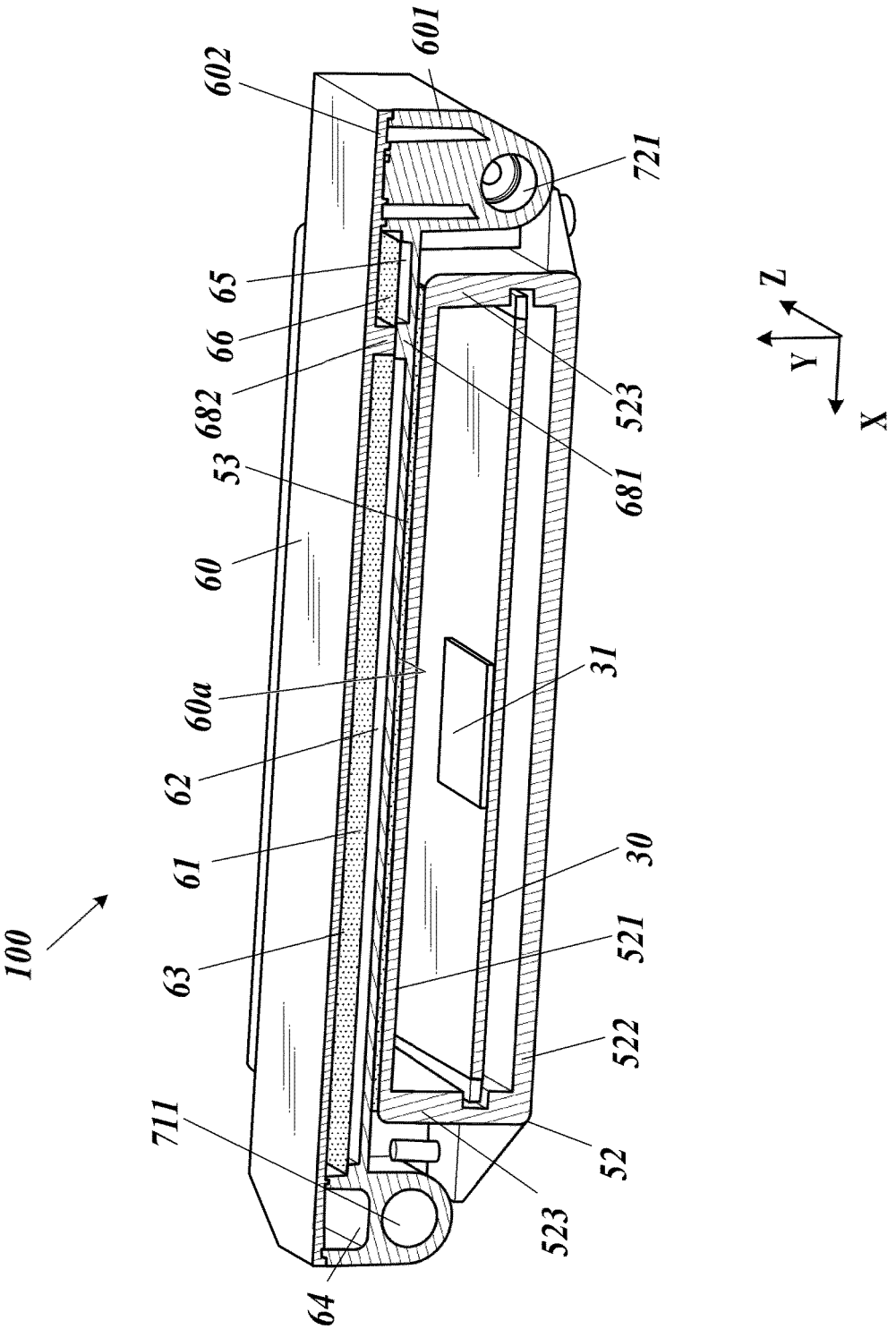

10
HC
12
11
12c
12b
12a
133
40
13
131
132
125
126
124
123
127
121
122
111
112
Y
Z
X

FIG. 6


100
601
602
721
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66
682
53
60
60a
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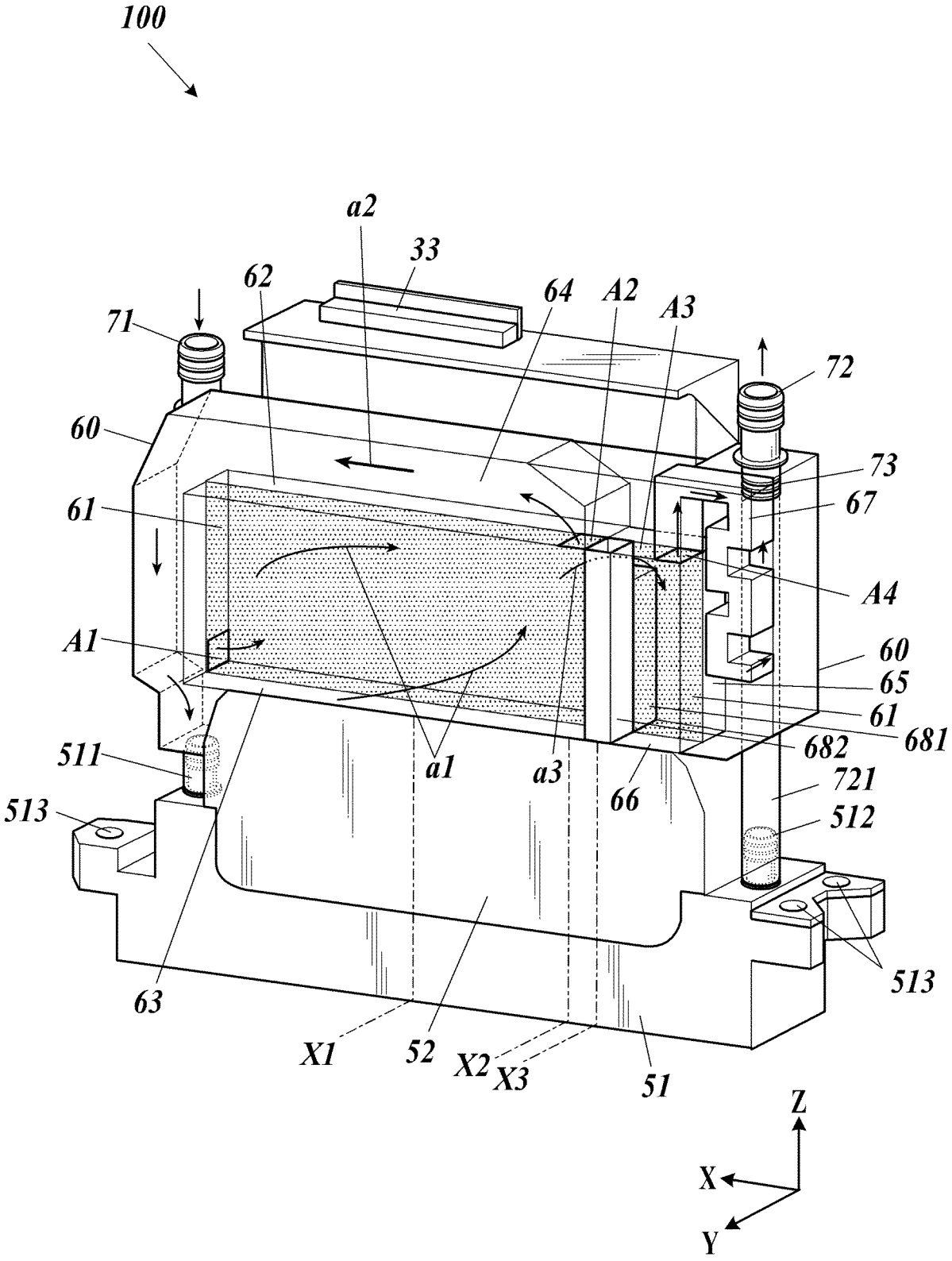
61
63
711
64
681
523
31
30
521
522
52
523
Z
Y
X

FIG. 7


100
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33
62
64
A2
A3
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60
73
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67
A4
A1
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61
681
682
511
a1
a3
66
721
513
512
513
63
X1
52
X2
X3
51
Z
X
Y

FIG. 8A

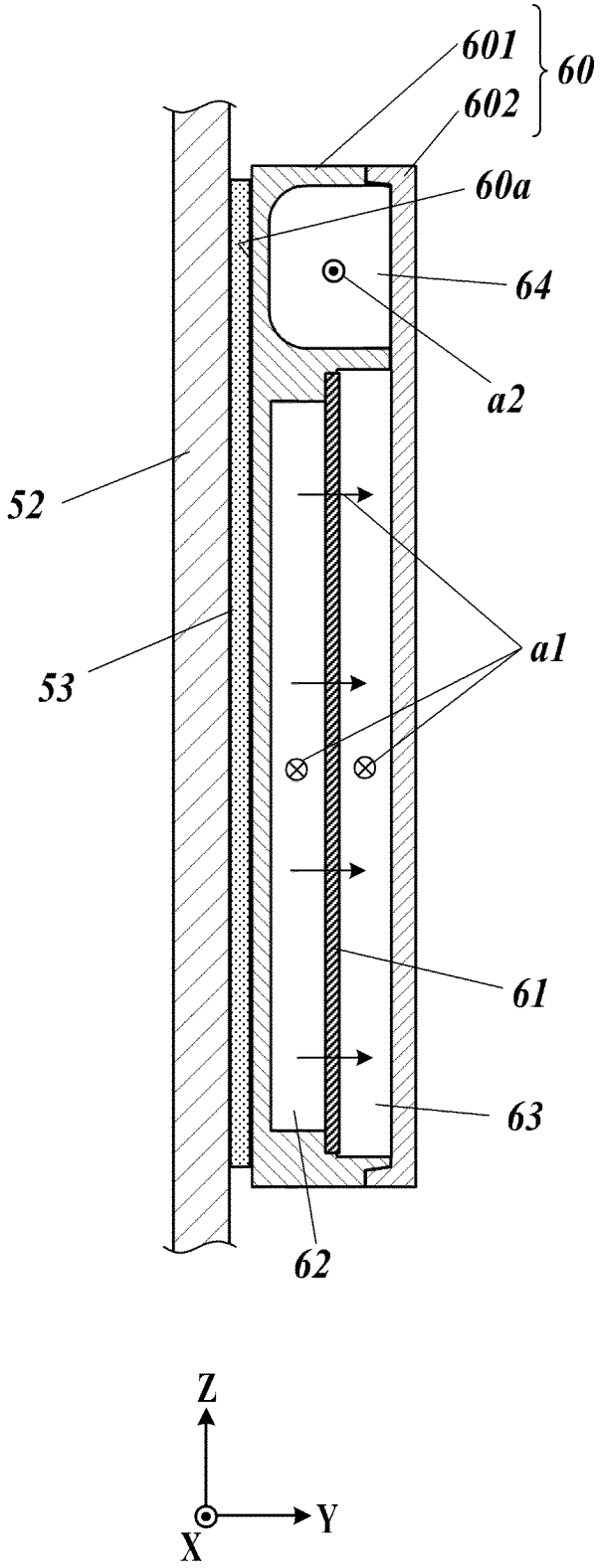


FIG. 8B

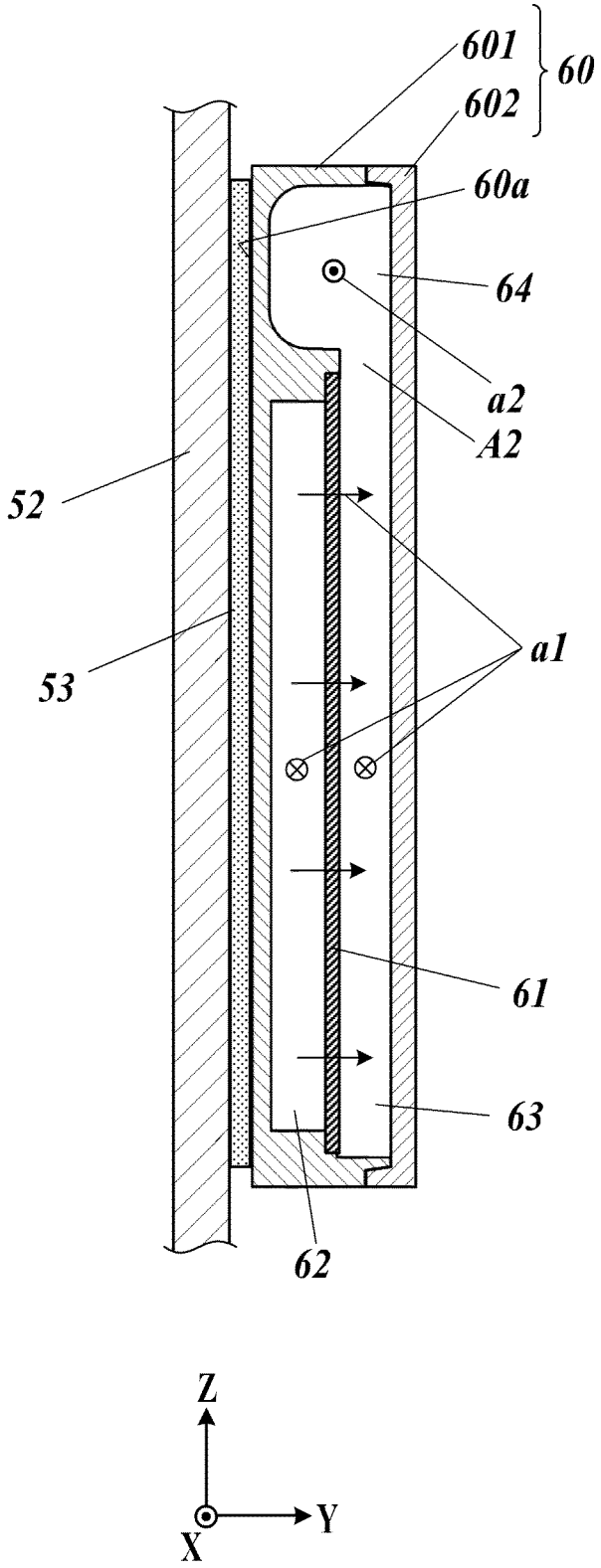


FIG. 8C

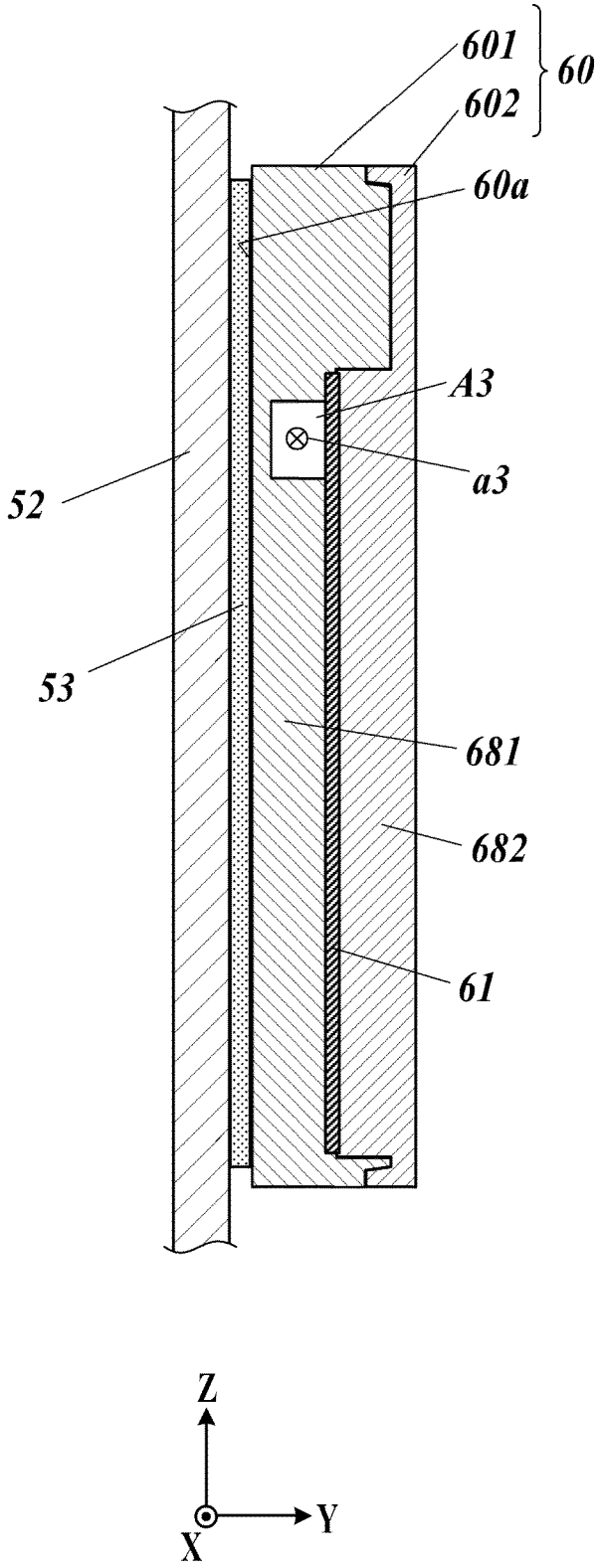


FIG. 9

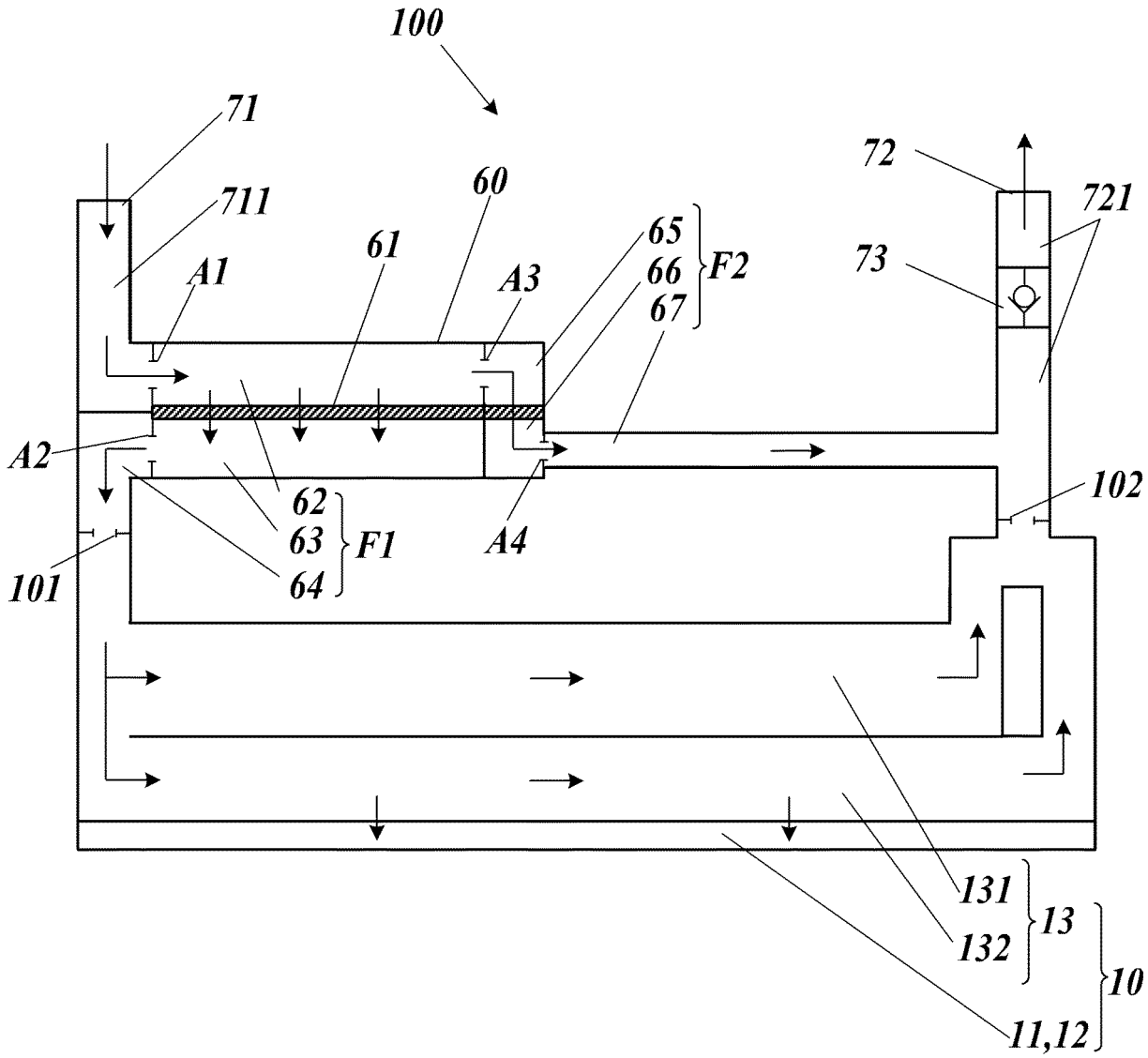

100
71
711
A1
60
61
A3
65
66
67
F2
72
721
73
A2
62
63
64
F1
A4
101
102
131
132
13
10
11,12

FIG. 10

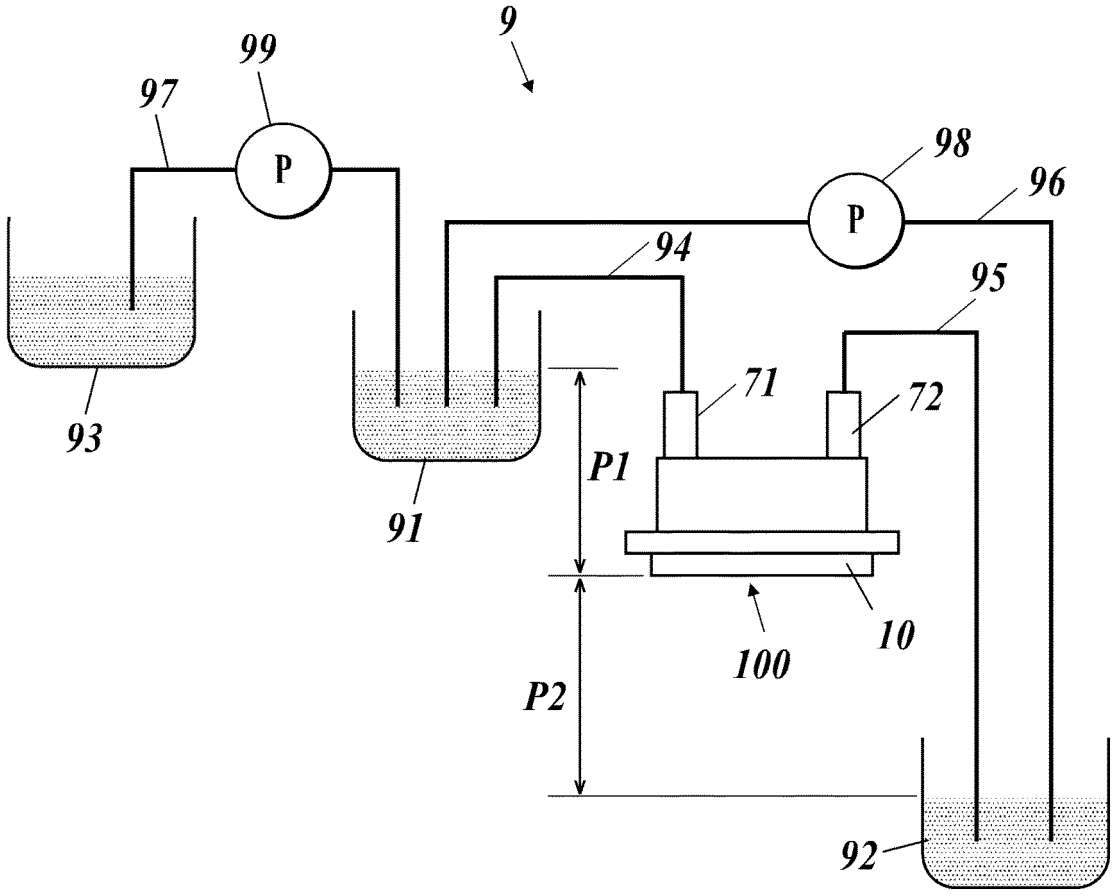


FIG. 11

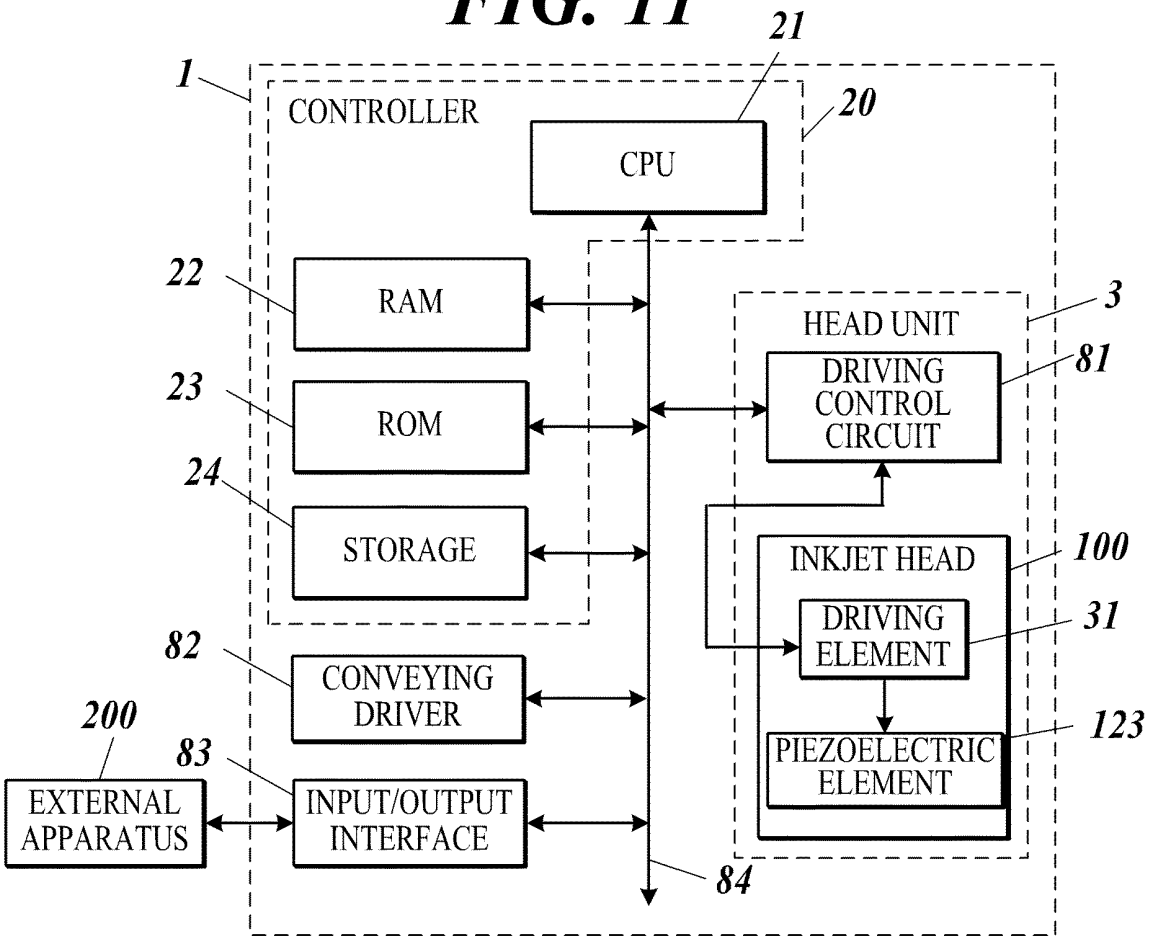
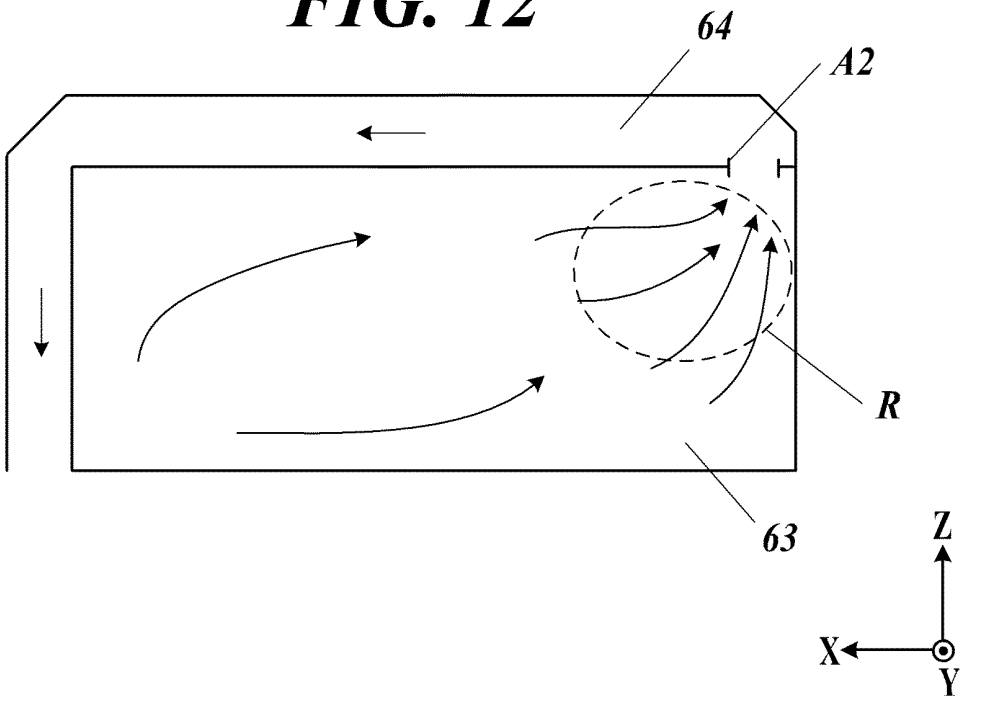

1
21
20
CONTROLLER
CPU
22
RAM
23
ROM
24
STORAGE
3
HEAD UNIT
81
DRIVING CONTROL CIRCUIT
100
INKJET HEAD
31
DRIVING ELEMENT
123
PIEZOELECTRIC ELEMENT
82
CONVEYING DRIVER
200
83
EXTERNAL APPARATUS
INPUT/OUTPUT INTERFACE
84

FIG. 12


64
A2
R
63
Z
X
Y

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/033162

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. B41J2/14(2006.01)i, B41J2/01(2006.01)i, B41J2/175(2006.01)i

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)
Int. Cl. B41J2/14, B41J2/01, B41J2/175

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 1971-2018
Registered utility model specifications of Japan 1996-2018
Published registered utility model applications of Japan 1994-2018

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 Y A	JP 2007-90627 A (BROTHER INDUSTRIES, LTD.) 12 April 2007, claims, paragraphs [0009], [0010], [0038]-[0044], fig. 1-4 (Family: none)	1, 2, 10, 12 3-6, 9, 11 7, 8
Y A	JP 8-252924 A (HITACHI KOKI CO., LTD.) 01 October 1996, paragraphs [0003]-[0009], fig. 1, 2 (Family: none)	3-6, 9 1, 2, 7, 8, 10-12
Y A	JP 2014-87983 A (SII PRINTEK INC.) 15 May 2014, claims, paragraph [0043], fig. 1 & US 2014/0118448 A1, claims, paragraph [0058], fig. 1 & GB 2509367 A1	6 1-5, 7-12
Y A	JP 2016-129169 A (CANON INC.) 14 July 2016, claims, paragraph [0048] (Family: none)	11 1-10, 12

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

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Date of the actual completion of the international search	Date of mailing of the international search report
29.10.2018	06.11.2018
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/033162

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2009/0135219 A1 (NATHAN, Roi) 28 May 2009, entire text, all drawings & WO 2007/015230 A2	1-12

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2014004767 A **[0003]**