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Tomimatsu et al.

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(54) **LIQUID EJECTING APPARATUS AND LIQUID EJECTING HEAD**

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B41J 2/14 (2006.01)

(52) **U.S. Cl.**
CPC ***B41J 25/34*** (2013.01); ***B41J 2/14201*** (2013.01)

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See application file for complete search history.

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(57) **ABSTRACT**

A liquid ejecting apparatus includes a liquid ejecting head including head chips each including a nozzle plate, a holder that is formed of resin, holds the head chips, and includes a flow path for supplying the liquid to each of the head chips, a holder cover that is formed of a material having a higher thermal conductivity than a thermal conductivity of the holder and houses the head chips and the holder, and a fixing plate that is formed of metal and to which the holder cover and the head chips are fixed, a carriage on which the liquid ejecting head is mounted, and a heater that is mounted on the carriage and heats the liquid inside each of the head chips via the holder cover and the fixing plate.

14 Claims, 12 Drawing Sheets

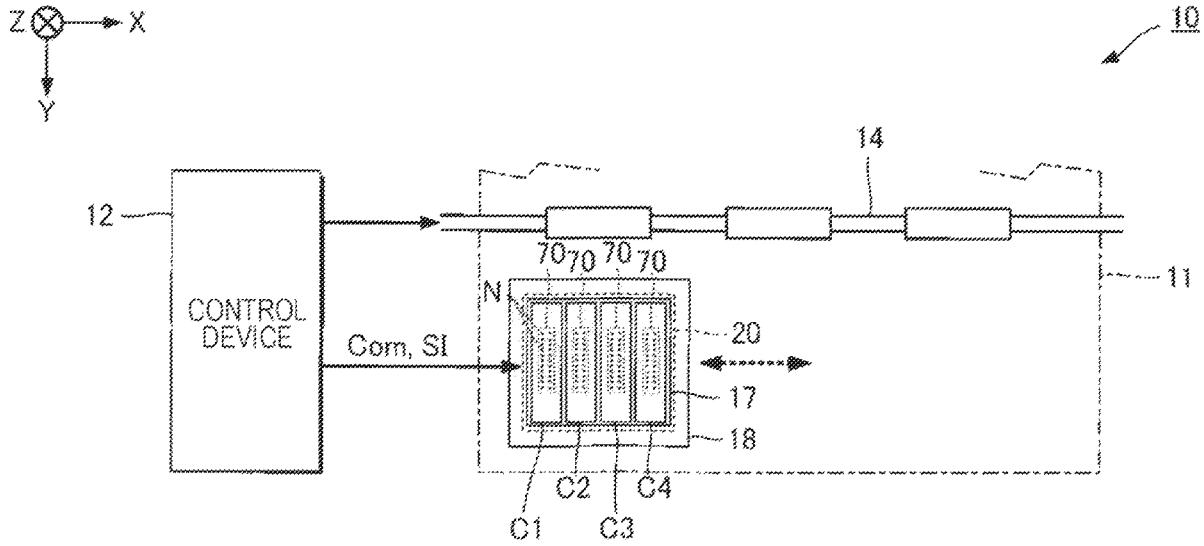
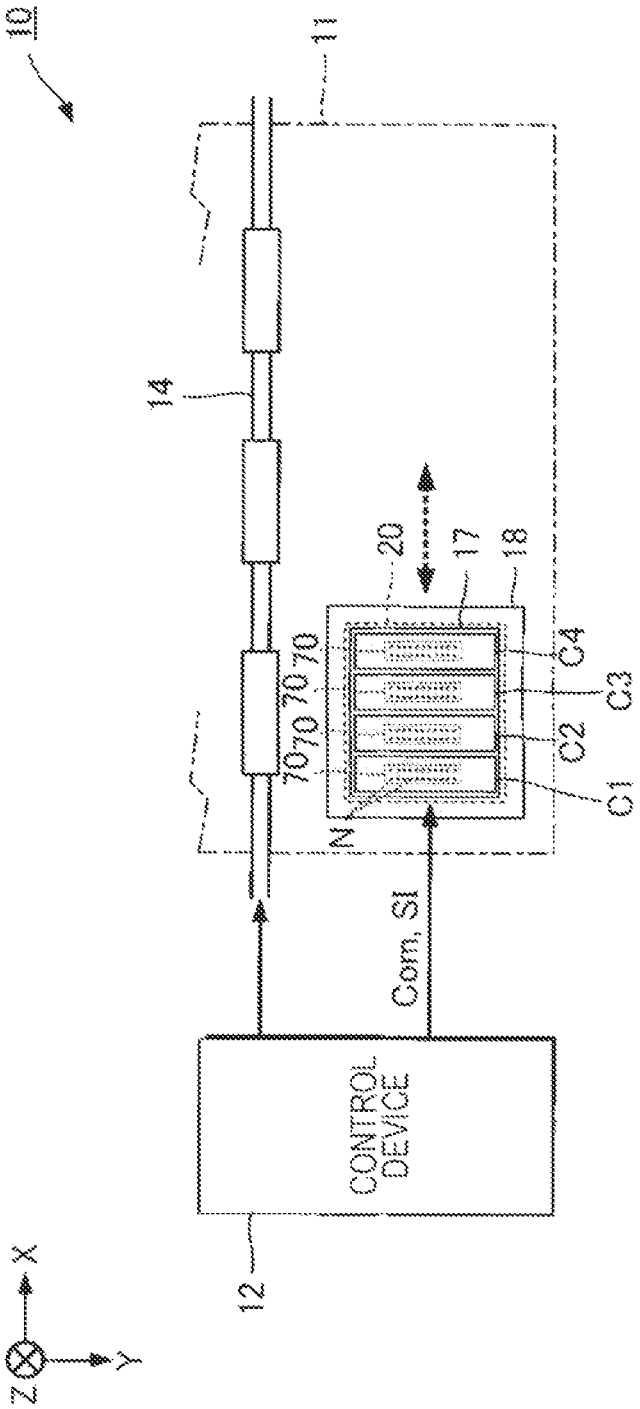


FIG. 1


10
11
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C4
C3
C2
C1
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Com, SI
CONTROL DEVICE
12
X
Y
Z

FIG. 2

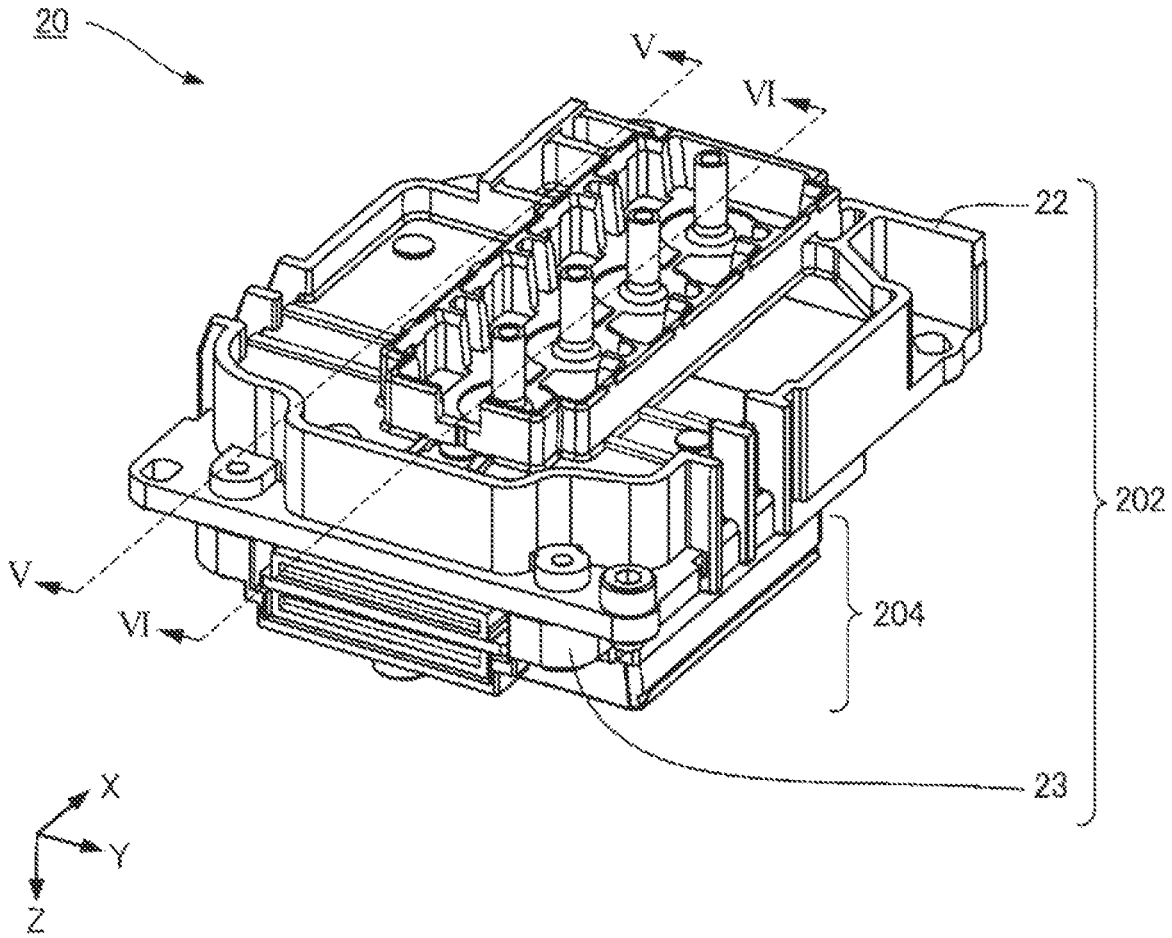
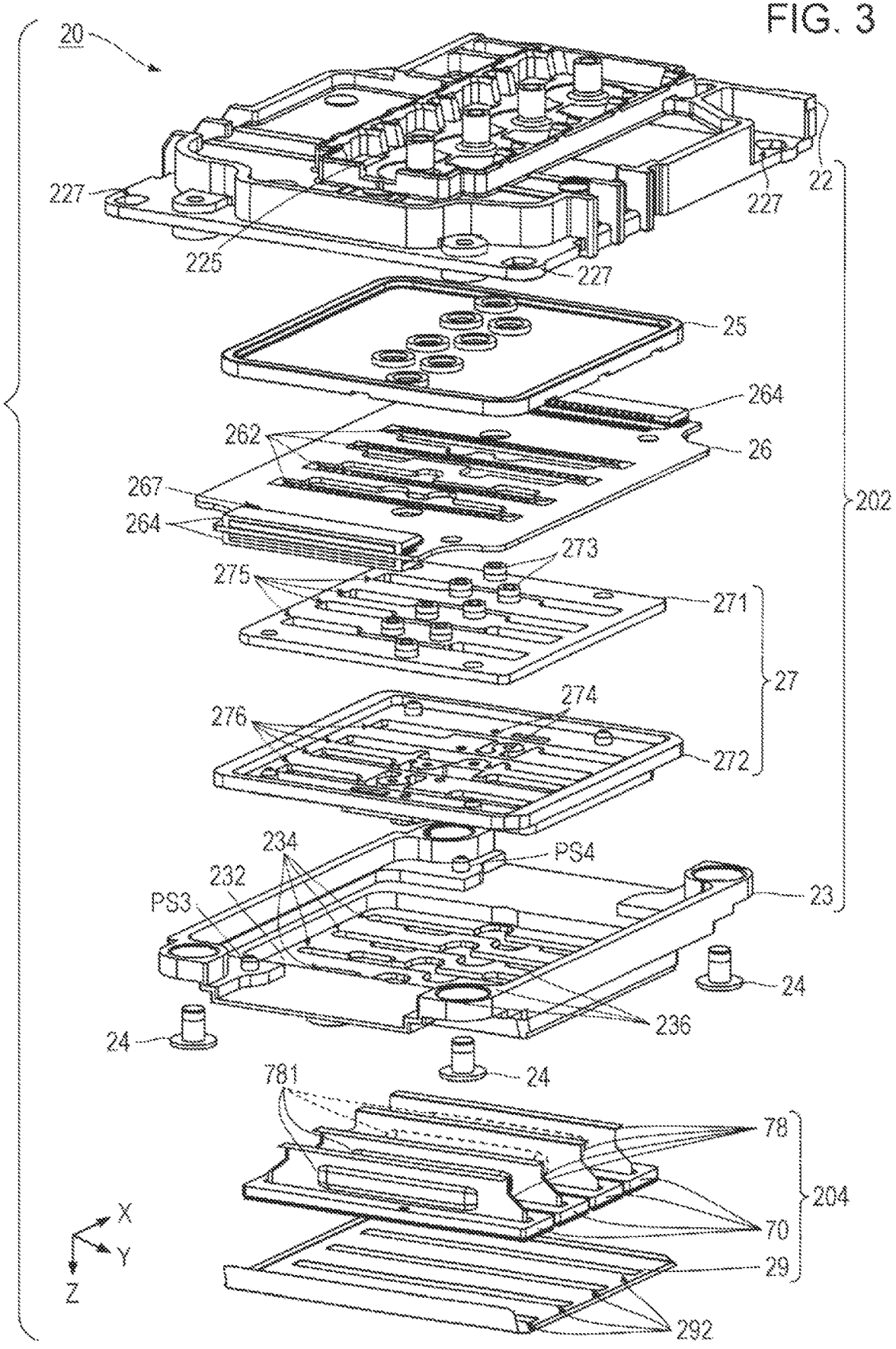


FIG. 3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227
225
227
227
22
25
264
262
26
267
264
202
273
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271
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274
276
272
234
PS4
232
PS3
23
24
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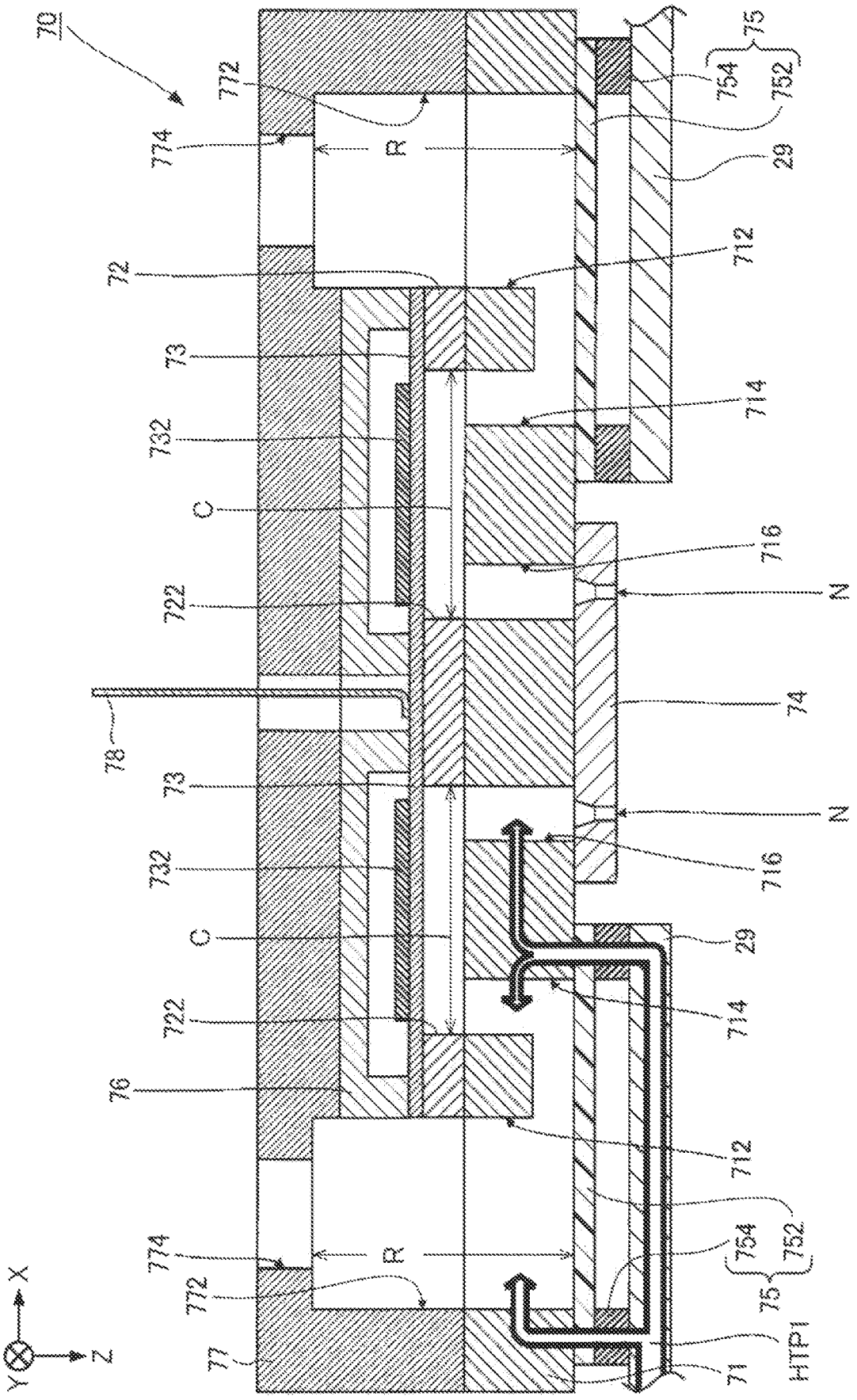
236
24
781
78
204
70
29
292
X
Y
Z

FIG. 4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714
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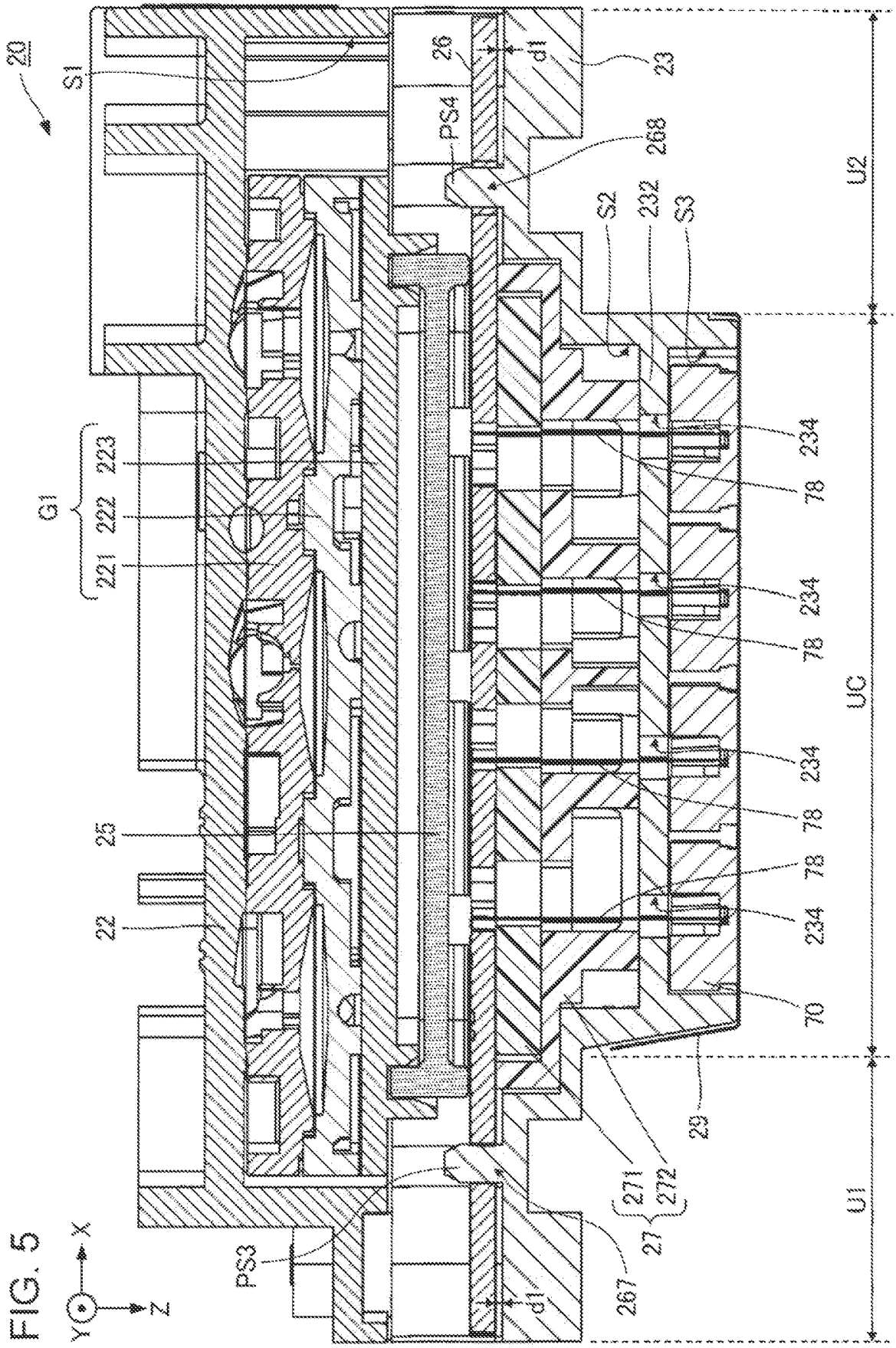
754
752
75
HTP1
71
X
Z
Y


20
S1
26
d1
23
PS4
268
U2
S2
232
S3
G1
223
222
221
234
78
25
22
UG
70
29
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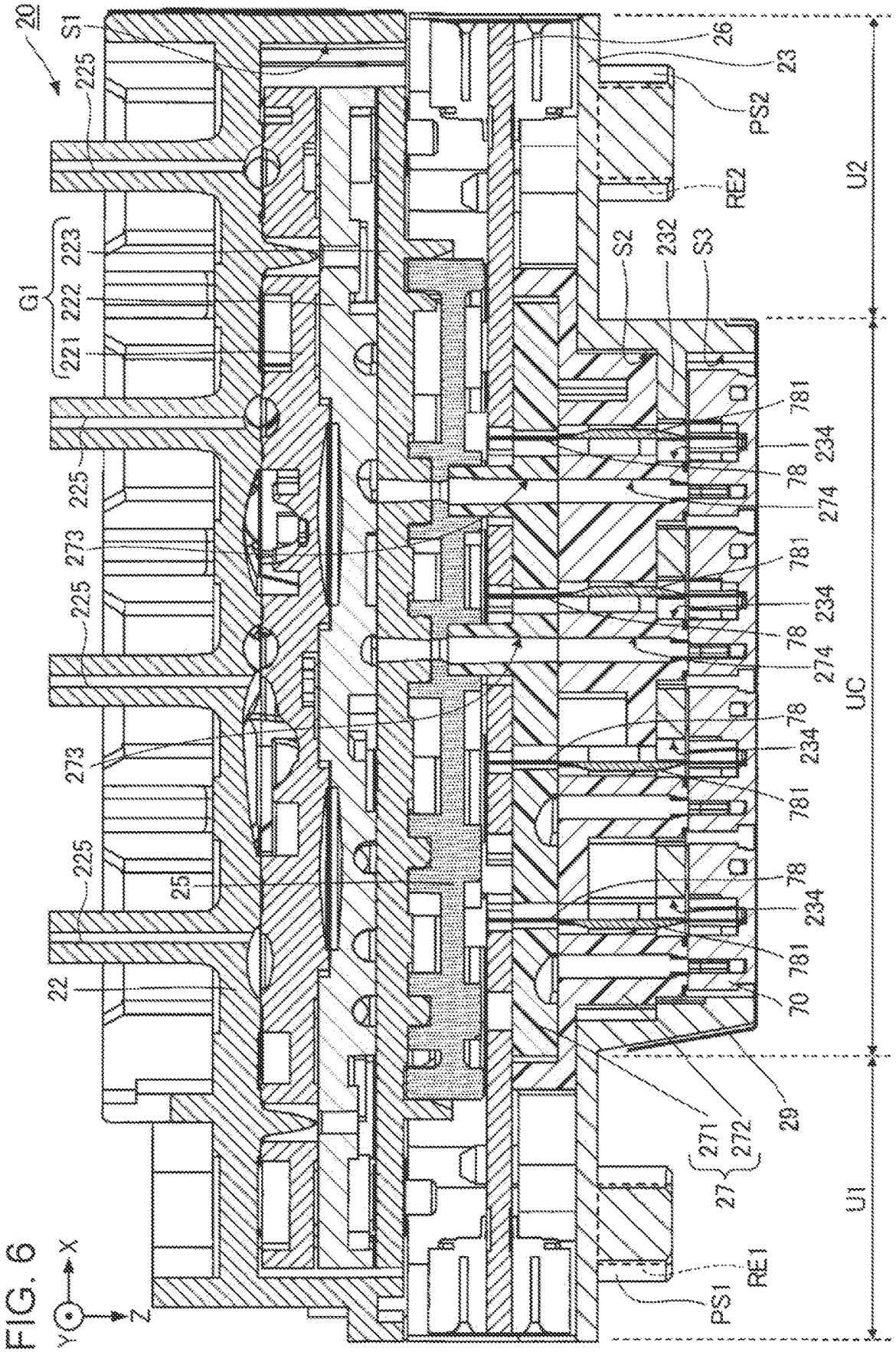
272
27
267
U1
PS3
X
Y
Z

FIG. 5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PS2
RE2
U2
G1
223
222
221
S2
232
S3
781
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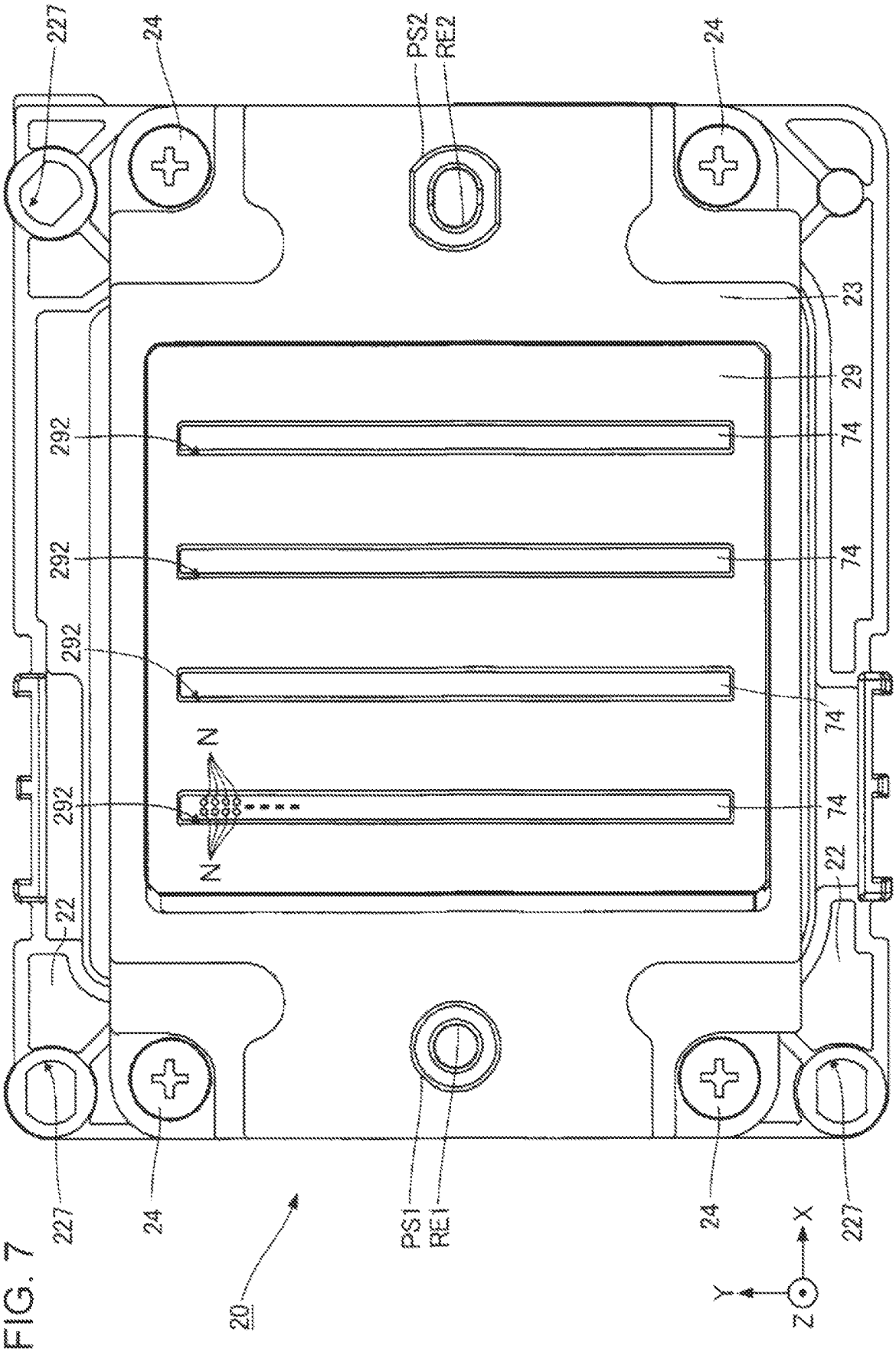
70
U1
RE1
PS1
X
Y
Z

FIG. 6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RE2
24
23
29
292
74
292
74
292
74
N
292
74
N
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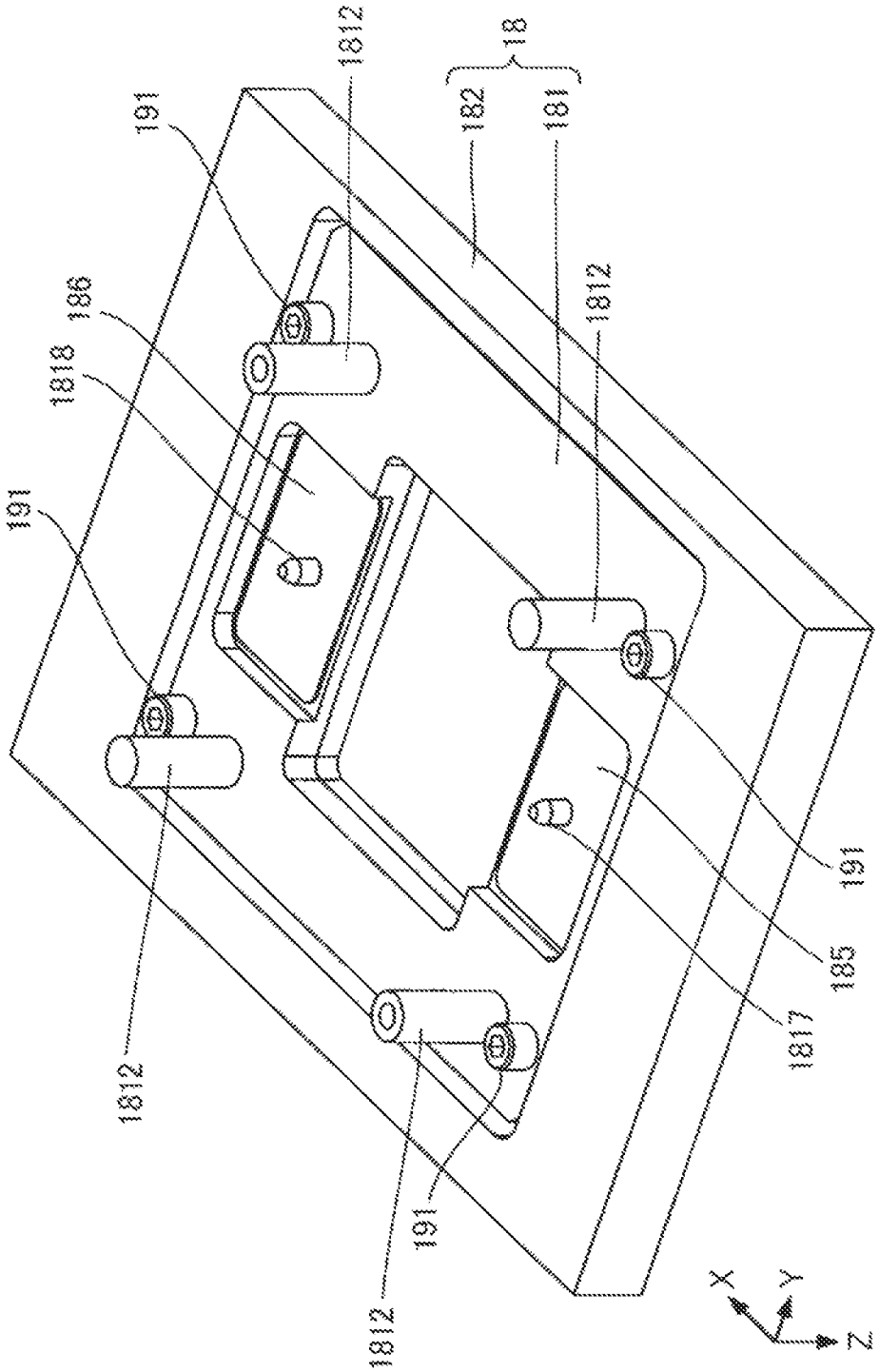
22
227
24
PS1
RE1
24
227
20
X
Y
Z

FIG. 7

FIG. 8


1812
18
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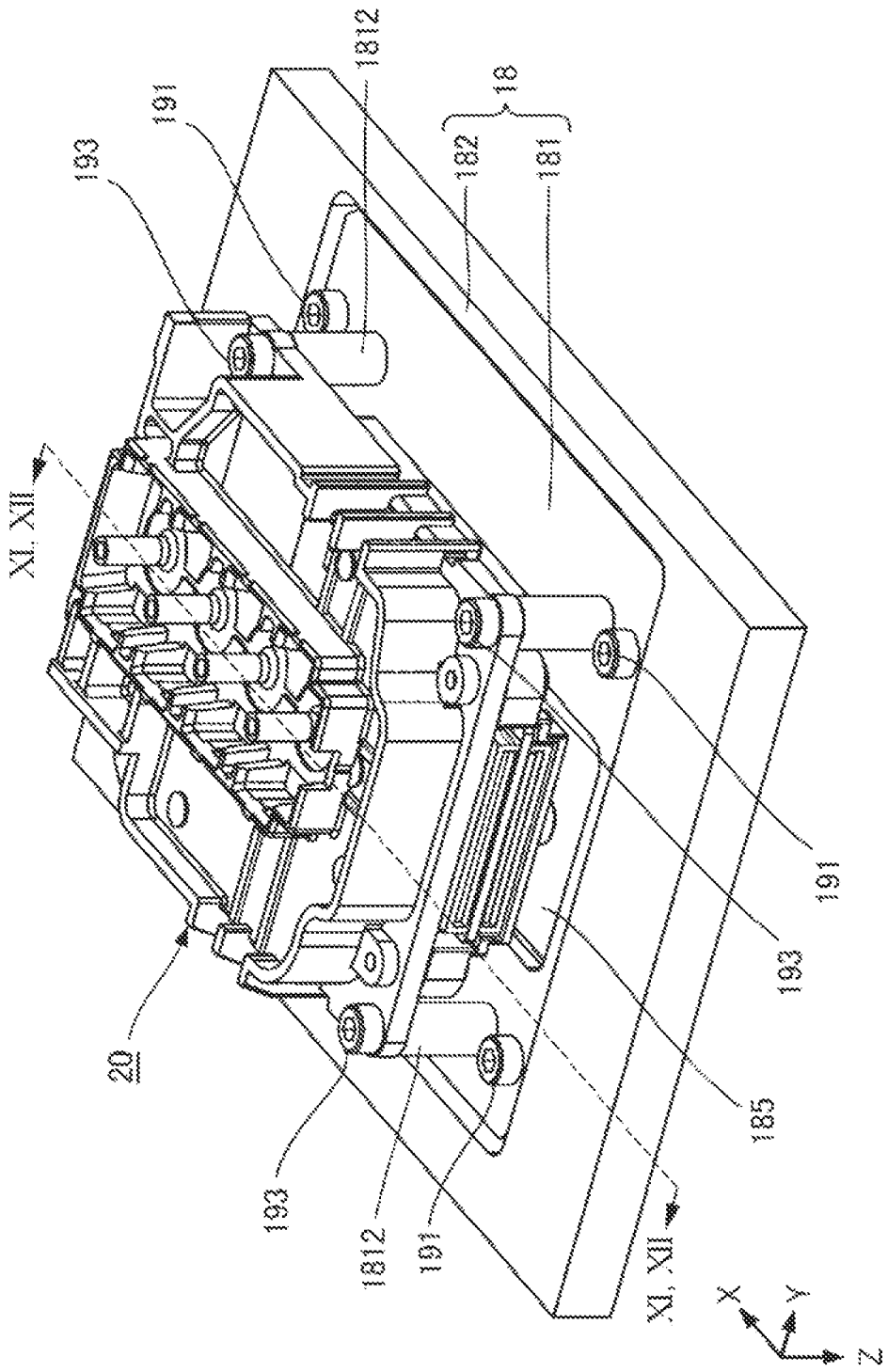
1818
1812
191
191
185
1817
1812
191
1812
X
Y
Z

FIG. 9


1812
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XI, XII
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XI, XII
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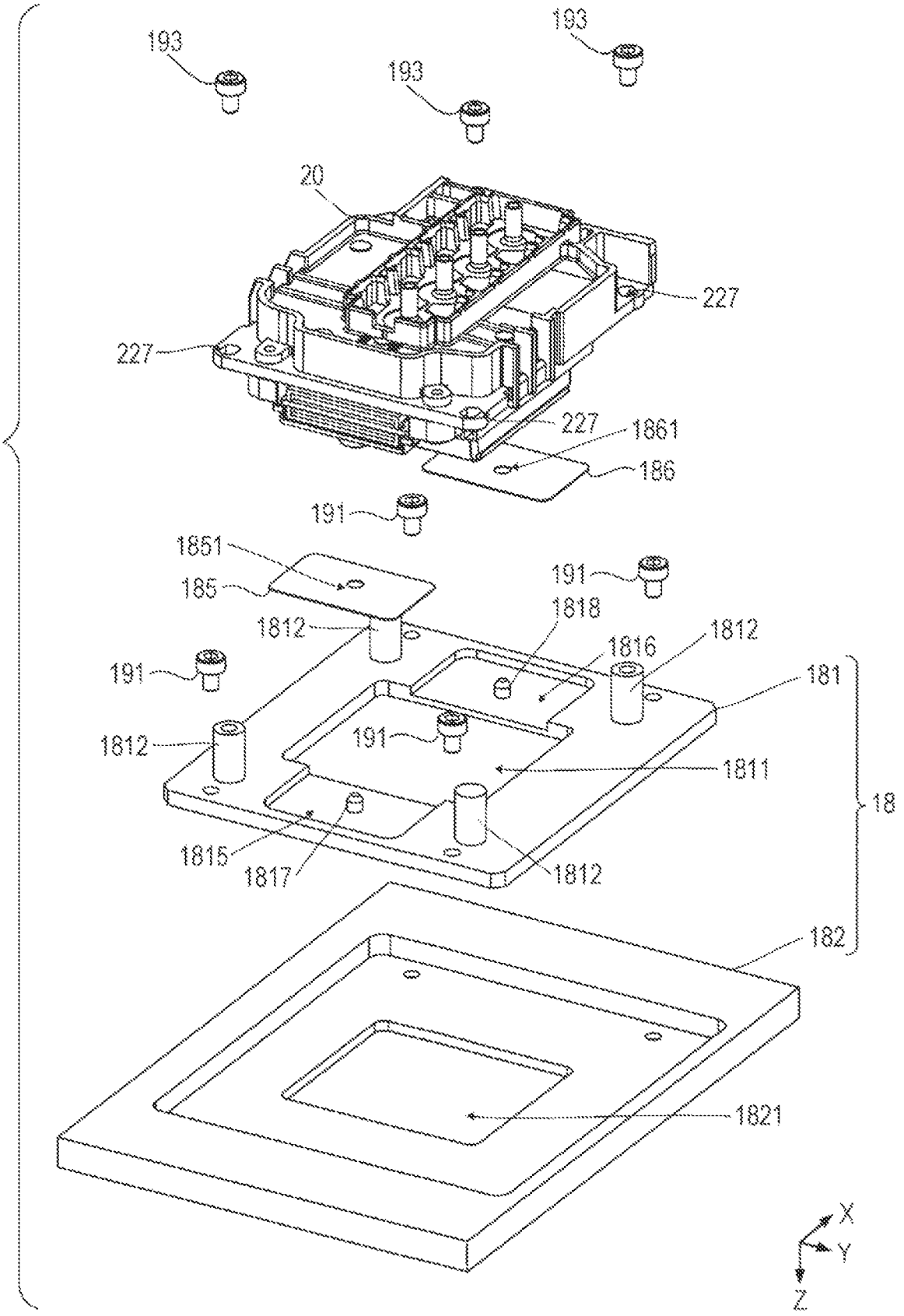
FIG. 10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1811
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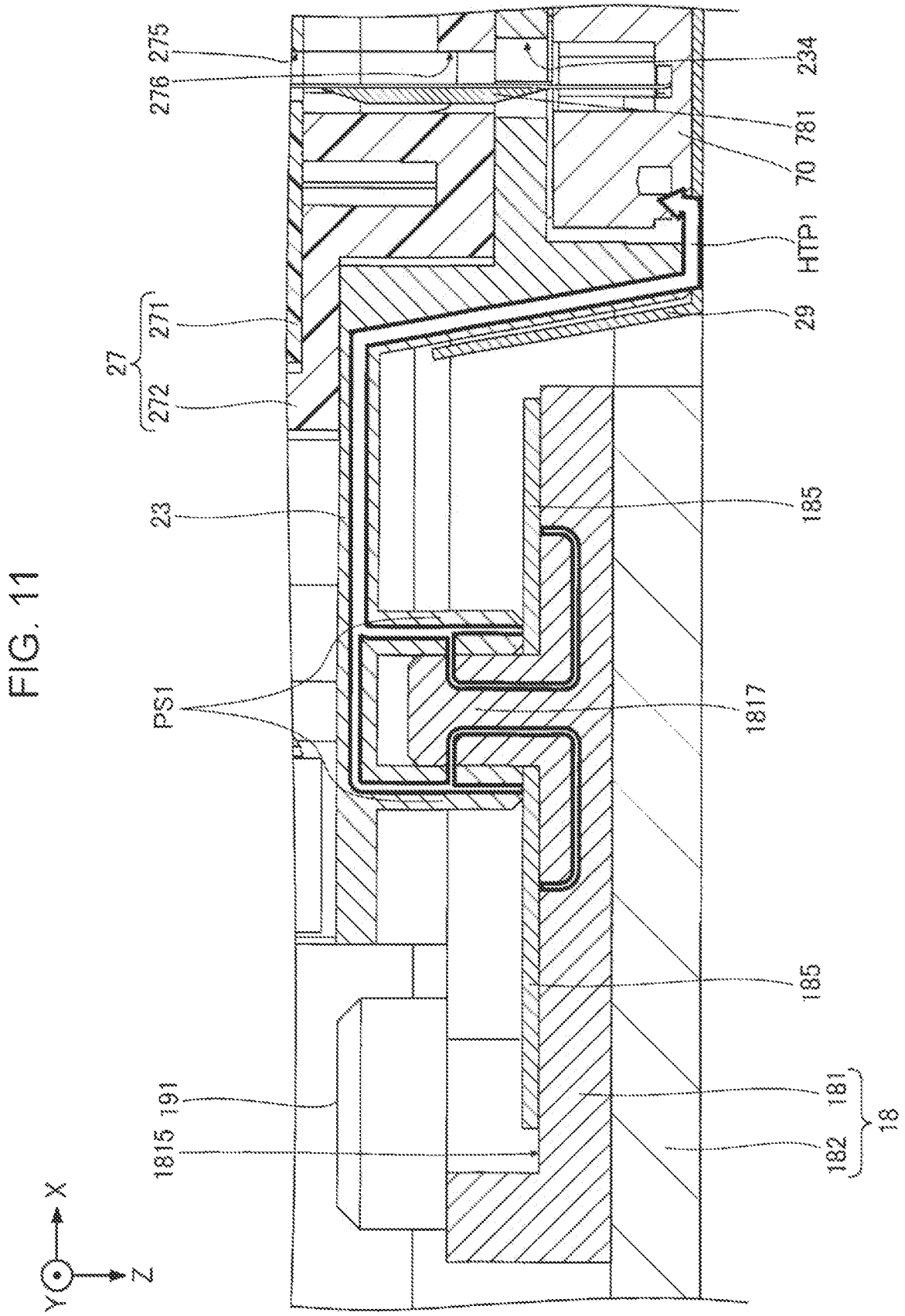
182
1821
X
Y
Z

FIG. 11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HTP1
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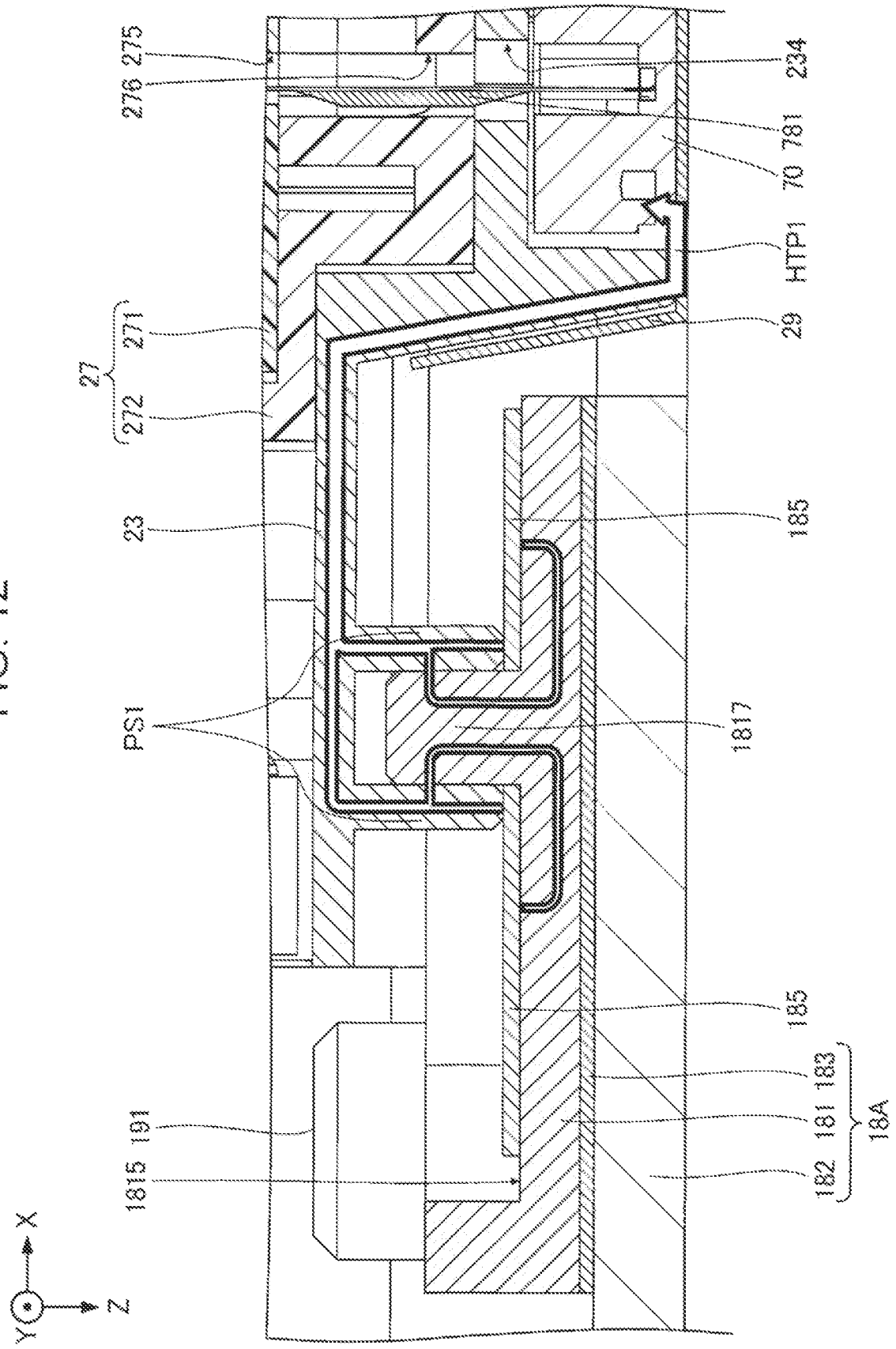
1815
182
X
Z
Y

FIG. 12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PS1
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185
183
181
182
18A
191
1815
X
Y
Z

LIQUID EJECTING APPARATUS AND LIQUID EJECTING HEAD

The present application is based on, and claims priority from JP Application Serial Number 2021-031443, filed Mar. 1, 2021, the disclosure of which is hereby incorporated by reference herein in its entirety.

BACKGROUND

1. Technical Field

The present disclosure relates to a liquid ejecting apparatus and a liquid ejecting head.

2. Related Art

In a related art, there is a known liquid ejecting apparatus, typically ink jet printer, including a liquid ejecting head that ejects a liquid such as ink. For example, JP-A-2019-89310 discloses a liquid ejecting apparatus including a holder that holds a plurality of head chips and forms a flow path to supply a liquid to the plurality of head chips. The holder included in the liquid ejecting apparatus is formed of resin. JP-A-2010-214743 discloses a liquid ejecting head including a heater that heats a liquid inside each of a plurality of head chips.

In the liquid ejecting apparatus described in JP-A-2019-89310 above, the liquid inside each of the plurality of head chips may be heated as described in JP-A-2010-214743. In the liquid ejecting apparatus described in JP-A-2019-89310, however, as the plurality of head chips is held by a holder formed of a resin generally having a low thermal conductivity, it is difficult to heat, from outside the liquid ejecting head, the liquid inside each of the plurality of head chips.

SUMMARY

According to an aspect of the present disclosure, a liquid ejecting apparatus includes a liquid ejecting head including a plurality of head chips each including a nozzle plate including a nozzle ejecting a liquid, a holder that is formed of resin, holds the plurality of head chips, and includes a flow path for supplying the liquid to each of the plurality of head chips, a holder cover that is formed of a material having a higher thermal conductivity than a thermal conductivity of the holder and houses the plurality of head chips and the holder, and a fixing plate that is formed of metal and to which the holder cover and the plurality of head chips are fixed, a carriage on which the liquid ejecting head is mounted, and a heater that is mounted on the carriage and heats the liquid inside each of the plurality of head chips via the holder cover and the fixing plate.

According to an aspect of the present disclosure, a liquid ejecting head mounted on a carriage on which a heater is mounted includes a plurality of head chips each including a nozzle plate including a nozzle ejecting a liquid, a holder that is formed of resin, holds the plurality of head chips, and includes a flow path for supplying the liquid to each of the plurality of head chips, a holder cover that is formed of a material having a higher thermal conductivity than a thermal conductivity of the holder and houses the plurality of head chips and the holder, and a fixing plate that is formed of metal and to which the holder cover and the plurality of head chips are fixed. The heater heats the liquid inside each of the plurality of head chips via the holder cover and the fixing plate.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial configuration diagram of a liquid ejecting apparatus according to a first embodiment of the present disclosure.

FIG. **2** is an external perspective view of a liquid ejecting head.

FIG. **3** is an exploded perspective view of the liquid ejecting head.

FIG. **4** is a sectional view of a head chip.

FIG. **5** is a V-V sectional view of the liquid ejecting head illustrated in FIG. **2**.

FIG. **6** is a VI-VI sectional view of the liquid ejecting head illustrated in FIG. **2**.

FIG. **7** is a bottom view of the liquid ejecting head.

FIG. **8** is an external perspective view of a carriage.

FIG. **9** is an external perspective view illustrating a state where the liquid ejecting head is attached to the carriage.

FIG. **10** is an exploded perspective view when the liquid ejecting head is attached to the carriage.

FIG. **11** is an XI-XI sectional view illustrating a state where the liquid ejecting head illustrated in FIG. **7** is attached to the carriage.

FIG. **12** is a sectional view of a carriage according to a third modification.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

An embodiment of the present disclosure will be described below with reference to the accompanying drawings. In each drawing, the dimension and scale of each unit are different from the actual ones as appropriate. The embodiment described below is a suitable specific example of the present disclosure, and therefore various technically preferable limitations are given; however, the scope of the present disclosure is not limited to the embodiment unless there is a description below to particularly limit the present disclosure.

1. First Embodiment

FIG. **1** is a partial configuration diagram of a liquid ejecting apparatus **10** according to a first embodiment of the present disclosure. The liquid ejecting apparatus **10** according to the first embodiment is an ink jet printing apparatus that ejects an ink, which is an example of a liquid, onto a medium **11** such as print sheet. The liquid ejecting apparatus **10** illustrated in FIG. **1** includes a control device **12**, a transport mechanism **14**, a carriage **18**, and a liquid ejecting head **20**. The control device **12** collectively controls respective elements of the liquid ejecting apparatus **10**.

The transport mechanism **14** transports the medium **11** in a +Y direction, which is a sub-scanning direction, under the control of the control device **12**. The carriage **18** reciprocates in a +X direction and a −X direction, which are a main scanning direction, under the control of the control device **12**. The liquid ejecting head **20** ejects the ink onto the medium **11** in parallel with the transport of the medium **11** and the reciprocation of the carriage **18**, and a desired image is thus formed on a surface of the medium **11**. An ejection direction of the ink by the liquid ejecting head **20** is referred to as "+Z direction". Hereinafter, the +X direction and the −X direction are collectively referred to as "X-axis direction", the +Y direction and a −Y direction opposite from the +Y direction are collectively referred to as "Y-axis direc-

tion", and the +Z direction and a −Z direction opposite from the +Z direction are collectively referred to as "Z-axis direction".

The liquid ejecting head **20** is mounted on a surface of the carriage **18** in the −Z direction. In the −Z direction of the liquid ejecting head **20**, a liquid storage section **17** is provided, which houses a plurality of liquid containers C**1** to C**4** that separately stores a plurality of types of inks. The inks according to the present embodiment are, for example, UV inks. UV is an abbreviation for ultra violet. The UV inks have the property of high viscosity at low temperatures and low viscosity at high temperatures. In order to improve ejecting performance, the UV inks need to be used in a high-temperature state. The inks according to the present embodiment are not limited to the UV inks and may be water-based inks or organic solvent based inks used for typical printing applications. The inks are, for example, liquids in a total of four colors, e.g., cyan, magenta, yellow, and black. The liquid containers C**1** to C**4** according to the present embodiment contain cyan, magenta, yellow, and black inks, respectively. The configuration and the number of the liquid containers C**1** to C**4** are not limited to those illustrated.

The liquid ejecting head **20** includes a plurality of head chips **70**. Each of the head chips **70** is a flow path structure including a member in which a flow path is formed. In the example described according to the present embodiment, the four head chips **70** are arranged in the X-axis direction. Two nozzle rows are provided in each of the head chips **70**. Each of the plurality of head chips **70** extends in the Y-axis direction, and each of the nozzle rows is a set of nozzles N that are linearly arranged in the Y-axis direction. The numbers and the arrangements of the head chips **70** and the nozzle rows are not limited to those illustrated. The liquid ejecting head **20** includes a flow path through which the ink flows and a filter that filters the ink flowing through the flow path.

As illustrated in FIG. **1**, a drive signal Com for driving the liquid ejecting head **20** and a control signal S**1** for controlling the liquid ejecting head **20** are supplied from the control device **12** to the liquid ejecting head **20**. The liquid ejecting head **20** is driven by the drive signal Com under the control by the control signal S**1**, and all or some of the plurality of nozzles N included in the liquid ejecting head **20** eject the ink in the +Z direction.

1.1. Structure of Liquid Ejecting Head **20**

A structure of the liquid ejecting head **20** will be described with reference to FIGS. **2** to **7**.

FIG. **2** is an external perspective view of the liquid ejecting head **20**. FIG. **3** is an exploded perspective view of the liquid ejecting head **20**. FIG. **4** is a sectional view of any of the head chips **70**. FIG. **4** illustrates a fixing plate **29** in addition to the head chip **70**. FIG. **5** is a V-V sectional view of the liquid ejecting head **20** illustrated in FIG. **2**. FIG. **6** is a VI-VI sectional view of the liquid ejecting head **20** illustrated in FIG. **2**. The V-V section and the VI-VI section are sections parallel to an XZ plane. In order to avoid complication of the drawing, the inside of the head chip **70** is not illustrated in FIGS. **5** and **6**. FIG. **7** is a bottom view of the liquid ejecting head **20**.

As illustrated in FIGS. **2** and **3**, the liquid ejecting head **20** according to the present embodiment includes a flow path unit **202** and a head main body **204**. The head main body **204** houses the four head chips **70** described above. The flow path unit **202** supplies cyan, magenta, yellow, and black, which are the inks from the liquid containers C**1** to C**4**, to the respective head chips **70** of the head main body **204**.

As illustrated in FIG. **4**, the head chip **70** includes a flow path formation substrate **71**, a pressure chamber formation substrate **72** stacked on a surface of the flow path formation substrate **71** in the −Z direction, a vibration plate **73** stacked on the pressure chamber formation substrate **72** in the −Z direction, and a nozzle plate **74** and a compliance portion **75** provided on a surface of the flow path formation substrate **71** in the +Z direction. The nozzles N are formed in the nozzle plate **74**. The structure corresponding to each row of the nozzles N is formed substantially in line symmetry in each of the head chips **70**, and therefore the structure of the head chip **70** will be described below with a focus on one row of the nozzles N for convenience.

The flow path formation substrate **71** is a plate-shaped member forming a flow path of the ink. In the flow path formation substrate **71** according to the present embodiment, an opening **712**, a supply flow path **714**, and a communication flow path **716** are formed. The supply flow path **714** and the communication flow path **716** are formed for each of the nozzles N, and the opening **712** continues over the plurality of nozzles N. The pressure chamber formation substrate **72** is a plate-shaped member including a plurality of openings **722** corresponding to the different nozzles N. The flow path formation substrate **71** and the pressure chamber formation substrate **72** are formed of, for example, a single-crystal substrate of silicon.

The compliance portion **75** is a mechanism that suppresses pressure fluctuations in the flow path of the head chip **70** and includes a sealing plate **752** and a support body **754**. The sealing plate **752** is a film-shaped resin member having flexibility. The support body **754** fixes the sealing plate **752** to the flow path formation substrate **71** to close the opening **712** and each of the supply flow paths **714** of the flow path formation substrate **71**. The support body **754** is formed of metal such as stainless steel.

The vibration plate **73** is a plate-shaped member capable of elastically vibrating and is formed by stacking an elastic film formed of an elastic material such as silicon oxide and an insulating film formed of an insulating material such as zirconium oxide. The vibration plate **73** and the flow path formation substrate **71** face each other with a gap interposed therebetween inside each of the openings **722** formed in the pressure chamber formation substrate **72**. The space between the flow path formation substrate **71** and the vibration plate **73** inside each of the openings **722** functions as a pressure chamber C that applies pressure to the ink. According to the present embodiment, two rows of the pressure chambers C arranged in the Y-axis direction are arranged in the X-axis direction.

As illustrated in FIG. **4**, a support body **77** is fixed to the flow path formation substrate **71** and a protective plate **76**. The support body **77** is integrally formed by molding a resin material, for example. The support body **77** according to the present embodiment is a member including a space **772** forming, together with the opening **712** of the flow path formation substrate **71**, a liquid storage chamber R, and a supply port **774** communicating with the liquid storage chamber R. The liquid storage chamber R stores the ink introduced through the supply port **774**. The ink stored in the liquid storage chamber R is distributed by the plurality of supply flow paths **714**, fills each of the pressure chambers C, is passed through the communication flow path **716** and the nozzle N from each of the pressure chambers C, and is ejected in the +Z direction.

An end portion of a wiring member **78** is joined to the vibration plate **73**. The wiring member **78** is a wiring substrate on which wires are formed to transmit the drive signal Com and a power supply voltage to each piezoelectric element **732**. Each of the four head chips **70** has a corresponding wiring member **78** coupled thereto. A flexible wiring substrate such as FPC, COF, or FFC is suitably used as the wiring member **78**. Here, FPC is an abbreviation for flexible printed circuit. COF is an abbreviation for chip on film. FFC is an abbreviation for flexible flat cable.

As illustrated in FIGS. **3** and **6**, the wiring member **78** includes a drive circuit **781**. The drive circuit **781** is provided on the surface of the wiring member **78** in the −X direction in the two head chips **70** out of the four head chips **70** illustrated in FIG. **3**, and the drive circuit **781** is provided on the surface of the wiring member **78** in the +X direction in the remaining two head chips **70**. In FIG. **3**, the drive circuit **781** provided on the surface of the wiring member **78** in the +X direction is indicated by a broken line. The drive circuit **781** is an electric circuit that performs, based on the control signal S**1**, switching whether to supply the drive signal Com to the piezoelectric element **732**. Each of the wiring members **78** is coupled to a circuit substrate **26** described below.

As illustrated in FIGS. **2** and **3**, the flow path unit **202** is formed by housing each component in a member including a case **22** and a holder cover **23**. The case **22** is formed by injection molding of a resin material, for example, and is stacked on the holder cover **23**. As illustrated in FIGS. **3** and **7**, the case **22** and the holder cover **23** are fixed to each other by a plurality of screws **24**. As illustrated in FIGS. **3** and **7**, the case **22** includes a plurality of through-holes **227** extending in the Z-axis direction. The plurality of through-holes **227** are used to fix the liquid ejecting head **20** to the carriage **18**.

As illustrated in FIGS. **5** and **6**, a space S**1** is formed in the +Z direction of the case **22**. The holder cover **23** includes an inner bottom surface **232** substantially parallel to the XY plane. The inner bottom surface **232** includes four openings **234** through which the respective four wiring members **78** are inserted. The four openings **234** are provided to extend in the Y-axis direction. Due to the four openings **234** extending in the Y-axis direction, the inner bottom surface **232** includes three beam portions **236** extending in the Y-axis direction. A space S**2** is formed in the −Z direction with respect to the inner bottom surface **232**, and a space S**3** is formed in the +Z direction with respect to the inner bottom surface **232**.

The +Y direction and the −Y direction are examples of a "second direction".

As illustrated in FIGS. **5** and **6**, the space S**2** of the holder cover **23** houses a sealing member **25**, the circuit substrate **26**, and a holder **27**. As illustrated in FIG. **5**, the circuit substrate **26** is stacked on the holder **27** with a gap dl interposed between the circuit substrate **26** and the holder cover **23** in the Z-axis direction.

The Z-axis direction, that is, the +Z direction and the −Z direction, are examples of "stacking direction".

The holder **27** includes a first holder **271** and a second holder **272**. In the space S**2**, the first holder **271** and the second holder **272** are sequentially stacked from the −Z direction. The space S**3** of the holder cover **23** houses the plurality of head chips **70**, and the holder cover **23** is closed by the fixing plate **29** from the +Z direction. The space S**1** of the case **22** houses a filter unit G**1**. The filter unit G**1** is stacked at the sealing member **25** in the −Z direction on the side opposite from the circuit substrate **26**.

As illustrated in FIGS. **5** and **6**, the filter unit G**1** is a flow path structure including a plurality of stacked constituent members **221**, **222**, and **223**. The constituent members **221**, **222**, and **223** are members in which an ink flow path is formed. The flow paths formed in the constituent members **221**, **222**, and **223** are not illustrated. The above-described filter is provided in the middle of the flow path in the constituent member **222**. As FIG. **3** illustrates a state where the filter unit G**1** is fixed to the surface of the case **22** in the +Z direction, the filter unit G**1** is not illustrated. Instead of the filter unit G**1**, it is possible to provide a flow path component in which a flow path without a filter is formed. The filter unit G**1** is formed by injection molding of a resin material. The filter unit G**1** is formed of, for example, a thermoplastic resin or a thermosetting resin. Examples of the thermoplastic resin include Zylon, LCP, PPS, and PP. Zylon is a registered trademark. LCP is a liquid crystal polymer. PPS is polyphenylene sulfide. PP is polypropylene. Examples of the thermosetting resin include an epoxy resin and a phenol resin.

The circuit substrate **26** is a substrate that relays the drive signal Com, the control signal S**1**, and the like, supplied from the control device **12**. The circuit substrate **26** includes terminal portions **262** that are electrically coupled to the wiring members **78** of the respective head chips **70**. The circuit substrate **26** has a connector **264** for coupling with the control device **12** and has other electronic components mounted thereon. The terminal portions **262** and the connector **264** are electrically coupling portions. On the circuit substrate **26** according to the present embodiment, the four terminal portions **262** corresponding to the wiring members **78** of the four head chips **70** are formed in the −Z direction of the circuit substrate **26**. A wiring member such as FFC is coupled to the connector **264**, and the circuit substrate **26** receives the drive signal Com from the control device **12** via the FFC. FFC is an abbreviation for flexible flat cable. The connector **264** of the circuit substrate **26** according to the present embodiment is provided to be exposed from the respective end portions in the +X direction and the −X direction.

As illustrated in FIGS. **3** and **5**, the circuit substrate **26** includes a through-hole **267** extending in the Z-axis direction. As illustrated in FIG. **5**, the circuit substrate **26** includes a through-hole **268** extending in the Z-axis direction. The through-holes **267** and **268** are used for positioning the circuit substrate **26** with respect to the holder cover **23**.

The first holder **271** and the second holder **272** are plate-shaped flow path structures in which ink flow paths are formed. The first holder **271** and the second holder **272** are formed by injection molding of a resin material. The first holder **271** and the second holder **272** are formed of, for example, a thermoplastic resin or a thermosetting resin, similarly to the filter unit G**1**. On the surface of the first holder **271** in the −Z direction, a plurality of flow paths **273** protruding in the −Z direction is formed. Although the first holder **271** includes the eight flow paths **273**, only the two flow paths **273** out of the eight flow paths **273** are denoted by the reference numeral in FIGS. **3** and **6** to avoid complication of the drawing. Each of the plurality of flow paths **273** passes through a through-hole formed in the circuit substrate **26** and communicates with flow paths of the constituent members **221**, **222**, and **223** via a through-hole of the sealing member **25**.

A plurality of flow paths **274** extending in the Z-axis direction is formed in the second holder **272**. Although the second holder **272** includes the eight flow paths **274**, only the two flow paths **274** out of the eight flow paths **274** are

denoted by a reference numeral in FIGS. **3** and **6** to avoid complication of the drawing. Each of the plurality of flow paths **274** communicates with the corresponding one of the plurality of flow paths **273**. The inks are introduced into the head chips **70** through the respective flow paths **273** and the respective flow paths **274**.

The first holder **271** further includes four openings **275** through which the four wiring members **78** are inserted, respectively. Similarly, the second holder **272** includes four openings **276** through which the four wiring members **78** are inserted, respectively. The openings **275** and the openings **276** are holes penetrating in the Z-axis direction.

The holder cover **23** is formed of a material having a higher thermal conductivity than that of the first holder **271** and the second holder **272**. Examples of the material having a higher thermal conductivity than that of a resin material include metal and a ceramic having a higher thermal conductivity than that of a resin material. Examples of the metal suitable for forming the holder cover **23** include stainless steel, aluminum, titanium, and magnesium alloy. Examples of the ceramic having a higher thermal conductivity than that of a resin material include silicon carbide, aluminum nitride, sapphire, alumina, silicon nitride, cermet, and yttria. In the following description, it is assumed that the holder cover **23** is formed of metal.

As described above, the space S**3** of the holder cover **23** houses the plurality of head chips **70**. The plurality of head chips **70** is arranged side by side in the space S**3** along the X-axis. Each of the piezoelectric elements **732** in the respective head chips **70** vibrates in response to the drive signal Com supplied from the control device **12** via the circuit substrate **26** and the wiring member **78**. Fluctuations in the pressure in the pressure chamber C due to the vibration of the piezoelectric element **732** cause the ink filling the pressure chamber C to be ejected through each of the nozzles N of the nozzle plate **74**.

The fixing plate **29** is a plate-shaped member. The fixing plate **29** is formed of metal. Examples of the metal suitable for forming the fixing plate **29** include stainless steel. As illustrated in FIGS. **3** and **7**, four openings **292** each having the shape corresponding to the nozzle plate **74** of each of the head chips **70** are formed in the fixing plate **29** for the respective head chips **70**. Each opening **292** has a rectangular shape that is elongated in the Y direction. In a state where the nozzle plate **74** is positioned inside the opening **292**, each of the head chips **70** is fixed to the surface of the fixing plate **29** in the −Z direction with, for example, an adhesive. Accordingly, each of the nozzles N of each nozzle row is arranged inside the opening **292**. In order to avoid complication of the drawing, FIG. **7** illustrates only some of the nozzles N among the nozzles N included in the four head chips **70**.

As illustrated in FIGS. **3** and **6**, the surface of the case **22** in the −Z direction includes a plurality of pipes protruding in the −Z direction, and the plurality of pipes includes a plurality of flow paths **225**, respectively, for introducing the inks from the liquid containers C**1** to C**4**. The flow paths **225** introduce the inks in the liquid containers C**1** to C**4** into the respective head chips **70** via the flow paths in the constituent members **221**, **222**, and **223**, the flow paths **273** of the first holder **271**, and the flow paths **274** of the second holder **272**.

The sealing member **25** illustrated in FIGS. **5** and **6** is a plate-like elastic member. The sealing member **25** includes a through-hole that couples the flow path in the filter unit G**1** and the flow paths **273** of the first holder **271** in a liquid-tight manner.

1.2. Positioning of Liquid Ejecting Head **20** and Positioning of Circuit Substrate **26**

Positioning of the liquid ejecting head **20** with respect to the carriage **18** and positioning of the circuit substrate **26** with respect to the holder cover **23** will be described with reference to FIGS. **5**, **6**, **8**, and **9**.

As illustrated in FIGS. **5** and **6**, the holder cover **23** includes a holding portion UC, a first flange portion U**1**, and a second flange portion U**2**. The holding portion UC holds the holder **27**. The first flange portion U**1** is provided to extend from the holding portion UC in the −X direction. Being provided to extend from the holding portion UC in the −X direction specifically means that an end portion of the holding portion UC in the −X direction has a shape extending by a predetermined distance in the −X direction. The second flange portion U**2** is provided to extend from the holding portion UC in the +X direction.

The −X direction is a direction in which the plurality of head chips **70** is arranged and is an example of a "first direction". The direction in which the plurality of head chips **70** is arranged is a direction in which any positions of the respective head chips **70** are arranged. The points at the positions of the respective head chips **70** may be, for example, the end portions of the respective head chips **70** in the −Y direction, the centers of the respective head chips **70**, or the end portions of the respective head chips **70** in the +Y direction.

1.2.1. Positioning of Liquid Ejecting Head **20** with Respect to Carriage **18**

As illustrated in FIGS. **6** and **7**, the first flange portion U**1** includes a first positioning portion PS**1** for positioning the liquid ejecting head **20** with respect to the carriage **18**. The second flange portion U**2** includes a second positioning portion PS**2** for positioning the liquid ejecting head **20** with respect to the carriage **18**. Specifically, the first positioning portion PS**1** and the second positioning portion PS**2** are substantially columnar members protruding in the +Z direction. As illustrated in FIG. **6**, the surface of the first positioning portion PS**1** in the +Z direction includes a recessed portion RE**1** that is recessed in the −Z direction, and the surface of the second positioning portion PS**2** in the +Z direction includes a recessed portion RE**2** that is recessed in the −Z direction. In the following description, the recessed portion RE**1** and the recessed portion RE**2** may be collectively referred to as "recessed portion RE". As the recessed portion RE does not appear in the VI-VI section, the outline of the recessed portion RE is indicated by a broken line in FIG. **6**. As illustrated in FIG. **6**, the second positioning portion PS**2** is larger than the first positioning portion PS**1** with respect to the X-axis direction, which is a direction in which the first positioning portion PS**1** and the second positioning portion PS**2** are arranged. Similarly, the recessed portion RE**2** is larger than the recessed portion RE**1** with respect to the X-axis direction.

FIG. **8** is an external perspective view of the carriage **18**. FIG. **9** is an external perspective view illustrating a state where the liquid ejecting head **20** is attached to the carriage **18**. FIG. **10** is an exploded perspective view when the liquid ejecting head **20** is attached to the carriage **18**.

As illustrated in FIGS. **8**, **9**, and **10**, the carriage **18** includes a spacer **181** and a carriage main body portion **182**. The carriage **18** has a first heater **185** and a second heater **186** mounted thereon. The spacer **181** and the carriage main body portion **182** are formed of metal. Examples of the metal suitable for forming the spacer **181** and the carriage main body portion **182** include stainless steel, aluminum,

titanium, and magnesium alloy. In plan view in the +Z direction, the carriage main body portion **182** is larger than the spacer **181**. Hereinafter, the plan view in the +Z direction is simply referred to as "plan view".

The first heater **185** and the second heater **186** correspond to "heater".

As illustrated in FIG. **10**, the carriage main body portion **182** is a plate-shaped member substantially parallel to the XY plane and includes a through-hole **1821** extending in the Z-axis direction. In plan view, the edges of the through-hole **1821** form substantially a rectangle. The diameter of the through-hole **1821** increases toward the −Z direction. As the diameter increases, a step is formed in the through-hole **1821**. The spacer **181** is fitted into the step formed in the through-hole **1821**, and the carriage main body portion **182** thus holds the spacer **181**. The spacer **181** and the carriage main body portion **182** are fixed to each other with a plurality of screws **191**. The carriage main body portion **182** is not limited to a plate-shape and may be a recessed shape including a wall rising in the −Z direction from an outer peripheral portion of the flat plate.

As illustrated in FIGS. **8** and **10**, the spacer **181** is a plate-shaped member substantially parallel to the XY plane and includes a through-hole **1811** extending in the Z-axis direction and a plurality of columnar portions **1812** protruding in the −Z direction. The through-hole **1811** has substantially a rectangular shape in plan view. The diameter of the through-hole **1811** increases toward the −X direction and the +X direction in the −Z direction. The diameter increases toward the −X direction so that a bottom portion **1815** is formed, and the diameter increases toward the +X direction so that a bottom portion **1816** is formed. The surface of the bottom portion **1815** in the −Z direction includes a protruding portion **1817** protruding in the −Z direction. The surface of the bottom portion **1816** in the −Z direction includes a protruding portion **1818** protruding in the −Z direction.

Although not illustrated, the carriage **18** may include a positioning portion that enables positioning of the spacer **181** with respect to the carriage main body portion **182**. The positioning portion is formed by, for example, a plurality of adjustment screws extending in the Y-axis direction.

The first heater **185** and the second heater **186** heat, via the holder cover **23** and the fixing plate **29**, the ink filling each of the plurality of head chips **70**. In other words, the heat generated by the first heater **185** and the second heater **186** is transferred to the ink inside the head chip **70** via the holder cover **23** and the fixing plate **29**, and thus the ink inside each of the plurality of head chips **70** is heated. According to the present embodiment, the first heater **185** and the second heater **186** are plate-shaped members substantially parallel to the XY plane. Each of the first heater **185** and the second heater **186** is not necessarily limited to a plate-shaped member. Any heater such as a film heater or a ceramic heater may be used as the first heater **185** and the second heater **186**. The first heater **185** includes a through-hole **1851** extending in the Z-axis direction. As illustrated in FIG. **8**, the protruding portion **1817** is inserted into the through-hole **1851** so that the first heater **185** is mounted on the bottom portion **1815**. Similarly, as illustrated in FIG. **8**, the protruding portion **1818** is inserted into a through-hole **1861** so that the second heater **186** is mounted on the bottom portion **1816**. The protruding portion **1817** is fitted into the recessed portion RE**1** included in the first positioning portion PS**1** and the protruding portion **1818** is fitted into the recessed portion RE**2** included in the second positioning portion PS**2**, whereby the liquid ejecting head **20** is positioned with respect to the carriage **18**.

The surfaces of some of the columnar portions **1812** in the −Z direction include recessed portions protruding in the +Z direction. Screws **193** are in one-to-one correspondence with the through-holes **227** included in the case **22**. The respective screws **193** are inserted into the corresponding through-holes **227** and are engaged with the recessed portions included in any of the columnar portions **1812**. Thus, the liquid ejecting head **20** is fixed to the spacer **181** of the carriage **18** at the position where the liquid ejecting head **20** is positioned by the spacer **181** of the carriage **18**.

1.2.2. Positioning of Circuit Substrate **26** with Respect to Holder Cover **23**

As illustrated in FIG. **5**, the first flange portion U**1** includes a third positioning portion PS**3** for positioning the circuit substrate **26** with respect to the holder cover **23**. The second flange portion U**2** includes a fourth positioning portion PS**4** for positioning the circuit substrate **26** with respect to the holder cover **23**. Specifically, the third positioning portion PS**3** and the fourth positioning portion PS**4** are substantially columnar members protruding in the −Z direction.

As illustrated in FIG. **5**, the third positioning portion PS**3** passes through the through-hole **267** and the fourth positioning portion PS**4** passes through the through-hole **268** so that the circuit substrate **26** is positioned with respect to the holder cover **23**. The circuit substrate **26** is provided with the gap dl interposed between the circuit substrate **26** and the holder cover **23** in the Z-axis direction. The circuit substrate **26** is in contact with the third positioning portion PS**3** and the fourth positioning portion PS**4** in the X-axis direction and the Y-axis direction perpendicular to the Z-axis direction. Portions where the holder cover **23** is in contact with the circuit substrate **26** are only the third positioning portion PS**3** and the fourth positioning portion PS**4**. As the holder cover **23** is formed of metal, no wires are provided on the inner peripheral surfaces of the through-hole **267** and the through-hole **268** of the circuit substrate **26**.

1.3. Heat-Transfer Path of First Heater **185**

A heat-transfer path of the first heater **185** will be described with reference to FIGS. **5** and **11**.

FIG. **11** is an XI-XI sectional view illustrating a state where the liquid ejecting head **20** illustrated in FIG. **8** is attached to the carriage **18**. The XI-XI section is a section parallel to the XZ plane. In order to avoid complication of the drawing, the sectional view in FIG. **11** illustrates only the vicinity of the first positioning portion PS**1**. In order to avoid complication of the drawing, the inside of the head chip **70** is not illustrated in the sectional view in FIG. **11**.

FIG. **11** illustrates a heat-transfer path HTP**1** from the first heater **185** to the ink of the liquid ejecting head **20**. As the inside of the head chip **70** is not illustrated in FIG. **11**, a heat-transfer path in the head chip **70** included in the heat-transfer path HTP**1** is also not illustrated. FIG. **4** illustrates the heat-transfer path in the head chip **70**.

First, the heat-transfer path from the first heater **185** to the head chip **70** will be described with reference to FIG. **11**. The first heater **185** is mounted on the bottom portion **1815** of the spacer **181**. Further, as illustrated in FIG. **11**, the end of the first positioning portion PS**1** in the +Z direction is in contact with the surface of the first heater **185** in the −Z direction. The heat generated by the first heater **185** is transferred to the holder cover **23** via the protruding portion **1817** of the spacer **181** and the end of the first positioning portion PS**1** in the +Z direction. The holder cover **23** is formed of metal having a relatively high thermal conductivity and heat is

thus easily transmitted thereto. The holder cover **23** is in contact with the second holder **272** formed of resin and the fixing plate **29** formed of metal. As the metal has higher thermal conductivity than that of the resin, the heat in the holder cover **23** is transferred to the fixing plate **29**. The heat transferred to the fixing plate **29** is then transferred to the head chip **70**.

Although the end of the first positioning portion PS**1** in the +Z direction is in contact with the surface of the first heater **185** in the −Z direction according to the present embodiment, the end of the first positioning portion PS**1** in the +Z direction is not necessarily in contact with the surface of the first heater **185** in the −Z direction. Even when the end of the first positioning portion PS**1** in the +Z direction is not in contact with the surface of the first heater **185** in the −Z direction, the heat generated by the first heater **185** is transferred to the holder cover **23** via the protruding portion **1817**.

Next, the heat-transfer path in the head chip **70** will be described with reference to FIG. **4**. The compliance portion **75** is in contact with the fixing plate **29**. The heat transferred to the fixing plate **29** is then transferred to the flow path formation substrate **71** via the compliance portion **75**. As the support body **754** included in the compliance portion **75** is formed of metal having a high thermal conductivity, the heat of the support body **754** is transferred to the sealing plate **752**. Although the sealing plate **752** is formed of a resin having a low thermal conductivity, the sealing plate **752** is thinner than the flow path formation substrate **71** and therefore the heat transferred to the sealing plate **752** is then transferred to the flow path formation substrate **71**. The heat transferred to the flow path formation substrate **71** is then transferred to the ink in the opening **712**, the supply flow path **714**, and the communication flow path **716**. As described above, the ink inside each of the plurality of head chips **70** is heated by the first heater **185**.

As illustrated in FIG. **11**, the drive circuit **781** is partially located in the opening **276** of the second holder **272**. The drive circuit **781** being partially located in the opening **276** means that the drive circuit **781** and the opening **276** are partially overlapped with each other when viewed in a direction perpendicular to the extending direction of the opening **276**, in other words, a direction parallel to the XY plane.

Although not illustrated, the second heater **186** also heats the ink inside each of the plurality of head chips **70** via the holder cover **23** and the fixing plate **29**.

1.4. Summary of First Embodiment

As described above, the liquid ejecting apparatus **10** according to the first embodiment includes the liquid ejecting head **20**, the carriage **18**, the first heater **185**, and the second heater **186**. The liquid ejecting head **20** includes the plurality of head chips **70**, the holder **27**, the holder cover **23**, and the fixing plate **29**. Each of the plurality of head chips **70** includes the nozzle plate **74** including the nozzles N for ejecting the ink. The holder **27** is formed of resin, holds the plurality of head chips **70**, and includes the flow path for supplying the ink to each of the plurality of head chips **70**. The holder cover **23** is formed of a material having a higher thermal conductivity than that of the holder **27** and houses the plurality of head chips **70** and the holder **27**. The fixing plate **29** is formed of metal and has the holder cover **23** and the plurality of head chips **70** fixed thereto. The liquid ejecting head **20** is mounted on the carriage **18**. The first heater **185** and the second heater **186** are mounted on the carriage **18** and heat the ink inside each of the plurality of head chips **70** via the holder cover **23** and the fixing plate **29**.

When using an ink that needs to be used in a high-temperature state, such as UV ink, it is desirable to heat the ink near the head chip, more preferably the ink near the nozzle N, in order to improve ejection performance. However, in a liquid ejecting head in which a plurality of head chips is held only by a holder formed of a resin having a low thermal conductivity, it is difficult to heat the liquid inside each of the plurality of head chips from outside the liquid ejecting head. There is a possible aspect in which the holder is formed of metal or ceramic having a higher thermal conductivity than that of resin and the ink in the head chip is thus heated by a heater provided outside the liquid ejecting head. However, a complicated shape of a flow path formed in the holder makes it difficult to accurately form the flow path in the holder using metal or ceramic in this aspect, and the manufacturing cost of the liquid ejecting head increases.

Therefore, the liquid ejecting head **20** according to the embodiment includes the holder cover **23** formed of a material having a higher thermal conductivity than that of resin. Thus, the first heater **185** and the second heater **186** may heat the ink in the head chip **70** via the holder cover **23**. As the holder **27** including the flow path is formed of resin, it is possible to suppress an increase in the manufacturing cost of the liquid ejecting head **20**. Furthermore, the liquid ejecting head **20** according to the present embodiment facilitates the wiring of the first heater **185** and the second heater **186** as compared with a configuration in which the first heater **185** and the second heater **186** are provided in the liquid ejecting head **20**. The reason why the wiring is facilitated is that, in the configuration in which the first heater **185** and the second heater **186** are provided in the liquid ejecting head **20**, it is necessary to consider the wiring of the first heater **185** and the second heater **186** in the liquid ejecting head **20** and a bonding portion between the above wiring and the wiring outside the liquid ejecting head **20**. Furthermore, in the liquid ejecting apparatus **10** according to the present embodiment, there is no bonding portion between the wiring of the first heater **185** and the second heater **186** in the liquid ejecting head **20** and the wiring outside the liquid ejecting head **20**, and therefore it is easy to replace the liquid ejecting head **20**, as compared with the configuration in which the first heater **185** and the second heater **186** are provided in the liquid ejecting head **20**.

The holder cover **23** includes the holding portion UC that holds the holder **27**, the first flange portion U**1** provided to extend from the holding portion UC in the −X direction in which the plurality of head chips **70** is arranged, and the second flange portion U**2** provided to extend from the holding portion UC in the +X direction. The first flange portion U**1** includes the first positioning portion PS**1** for positioning the liquid ejecting head **20** with respect to the carriage **18**. The second flange portion U**2** includes the second positioning portion PS**2** for positioning the liquid ejecting head **20** with respect to the carriage **18**. The first heater **185** heats the holder cover **23** via the first positioning portion PS**1**. The second heater **186** heats the holder cover **23** via the second positioning portion PS**2**.

The accurate positioning of the liquid ejecting head **20** with respect to the carriage **18** is needed to improve the printing quality. According to the present embodiment, the heat-transfer path HTP**1** includes the first positioning portion PS**1** that needs to be in contact with the carriage **18** for the positioning. In an aspect where the first positioning portion PS**1** is not included in the heat-transfer path from the first heater **185** to the ink in the liquid ejecting head **20**, a

metal component needs to be prepared to fill a space between the carriage **18** and the holder cover **23**. Therefore, according to the present embodiment, as compared with the aspect where the first positioning portion PS**1** is not included in the heat-transfer path from the first heater **185** to the ink in the head chip **70**, the number of components of the liquid ejecting apparatus **10** may be reduced, and therefore the manufacturing of the liquid ejecting apparatus **10** is facilitated.

The carriage **18** includes the spacer **181** that is formed of metal and is brought into contact with the first positioning portion PS**1** and the second positioning portion PS**2** to be positioned with respect to the liquid ejecting head **20** and includes the carriage main body portion **182** that is formed of metal and holds the spacer **181**. The first heater **185** and the second heater **186** heat the spacer **181** and heat the first positioning portion PS**1** and the second positioning portion PS**2** via the spacer **181**.

As illustrated in FIG. **8** and the like, the carriage main body portion **182** is, to hold the spacer **181**, large and has a large surface area as compared with the spacer **181**. As the surface area is larger, heat radiation is more likely to occur. Therefore, according to the present embodiment, compared to an aspect in which the ink inside the head chip **70** is heated via the carriage main body portion **182**, heat release due to heat radiation may be suppressed and thus a decrease in the heating efficiency for the ink may be reduced. The heating efficiency for the ink is the ratio of the amount of heat to heat the ink in the head chip **70** to the amount of heat generated by the first heater **185** and the second heater **186**.

The liquid ejecting head **20** includes the case **22** that is formed of resin, is stacked on the side opposite from the fixing plate **29** with respect to the holder cover **23**, and includes the flow path **225** for supplying the liquid to the holder **27**. The case **22** is an example of "flow path member".

The case **22** serving as a flow path member formed of a resin having a lower thermal conductivity than that of metal may suppress the release of heat transferred to the holder cover **23** in the −Z direction.

The liquid ejecting head **20** includes the circuit substrate **26** that is stacked on the holder **27** with a gap interposed between the circuit substrate **26** and the holder cover **23** in the Z-axis direction. The holder cover **23** is made of metal. The first flange portion U**1** includes the third positioning portion PS**3** for positioning the circuit substrate **26** with respect to the holder cover **23**. The second flange portion U**2** includes the fourth positioning portion PS**4** for positioning the circuit substrate **26** with respect to the holder cover **23**.

The positioning accuracy is improved when the third positioning portion PS**3** and the fourth positioning portion PS**4** are both located at positions away from the center of the circuit substrate **26** in plan view, compared to when the third positioning portion PS**3** and the fourth positioning portion PS**4** are located near the center of the circuit substrate **26** in plan view. Therefore, with regard to the first flange portion U**1** and the second flange portion U**2** separated from each other in the X-axis direction, as the first flange portion U**1** includes the third positioning portion PS**3** and the second flange portion U**2** includes the fourth positioning portion PS**4**, the circuit substrate **26** may be accurately arranged as compared to an aspect where the holding portion UC includes the third positioning portion PS**3** and the fourth positioning portion PS**4**. According to the present embodiment, although the holder cover **23** is formed of metal in order to heat the ink inside each of the plurality of head chips **70** from outside the liquid ejecting head **20**, it is possible to ensure insulation between the holder cover **23** and the circuit substrate **26**, because the circuit substrate **26** is in contact with the holder cover **23** formed of metal, which is also a conductive material, at only the third positioning portion PS**3** and the fourth positioning portion PS**4**.

The liquid ejecting apparatus **10** includes the wiring member **78** that includes the drive circuit **781** and is coupled to the circuit substrate **26** and any one of the plurality of head chips **70**. The first holder **271** includes the opening **275** through which the wiring member **78** is inserted. Similarly, the second holder **272** includes the opening **276** through which the wiring member **78** is inserted. The drive circuit **781** is partially located in the opening **276**.

As the drive circuit **781** is partially located in the opening **276** of the second holder **272** formed of resin, it is possible to suppress an abnormal operation of the drive circuit **781** due to the holder cover **23** heated to a high temperature by the first heater **185** and the second heater **186**. As the resin has an insulating property, short-circuiting of the wiring of the drive circuit **781** may be inhibited even when the drive circuit **781** is brought into contact with the opening **276**.

The holder cover **23** is provided between the holder **27** and the head chip **70** and includes the beam portion **236** extending in the Y-axis direction.

As the beam portion **236** is heated, the plurality of head chips **70** provided in the space S**3** may be heated via the air in the space S**3**.

2. Modification

Each embodiment described above may be modified in various ways. Specific modification aspects will be described as examples below. Two or more aspects optionally selected from the following examples may be combined as appropriate as long as there is no contradiction from each other.

2.1. First Modification

According to the first embodiment, although the carriage **18** includes the spacer **181** and the carriage main body portion **182**, the carriage **18** may have an integrated combination of the spacer **181** and the carriage main body portion **182**. According to a first modification, the carriage **18** is made of metal. The first heater **185** and the second heater **186** heat the ink inside each of the plurality of head chips **70** via the carriage **18** according to the first modification, the first positioning portion PS**1**, and the second positioning portion PS**2**.

2.2. Second Modification

According to the first embodiment and the first modification, the case **22** includes the through-hole **227** used for the screw **193** for fixing the liquid ejecting head **20** to the carriage **18**, but this is not a limitation. For example, the holder cover **23** may include a through-hole used for a screw for fixing the liquid ejecting head **20** to the carriage **18**. For example, the first flange portion U**1** and the second flange portion U**2** according to a second modification include the through-hole described above.

According to the second modification, the first heater **185** and the second heater **186** may heat the ink in the head chip **70** via the screw that needs to be in contact with the carriage **18** in order to fix the liquid ejecting head **20** to the carriage **18**, and it is possible to improve the heating efficiency for the ink as compared with the first embodiment.

2.3. Third Modification

According to the first embodiment and the second modification, the carriage **18** may include a heat insulating material.

FIG. **12** is a sectional view of a carriage **18**A according to a third modification. More specifically, the sectional view illustrated in FIG. **12** is an XII-XII sectional view of the state where the liquid ejecting head **20** illustrated in FIG. **8** is attached to the carriage **18**A according to the third modification.

As illustrated in FIG. **12**, the carriage **18**A includes the spacer **181**, the carriage main body portion **182**, and a heat insulating material **183**. The heat insulating material **183** is provided between the spacer **181** and the carriage main body portion **182** and has a lower thermal conductivity than that of the holder cover **23**. Examples of the material having a lower thermal conductivity than that of the holder cover **23** include a resin or ceramic having a thermal conductivity lower than that of metal forming the holder cover **23**. The heat insulating material **183** preferably has a lower thermal conductivity than that of the holder **27**.

As described above, according to the third modification, the heat generated by the first heater **185** and the second heater **186** may be inhibited from being transferred to the carriage main body portion **182** and being released.

2.4. Fourth Modification

According to the first embodiment, the second modification, and the third modification, the first positioning portion PS**1** and the second positioning portion PS**2** include the recessed portions RE and the spacer **181** includes the protruding portion **1817** and the protruding portion **1818**, but this is not a limitation. For example, the spacer **181** may include a recessed portion that is recessed in the +Z direction, and the first positioning portion PS**1** and the second positioning portion PS**2** may include a protruding portion that protrudes in the −Z direction. The recessed portions of the spacer **181** are fitted into the protruding portions included in the first positioning portion PS**1** and the second positioning portion PS**2** so that the liquid ejecting head **20** is positioned with respect to the carriage **18**.

2.5. Fifth Modification

According to each of the aspects described above, the plurality of head chips **70** is arranged in a line in the X-axis direction, but may be arranged in a staggered manner in the X-axis direction. For example, the head chip **70** located farthest in the −X direction and the head chip **70** located third from the −X direction may be arranged along a first straight line parallel to the X-axis direction, and the head chip **70** located second from the −X direction and the head chip **70** located farthest in the +Z direction may be arranged along a second straight line parallel to the first straight line.

2.6. Sixth Modification

According to each of the aspects described above, the drive circuit **781** is partially located in the opening **276** of the second holder **272**, but the entire drive circuit **781** may be located in the opening **276** of the second holder **272**. Alternatively, the drive circuit **781** may be partially located in the opening **275** of the first holder **271**, and the remaining part of the drive circuit **781** may be located in the opening **276** of the second holder **272**.

2.7. Seventh Modification

According to each of the aspects described above, each of the plurality of head chips **70** extends in the Y-axis direction, but may extend not only in a direction perpendicular to the X-axis direction, such as the Y-axis direction, but also a direction intersecting with the X-axis direction. When each of the plurality of head chips **70** extends in a specific direction intersecting with the X-axis direction, the beam portion **236** included in the holder cover **23** also extends in the specific direction described above.

2.8. Eighth Modification

According to each of the aspects described above, the first heater **185** is mounted on the bottom portion **1815** and the second heater **186** is mounted on the bottom portion **1816**, but this is not a limitation. For example, the first heater **185** may be attached to a side surface of the holding portion UC of the holder cover **23** in the −X direction, may be attached to a surface of the fixing plate **29** in the −X direction, or may be attached to a side surface of the holding portion UC of the holder cover **23** in the +Y direction. Similarly, the second heater **186** may be attached to a side surface of the holding portion UC in the +X direction, or may be attached to a side surface of the holding portion UC of the holder cover **23** in the −Y direction. The first heater **185** may be provided at a portion of the carriage **18** located in the +Y direction with respect to a side surface of the holding portion UC of the holder cover **23** in the +Y direction so as to heat the side surface. Similarly, the second heater **186** may be provided at a portion of the carriage **18** located in the −Y direction with respect to a side surface of the holding portion UC of the holder cover **23** in the −Y direction so as to heat the side surface.

2.9. Ninth Modification

In the serial head described according to each of the aspects above, the carriage **18** having the liquid ejecting head **20** mounted thereon is repeatedly reciprocated in the X direction, but the present disclosure may also be applied to a line head in which the liquid ejecting head **20** is arranged over the entire width of the medium **11**.

2.10. Tenth Modification

In the piezoelectric liquid ejecting head **20** described according to the embodiment above, the piezoelectric element **732** that applies a mechanical vibration to the pressure chamber C is used, but it is possible to use a thermal liquid ejecting head that uses a heat generating element that generates air bubbles inside the pressure chamber C due to the heat.

2.11. Eleventh Modification

In the configuration described according to the above-described embodiment, the ink is supplied to the flow path **225** of the case **22** from the liquid storage section **17** mounted on the carriage **18**, but a configuration may be such that the ink is supplied from a liquid storage section provided outside the carriage **18** via a tube.

2.12. Twelfth Modification

The opening shape of one of the through-hole **267** and the through-hole **268** may be an oval shape that is elongated in the X-axis direction, which is a direction in which the through-hole **267** and the through-hole **268** are arranged. Even when the positions of the third positioning portion PS**3** and the fourth positioning portion PS**4** are shifted in the X-axis direction due to a manufacturing error, it is possible to inhibit the third positioning portion PS**3** and the fourth positioning portion PS**4** from being unable to be inserted into the through-hole **267** and the through-hole **268**.

2.13. Other Modifications

The liquid ejecting apparatus **10** described in the above embodiment may be used for various apparatuses such as facsimile apparatuses and copiers in addition to apparatuses dedicated for printing. However, the application of the liquid ejecting apparatus **10** according to the present disclosure is not limited to printing. For example, a liquid ejecting apparatus that ejects a solution of a coloring material is used as a manufacturing apparatus that forms a color filter of a liquid crystal display device, an organic EL display, and the like. EL is an abbreviation for electro luminescence. FED is an abbreviation for field emission display. A liquid ejecting apparatus that ejects a solution of a conductive material is used as a manufacturing apparatus that forms wiring or electrodes of a wiring substrate.

3. Note

From the aspects described above, for example, the following configurations are comprehended.

According to a first aspect that is a suitable aspect, a liquid ejecting apparatus includes a liquid ejecting head including a plurality of head chips each including a nozzle plate including a nozzle ejecting a liquid, a holder that is formed of resin, holds the plurality of head chips, and includes a flow path for supplying the liquid to each of the plurality of head chips, a holder cover that is formed of a material having a higher thermal conductivity than a thermal conductivity of the holder and houses the plurality of head chips and the holder, and a fixing plate that is formed of metal and to which the holder cover and the plurality of head chips are fixed; a carriage on which the liquid ejecting head is mounted; and a heater that is mounted on the carriage and heats the liquid inside each of the plurality of head chips via the holder cover and the fixing plate.

The liquid ejecting head according to the first aspect includes the holder cover formed of a material having a higher thermal conductivity than that of resin. Therefore, the heater may heat ink in the head chips via the holder cover. As the holder including the flow path is formed of resin, it is possible to suppress an increase in the manufacturing cost of the liquid ejecting head.

According to a second aspect that is a specific example of the first aspect, the holder cover includes a holding portion holding the holder, a first flange portion provided to extend from the holding portion in a first direction in which the plurality of head chips is arranged, and a second flange portion provided to extend from the holding portion in a direction opposite from the first direction, the first flange portion includes a first positioning portion for positioning the liquid ejecting head with respect to the carriage, the second flange portion includes a second positioning portion for positioning the liquid ejecting head with respect to the carriage, and the heater heats the holder cover via the first positioning portion and the second positioning portion.

According to the second aspect, as compared to an aspect in which a heat-transfer path from the heater to the ink does not include the first positioning portion and the second positioning portion, it is possible to reduce the number of components of the liquid ejecting apparatus, and thus it is easy to manufacture the liquid ejecting apparatus.

According to a third aspect that is a specific example of the second aspect, the holder cover includes a hole through which a screw for fixing the liquid ejecting head to the carriage is inserted.

The heater may heat the liquid in the head chips via the screw that needs to be in contact with the carriage in order to fix the liquid ejecting head to the carriage, and it is possible to improve the heating efficiency for the liquid as compared to the first aspect.

According to a fourth aspect that is a specific example of the second or third aspect, the carriage includes a spacer that is formed of metal and is brought into contact with the first positioning portion and the second positioning portion to be positioned with respect to the liquid ejecting head and a carriage main body portion that is formed of metal and holds the spacer, and the heater heats the spacer and heats the first positioning portion and the second positioning portion via the spacer.

According to the fourth aspect, as compared to an aspect in which the liquid in the head chips is heated via the carriage main body portion, it is possible to suppress heat release due to heat radiation, and thus it is possible to reduce a decrease in the heating efficiency for the liquid.

According to a fifth aspect that is a specific example of the fourth aspect, the carriage further includes a heat insulating material that is provided between the spacer and the carriage main body portion and has a lower thermal conductivity than a thermal conductivity of the holder cover.

According to the fifth aspect, it is possible to suppress transfer of the heat generated by the heater to the carriage main body portion.

According to a sixth aspect that is a specific example of any one of the first to fifth aspects, the liquid ejecting head includes a flow path member that is formed of resin, is stacked on a side opposite from the fixing plate with respect to the holder cover, and includes a flow path for supplying the liquid to the holder.

According to the sixth aspect, since the liquid ejecting head includes the flow path member formed of a resin having a lower thermal conductivity than that of metal, the heat transferred to the holder cover may be inhibited from being released to the side opposite from the fixing plate with respect to the holder cover.

According to a seventh aspect that is a specific example of any one of the first to sixth aspects, the liquid ejecting head includes a circuit substrate that is stacked on the holder with a gap between the circuit substrate and the holder cover in a stacking direction, the holder cover includes a holding portion holding the holder, a first flange portion provided to be positioned, from the holding portion, in a first direction in which the plurality of head chips is arranged, and a second flange portion provided to be positioned in a direction opposite from the first direction, the holder cover is formed of metal, the first flange portion includes a third positioning portion for positioning the circuit substrate with respect to the holder cover, and the second flange portion includes a fourth positioning portion for positioning the circuit substrate with respect to the holder cover.

According to the seventh aspect, although the holder cover is formed of metal in order to heat the ink inside the head chips from outside the liquid ejecting head, it is possible to ensure insulation between the holder cover and the circuit substrate as the circuit substrate is in contact with the holder cover formed of metal, which is also a conductive material, only at the third positioning portion and the fourth positioning portion.

According to an eighth aspect that is a specific example of the seventh aspect, a wiring member is included, which includes a drive circuit and is coupled to the circuit substrate and one of the plurality of head chips, in which the holder includes an opening through which the wiring member is inserted, and the drive circuit is partially or entirely located in the opening.

According to the eighth aspect, as the drive circuit is partially or entirely located in the opening of the holder formed of resin, it is possible to inhibit an abnormal operation of the drive circuit due to the holder cover heated to a high temperature by the heater. As the resin has an insulating property, short-circuiting of the wiring of the drive circuit may be inhibited even when the drive circuit is brought into contact with the opening of the holder.

According to a ninth aspect that is a specific example of the first to eighth aspects, the holder cover includes a beam portion that is provided between the holder and the head chips and extends in a second direction intersecting a first direction in which the plurality of head chips is arranged.

According to the ninth aspect, as the beam portion is heated, the plurality of head chips provided in the space may be heated via the air in the space having the beam portion as part of the wall surface.

According to a tenth aspect that is a suitable aspect, a liquid ejecting head is mounted on a carriage on which a heater is mounted, and the liquid ejecting head includes a plurality of head chips each including a nozzle plate including a nozzle ejecting a liquid, a holder that is formed of resin, holds the plurality of head chips, and includes a flow path for supplying the liquid to each of the plurality of head chips, a holder cover that is formed of a material having a higher thermal conductivity than a thermal conductivity of the holder and houses the plurality of head chips and the holder, and a fixing plate that is formed of metal and to which the holder cover and the plurality of head chips are fixed. The heater heats the liquid inside each of the plurality of head chips via the holder cover and the fixing plate.

The liquid ejecting head according to the tenth aspect includes the holder cover formed of a material having a higher thermal conductivity than that of resin. Therefore, the heater may heat ink in the head chips via the holder cover. As the holder including the flow path is formed of resin, it is possible to suppress an increase in the manufacturing cost of the liquid ejecting head.

What is claimed is:

1. A liquid ejecting apparatus comprising:

a liquid ejecting head including:

head chips each including a nozzle plate including nozzles configured to eject a liquid;

a holder that is formed of resin, the holder holding the head chips and including a flow path for supplying the liquid to each of the head chips;

a holder cover that is formed of a material having a higher thermal conductivity than a thermal conductivity of the holder and houses the head chips and the holder; and

a fixing plate that is formed of metal and to which the holder cover and the head chips are fixed, the fixing plate including openings respectively exposing each of the nozzle plates;

a carriage on which the liquid ejecting head is mounted; and

a heater that is mounted on the carriage and heats the liquid inside each of the head chips via the holder cover and the fixing plate.

2. The liquid ejecting apparatus according to claim **1**, wherein

the holder cover includes

a holding portion holding the holder,

a first flange portion provided to extend from the holding portion in a first direction in which the head chips is arranged, and

a second flange portion provided to extend from the holding portion in a direction opposite from the first direction,

the first flange portion includes a first positioning portion for positioning the liquid ejecting head with respect to the carriage,

the second flange portion includes a second positioning portion for positioning the liquid ejecting head with respect to the carriage, and

the heater heats the holder cover via the first positioning portion and the second positioning portion.

3. The liquid ejecting apparatus according to claim **2**, wherein

the holder cover includes a hole through which a screw for fixing the liquid ejecting head to the carriage is inserted.

4. The liquid ejecting apparatus according to claim **2**, wherein

the carriage includes

a spacer that is formed of metal and is brought into contact with the first positioning portion and the second positioning portion to be positioned with respect to the liquid ejecting head, and

a carriage main body portion that is formed of metal and holds the spacer, and

the heater heats the spacer and heats, via the spacer, the first positioning portion and the second positioning portion.

5. The liquid ejecting apparatus according to claim **3**, wherein

the carriage includes

a spacer that is formed of metal and is brought into contact with the first positioning portion and the second positioning portion to be positioned with respect to the liquid ejecting head, and

a carriage main body portion that is formed of metal and holds the spacer, and

the heater heats the spacer and heats, via the spacer, the first positioning portion and the second positioning portion.

6. The liquid ejecting apparatus according to claim **4**, wherein

the carriage further includes a heat insulating material that is provided between the spacer and the carriage main body portion and has a lower thermal conductivity than a thermal conductivity of the holder cover.

7. The liquid ejecting apparatus according to claim **5**, wherein

the carriage further includes a heat insulating material that is provided between the spacer and the carriage main

body portion and has a lower thermal conductivity than a thermal conductivity of the holder cover.

8. The liquid ejecting apparatus according to claim **1**, wherein

the liquid ejecting head includes a flow path member that is formed of resin, is stacked on a side opposite from the fixing plate with respect to the holder cover, and includes a flow path for supplying the liquid to the holder.

9. The liquid ejecting apparatus according to claim **1**, wherein

the liquid ejecting head includes a circuit substrate that is stacked on the holder with a gap between the circuit substrate and the holder cover in a stacking direction,

the holder cover includes

a holding portion holding the holder,

a first flange portion provided to be positioned, from the holding portion, in a first direction in which the head chips is arranged, and

a second flange portion provided to be positioned in a direction opposite from the first direction,

the holder cover is formed of metal,

the first flange portion includes a third positioning portion for positioning the circuit substrate with respect to the holder cover, and

the second flange portion includes a fourth positioning portion for positioning the circuit substrate with respect to the holder cover.

10. The liquid ejecting apparatus according to claim **9**, further comprising

a wiring member that includes a drive circuit and is coupled to the circuit substrate and one of the head chips, wherein

the holder includes an opening through which the wiring member is inserted, and

the drive circuit is partially or entirely located in the opening.

11. The liquid ejecting apparatus according to claim **1**, wherein

the holder cover includes a beam portion that is provided between the holder and the head chips and extends in a second direction intersecting a first direction in which the plurality of head chips is arranged.

12. A liquid ejecting head mounted on a carriage on which a heater is mounted, the liquid ejecting head comprising:

head chips each including a nozzle plate including a nozzle configured to eject a liquid;

a holder that is formed of resin, the holder holding the head chips and including flow path for supplying the liquid to each of the head chips;

a holder cover that is formed of a material having a higher thermal conductivity than a thermal conductivity of the holder and houses the head chips and the holder; and

a fixing plate that is formed of metal and to which the holder cover and the head chips are fixed, the fixing plate including openings respectively exposing each of the nozzle plates, wherein

the heater heats the liquid inside each of the head chips via the holder cover and the fixing plate.

13. The liquid ejecting apparatus according to claim **1**, wherein

the holder cover includes:

a first positioning portion for positioning the liquid ejecting head with respect to the carriage; and

a second positioning portion for positioning the liquid ejecting head with respect to the carriage, and

the heater heats the holder cover via the first positioning portion and the second positioning portion.

14. The liquid ejecting head according to claim **12**, wherein

the holder cover includes:

a first positioning portion for positioning the liquid ejecting head with respect to the carriage; and

a second positioning portion for positioning the liquid ejecting head with respect to the carriage, and

the heater heats the holder cover via the first positioning portion and the second positioning portion.

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