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(54) **Inkjet head and method for leading out wiring line of inkjet head**

Tintenstrahldruckkopf und Verfahren zum Herausleiten einer Verdrahtungsleitung eines
Tintenstrahlkopfes

Tête à jet d'encre et procédé de retrait de ligne de câble de tête à jet d'encre

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Description

TECHNICAL FIELD

[0001] The present invention relates to an inkjet head, and more particularly to an inkjet head which is provided with a wiring line for electrically leading out an individual electrode arranged on one side of an ink chamber forming member to the outside of the ink chamber forming member by using a substrate provided on the one side of the ink chamber forming member.

BACKGROUND

[0002] An inkjet head gives discharge energy to an ink in an ink chamber and discharges ink drops. As means for giving the discharge energy, there have been conventionally known means using a piezoelectric element such as a PZT that is mechanically displaced by application of a voltage, means for generating air bubbles in an ink by energizing a heater arranged in an ink chamber and utilizing a breaking operation of the air bubbles, and others.

[0003] Among others, a shearing mode type inkjet head that has drive walls formed of piezoelectric elements and narrow-groove-like ink chambers alternately arranged therein, shear-deforms each drive wall by applying a voltage to a drive electrode formed on the drive wall, and discharges an ink in each ink chamber from a nozzle has an advantage that densification is easy, for example. In such shearing mode type inkjet heads, an inkjet head having an ink chamber forming member with a so-called harmonica structure in which opening portions of each inkjet chamber are arranged in a front end face and a rear end face that face each other and the ink chamber is formed into a straight type hexahedral shape has many ink chamber forming members taken from one wafer and is thus superior in productivity.

[0004] To apply a drive signal from a drive signal generation circuit to a drive electrode facing each ink chamber, it is necessary to electrically lead the drive electrode to the outside of such an ink chamber forming member having the harmonica structure and facilitate achieving electrical connection between the ink chamber forming member and an external wiring member such as an FPC.

[0005] As a technique for electrically leading the drive electrode in the ink chamber to the outside of the ink chamber forming member, techniques described in Patent Literatures 1 and 2 have been conventionally known.

[0006] In an inkjet head described in JP 2008-143167A, a first individual electrode electrically connected to a drive electrode in an ink chamber and a second individual electrode arranged at an end portion of a rear end face of the ink chamber forming member are separately provided on the rear end face, these individual electrodes are electrically connected through a wiring line having an insulator layer, a separate substrate is bonded to this rear end face, and one end of a wiring

line formed on this substrate is electrically connected to the second individual electrode, whereby the drive electrode in the ink chamber is electrically led to an end portion of the substrate.

[0007] In an inkjet head described in JP 2009-274327A, an individual electrode electrically connected to a drive electrode in an ink chamber is arranged on a rear end face of an ink chamber forming member, a separate substrate is bonded to this rear end face, wiring lines formed on this substrate are used to electrically lead the drive electrode in the ink chamber to an end portion of the drive electrode. The wiring lines on the substrate are allocated to front and back surfaces of the substrate in accordance with each ink chamber column, and the wiring line on the back surface of the substrate has one end electrically connected to the individual electrode and the other end led to the back surface side via a through electrode formed on the substrate. This substrate is larger enough to cover the substantially entire rear end face of the ink chamber forming member, and a through hole for an ink channel individually corresponding to each ink channel is formed in a region of the ink chamber corresponding to an opening portion of the ink chamber from which an ink is discharged.

[0008] US 2010/156997A discloses an inkjet head which includes an inlet channel that receives ink from an ink supply system through a via structure formed in the circuit carrying substrate. The ink flows into an ink pressure or pump chamber that is bounded on one side by a flexible diaphragm. An electromechanical piezoelectric transducer is attached to the flexible diaphragm and overlies the pressure chamber. A contact element of an interconnect structure electrically connects the electromechanical transducer to a contact pad on the circuit carrying substrate. Electrical actuation of the electromechanical transducer causes ink to flow from the pressure chamber to a drop forming nozzle or orifice, from which an ink drop is emitted toward a receiver medium. The via structure is configured to conduct electrical signals to the electromechanical transducer, and also to convey liquid from one side of the circuit carrying substrate to the other side. For this purpose the via structure comprises an electrically conductive layer disposed in an opening in the circuit carrying substrate so as to extend from a first side to second side of the circuit carrying substrate.

SUMMARY OF INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0009] In recent years, to enable high-definition recording with the use of an inkjet head, further densification of an ink chamber has been demanded, this demand for densification produces a new problem in the conventional inkjet head.

[0010] That is, in the inkjet head described in JP 2008-143167A, since wiring lines with an insulator layer must be provided on the rear end face of the ink chamber

forming member, the wiring lines with the insulator layer must be also formed with high density as density of the ink chamber increases, and an operation of forming the wiring lines with the insulator layer is complicated.

[0011] On the other hand, according to the inkjet head described in JP 2009-274327A, the wiring lines having the insulator layer do not have to be formed on the rear end face of the ink chamber forming member, the wiring lines for each column of the ink chambers are formed on both sides of the substrate, and hence there is an advantage that the wiring lines are hard to be short-circuited even if density of the ink chamber is increased. However, since a dedicated through hole must be provided to lead the wiring lines on the front surface of the substrate to the back surface of the same and the through electrode must be formed by using this through hole, an operation of enabling penetration of the wiring lines is complicated, the number of through holes increases as the density of the ink chamber rises, and hence there is a problem that an increase in number of through holes leads to a reduction in strength of the substrate.

[0012] Therefore, it is an object of the present invention to provide an inkjet head according to claim 1.

[0013] Other objects of the present invention will become apparent from the following description.

PROBLEM TO BE SOLVED BY THE INVENTION

[0014] The present invention provides an inkjet head with the features of claim 1. Preferred embodiments of the inkjet head are defined in the dependent claims.

EFFECT OF THE INVENTION

[0015] According to the present invention, it is possible to provide the inkjet head that enables electrically leading the individual electrode corresponding to the ink chamber provided in the ink chamber forming member to the outside of the ink chamber forming member by using the substrate bonded to the ink chamber forming member without lowering strength of the substrate.

BRIEF DESCRIPTION OF DRAWINGS

[0016]

FIG. 1 is a horizontal exploded view showing a cross section of an inkjet head for explaining the concept of the present invention;

FIGS. 2(a) and (b) are cross-sectional views of a substrate showing a mode that wiring lines are led back to a front surface;

FIG. 3 is an exploded perspective view of an inkjet head according to a first embodiment;

FIG. 4 is a view showing ink chambers of an ink chamber forming member from a rear end face side;

FIG. 5 is a view showing a state that the inkjet head depicted in FIG. 3 is seen from a back surface side

of a substrate;

FIG. 6 is a horizontal exploded view showing a cross section taken along a line (vi)-(vi) in FIG. 5;

FIG. 7 is a horizontal exploded view showing a cross section taken along a line (vii)-(vii) in FIG. 5;

FIG. 8 is an exploded perspective view of an inkjet head according to a second embodiment;

FIG. 9 is a view showing a state that the inkjet head depicted in FIG. 8 is seen from a back surface side of a substrate;

FIG. 10 is a horizontal exploded view showing a cross section taken along a line (x)-(x) in FIG. 9;

FIG. 11 is an exploded perspective view of an inkjet head according to a third embodiment;

FIG. 12 is a view showing a state that the inkjet head depicted in FIG. 11 is seen from a back surface side of a substrate;

FIG. 13 is a horizontal exploded view showing a cross section taken along a line (xiii)-(xiii) in FIG. 12;

FIG. 14 is an exploded perspective view of an inkjet head according to a fourth embodiment;

FIG. 15 is a view showing a state that the inkjet head depicted in FIG. 14 is seen from a back surface side of a substrate; and

FIG. 16 is a partial cross-sectional view of an inkjet head according to a fifth embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] Embodiments according to the present invention will now be described hereinafter.

(Description on Outline of Present Invention)

[0018] Before explaining specific embodiments according to the present invention, an outline of the present invention will be described.

[0019] FIG. 1 is a horizontal exploded cross-sectional view showing an example of an inkjet head for explaining an outline of an inkjet head and a method for leading out a wiring line of an inkjet head according to the present invention.

[0020] In the drawing, reference numeral 1 denotes an ink chamber forming member; 2, a nozzle plate; and 3, a substrate.

[0021] The ink chamber forming member 1 has an ink chamber 11 from which an ink is discharged. Here, an example where opening portions 11a and 11b of the ink chamber 11 are arranged on a front end face 1a and a rear end face 1b of the ink chamber forming member 1 is shown. One opening portion 11a is an opening portion on an outlet side that communicates with a nozzle 21 formed in the nozzle plate 2 and allows the ink in the ink chamber 11 to be discharged from the nozzle 21. The other opening portion 11b is an opening portion on an inlet side and also an ink inlet that allows the ink to enter the ink chamber 11.

[0022] The ink chamber forming member 1 has an in-

dividual electrode 12 provided on the rear end face 1b. Therefore, the ink chamber forming member 1 has the opening portion 11b as the ink inlet and the individual electrode 12 arranged on the rear end face 1b that is one side thereof. In the ink chamber forming member 1, a voltage for providing the ink in the ink chamber 11 with discharge energy is applied to this individual electrode 12.

[0023] The substrate 3 has a through hole 31 (a first through hole) formed at a position corresponding to the opening portion 11b of the ink chamber 11 and also has a front face wiring portion 32a of a wiring line 32 formed on a front surface 3a that is a surface on the ink chamber forming member 1 side.

[0024] The substrate 3 has its front surface 3a arranged and provided on the rear end face 1b side of the ink chamber forming member 1. As a result, the opening portion 11b as the ink inlet of the ink chamber forming member 1 communicates with the through hole 31 in the substrate 3 and forms an ink channel through which the ink is supplied to the ink chamber 11, and the front surface wiring portion 32a of the wiring line 32 is electrically connected with the individual electrode 12.

[0025] This wiring line 32 is led out from the front surface 3a of the substrate 3 to a back surface 3b, which is a surface on the opposite side of the ink chamber forming member 1, through the substrate 3, and the wiring line 32 in the present invention is led out to the back surface 3b of the substrate 3 via the through hole 31 constituting the ink channel by utilizing this through hole 31. Reference numeral 32b denotes a back surface wiring portion of the wiring line 32 led out to the back surface 3b via the through hole 31.

[0026] According to the present invention, as described above, since the wiring line 32 that is electrically connected with the individual electrode 12 arranged on the end face 1b of the ink chamber forming member 1 is led out to the back surface 3b of the substrate 3 via the through hole 31 formed in the substrate 3 to supply the ink to the ink chamber 11, an additional through hole configured to pull out this wiring line 32 to the back surface 3b does not have to be separately provided. Therefore, the number of steps for machining through holes in the substrate 3 can be reduced, and the individual electrode 12 can be electrically led to the outside of the ink chamber forming member 1 without causing a reduction in strength of the substrate 3 due to an increase in number of through holes.

[0027] To insert the wiring line 32 through the through hole 31, if the ink can be circulated, the front surface wiring portion 32a and the back surface wiring portion 32b may be electrically connected via the through hole 31 by using a metal wire or the like. However, as shown in the drawing, it is preferable to form the wiring line 32 along an inner peripheral surface 31a of the first through hole 31 and an inner peripheral surface 32a of a second through hole 34 in a tight contact manner by forming the wiring line 32 based on, e.g., an evaporation method, a

sputtering method, or a plating method, and lead out the wiring line 32 to the back surface 3b of the substrate 3 through the inner peripheral surface 31a. In particular, using both the evaporation method and an electrolytic plating method or using both the sputtering method and the electrolytic plating method is notably preferable since a metal film with a uniform thickness can be formed over the full length of the through hole 31.

[0028] Reference numeral 32c in FIG. 1 denotes a through hole wiring portion that is formed along the inner peripheral surface 31a of the through hole 31 and connects the front surface wiring portion 32a with the back surface wiring portion 32b.

[0029] As a result, the through hole 31 can function as an ink channel without substantially changing its shape, and hence a flow of the ink as the ink channel is not obstructed. Moreover, since the through hole wiring portion 32c provided along the inner peripheral surface 31a of the through hole 31 can be made of the same material with substantially the same thickness as the front surface wiring portion 32a and the back surface wiring portion 32b formed on the front surface 3a and the back surface 3b of the substrate 3, electric resistance is not increased in a region of the of the through hole wiring portion 32c.

[0030] A material used for the substrate 3 is not restricted in particular as long as it can insulate the wiring line 32, there are glass, silicon, ceramics, plastic, and others. Among others, using a glass substrate is preferable since a dimension change due to heat is hardly observed, its price is low, and processing is easy.

[0031] The substrate 3 is not restricted to a single-layer substrate, and it may be formed by laminating a plurality of layers 3. The plurality of respective layers may be all made of the same material or made of different materials.

[0032] It is satisfactory to provide the substrate 3 on one side of the ink chamber forming member 1 so that formation of the ink channel and electric connection with the individual electrode 12 can be achieved, and the substrate 3 is not restricted to bonding to the ink chamber forming member 1 through an adhesive alone. For example, additional intermediate members that connect the opening portion 11b with the through hole 31 or electrically connect the individual electrode 12 with the wiring line 32 may be interposed, respectively.

[0033] The through hole 31 forming the ink channel may have the same opening area as an opening area of the opening portion 11b that serves as the ink inlet of the ink chamber 11 or may have a different opening area. If the through hole 31 has a different opening area, the through hole 31 may be larger than the opening portion 11b or smaller than the opening portion 11b. The through hole 31 smaller than the opening portion 11b is allowed to function as a restriction hole that narrows the ink channel. Further, if the ink can be circulated, the center of the through hole 31 may be arranged to deviate from the center of the opening portion 11b.

[0034] An opening shape of the through hole 31 is not restricted in particular, and it may be an arbitrary shape

such as a square shape or a circular shape. Furthermore, the cross-sectional shape is not restricted to a straight shape formed along a flow direction of the ink as shown in the drawing, and it may be a tapered shape in which a diameter is expanded on an inlet side of the ink channel (a right-hand side in FIG. 1).

[0035] The wiring line 32 is electrically connected to a non-illustrated external wiring member in order to apply a drive signal of a predetermined voltage from a non-illustrated drive signal generation circuit to the individual electrode 12. It is preferable for the other end side of the wiring line 32 to be drawn to the end portion of the substrate 3 for connection with this external wiring member. Here, since the substrate 3 having an area larger than the rear end face 1b of the ink chamber forming member 1 is used, at least one end portion of the substrate 3 has a projecting portion 33 projecting toward a lateral side (a lower side in the drawing) of the ink chamber forming member 1, and a front surface 3a side or a back surface 3b side of this projecting portion 33 forms a connecting region with respect to the external wiring member.

[0036] In FIG. 1, the other end side of the wiring line 32 extends to the back surface 3b side of the projecting portion 33 and is arranged on this projecting portion 33. Since the large connecting region can be assured by forming the connecting region with respect to an external wiring member with the use of the projecting portion 33 that projects to the lateral side of the ink chamber forming member 1 in this manner, a connecting operation for the external wiring member can be easily performed.

[0037] The wiring line 32 led out to the back surface 3b of the substrate can be again pulled back to the front surface 3a of the substrate 3. As a result, a degree of freedom of a wiring route can be further improved.

[0038] FIGS. 2 show the substrate 3 in a mode that the wiring line 32 is pulled back to the front surface 3a. Since portions denoted by the same reference numerals as those in FIG. 1 represent portions having the same structures, different structures alone will be described here, and the description of FIG. 1 will be cited for any other explanation, thereby omitting the description.

[0039] FIG. 2(a) shows a mode that a through hole 34 (a second through hole) different from the through hole 31 constituting the ink channel is formed in the projecting portion 33 of the substrate 3. The wiring line 32 led to the back surface 3b of the substrate 3 runs along an inner peripheral surface 34a of the other through hole 34 and is pulled back from the back surface 3b to the front surface 3a, whereby a second surface wiring portion 32d is formed on the front surface 3a. This second front surface wiring portion 32c is arranged on the front surface 3a side of the projecting portion 33.

[0040] In this mode, although the through hole 34 must be provided separately from the through hole 31 constituting the ink channel, the number of machining the through holes in the substrate 3 can be reduced since an additional through hole used for leading out the wiring line 32 from the front surface 3a to the back surface 3b

of the substrate 3 is not required, and hence a reduction in strength of the substrate 3 can be suppressed.

[0041] At the time of allowing the wiring line 32 to penetrate through the substrate 3 to be pulled back from the back surface 3b to the front surface 3a, a through electrode made of a conductive material can be used in the through hole like the prior art. Furthermore, the back surface wiring portion 32b and the second front surface wiring portion 32d can be electrically connected with the use of a metal wire or the like via the through hole 34. However, like the through hole wiring portion 32c in the through hole 31, when a through hole wiring portion 32e is formed by allowing it to run along the inner peripheral surface 34a of the through hole 34, an operation for allowing penetration of the wiring line 32 is facilitated, and electrical resistance is not increased in a region of the through hole wiring portion 32e.

[0042] Moreover, the other end side of the wiring line 32 is arranged on the front surface 3a side of the projecting portion 33, electrical connection with an external wiring member can be achieved on the front surface 3a side of this substrate 3. Although an external wiring member connecting operation is performed after providing the substrate 3 on the end face 1b side of the ink chamber forming member 1, the external wiring member can be connected from the upper side of the projecting portion 3a, i.e., from the ink chamber forming member 1 side in a state that the back surface 3b side of the substrate 3 which serves as a flat surface is mounted on a work table, and hence the connecting operation can be performed in a stable state.

[0043] FIG. 2(b) shows a mode that the through hole 34 is not used at the time of pulling back the wiring line 32 to the front surface 3a.

[0044] That is, the wiring line 32 led out to the back surface 3b of the substrate extends from the through hole 31 toward the end portion of the substrate 3 on the lower side in the drawing. Additionally, the wiring line 32 runs on the end face 3c of the substrate 3 on the projecting portion 33 side and is pulled back to the front surface 3a, thereby forming the second surface wiring portion 32d of the front surface 3a. The second front surface wiring portion 32d extends toward the upper side from the end face 3c and is arranged on the front surface 3a side of the projecting portion 33.

[0045] In this mode, even though the substrate 3 is configured in such a manner that the wiring line 32 is again pulled back to the front surface 3a, the through hole 34 configured to again pull back the wiring line 32 to the front surface 3a of the substrate 3 is not required. Therefore, the number of machining through holes in the substrate 3 can be reduced, and a reduction in strength of the substrate 3 can be suppressed.

[0046] Further, since the other end side of the wiring line 32 is arranged on the front surface 3a side of the projecting portion 33, the external wiring member connecting operation can be performed in a stable state.

[0047] A specific embodiment of the inkjet head to

which the present invention is applied will now be described. To facilitate understanding of the embodiment, like reference numerals denote parts having like configurations corresponding to FIG. 1 and FIG. 2.

(First Embodiment)

[0048] FIG. 3 is an exploded perspective view of an inkjet head according to a first embodiment, FIG. 4 is a view showing an ink chamber of an ink chamber forming member from a rear end face side, FIG. 5 is a view showing the inkjet head from a back surface side of a substrate, FIG. 6 is a horizontal exploded view of a cross section taken along a line (vi)-(vi) in FIG. 5, and FIG. 7 is a horizontal exploded view showing a cross section taken along a line (vii)-(vii) in FIG. 5.

[0049] This embodiment shows an example of the inkjet head adopting the wiring lead-out structure depicted in FIG. 2.

[0050] In this inkjet head H1, a manifold member 4 that stores an ink that is supplied to each ink chamber 11 in an ink chamber forming member 1 is bonded to a back surface 3b of a substrate 3, and an FPC 5 is bonded to a front surface 3a of the substrate 3. The FPC 5 is an example of an external wiring member.

[0051] It is to be noted that FIG. 3 shows a horizontally developed state between the ink chamber forming member 1 and the substrate 3.

[0052] In the ink chamber forming member 1, a plurality of drive walls 13 each of which is formed of a piezoelectric element are aligned, and the ink chambers 11 each of which is formed between a pair of drive walls 13 and 13 adjacent to each other and the drive walls 13 are alternately arranged. Here, a column of the ink chambers 11 is formed by aligning the plurality of ink chambers 11. The number of the ink chambers 11 in each column is not restricted at all. Here, there is provided an illustrative example that two columns of the ink chambers 11, which are a column A as a first column and a column B as a second column are arranged in parallel. Further, although each drive wall 13 is formed of a piezoelectric element, providing the piezoelectric element on at least part of the drive wall 13 can suffice.

[0053] As shown in FIG. 6 and FIG. 7, opening portions 11a and 11b of each ink chamber 11 are arranged in a front end face 1a and a rear end face 1b of the ink chamber forming member 1. One opening portion 11a is an opening portion on an ink outlet side communicating with each nozzle 21, and the other opening portion 11b is an ink inlet from which the ink is supplied. Each ink chamber 11 is formed into a straight shape extending from the opening portion 11b as the ink inlet arranged in the rear end face 1b to the opening portion 11a on the outlet side arranged in the front end face 1a.

[0054] As shown in FIG. 4, a drive electrode 14 formed of a metal film of Ni, Au, Cu, Al, or the like is formed on a front surface of each drive wall 13 facing each ink chamber 11. The drive electrodes 14 are formed to be con-

nected from the entire front surfaces of the respective drive walls 13 and 13 facing the ink chambers 11 to at least any one wall surface (here, a wall surface on the lower side in FIG. 4) adjacent to these drive walls 13 and 13.

[0055] This ink chamber forming member 1 is a so-called harmonica type ink chamber forming member formed of a hexahedron, and each drive wall 13 is operated to deform when a drive signal of a predetermined voltage is applied from a non-illustrate drive signal generation circuit (a drive IC) to each of the drive electrodes 14 on both surfaces of each drive wall 13. When this drive wall 13 is operated to deform, a capacity of the ink chamber 11 varies, a pressure for discharging the ink supplied to the inside of the ink chamber 11 is thereby changed, and the ink is discharged from each nozzle 21.

[0056] Here, in this ink chamber forming member 1, an end face on a side where the nozzles 21 are arranged and from which the ink is discharged is defined as a "front end face", and an end face opposite to this end face is defined as a "rear end face". Additionally, a direction that is parallel to the front end face 1a and the rear end face 1b of the ink chamber forming member 1 and also a direction away from the ink chamber forming member 1 is defined as a "lateral side" of the ink chamber forming member.

[0057] All the ink chambers 11 in each column in the ink chamber forming member 1 described in this embodiment are ink chambers that discharge the ink when the ink is supplied thereto.

[0058] Individual electrodes 12 electrically connected with the drive electrodes 14 in the respective ink chambers 11 in the column A and individual electrodes 12 electrically connected with the drive electrodes 14 in the respective ink chambers 11 in the column B are individually led out on the rear end face 1b, which is one side of the ink chamber forming member 1, via the opening portions 11b of the respective ink chambers 11 in accordance with each of the ink chambers 11. In this ink chamber forming member 1, a voltage used for providing the ink in the ink chambers 11 with discharge energy is first applied to the individual electrodes 12 and transmitted to the respective drive electrodes 14 via the individual electrodes 12.

[0059] The other end of each individual electrode 12 extends from each opening portion 11b in the same direction. Here, it extends toward the lower side in the drawing that is a direction orthogonal to a column direction of the ink chambers 11, but each of the individual electrodes 12 of the ink chambers 11 in the column A stops just before the column B without intersecting with the column B.

[0060] The substrate 3 has a larger area than the rear end face 1b of the ink chamber forming member 1 and is bonded to the rear end face 1b of the ink chamber forming member 1 through an adhesive. A projecting portion 33 of the substrate 3 that largely projects toward the lower lateral side of the ink chamber forming member 1 in the drawing forms a connecting region with respect to the FPC 5.

[0061] Through holes 31 (first through holes) that form ink channels through which the ink in a later-described common ink chamber 41 of the manifold member 4 is supplied to the respective ink chambers 11 in the column A through the opening portions 11b and through holes 35 forming ink channels through which the ink is supplied to the respective ink chambers 11 in the column B are individually formed in the substrate 3 at positions corresponding to the opening portions 11b of the respective ink chambers 11 in the rear end face 1b of the ink chamber forming member 1 in accordance with each of the ink chambers 11.

[0062] Column B wiring lines 36 electrically connected with the individual electrodes 12 in the column B of the ink chamber forming member 1 are individually formed on the front surface 3a of the substrate 3. Ends of the column B wiring lines 36 on one side are arranged near the through holes 35, and ends of the same on the other side extend to the end portion of the substrate 3 on the lower side in the drawing and aligned on the front surface 3a side of the projecting portion 33 serving as the connection region with respect to the FPC 5 at the same pitch as that of the ink chambers 11 in the column B.

[0063] Further, column A wiring lines 32 electrically connected with the individual electrodes 12 in the column A of the ink chamber forming member 1 are likewise individually formed on the front surface 3a. Each column A wiring line 32 corresponds to a "wiring line" led out to the surface on the opposite side of the ink chamber forming member in the present invention.

[0064] A first front surface wiring portion 32a of each column A wiring line 32, which is provided on the front surface 3a of the substrate 3 to be electrically connected with each individual electrode 12, is arranged near each through hole 31. When the substrate 3 is bonded to the rear end face 1b of the ink chamber forming member 1, each column A wiring line 32 is electrically connected with the individual electrode 12 through this first surface wiring portion 32a. As a result, since the individual electrode 12 and the column A wiring line 32 can be electrically connected between the rear end face 1b of the ink chamber forming member 1 and the front surface 3a of the substrate 3 that face each other, an operation for electrical connection is easy.

[0065] Each column A wiring line 32 runs along an inner peripheral surface 31a of the through hole 31, is led out to the back surface 3b, and forms a back surface wiring portion 32b. The back surface wiring portion 32b further extends toward the projecting portion 33 of the substrate 3 from the through hole 31 and runs between the through holes 35 and 35 aligned in accordance with the ink chambers 11 in the column B, thereby straddling the column B on the back surface 3b.

[0066] As described above, since the column A wiring lines 32 do not cross the ink chambers 11 in the column B or the drive walls 13 on the front surface 3a of the substrate 3 that is in contact with the rear end face 1b of the ink chamber forming member 1, there is no fear of a

short circuit with the drive electrodes 14 exposed from the opening portion 11b of the respective ink chambers 11 in the column B or the individual electrodes 12. As a result, even in case of the ink chamber forming member 1 that has high density due to an increase in number of the ink chambers 11 or in number of columns of the ink chamber forming member 1, the respective drive electrodes 14 can be electrically led out to the end portion of the substrate 3 through the individual electrodes 12 without concern about a short circuit.

[0067] The through holes 34 as the second through holes are individually formed in the projecting portion 33 that is placed on the lower side of a bonding region 30 of the ink chamber forming member 1 to be equal with the through holes 31 in number and pitch. The back surface wiring portion 32b of each column A wiring line 32 extends from the through hole 31 to the corresponding through hole 34, runs along the inner peripheral surfaces 34a of the through holes 34, is pulled back to the front surface 3a of the substrate 3, and forms the second front surface wiring portion 32d.

[0068] The second front surface wiring portions 32d extend to the end portion of the substrate 3 on the lower side of the drawing which is an opposite direction of a direction extending from the through holes 34 toward the through holes 31, and they are aligned on the front surface 3a side of the projecting portion 33 as the connecting region with respect to the FPC 5 at the same pitch as that of the ink chambers 11 in the column A. Therefore, on the projecting portion 33, the second front surface wiring portions 32d of the column A wiring lines 32 and the column B wiring lines 36 are alternately aligned. Therefore, on the front surface 3a side of this projecting portion 33, an operation for connecting one FPC 5 with the column A wiring lines 32 and the column B wiring lines 36 can be easily performed in a stable state.

[0069] The manifold member 4 is an example of ink supplying means for supplying the ink to the respective ink chambers 11 through the first through holes 31 and the through holes 35, and it is formed into an opened box shape having one surface large enough to surround all the ink chambers 11 formed in the ink chamber forming member 1 and bonded to the back surface 3b of the substrate 3 through an adhesive. The inside of the manifold member 4 serves as a common ink chamber 41 that stores the ink that is supplied to the respective ink chambers 11 in the column A and the column B in common, and the ink in this common ink chamber 41 is supplied to the respective ink chambers 11 through the respective through holes 31 and 35 in the substrate 3 and the respective opening portions 11b as the ink inlets.

[0070] Here, although the manifold member 4 surrounds all of the respective through holes 31 and 35 of the substrate 3, it is formed with such a size as that the through holes 34 are not surrounded. Therefore, the through holes 34 of the substrate 3 are arranged outside the manifold member 4 bonded to the substrate 3, and the ink in the common ink chamber 41 does not leak from

the through holes 34.

[0071] The FPC 5 is connected to the projecting portion 33 of the substrate 3 through an anisotropic conductive film or the like and applies a drive signal of a predetermined voltage from a non-illustrated drive signal generation circuit to each of the column A wiring lines 32 and the column B wiring lines 36 aligned on the projecting portion 33. The drive signal applied to each of the column A wiring lines 32 and the column B wiring lines 36 is transmitted through each of the column A wiring lines 32 and the column B wiring lines 36, and applied to the drive electrode 14 in each ink chamber 11 through each individual electrode 12 of the ink chamber forming member 1, thereby deforming each drive wall 13. The drive IC may be mounted on the FPC 5.

[0072] According to this inkjet head H1, since the column A wiring lines 32 are led out to the back surface 3b by using the through holes 31 in the substrate 3 constituting the ink channels, the number of steps for machining the through holes in the substrate 3 can be reduced, and a decrease in strength of the substrate 3 due to an increase in number of the through holes can be suppressed.

[0073] It is to be noted that, since the column A wiring lines 32 led out to the back surface 3b of the substrate 3 are arranged in the common ink chamber 41 of the manifold member 4, they directly come into contact with the ink. Therefore, after bonding the substrate 3 to the ink chamber forming member 1 and before bonding the manifold member 4, it is preferable to form a protective film that protects the column A wiring lines 32 against the ink.

[0074] As the protective film, a film made of paraxylylene and its derivative (which is called a parylene film) is preferable. The parylene film is a resin film made of a polyparaxylylene resin and/or its derivative resin, and it is made based on a chemical vapor deposition method (a CVD method) using a solid diparaxylylene dimer or its derivative as a deposition source. That is, a paraxylylene radical generated when the diparaxylylene dimer is vaporized and pyrolytically decomposed is absorbed to the front surface of the ink chamber forming member 1 and shows a polymerization reaction, thereby forming a film.

[0075] As the parylene film, there are various parylene films, and various parylene films, a parylene film having a multilayer configuration obtained by laminating the various parylene films, or the like can be applied as a desired parylene film.

[0076] When the parylene film is formed on the ink chamber forming member 1 and the substrate 3 after bonding the ink chamber forming member 1 and the substrate 3 and before bonding the nozzle plate 2 and the manifold member 4, the drive electrodes 14 in the respective ink chambers 11 as well as the respective wiring lines on the substrate 3 can be protected against the ink by using the parylene film.

[0077] It is preferable to set a film thickness of such a parylene film to 1 μm to 10 μm .

(Second Embodiment)

[0078] FIG. 8 is an exploded perspective view of an inkjet head according to a second embodiment, FIG. 9 is a view showing the inkjet head depicted in FIG. 8 from a back surface side of a substrate, and FIG. 10 is a horizontal exploded view of a cross section taken along a line (x)-(x) in FIG. 9. Since parts denoted by the same reference numerals as those in the inkjet head H1 according to the first embodiment depicted in FIG. 3 to FIG. 7 represent parts having the same structures, different structures alone will be described here, and the description of the first embodiment will be cited for any other explanation to omit the description.

[0079] This inkjet head H2 is equal to the inkjet head H1 according to the first embodiment in that column A wiring lines 32 are led out to a back surface 3b from a front surface 3a of a substrate 3 via through holes 31 constituting ink channels and led back to the front surface 3a via through holes 34 but different from the same in that positions of the through holes 34 are placed near an end portion of the substrate 3 on the lower side in the drawing. Therefore, second front surface wiring portions 32d of the column A wiring lines 32 led back to the front surface 3a of the substrate 3 via the through holes 34 upwardly run from the through holes 34 and extend to a position just before a bonding region 30 with respect to an ink chamber forming member 1, and the second front surface wiring portions 32d and column B wiring lines 36 are alternately aligned on the front surface 3a side of a projecting portion 33 that can serve as a connecting region for an FPC 5.

[0080] Consequently, as shown in FIG. 9, a size of a manifold member 4 can be increased to reach a position near the through holes 34, a capacity of a common ink chamber 41 can be thus increased as compared with the inkjet head H1 according to the first embodiment.

[0081] Besides, the same effect as that of the inkjet head H1 according to the first embodiment can be provided.

(Third Embodiment)

[0082] FIG. 11 is an exploded perspective view of an inkjet head according to a third embodiment, FIG. 12 is a view showing the inkjet head depicted in FIG. 11 from a back surface side of a substrate, and FIG. 13 is a horizontal exploded view showing a cross section taken along a line (xii)-(xii) in FIG. 12. Since parts denoted by the same reference numerals as those in the inkjet head H1 according to the first embodiment depicted in FIG. 3 to FIG. 7 represent parts having the same structures, different structures alone will be described here, and the description of the first embodiment will be cited for any other explanation to omit the description.

[0083] In this inkjet head H3, column A wiring lines 32 are led back to a front surface 3a through an end face 3c of a substrate 3 like the mode in FIG. 2(b) without

forming through holes 34 as second through holes in the substrate 3.

[0084] Since the second through holes used for leading the column A wiring lines 32 back to the front surface 3a are not required, a reduction in strength of the substrate 3 can be suppressed. Further, since there is no concern about leakage of an ink due to omission of the second through holes, a size of a manifold member 4 can be equal to that of the substrate 3, and a capacity of a common ink chamber 41 can be increased to the maximum level. Furthermore, if the size of the manifold member 4 is equal to those of inkjet heads H1 and H2, the substrate 3 can be reduced in size due to omission of the second through holes.

[0085] Besides, the same effect as that of the inkjet head H1 according to the first embodiment can be provided.

(Fourth Embodiment)

[0086] FIG. 14 is an exploded perspective view of an inkjet head according to a fourth embodiment, and FIG. 15 is a view showing the inkjet head depicted in FIG. 14 from a back surface side of a substrate. Since parts denoted by the same reference numerals as those in the inkjet head H1 according to the first embodiment depicted in FIG. 3 to FIG. 7 represent parts having the same structures, different structures alone will be described here, and the description of the first embodiment will be cited for any other explanation to omit the description.

[0087] In this inkjet head H4, a column A and a column B are constituted by alternately aligning ink chambers 111 from which an ink is discharged when the ink is supplied thereto and dummy chambers 112 to which the ink is not supplied and from which the ink is not discharged through each drive wall 13 formed of a piezoelectric element. Through holes 31 and 35 are individually pierced and formed in a substrate 3 only at positions corresponding to the ink chambers 111 in the respective columns A and B, and the dummy chambers 112 are air chambers to which the ink is not supplied by closed with the substrate 3.

[0088] Although an individual electrode 12 in each ink chamber 111 is electrically connected with a drive electrode in each ink chamber 111, a drive electrode in each dummy chamber 112 is electrically connected with a common electrode 15 provided in accordance with each of the columns A and B. The common electrode for the column A on the upper side in the drawing is arranged on the opposite side of the column B to sandwich the column A on a rear end face 1b of an ink chamber forming member 1 and extends along a column direction. Moreover, the common electrode 15 for the column B on the lower side in the drawing extends between the column A and the column B along the column direction on the rear end face 1b of the ink chamber forming member 1.

[0089] On the other hand, common electrode wiring lines 37 and 37, which are electrically connected with the

common electrodes 15 and 15, respectively when they are bonded to the rear end face 1b of the ink chamber forming member 1, are formed on a front surface 3a of the substrate 3. One end side of each of the common electrode wiring lines 37 and 37 is arranged in a bonding region 30 with respect to the ink chamber forming member 1 to be electrically connected to each of the common electrodes 15 and 15 on the rear end face 1b of the ink chamber forming member 1, and the other end side of the same extends to the outside of the bonding region 30, runs toward an end portion of the substrate 3 on the lower side of the drawing, and is aligned on a front surface 3a side of a projecting portion 33 like column A wiring lines 32 and column B wiring lines 36.

[0090] In this inkjet head H4, since the column A wiring lines 32 straddle the ink chambers 111 and the dummy chambers 112 in the column B and the common electrode 15 for the column B on a back surface 3b of the substrate 3, they do not intersect with these members on the front surface 3a of the substrate 3 that is in contact with the rear end face 1b of the ink chamber forming member 1, and there is no fear of short circuits with drive electrodes 14 in the respective ink chambers 111 and the dummy chambers 112 in the column B, individual electrodes 12, and the common electrode 15.

[0091] Additionally, the dummy chambers 112 are electrically connected to the common electrodes 15, and individual wiring on the substrate 3 is not required, thus realizing high density of the wiring lines.

[0092] Further, since the through holes 31 and 35 are formed in the substrate 3 only at positions corresponding to the respective ink chambers 111, a reduction in strength of the substrate 3 can be suppressed.

[0093] It is to be noted that, in this inkjet head H4, the wiring lead-out structure that is completely the same as that of the inkjet head H1 is adopted for the column A wiring lines 32, a wiring lead-out structure that is completely the same as those of the respective column A wiring lines 32 in the inkjet heads H2 and H3 may be adopted.

[0094] Besides, the same effect as that of the inkjet head H1 according to the first embodiment can be provided.

(Fifth Embodiment)

[0095] Although the example of the shearing mode type ink chamber forming member 1 in which each drive wall 13 between the ink chambers 11 adjacent to each other or each drive wall 13 between the ink chamber 111 and the dummy chamber 112 adjacent to each other is formed of a piezoelectric element and which provides a pressure for discharging the ink into the ink chambers 11 or 111 based on deformation of the drive wall 13 has been given as the ink chamber forming member 1 in the above description, a specific structure for discharging the ink is out of the question in the present invention.

[0096] FIG. 16 is a partial cross-sectional view of an

inkjet head according to a fifth embodiment, and a description will be given on an example of an inkjet head in which one wall surface of an ink chamber is constituted of a diaphragm so that an ink in the ink chamber is provided with discharge energy by vibrating this diaphragm based on expansion and contraction movement of a piezoelectric element.

[0097] An inkjet head H5 has an ink chamber forming member 6 and a substrate 7 that is provided on one side of this ink chamber forming member 6 (the upper side in the drawing).

[0098] The ink chamber forming member 6 is constituted of a laminated substrate and has a nozzle plate 61 formed of an Si (silicon) substrate, an intermediate plate 62 formed of a glass substrate, a pressure chamber plate 63 formed of an Si (silicon) substrate, and a diaphragm 64 formed of an SiO₂ thin film. A nozzle 611 is opened in the nozzle plate 61.

[0099] An ink chamber 631 that contains an ink to be discharged is formed in the pressure chamber plate 63. An upper wall of the ink chamber 631 is formed of the diaphragm 64, and a lower wall of the same is formed of the intermediate plate 62. An ink inlet 632 from which the ink is supplied into the ink chamber 631 is formed in the diaphragm 64, and it is opened in an upper surface of the ink chamber forming member 6. Furthermore, a communication path 621 that allows the inside of the ink chamber 631 to communicate with the nozzle 611 is pierced and formed in the intermediate plate 62.

[0100] A piezoelectric element 65 is formed of a thin film PZT and sandwiched between an individual electrode 651 provided on an upper surface thereof and a common electrode 652 provided on a lower surface thereof. The common electrode 652 is formed on a front surface of the diaphragm 64, and the piezoelectric element 65 and the individual electrode 651 on the upper surface thereof are individually laminated on this common electrode 652 so as to associate with the ink chamber 631 on a one-to-one basis. A bump 653 made of gold or the like is formed to protrude on the individual electrode 651.

[0101] A substrate 7 has a through hole 71. The through hole 71 communicates with the ink inlet 632 in the ink chamber 631 with the use of a channel member 8 that is an intermediate member interposed between the ink chamber forming member 6 and the substrate 7, thereby forming an ink channel.

[0102] A lower surface wiring portion 72a of a wiring line 72 that is electrically connected with the individual electrode 651 is formed on a lower surface 7a of the substrate 7 facing the ink chamber forming member 6. A bump 721 is formed to protrude on the lower surface wiring portion 72a, this bump 721 is electrically connected with the upper bump 653 as an intermediate member, and the wiring line 72 is electrically connected with the individual electrode 651.

[0103] Furthermore, the other end side of this wiring line 72 runs along an inner peripheral surface of the

through hole 71 forming the ink channel, is led out to the upper surface 7b of the substrate 7, and forms the upper surface wiring portion 72b. This upper surface wiring portion 72b is electrically connected with a non-illustrated external wiring member such as an FPC at an end portion of the substrate 7.

[0104] In the inkjet head H5 having such a configuration, likewise, the ink inlet 632 and the individual electrode 651 are arranged on one side of the ink chamber forming member 6. Moreover, the wiring line 72 formed on the substrate 7 passes through the through hole 71 forming the ink channel and is led out from a lower surface 7a facing the ink chamber forming member 6 to the upper surface 7b facing the lower surface 7a. Therefore, an additional through hole in which the wiring line 72 is inserted does not have to be formed in the substrate 7, and the individual electrode 651 corresponding to the ink chamber 631 can be electrically led to the outside of the ink chamber forming member 6 without a reduction in strength of the substrate 7.

(Other Embodiments)

[0105] Although the example of the ink chamber forming member 1 having the two columns of the ink chambers 11 or 111 has been described as the ink chamber forming member 1 in each of the inkjet heads H1 to H4, the number of columns of the ink chambers 11 or 111 included in the ink chamber forming member 1 may be one, i.e., the column A alone. In this case, adopting the same wiring lead-out structure as that of the column A wiring lines 32 in each of the inkjet heads H1 to H4 enables providing an effect of easily leading the wiring line to the back surface of the substrate by using the ink channel without a reduction in strength of the substrate.

[0106] Additionally, in the inkjet heads H1 to H4, the number of columns of the ink channels 11 may be three or more. For example, when the ink chamber forming member 1 and the nozzle plate 2 are formed to be symmetrical in an up-and-down direction orthogonal to the columns of the ink chambers 11 in each of the inkjet heads H1 to H4, the inkjet head having four columns of the ink chambers 11 can be easily configured.

[0107] In the inkjet heads H1 to H3, although the through holes 31 in the substrate 3 corresponding to the ink chambers 11 in the column A are individually formed in accordance with the respective ink chambers 11, the through hole 31 may be one slot-like through hole that extends along the column direction of the ink chambers 11 in the column A and has a size including all the ink chambers 11 in the column A. Further, the through hole 31 may be divided into a plurality of through holes large enough to include the plurality of ink chambers 11, respectively.

[0108] Furthermore, in the inkjet heads H1, H2, and H4, although the through holes 34 are all arranged outside the manifold member 4, the through holes 34 may be closed by additionally using a filling member such as

an insulating tape so that the ink cannot leak from the through holes 34 after forming the column A wiring lines 32, whereby the through holes 34 can be thereby arranged in the common ink chamber 41 of the manifold member 4. As a result, even though the through holes 34 are formed in the substrate 3, the manifold member 4 can be increased in size, and a capacity of the common ink chamber 41 can be thereby increased.

[0109] Moreover, in the inkjet heads H1 to H4, although the other end of each of the wiring lines 32 and 36 in the respective columns is arranged on the front surface 3a of the substrate 3, the column A wiring lines 32 led out to the back surface 3b via the through holes 31 may be aligned on the back surface 3b of the substrate 3 as they are so that the wiring lines can be distributed on the front surface 3a and the back surface 3b of the substrate in accordance with the respective columns and can be electrically connected with external wiring members on the respective surfaces. As a result, since the wiring lines in the respective columns are not adjacent to each other, a possibility of short circuits can be further reduced, and higher density can be achieved.

Reference Signs List

[0110]

H1-H5 : inkjet head

1 : ink chamber forming member

1a: front end face

1b: rear end face

11: ink chamber

11a, 11b: opening portion

111: ink chamber

112: dummy chamber

12: individual electrode

13: drive wall

14: drive electrode

15: common electrode

2: nozzle plate

21: nozzle

3: substrate

3a: front surface

3b: back surface

3c: end face

30: bonding region

31: through hole (a first through hole)

31a: inner peripheral surface

32: wiring line (column A wiring line)

32a: front surface wiring portion (first surface wiring portion)

32b: back surface wiring portion

32c: first through hole wiring portion

32d: second surface wiring portion

32e: second through hole wiring portion

33: projecting portion

34: through hole(second through hole)

34a: inner peripheral surface

35: through holes

36: column B wiring lines

37: common electrode wiring lines 4: manifold member

41: common ink chamber

5: FPC (external wiring member)

6: ink chamber forming member

61: nozzle plate

611: nozzle

62: intermediate plate

621: communication path

63: pressure chamber plate

631: ink chamber

632: ink inlet

64: diaphragm

65: piezoelectric element

651: individual electrode

652: common electrode

653: bump

7: substrate

7a: lower surface

7b: upper surface

71: through hole

72: wiring line

72a: lower surface wiring portion

72b: upper surface wiring portion

721: bump

8: channel member

Claims

1. An inkjet head comprising:

an ink chamber forming member (1;6) that has an ink inlet (11b;632) of an ink chamber (11;111;631) from which an ink can be dis-

- charged and an individual electrode (12;651) to which a voltage for providing the ink in the ink chamber (11;111;631) with discharge energy is to be applied arranged on one side thereof; and a substrate (3;7) provided on the one side of the ink chamber forming member (1;6), wherein a first through hole (31;71) that communicates with the ink inlet (11b;632) of the ink chamber forming member (1;6) to form an ink channel is provided in the substrate (3;7), and one end side of a wiring line (32;72) which is electrically connected with the individual electrode (12;651) is led out to a surface (3b;7b) of the substrate (3;7) on the opposite side of the ink chamber forming member (1;6) via the first through hole (31;71), wherein the one end side of the wiring line (32;72) is formed on a surface (3a;7a) of the substrate (3;7) on the ink chamber forming member side and is electrically connected with the individual electrode (12;651) on the surface (3a;7a), **characterized in that** the substrate (3;7) has a projecting portion (33) that protrudes toward a lateral side of the ink chamber forming member (1;6) and is arranged to be electrically connected with an external wiring member (5), and wherein the other end side of the wiring line (32;72) extends to the projecting portion (33).
2. The inkjet head according to claim 1, wherein the wiring line (32;72) runs along an inner peripheral surface (31a) of the first through hole (31;71).
 3. The inkjet head according to claim 2, wherein a material of the wiring line (32;72) which runs along the inner peripheral surface (31a) of the first through hole (31) is the same as the material of a front surface wiring portion (32a;72a) which is formed on the surface (3a;7a) of the substrate (3;7) on the ink chamber forming member side and a back surface wiring portion (32b;72b) which is formed on the surface (3b;7b) of the substrate (3;7) on the opposite side of the ink chamber forming member (1;6).
 4. The inkjet head according to any one of claims 1 to 3, wherein the substrate (3) has a second through hole (34) different from the first through hole (31) which is provided in the projecting portion (33), and the wiring line (32) is led back to the surface (3a) of the substrate (3) on the ink chamber forming member side from the surface (3b) of the substrate (3) on the opposite side of the ink chamber forming member (1) via the second through hole (34).
 5. The inkjet head according to claim 4, wherein the wiring line (32) runs along an inner peripheral surface (43a) of the second through hole (34).
 6. The inkjet head according to any one of claims 1 to 3, wherein the wiring line (32) is pulled back to the surface (3a) of the substrate (3) on the ink chamber forming member side from the surface (3b) of the substrate (3) on the opposite side of the ink chamber forming member (1) through an end face (3c) of the substrate (3) on the projecting portion side.
 7. The inkjet head according to any one of claims 1 to 6, wherein the ink chamber forming member (1) has a configuration that drive walls (13), each of which is at least partially formed of a piezoelectric element, and the ink chambers (11), each of which is formed of a space between a pair of the drive walls (13) adjacent to each other, are alternately arranged, and a drive electrode (14) is formed on a surface of each drive wall (13) facing the ink chamber (11), wherein a pressure used for discharging an ink supplied to each ink chamber (11) can be given by applying a voltage to each drive electrode (14) and deforming the drive wall (13) to thereby discharge the ink from a nozzle (21), and the individual electrode (12) is electrically connected to each drive electrode (14) through the ink inlet (11b).
 8. The inkjet head according to any one of claims 1 to 6, wherein the ink chamber forming member (1) has a configuration that the ink chambers (111) from which the ink is to be discharged and dummy chambers (112) from which the ink is not to be discharged are alternately arranged through each drive wall (13) that is at least partially formed of a piezoelectric element, and a drive electrode is formed on a surface of the drive wall (13) facing the ink chamber (111), wherein a pressure used for discharging the ink supplied to each ink chamber (111) can be given by applying a voltage to each drive electrode and deforming the drive wall (13) to thereby discharge the ink from a nozzle (21), the wiring line (32) is electrically connected to the individual electrode (12) electrically connected to the drive electrode of each ink chamber (111) through the ink inlet, and the drive electrode formed on the surface of the drive wall (13) facing the dummy chamber (112) is electrically connected to a common electrode (15) formed on one surface of the ink chamber forming member (1).
 9. The inkjet head according to any one of claims 1 to 8, wherein the substrate (3) has a larger area than a rear end face (1b) of the ink chamber forming member (1).

10. The inkjet head according to any one of claims 1 to 9, wherein glass is used as the material for the substrate (3) .

11. The inkjet head according to any one of claims 1 to 10, wherein the external wiring member (5) is a FPC.

Patentansprüche

1. Ein Tintenstrahlkopf mit:

einem Tintenkamerbildungselement (1;6), das einen Tinteneinlass (11b;632) einer Tinten-
kammer (11;111;631), von der eine Tinte aus-
getragen werden kann, und eine individuelle
Elektrode (12;651), an der eine Spannung zum
Versehen der Tinte in der Tinten-
kammer (11;111;631) mit einer Ausstoßenergie anzule-
gen ist, die an einer Seite davon angeordnet ist,
aufweist, und

einem Substrat (3;7), das an der einen Seite des
Tintenkamerbildungselements (1;6) vorgese-
hen ist,

wobei ein erstes Durchgangsloch (31;71), das
mit dem Tinteneinlass (11b;632) des Tinten-
kamerbildungselements (1;6) zum Bilden ei-
nes Tintenkanals kommuniziert, in dem Substrat
(3;7) vorgesehen ist, und eine Endseite einer
Verdrahtungsleitung (32;72), die elektrisch mit
der individuellen Elektrode (12;651) verbunden
ist, zu einer Oberfläche (3b;7b) des Substrats
(3;7) an der gegenüberliegenden Seite des Tin-
tenkamerbildungselements (1;6) über das
erste Durchgangsloch (31;71) herausgeführt ist,
wobei die eine Endseite der Verdrahtungslei-
tung (32;72) an einer Oberfläche (3a;7a) des
Substrats (3;7) an der Seite des Tinten-
kamerbildungselements ausgebildet ist und elektrisch
mit der individuellen Elektrode (12;651) an der
Oberfläche (3a;7a) verbunden ist,

dadurch gekennzeichnet, dass

das Substrat (3;7) einen Vorsprungsabschnitt
(33) hat, der zu einer lateralen Seite des Tinten-
kamerbildungselements (1;6) vorsteht und
angeordnet ist, um elektrisch mit einem exter-
nen Verdrahtungselement (5) verbunden zu
werden, und

wobei die andere Endseite der Verdrahtungslei-
tung (32;72) sich zu dem Vorsprungsabschnitt
(33) erstreckt.

2. Der Tintenstrahlkopf gemäß Anspruch 1,
wobei die Verdrahtungsleitung (32;72) entlang einer
inneren Umfangsoberfläche (31a) des ersten Durch-
gangslochs (31;71) verläuft.

3. Der Tintenstrahlkopf gemäß Anspruch 2,
wobei ein Material der Verdrahtungsleitung (32;72),
die entlang der inneren Umfangsoberfläche (31a)
des ersten Durchgangslochs (31) verläuft, dasselbe
ist wie das Material eines Vorderoberflächen-Ver-
drahtungsabschnitts (32a;72a), der an der Oberflä-
che (3a;7a) des Substrats (3;7) an der Seite des Tin-
tenkamerbildungselements ausgebildet ist und ei-
nes Rückoberflächen-Verdrahtungsabschnitts
(32b;72b), der an der Oberfläche (3b;7b) des Sub-
strats (3;7) an der gegenüberliegenden Seite des
Tintenkamerbildungselements (1;6) ausgebildet
ist.

4. Der Tintenstrahlkopf gemäß einem der Ansprüche
1 bis 3,
wobei das Substrat (3) ein zweites Durchgangsloch
(34) verschieden von dem ersten Durchgangsloch
(31), das in dem Vorsprungsabschnitt (33) vorgese-
hen ist, hat, und
die Verdrahtungsleitung (32) zu der Oberfläche (3a)
des Substrats (3) an der Seite des Tinten-
kamerbildungselements von der Oberfläche (3b) des Sub-
strats (3) an der gegenüberliegenden Seite des Tin-
tenkamerbildungselements (1) über das zweite
Durchgangsloch (34) zurückgeführt ist.

5. Der Tintenstrahlkopf gemäß Anspruch 4,
wobei die Verdrahtungsleitung (32) entlang einer in-
neren Umfangsoberfläche (43a) des zweiten Durch-
gangslochs (34) verläuft.

6. Der Tintenstrahlkopf gemäß einem der Ansprüche
1 bis 3,
wobei die Verdrahtungsleitung (32) zu der Oberflä-
che (3a) des Substrats (3) an der Seite des Tinten-
kamerbildungselements von der Oberfläche (3b)
des Substrats (3) an der gegenüberliegenden Seite
des Tintenkamerbildungselements (1) durch eine
Endfläche (3c) des Substrats (3) an der Seite des
Vorsprungsabschnitts zurückgeführt ist.

7. Der Tintenstrahlkopf gemäß einem der Ansprüche
1 bis 6,
wobei das Tintenkamerbildungselement (1) eine
Konfiguration hat, bei der Antriebswände (13), von
denen jede zumindest teilweise aus einem piezoe-
lektrischen Element gebildet ist, und die Tinten-
kammern (11), von denen jede aus einem Raum zwi-
schen einem Paar der Antriebswände (13), die ein-
ander benachbart sind, gebildet ist, abwechselnd
angeordnet sind, und eine Antriebselektrode (14) an
einer Oberfläche jeder Antriebswand (13), die der
Tinten-
kammer (11) zugewandt ist, ausgebildet ist,
wobei ein zum Austragen einer Tinte, die jeder Tin-
ten-
kammer (11) zugeführt wird, verwendeter Druck
aufgebracht werden kann durch Anlegen einer
Spannung an jeder Antriebselektrode (14) und Ver-

formen der Antriebswand (13), um dadurch die Tinte aus einer Düse (21) auszutragen, und die individuelle Elektrode (12) mit jeder Antriebselektrode (14) durch den Tinteneinlass (11b) elektrisch verbunden ist.

8. Der Tintenstrahlkopf gemäß einem der Ansprüche 1 bis 6, wobei das Tintenammerbildungselement (1) eine Konfiguration hat, bei der die Tintenammern (111), von denen die Tinte auszutragen ist, und Dummy-Kammern (112), von denen die Tinte nicht auszutragen ist, abwechselnd über jeder Antriebswand (13), die zumindest teilweise aus einem piezoelektrischen Element gebildet ist, angeordnet sind, und eine Antriebselektrode an einer Oberfläche der Antriebswand (13), die der Tintenammer (111) zugewandt ist, ausgebildet ist, wobei ein zum Austragen der Tinte, jeder Tintenammer (111) zugeführt wird, verwendeter Druck aufgebracht werden kann durch Anlegen einer Spannung an jeder Antriebselektrode und Verformen der Antriebswand (13), um dadurch die Tinte von einer Düse (21) auszutragen, wobei die Verdrahtungsleitung (32) elektrisch mit der individuellen Elektrode (12) verbunden ist, welche elektrisch mit der Antriebselektrode jeder Tintenammer (111) über den Tinteneinlass verbunden ist, und die an der Oberfläche der Antriebswand (13), die der Dummy-Kammer (112) zugewandt ist, ausgebildete Antriebselektrode elektrisch mit einer gemeinsamen Elektrode (15), die an einer Oberfläche des Tintenammerbildungselements (1) ausgebildet ist, verbunden ist.

9. Der Tintenstrahlkopf gemäß einem der Ansprüche 1 bis 8, wobei das Substrat (3) eine größere Fläche hat als eine hintere Endfläche (1b) des Tintenammerbildungselements (1).
10. Der Tintenstrahlkopf gemäß einem der Ansprüche 1 bis 9, wobei Glas als das Material für das Substrat (3) verwendet ist.
11. Der Tintenstrahlkopf gemäß einem der Ansprüche 1 bis 10, wobei das externe Verdrahtungselement (5) ein FPC ist.

Revendications

1. Tête à jet d'encre comportant :
- un élément (1 ; 6) formant chambre d'encre, qui a une entrée (11b ; 632) d'encre d'une chambre

(11 ; 111 ; 631) d'encre de laquelle une encre peut être déchargée et une électrode (12 ; 651) individuelle, à laquelle une tension pour fournir à l'encre dans la chambre (11 ; 111 ; 631) d'encre une énergie de décharge doit être appliquée, agencée sur l'un de ses côtés ; et un substrat (3 ; 7) disposé sur ledit un côté de l'élément (1 ; 6) formant chambre d'encre ; dans laquelle un premier trou (31 ; 71) de traversée, qui communique avec l'entrée (11b ; 632) d'encre de la chambre d'encre formant un élément (1 ; 6) pour former un canal d'encre, est ménagé dans le substrat (3 ; 7), et un côté d'extrémité d'une ligne (32 ; 72) de câblage, qui est reliée électriquement à l'électrode (12 ; 651) individuelle, est menée jusqu'à une surface (3b ; 7b) du substrat (3 ; 7) sur le côté opposé de l'élément (1 ; 6) formant chambre d'encre par l'intermédiaire du premier trou (31 ; 71) de traversée, dans laquelle ledit un côté d'extrémité de la ligne (32 ; 72) de câblage est formé sur une surface (3a ; 7a) du substrat (3 ; 7) sur le côté de l'élément formant chambre d'encre et est relié électriquement à l'électrode (12 ; 651) individuelle sur la surface (3a ; 7a),

caractérisée en ce que

le substrat (3 ; 7) a une partie (33) en saillie, qui fait saillie en direction d'un côté latéral de l'élément (1 ; 6) formant chambre d'encre et est agencé pour être relié électriquement à un élément (5) de câblage extérieur, et dans laquelle l'autre côté d'extrémité de la ligne (32 ; 72) de câblage s'étend jusqu'à la partie (33) en saillie.

2. Tête à jet d'encre suivant la revendication 1, dans laquelle la ligne (32 ; 72) de câblage s'étend le long d'une surface (31a) périphérique intérieure du premier trou (31 ; 71) de traversée.
3. Tête à jet d'encre suivant la revendication 2, dans laquelle un matériau de la ligne (32 ; 72) de câblage, qui s'étend le long de la surface (31a) périphérique intérieure du premier trou (31) de traversée est le même que le matériau d'une partie (32a ; 72a) de câblage de surface avant, qui est formée sur la surface (3a ; 7a) du substrat (3 ; 7) sur le côté de l'élément formant chambre d'encre et une partie (32b ; 72b) de câblage de surface arrière, qui est formée sur la surface (3b ; 7b) du substrat (3 ; 7) sur les côtés opposés de l'élément (1 ; 6) formant chambre d'encre.
4. Tête à jet d'encre suivant l'une quelconque des revendications 1 à 3, dans laquelle le substrat (3) a un deuxième trou (34) de traversée différent du premier trou (31) de traversée, qui est disposé dans la partie (33) en saillie, et

- la ligne (32) de câblage est menée en retour jusqu'à la surface (3a) du substrat (3) du côté de l'élément formant chambre d'encre à partir de la surface (3b) du substrat (3) sur le côté opposé de l'élément (1) formant chambre d'encre par l'intermédiaire du deuxième trou (34) de traversée.
- 5
5. Tête à jet d'encre suivant la revendication 4, dans laquelle la ligne (32) de câblage s'étend le long d'une surface (43a) périphérique intérieure du deuxième trou (34) de traversée.
- 10
6. Tête à jet d'encre suivant l'une quelconque des revendications 1 à 3, dans laquelle la ligne (32) de câblage est tirée jusqu'à la surface (3a) du substrat (3) sur le côté de l'élément formant chambre d'encre à partir de la surface (3b) du substrat (3) sur le côté opposé de l'élément (1) formant chambre d'encre par l'intermédiaire d'une face (3c) d'extrémité du substrat (3) sur le côté de la partie en saillie.
- 20
7. Tête à jet d'encre suivant l'une quelconque des revendications 1 à 6, dans laquelle l'élément (1) formant chambre d'encre a une configuration qui attaque des parois (13), chacune d'entre elles étant au moins partiellement formée d'un élément piézoélectrique, et les chambres (11) d'encre, chacune d'entre elles étant formée d'un espace entre une paire des parois (13) d'attaque ad-
30
jacente l'une à l'autres, sont agencées en alternance, et une électrode (14) est formée sur une surface de chaque paroi (13) d'attaque faisant face à la chambre (11) d'encre, dans laquelle une pression utilisée pour décharger une encre fournie à chaque chambre (11) d'encre peut être fournie en appliquant une tension à chaque électrode (14) d'attaque et en déformant la paroi (13) d'attaque pour ainsi décharger l'encre d'une buse (21), et
35
l'électrode (12) individuelle est connectée électriquement à chaque électrode (14) d'attaque par l'intermédiaire de l'entrée (11b) d'encre.
- 40
8. Tête à jet d'encre suivant l'une quelconque des revendications 1 à 6, dans laquelle l'élément (1) formant chambre d'encre a une configuration telle que les chambres (111) d'encre desquelles l'encre doit être déchargée et des
45
chambres (112) fausses desquelles l'encre ne doit pas être déchargée sont agencées en alternance à travers chaque paroi (13) d'attaque, qui est au moins partiellement formée d'un élément piézoélectrique, et une électrode d'attaque est formée sur une surface de la paroi (13) d'attaque faisant face à la chambre (111) d'encre, dans laquelle une pression utilisée
50
pour décharger l'encre fournie à chaque chambre (111) d'encre peut être fournie en appliquant une tension à chaque électrode d'attaque et en défor-
- 55
- mant la paroi (13) d'attaque pour ainsi décharger l'encre d'une buse (21),
la ligne (32) de câblage étant connectée électriquement à l'électrode (12) individuelle électriquement connectée à l'électrode d'attaque de chaque chambre (111) d'encre par l'intermédiaire de l'entrée d'encre, et
l'électrode d'attaque formée à la surface de la paroi (13) d'attaque faisant face à la chambre (112) fausse est connectée électriquement à une électrode (15) commune formée sur une surface de l'élément (1) formant chambre d'encre.
9. Tête à jet d'encre suivant l'une quelconque des revendications 1 à 8, dans laquelle le substrat (3) a une aire plus grande qu'une face (1b) d'extrémité arrière de l'élément (1) formant chambre d'encre.
10. Tête à jet d'encre suivant l'une quelconque des revendications 1 à 9, dans laquelle du verre est utilisé en tant que matériau pour le substrat (3).
11. Tête à jet d'encre suivant l'une quelconque des revendications 1 à 10, dans laquelle l'élément (5) de câblage externe est un FPC ou carte à circuit imprimé souple.

FIG. 1

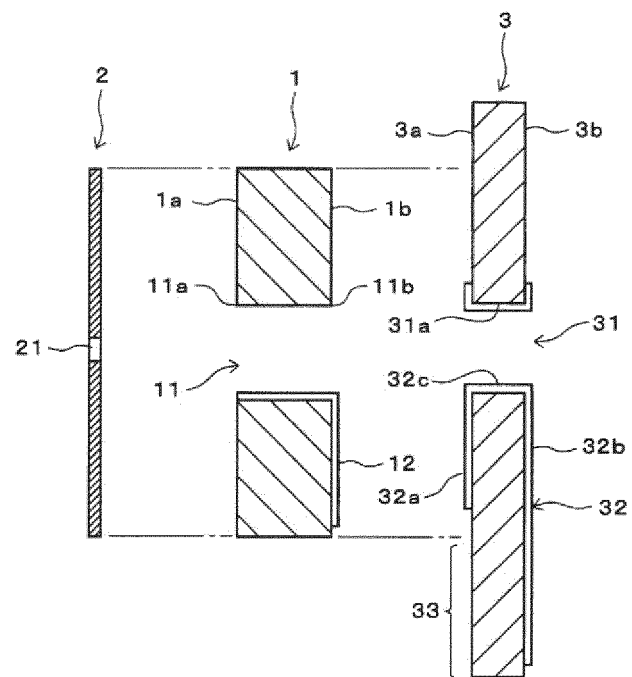


FIG. 2

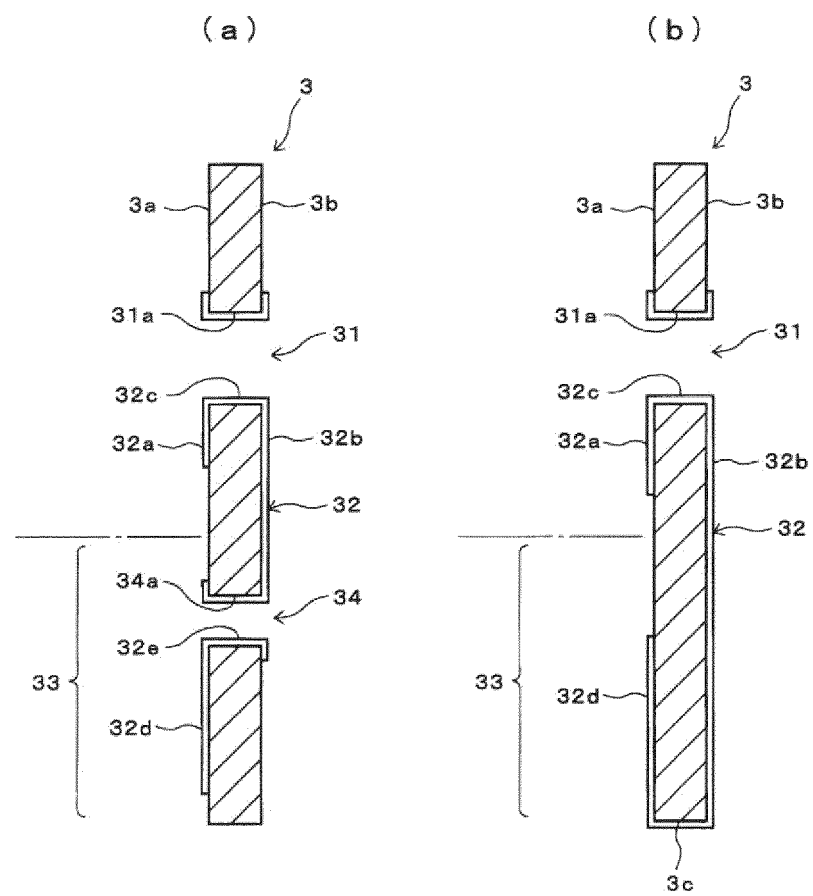


FIG. 3

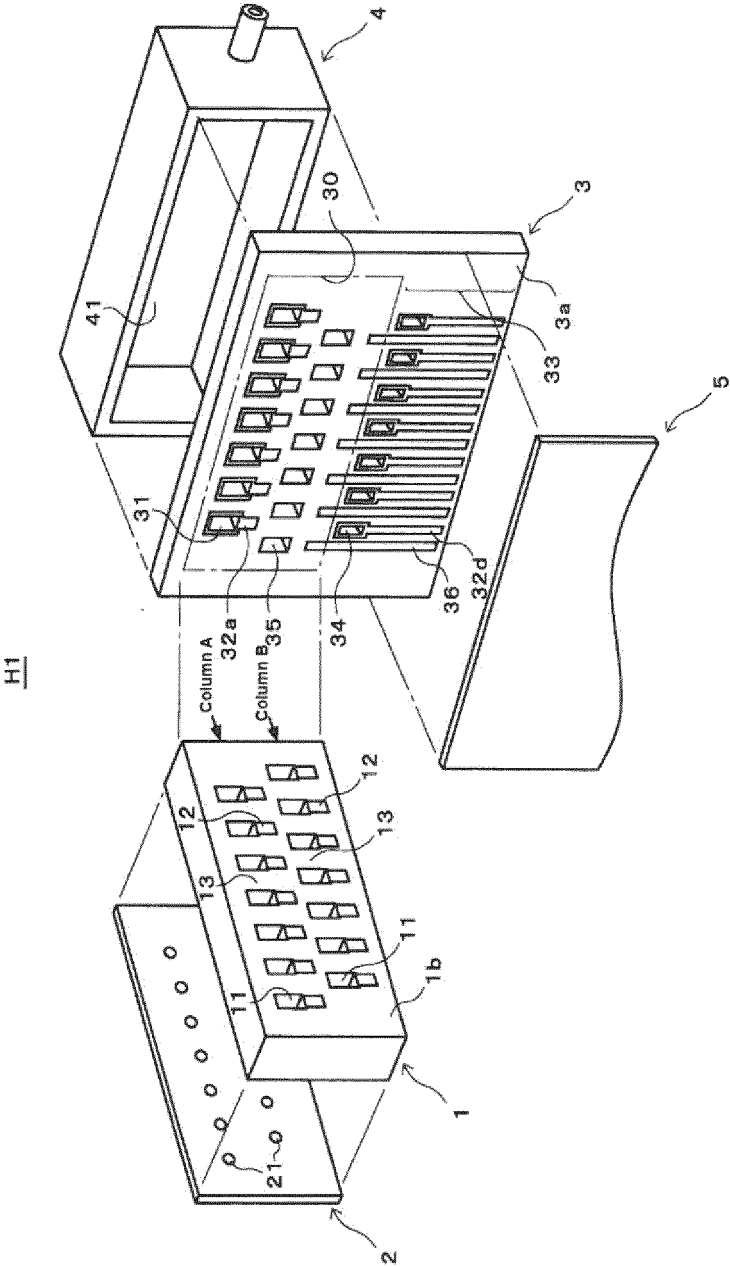


FIG. 4

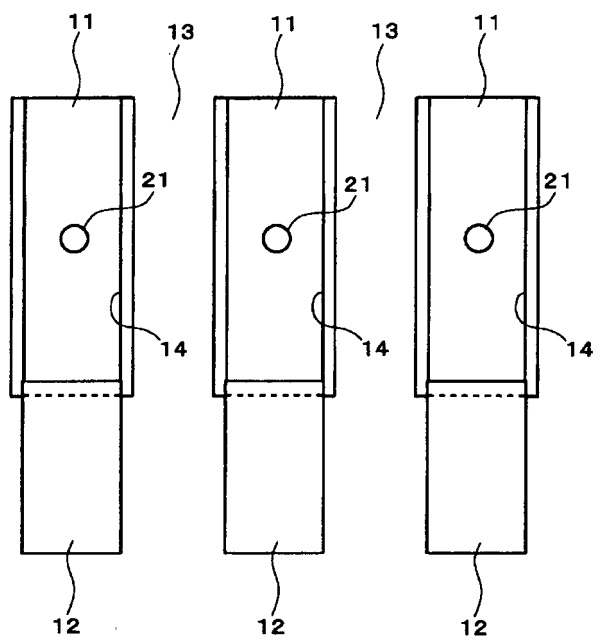


FIG. 5

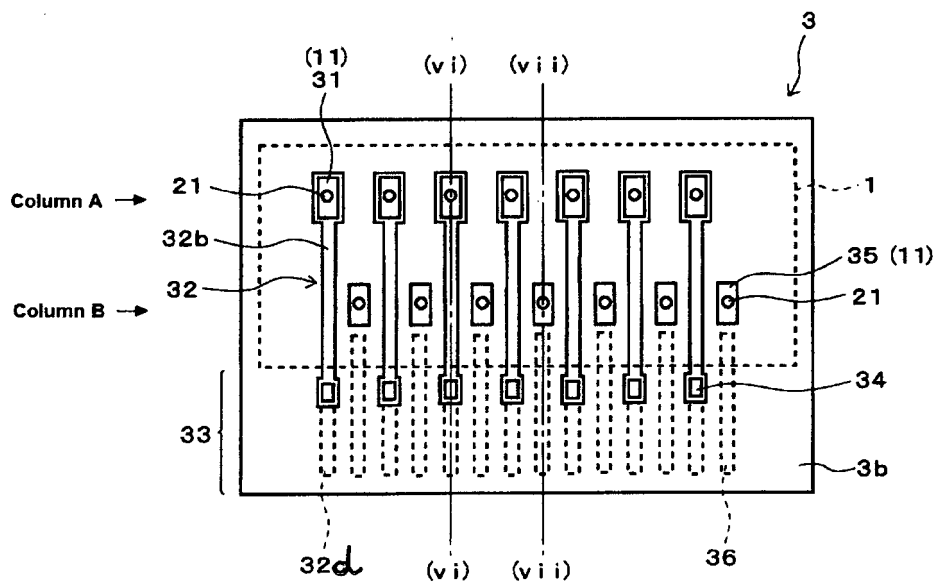


FIG. 6

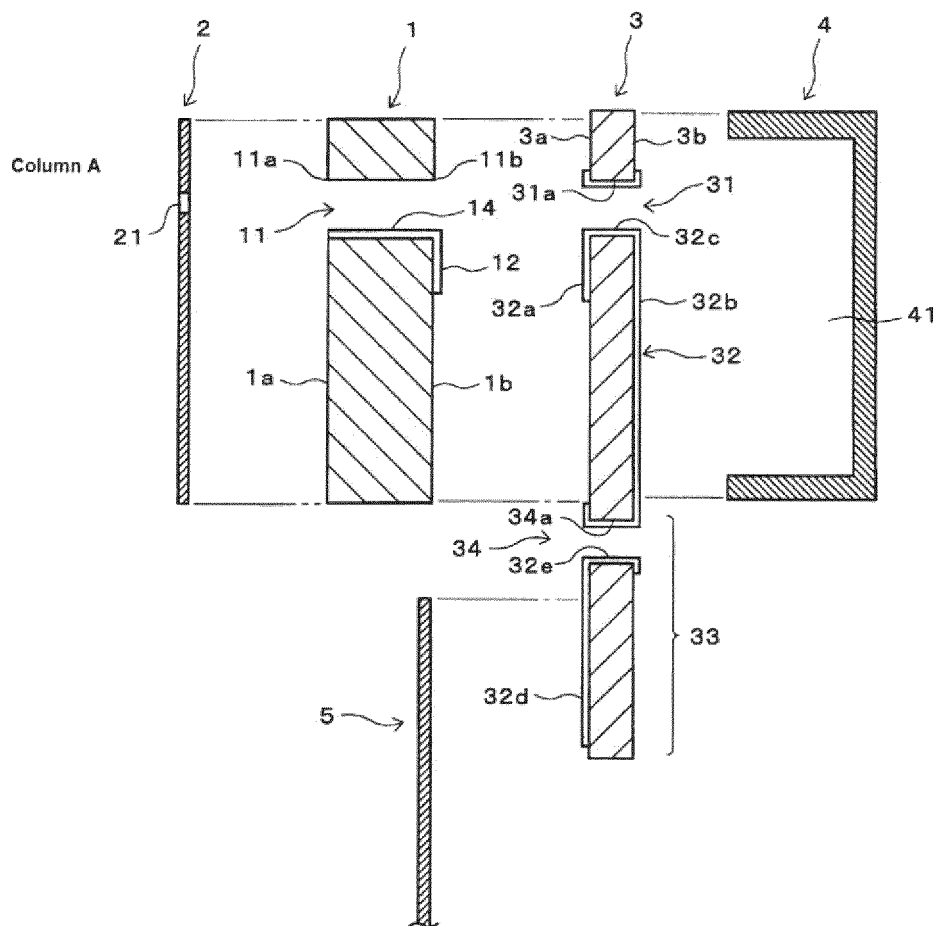


FIG. 7

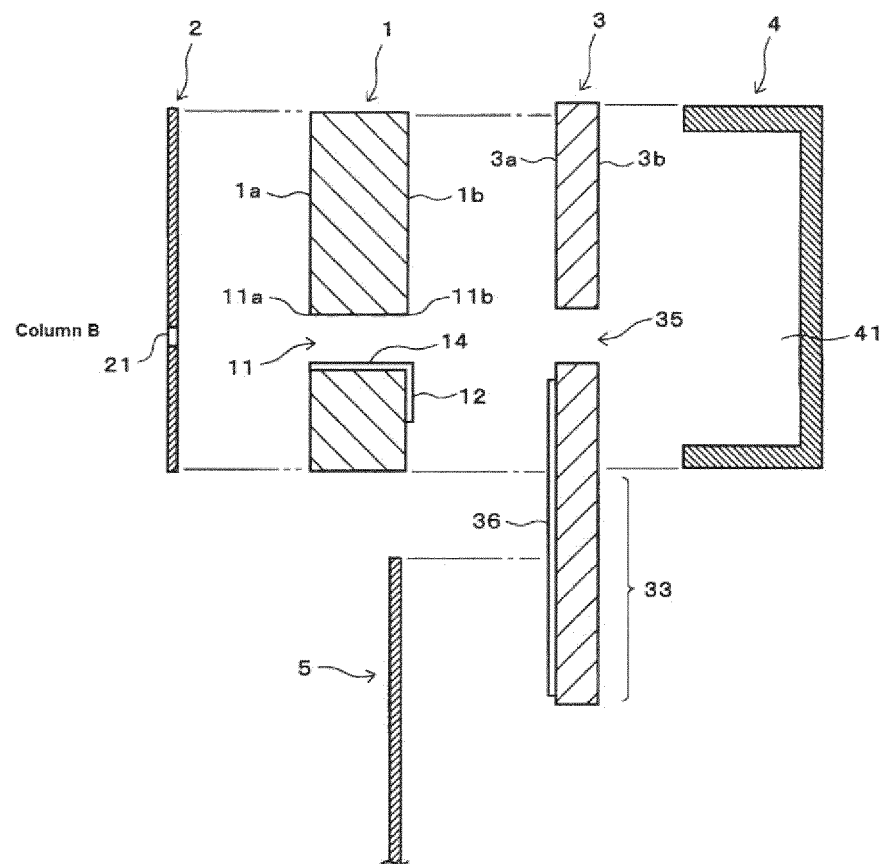


FIG. 8

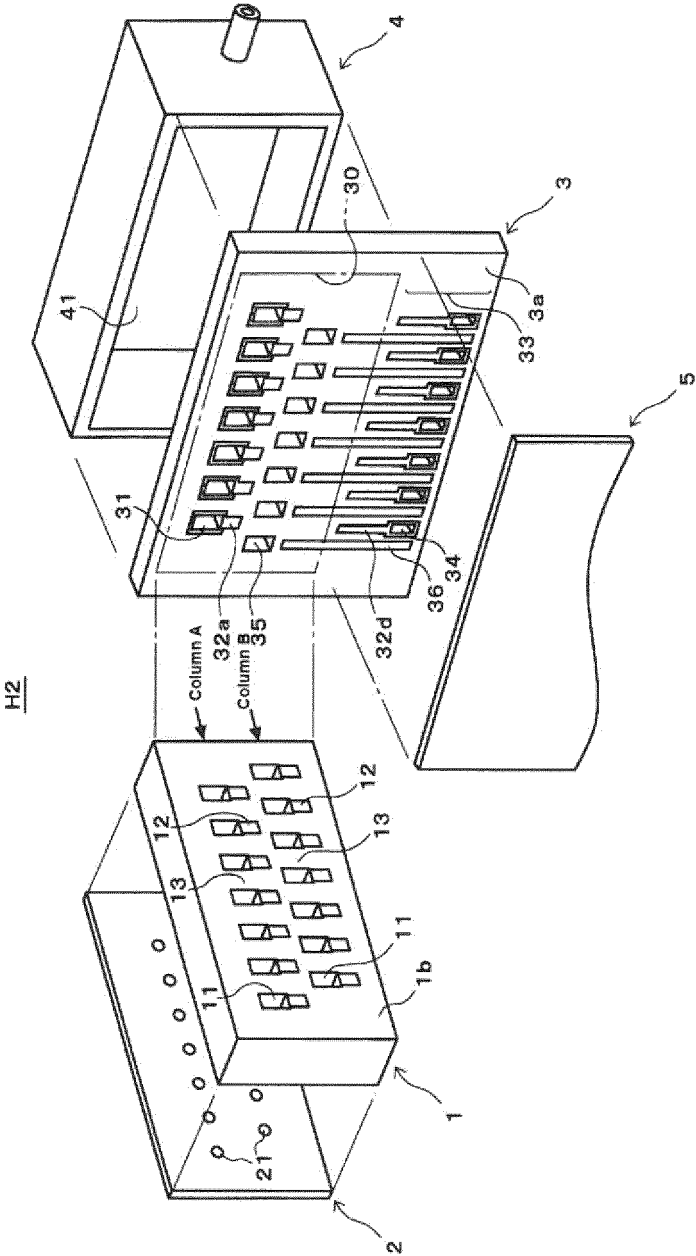


FIG. 9

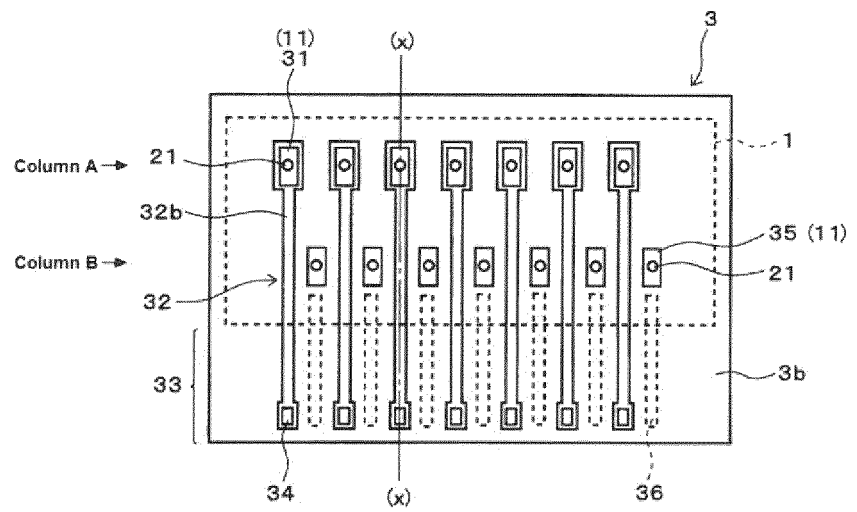


FIG. 10

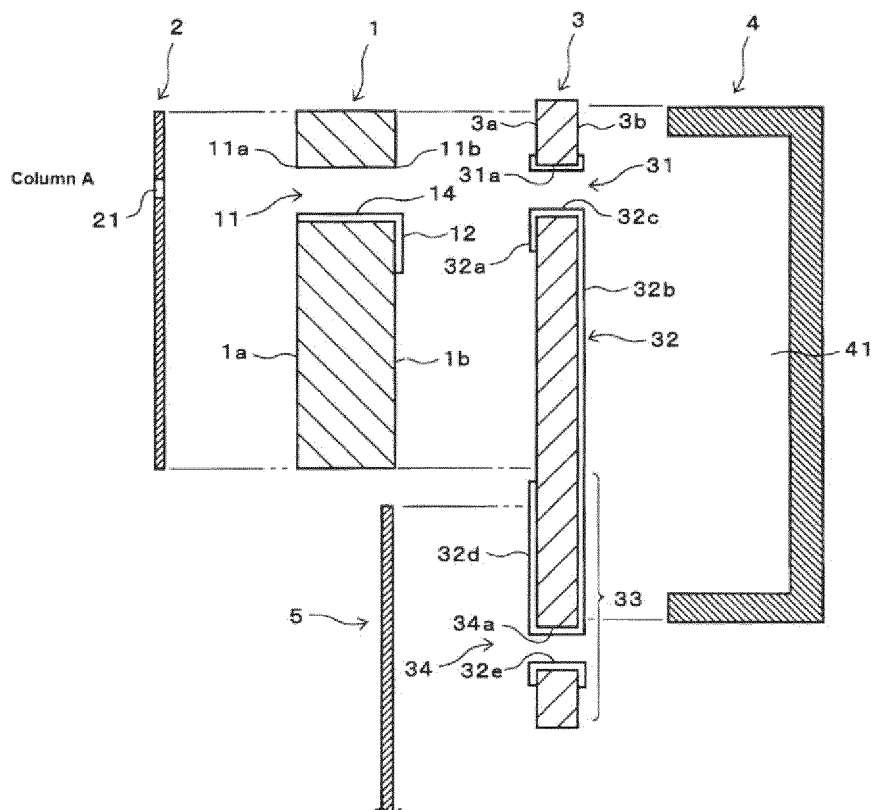


FIG. 11

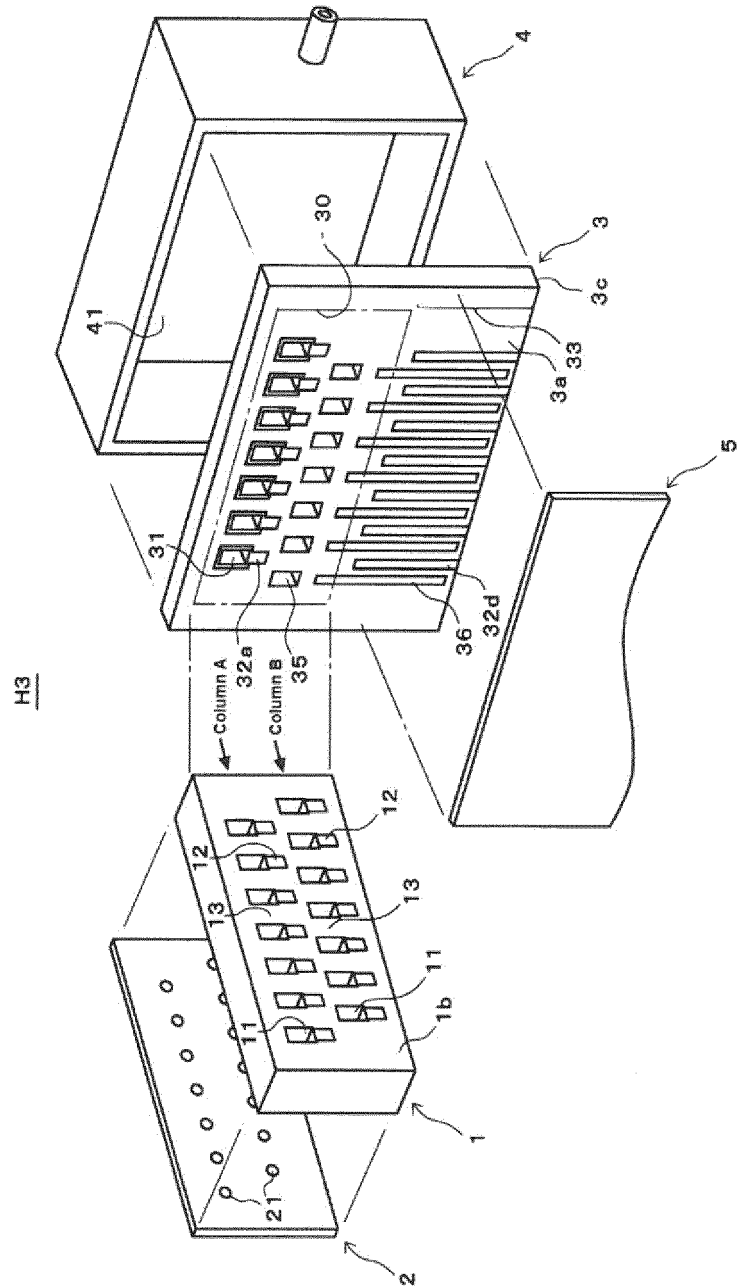


FIG. 12

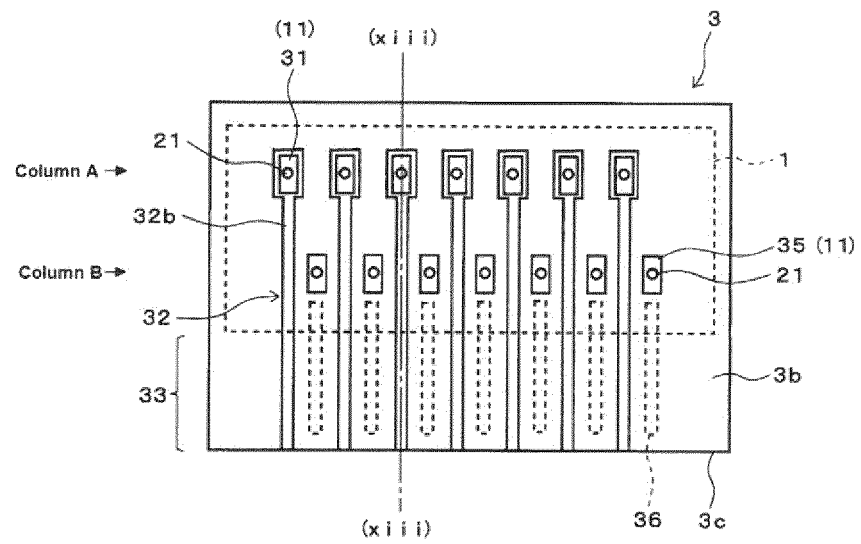


FIG. 13

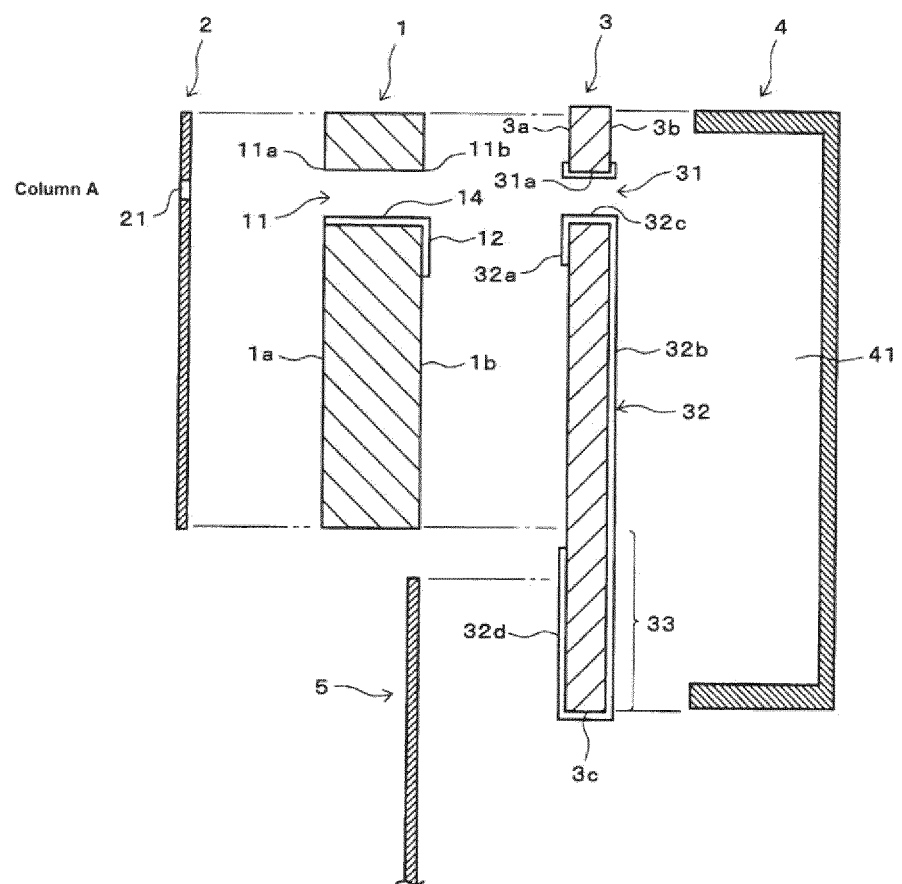


FIG. 14

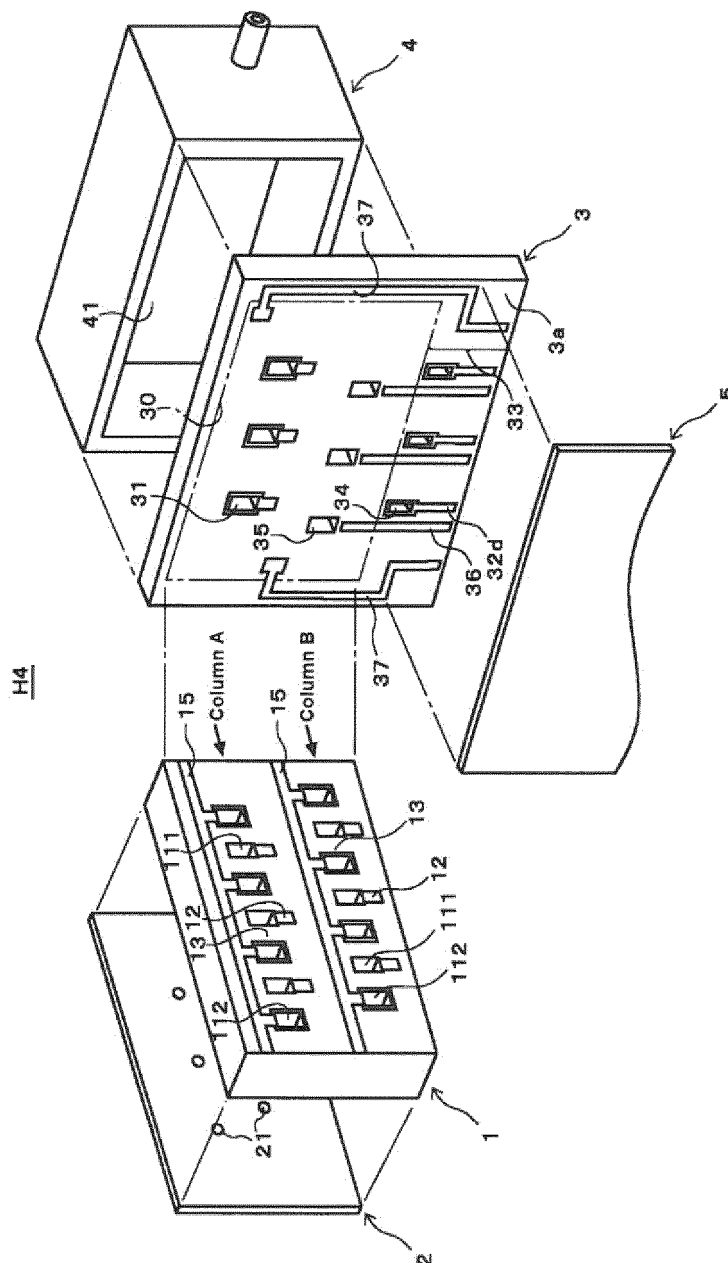


FIG.15

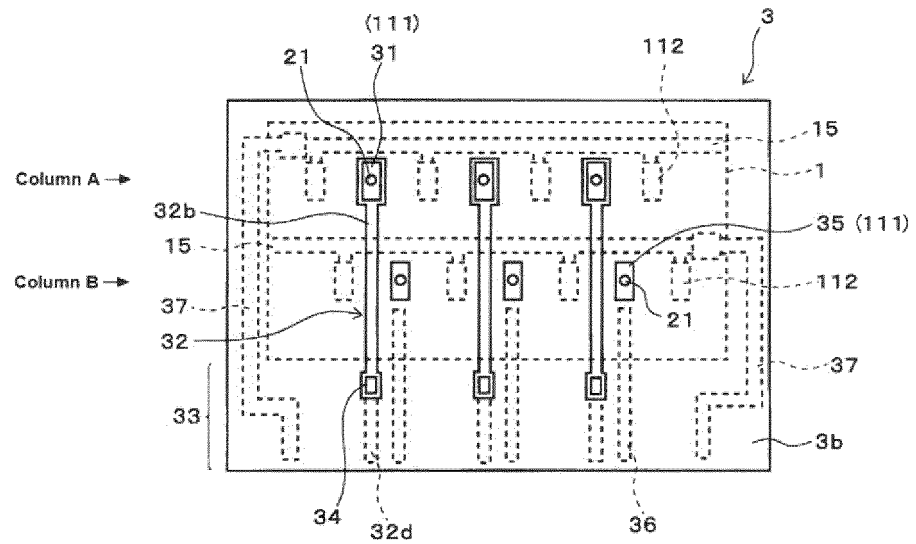
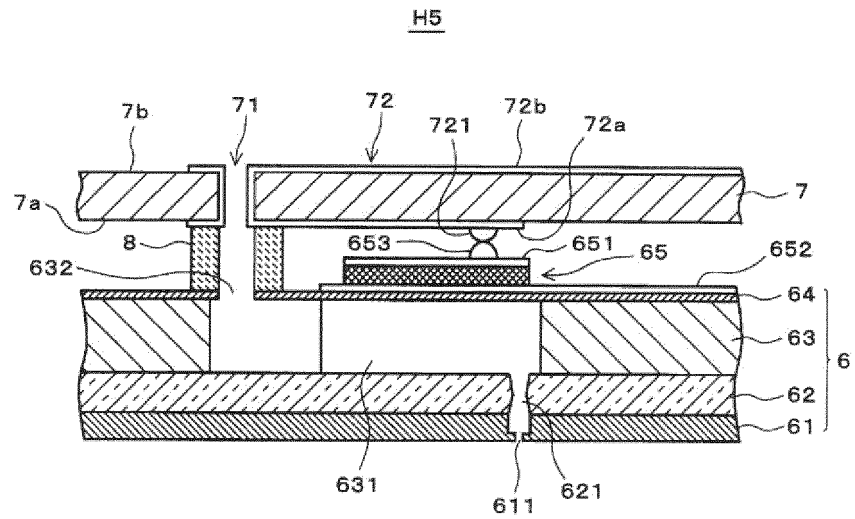


FIG.16



REFERENCES CITED IN THE DESCRIPTION

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