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

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(52) **U.S. Cl.**

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(57) **ABSTRACT**

A liquid ejecting head includes head modules to eject a liquid in a first direction, and a metallic holder to which the head modules are fixed in a detachably-attached manner. Each of the head modules includes a metallic channel orifice forming member in which a channel is defined, and which includes a first alignment portion. The holder includes second alignment portions which are inserted into or receive the first alignment portions, respectively, in a press-fit manner, positioning the head modules with respect to the holder. A channel orifice formed in the holder to make a channel-forming connection to each of the head modules and a channel orifice formed in the head module to make the channel-forming connection to the holder coincide with each other as viewed in a direction in which either of the first alignment portions and the second alignment portions are press-fitted into the other alignment portions.

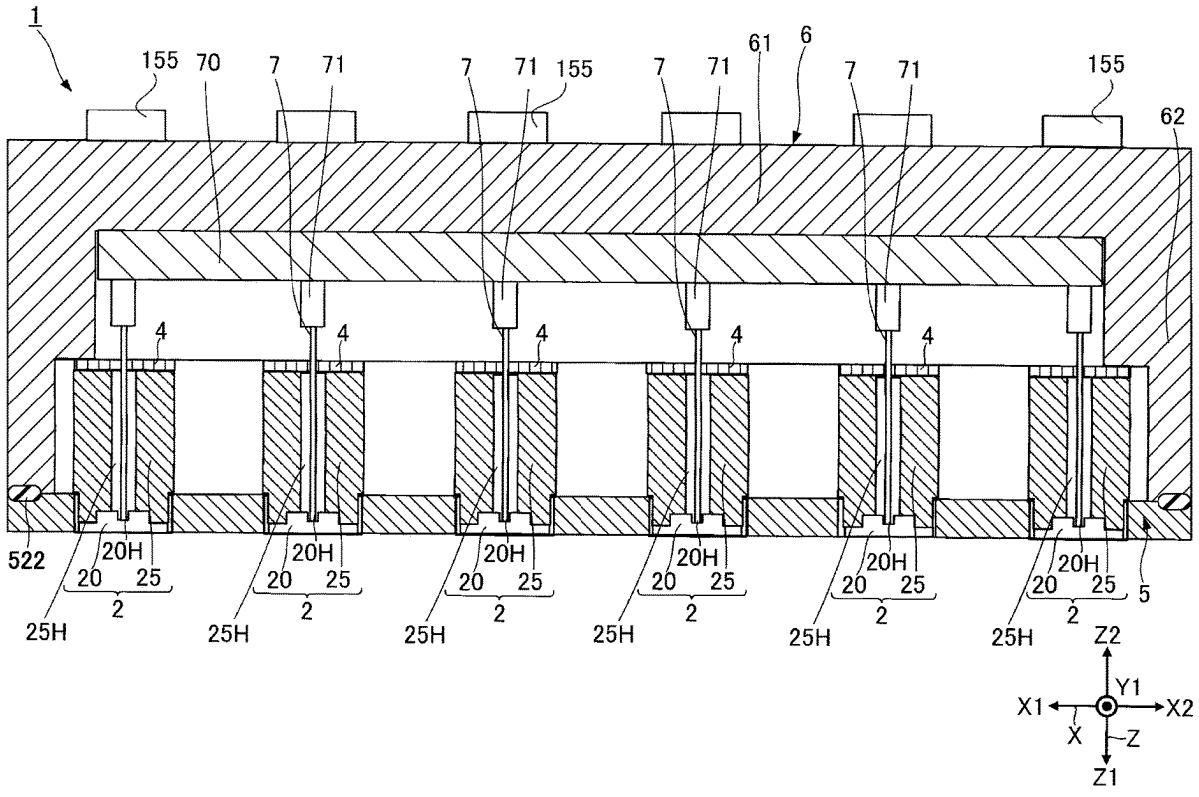


FIG. 1

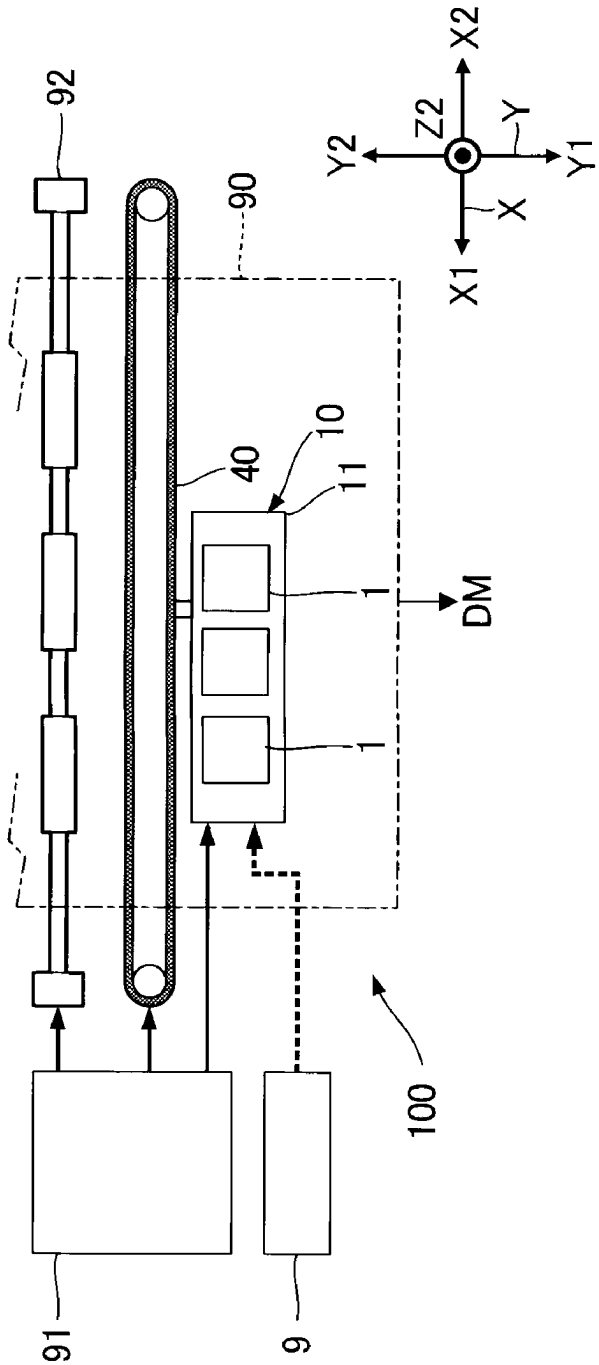


FIG. 2

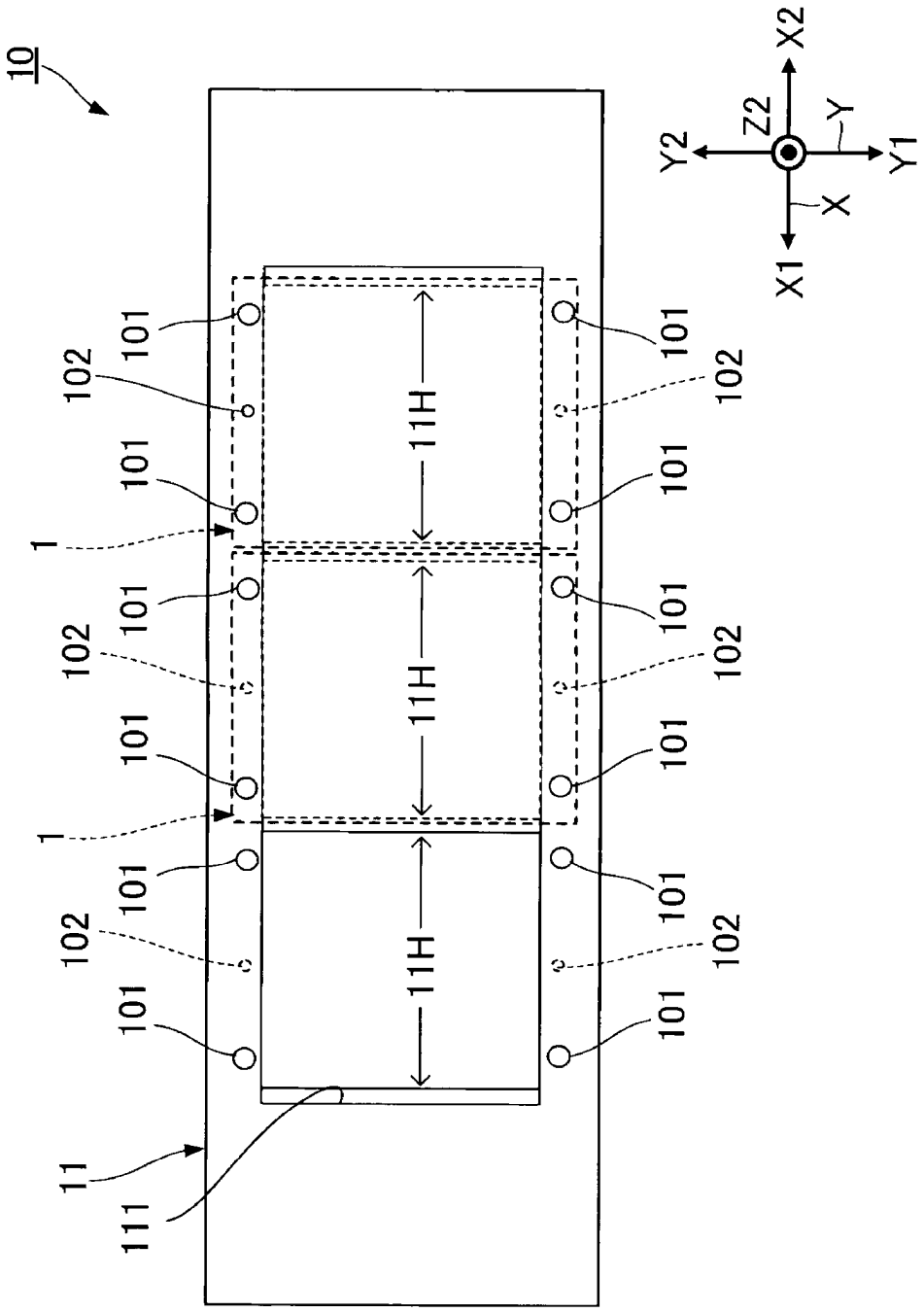


FIG. 3

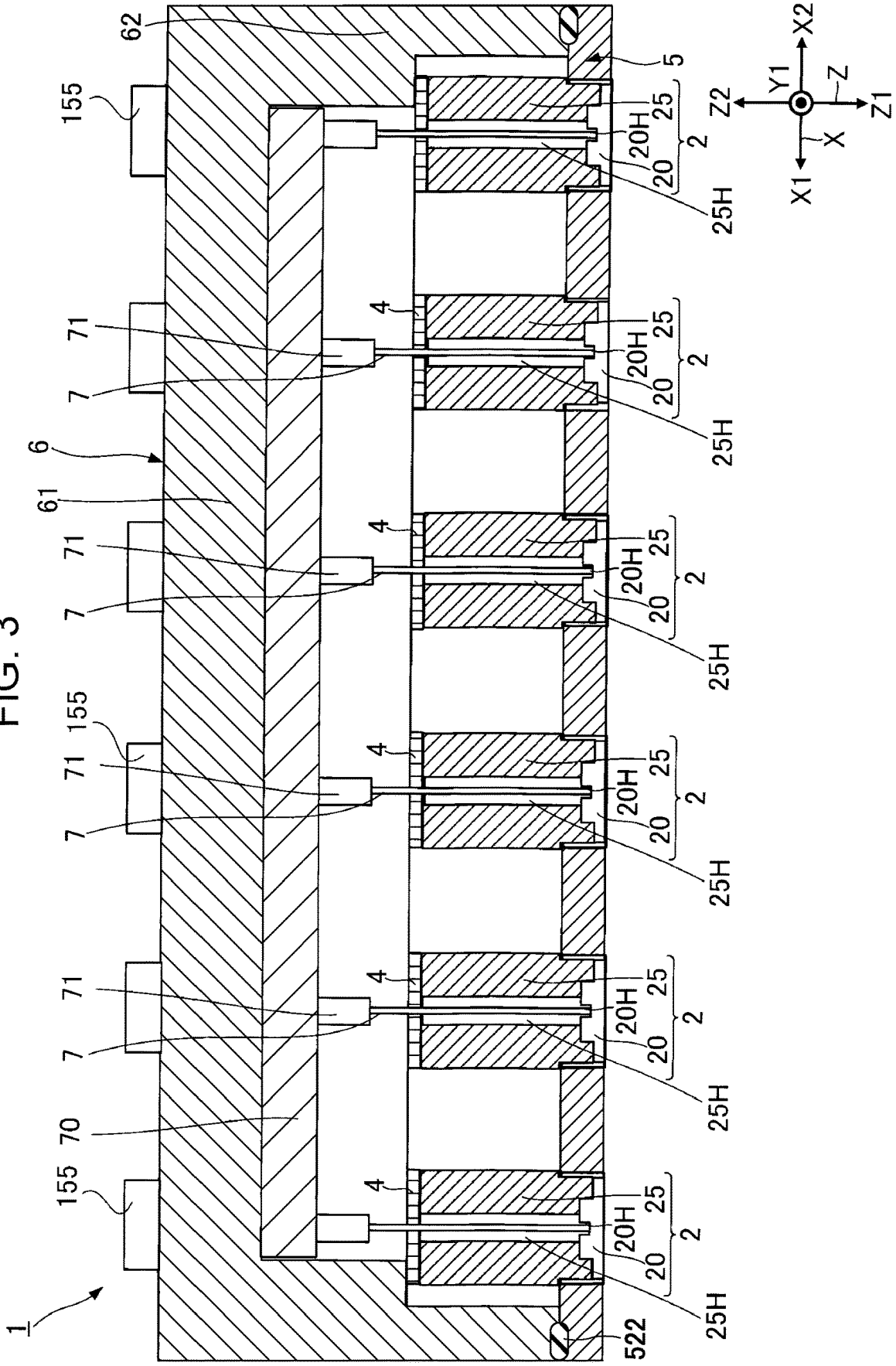
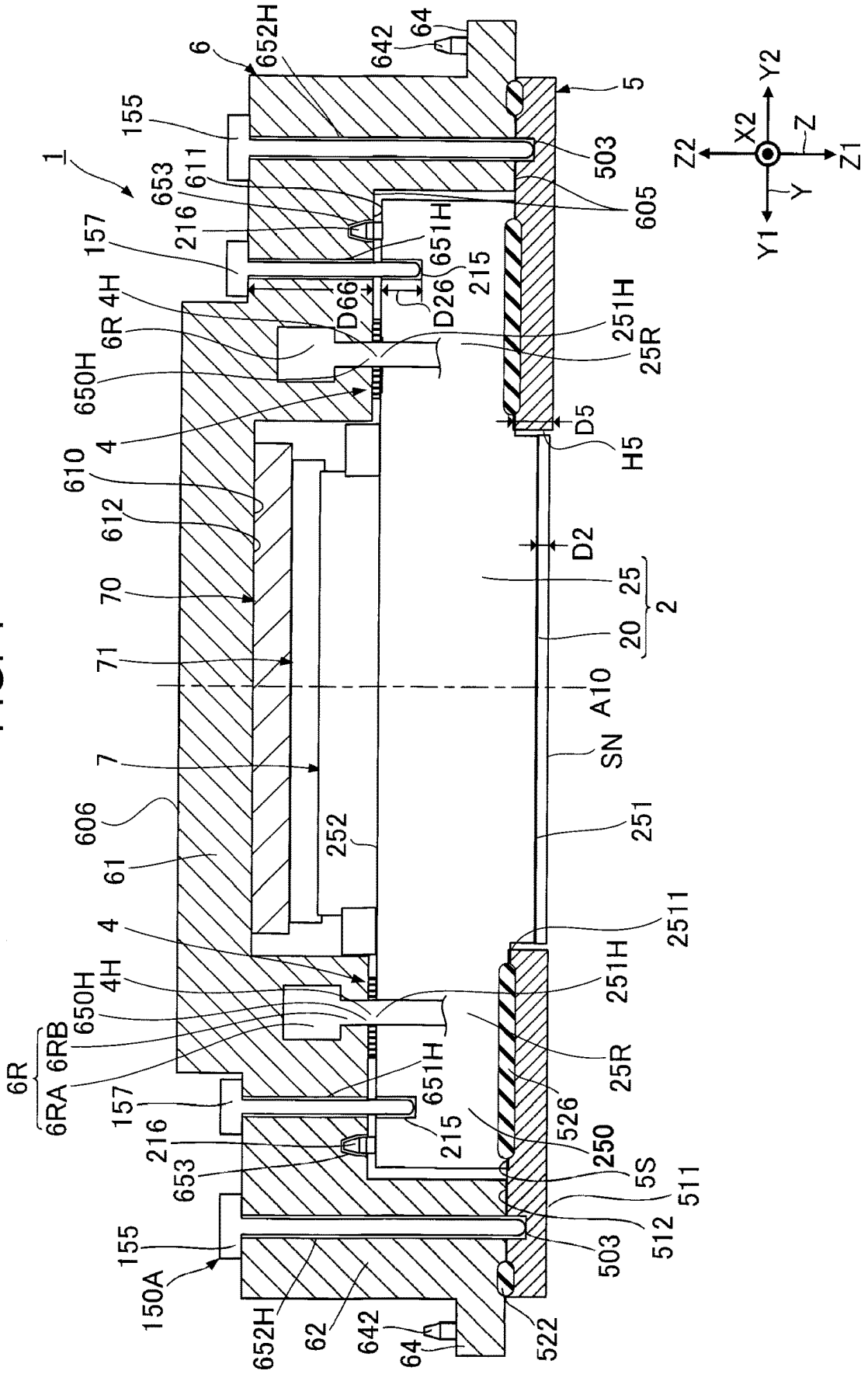


FIG. 4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642
64
5
155
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611
653
605
216
157
651H
215
D66
D26
4H
6R
251H
650H
25R
D5
H5
4
610
612
D2
70
25
2
20
71
A10
SN
7
606
252
251
61
2511
526
250
5S
511
512
522
62
150A
Y2
X2
Z
Z2
Z1
Y
Y1

FIG. 5

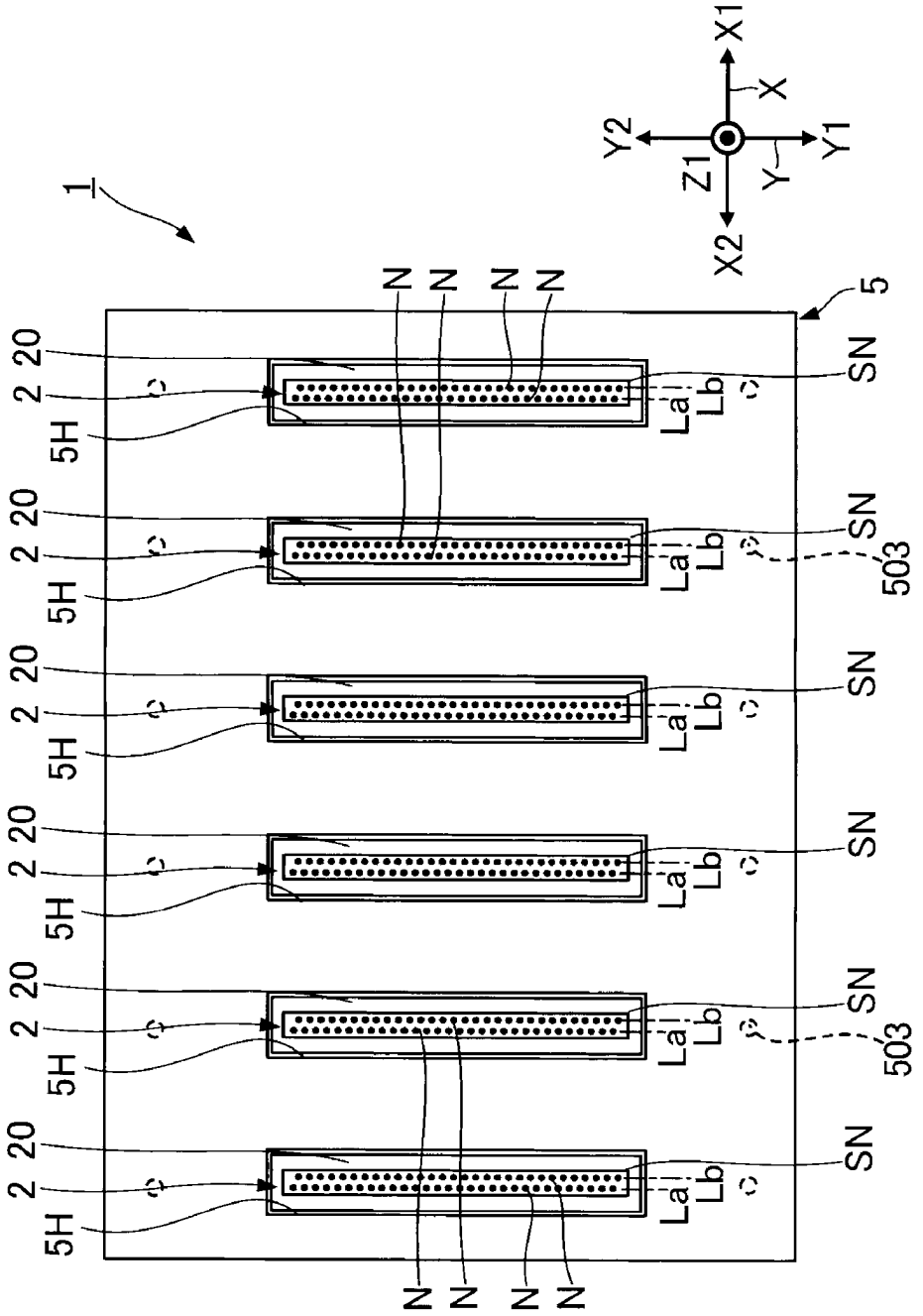
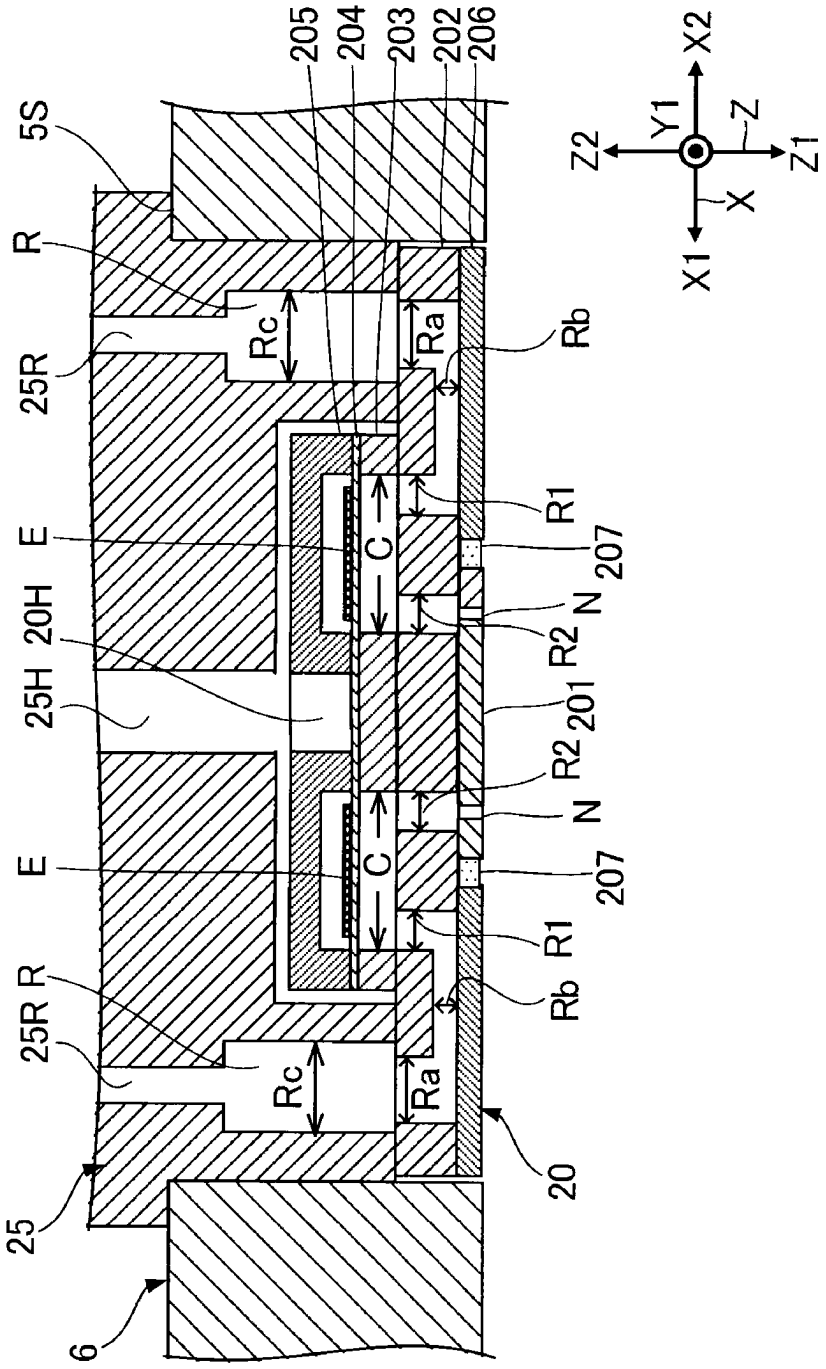


FIG 6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204
203
202
206
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R
25R
Rc
Ra
Rb
E
C
R1
207
N
20H
25H
R2
201
25
6
20
X2
Y1
Z
Z2
Z1
X
X1

FIG. 7

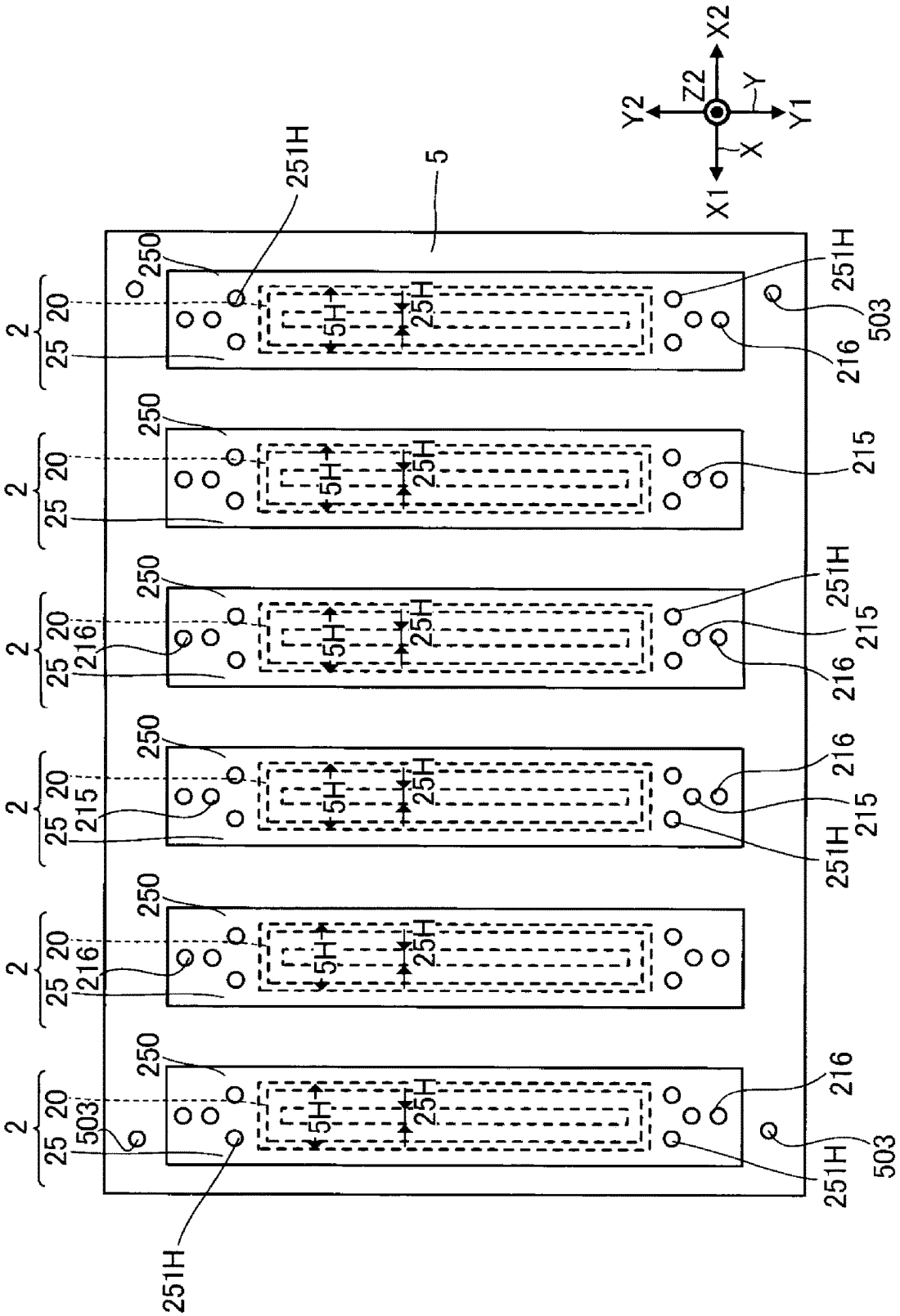


FIG. 8

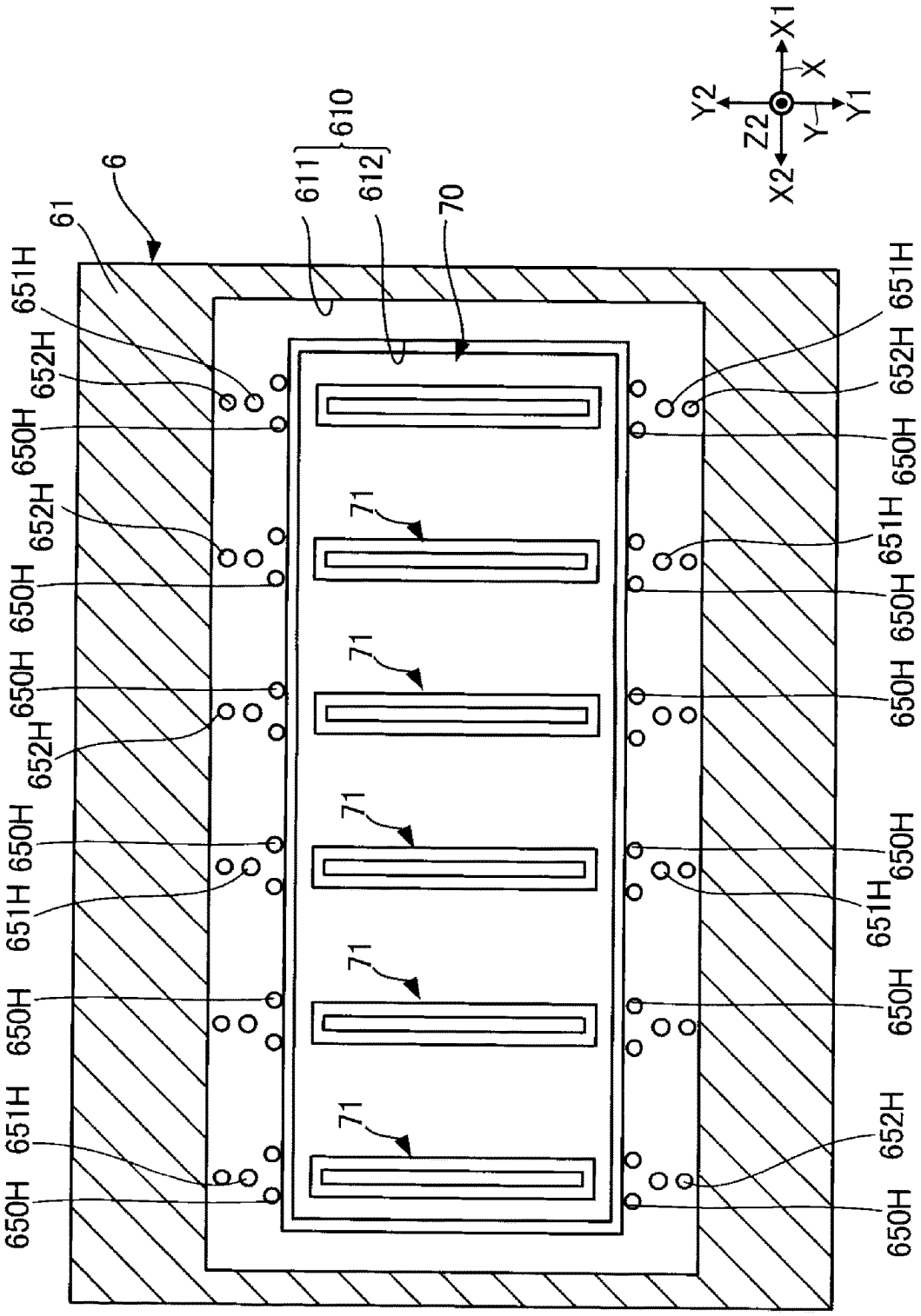


FIG. 9

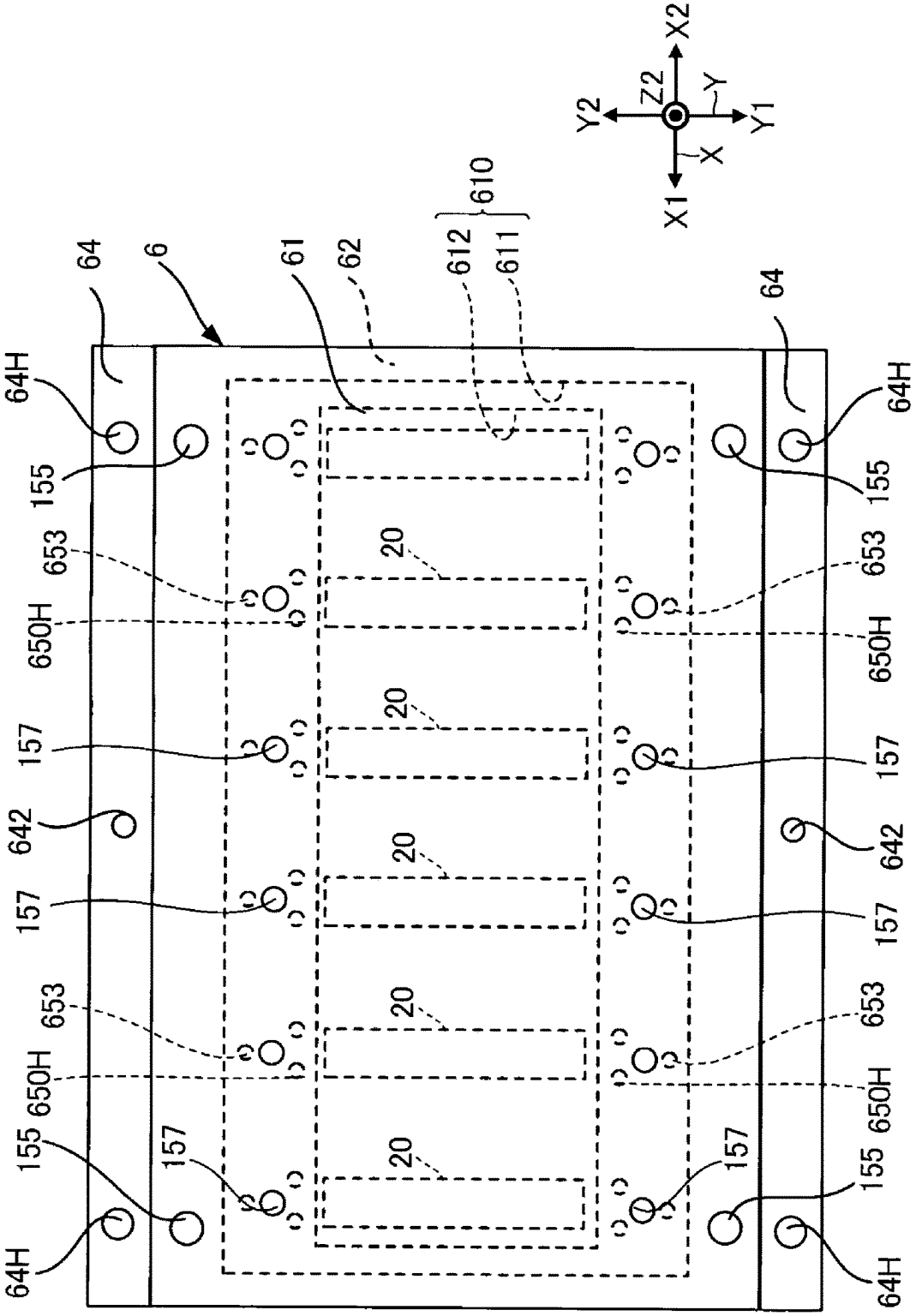
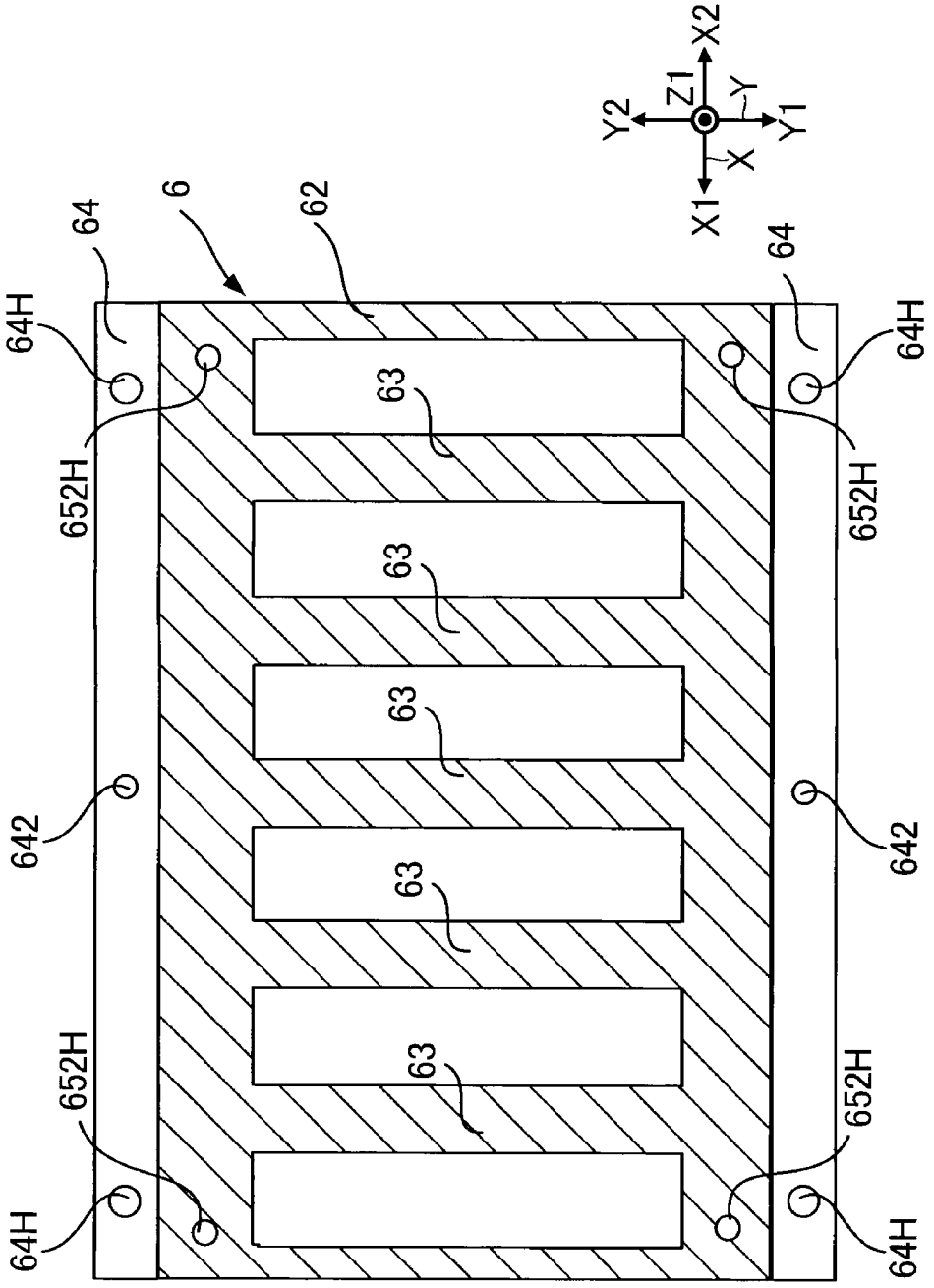


FIG. 10


X2
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Y1
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X1
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64H
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642
652H
652H
64H
64H

FIG. 11

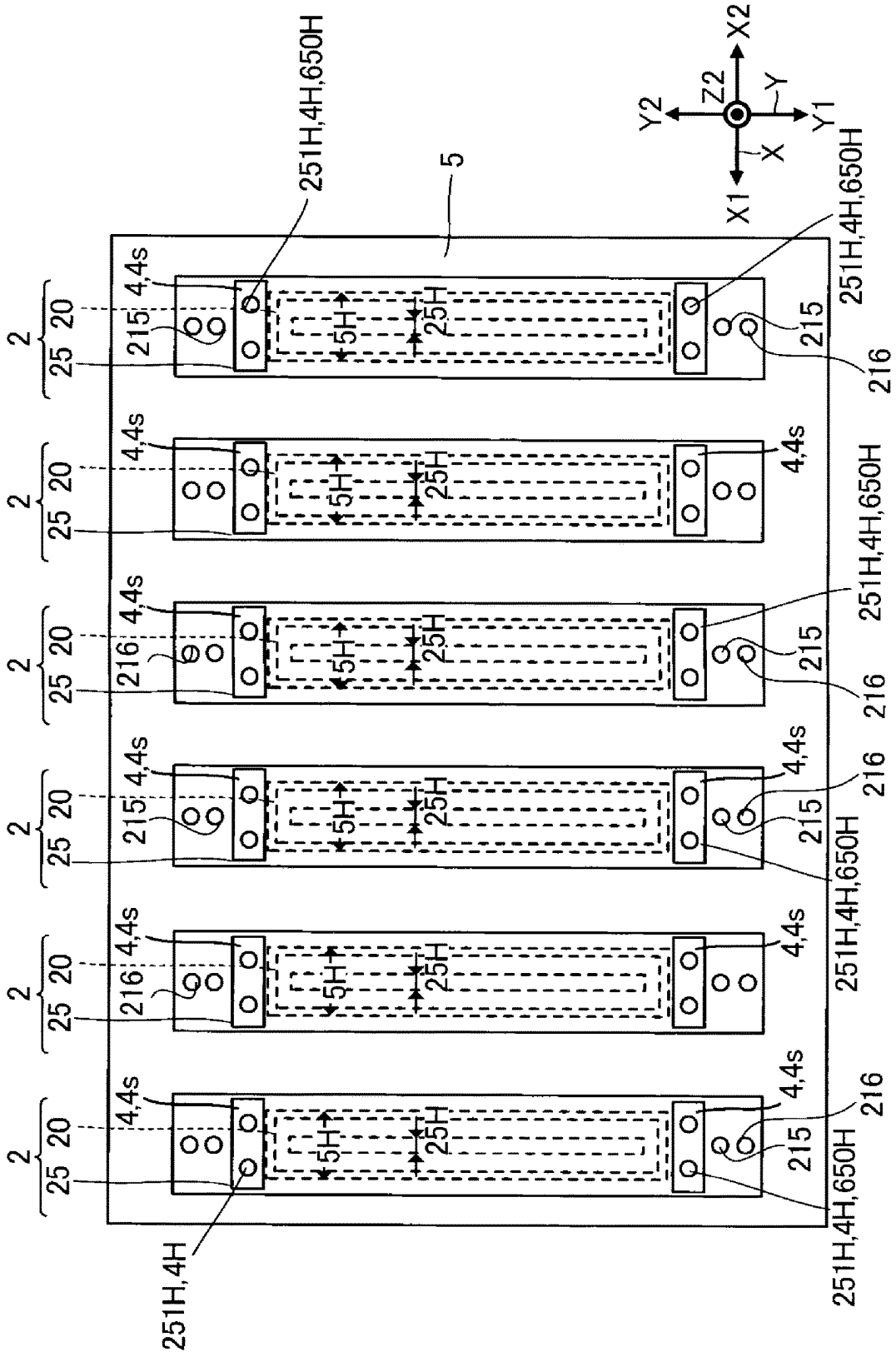


FIG. 12

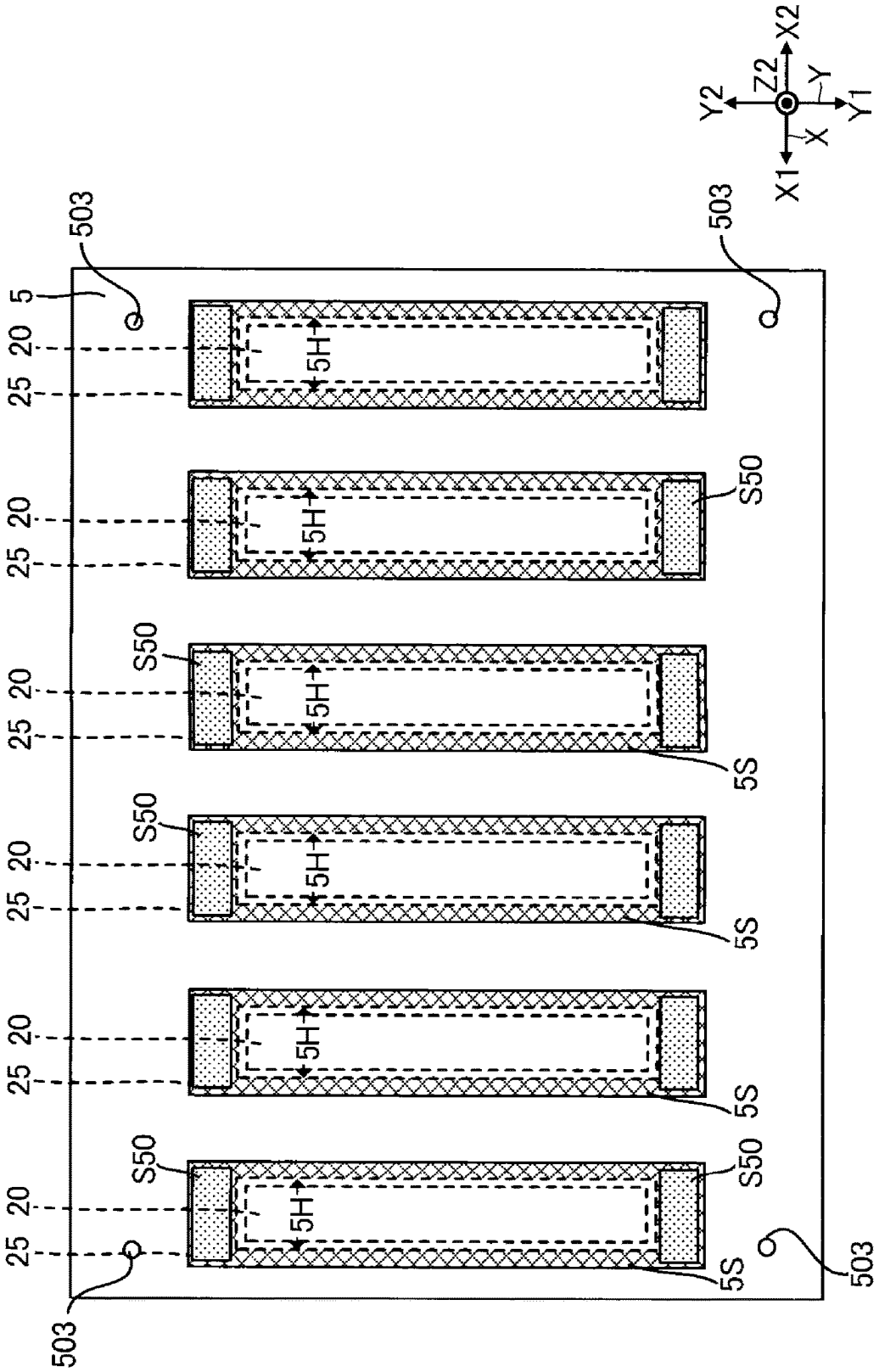
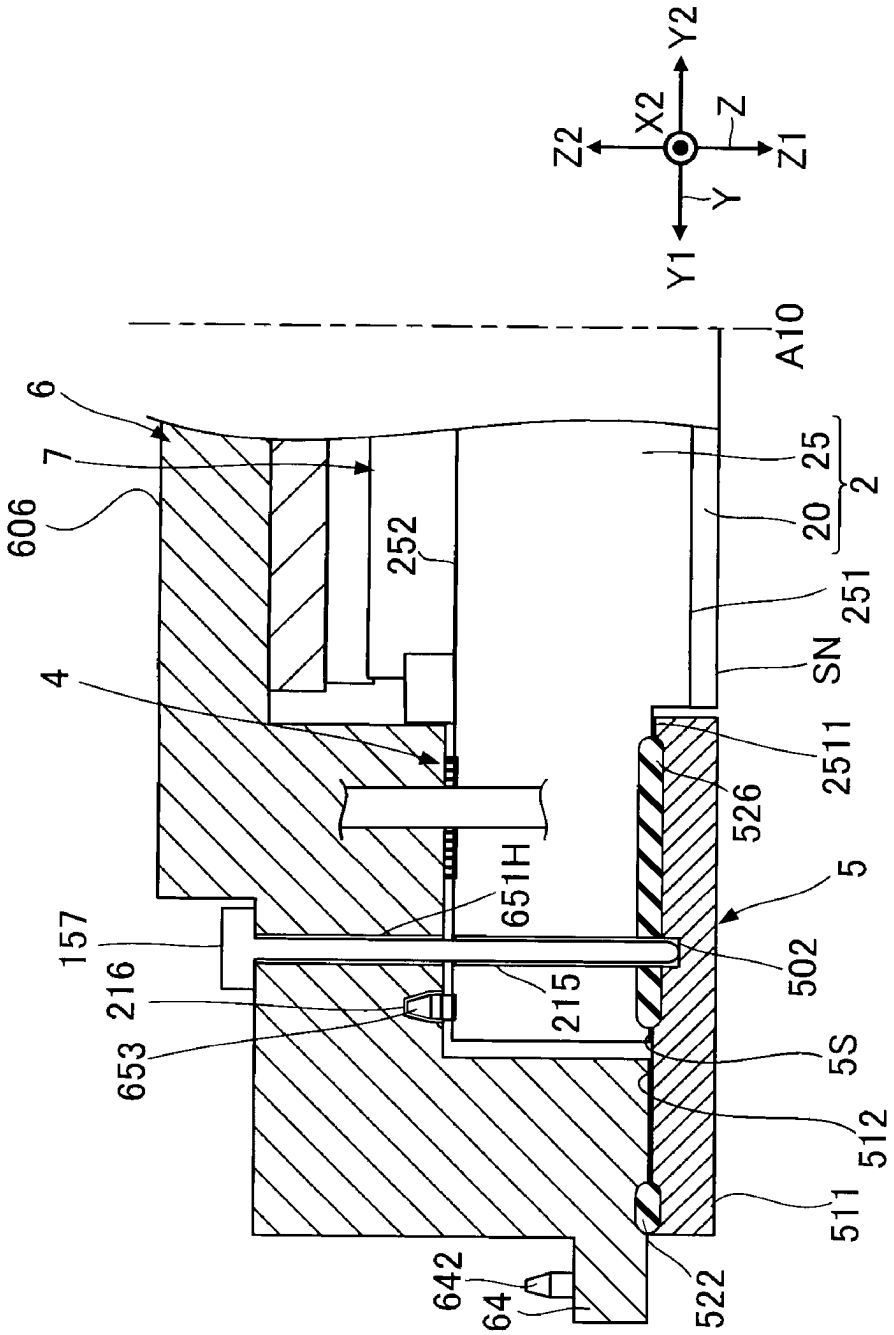


FIG. 13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Z1
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Y1
A10
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606
252
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SN
2511
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651H
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216
653
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502
5S
512
511
642
64
522

FIG. 14

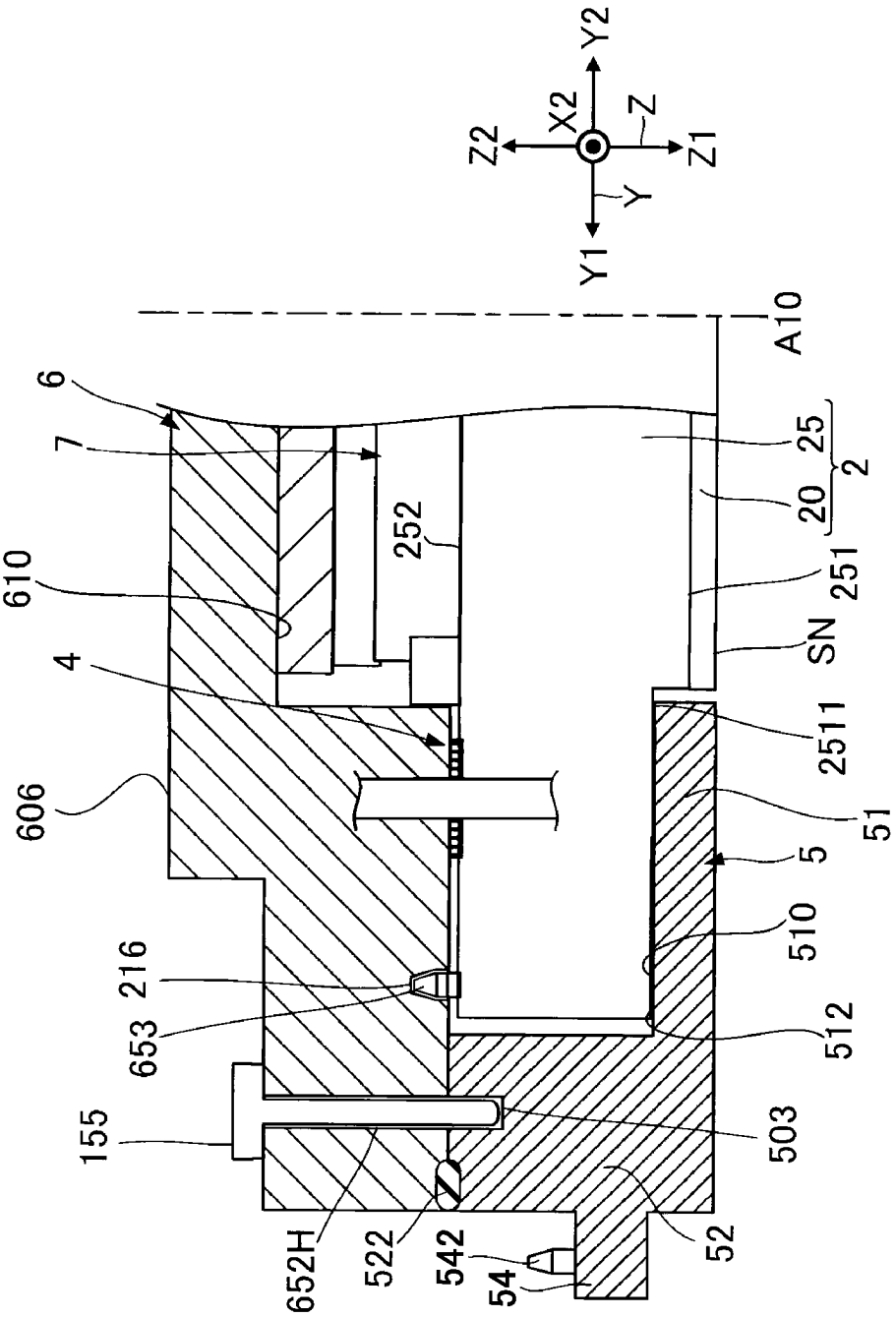
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FIG. 15

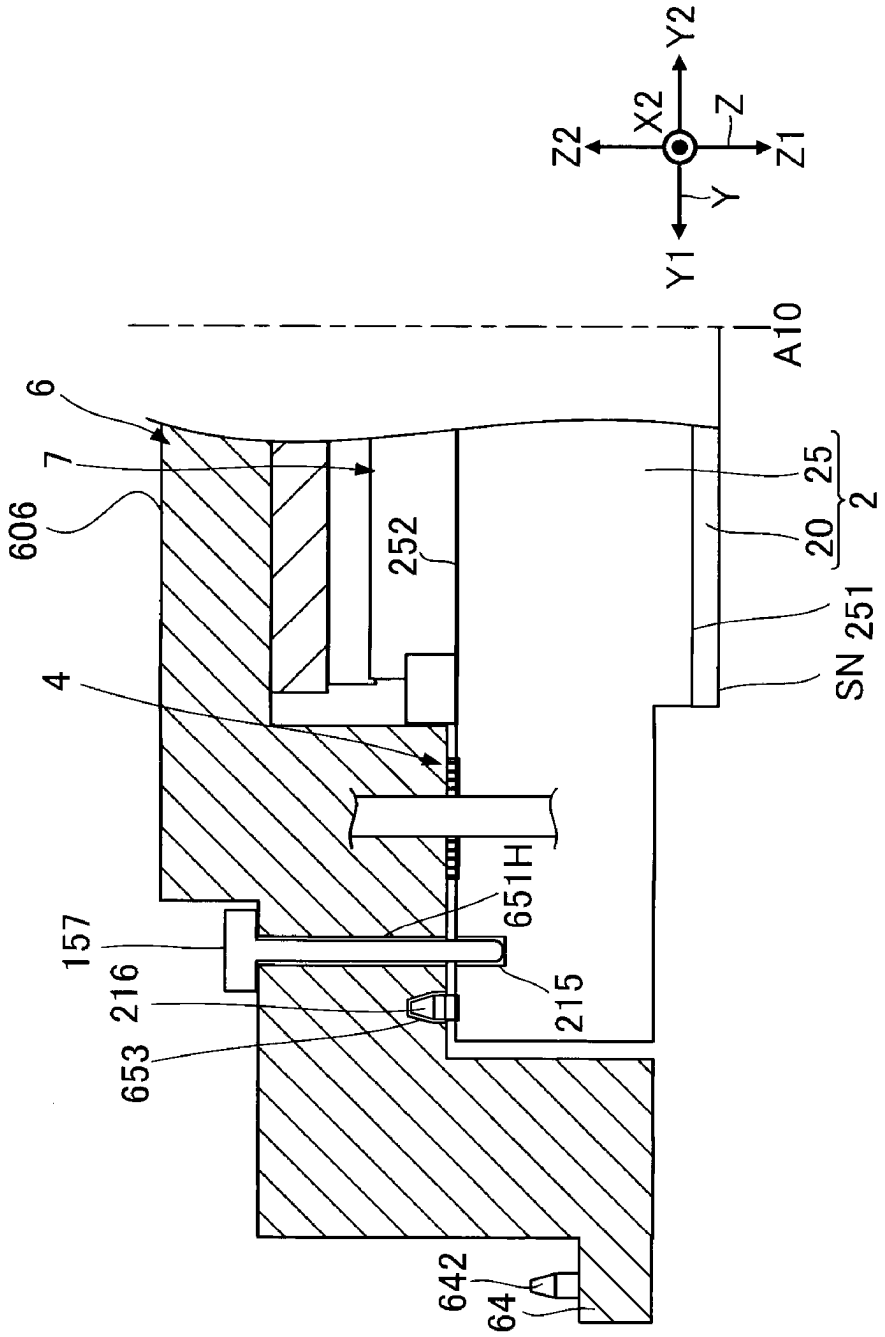
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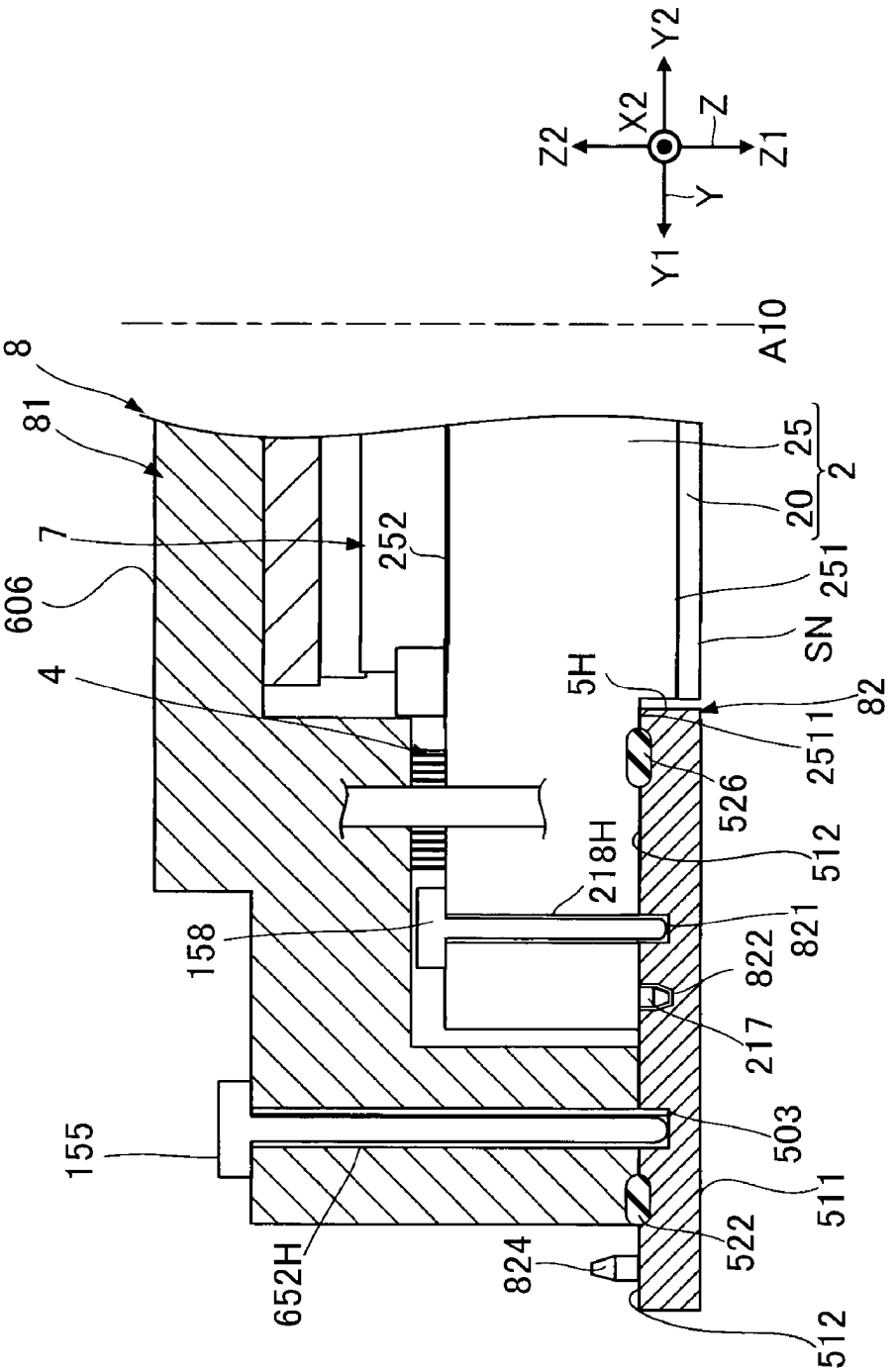
FIG. 16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5H
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2511
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218H
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217
158
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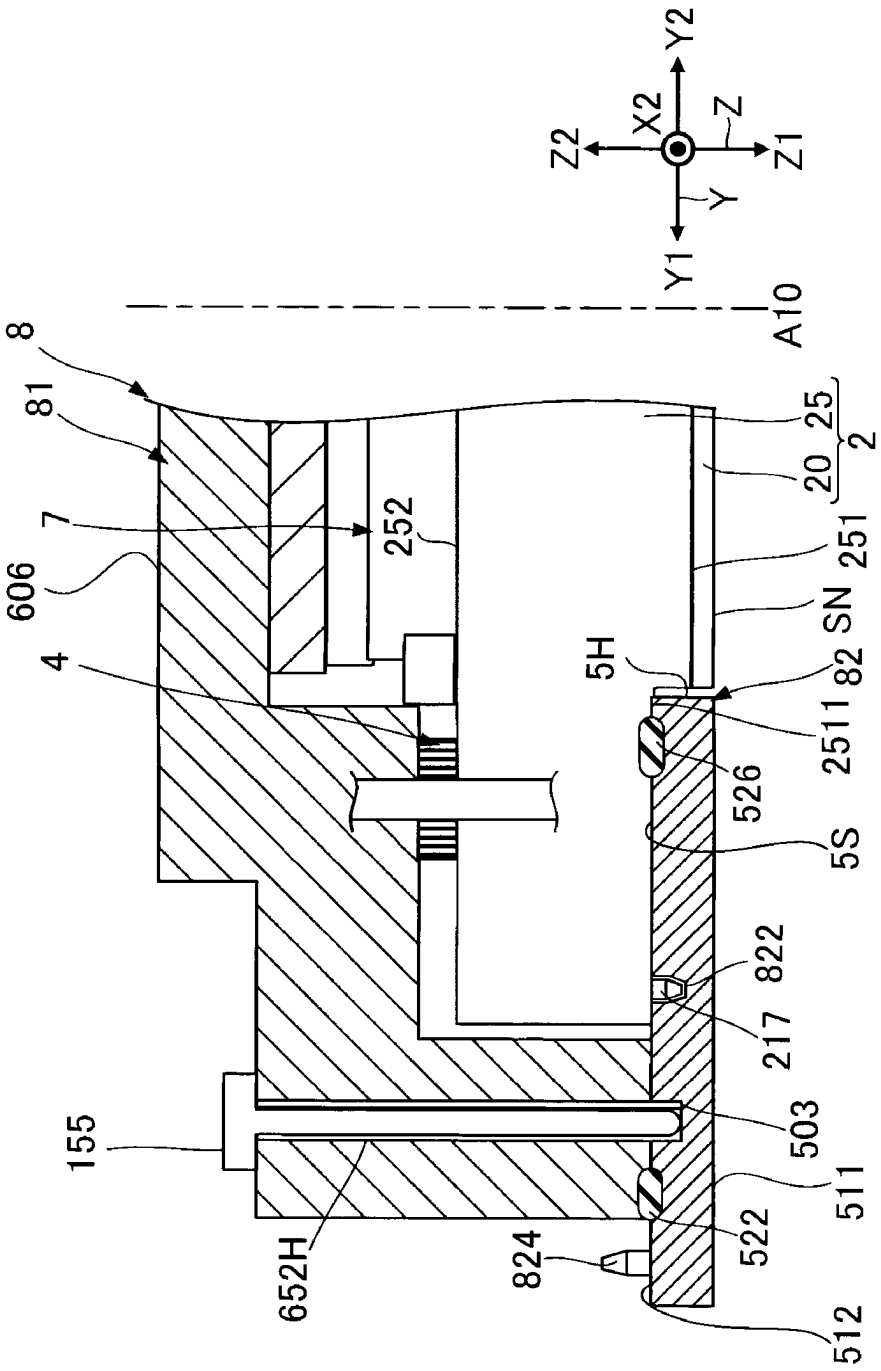
522
652H
824
512

FIG. 17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522
824
652H
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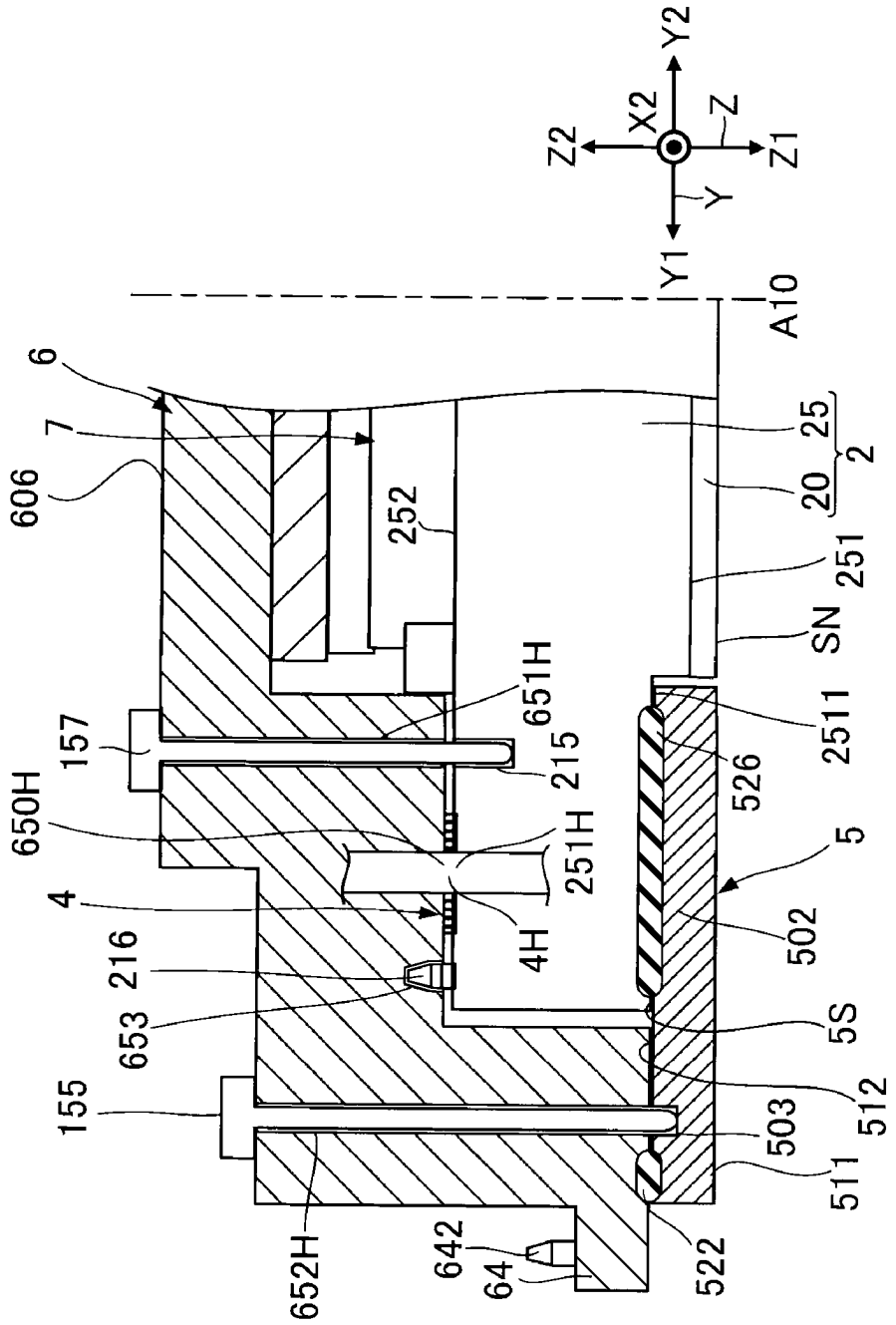
20
2

FIG. 18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502
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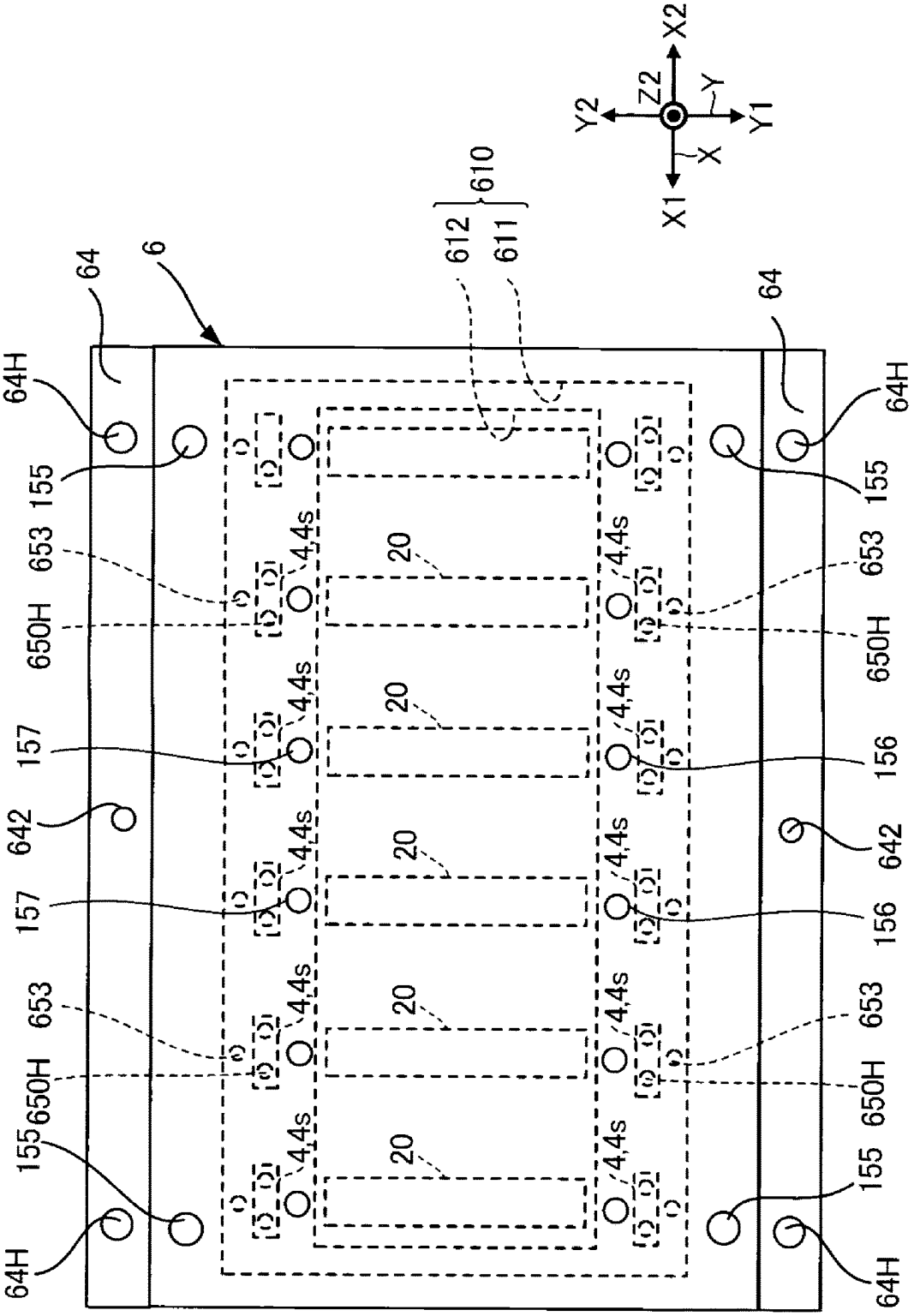
FIG. 19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Y1
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X1
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650H
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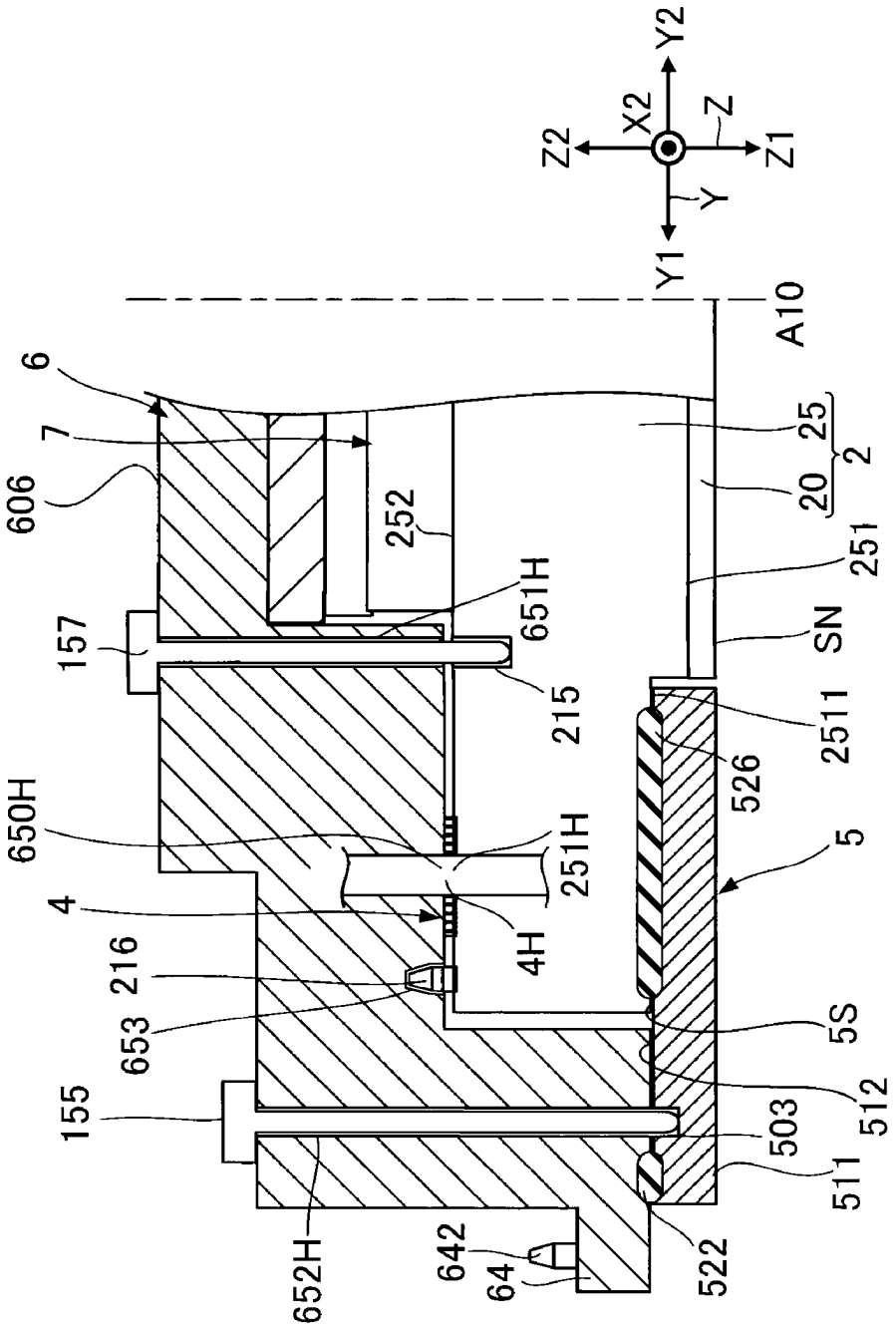
156
4,4s
20

FIG. 20


Y2
X2
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Z2
Z1
Y
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A10
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215
650H
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4H
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FIG. 21

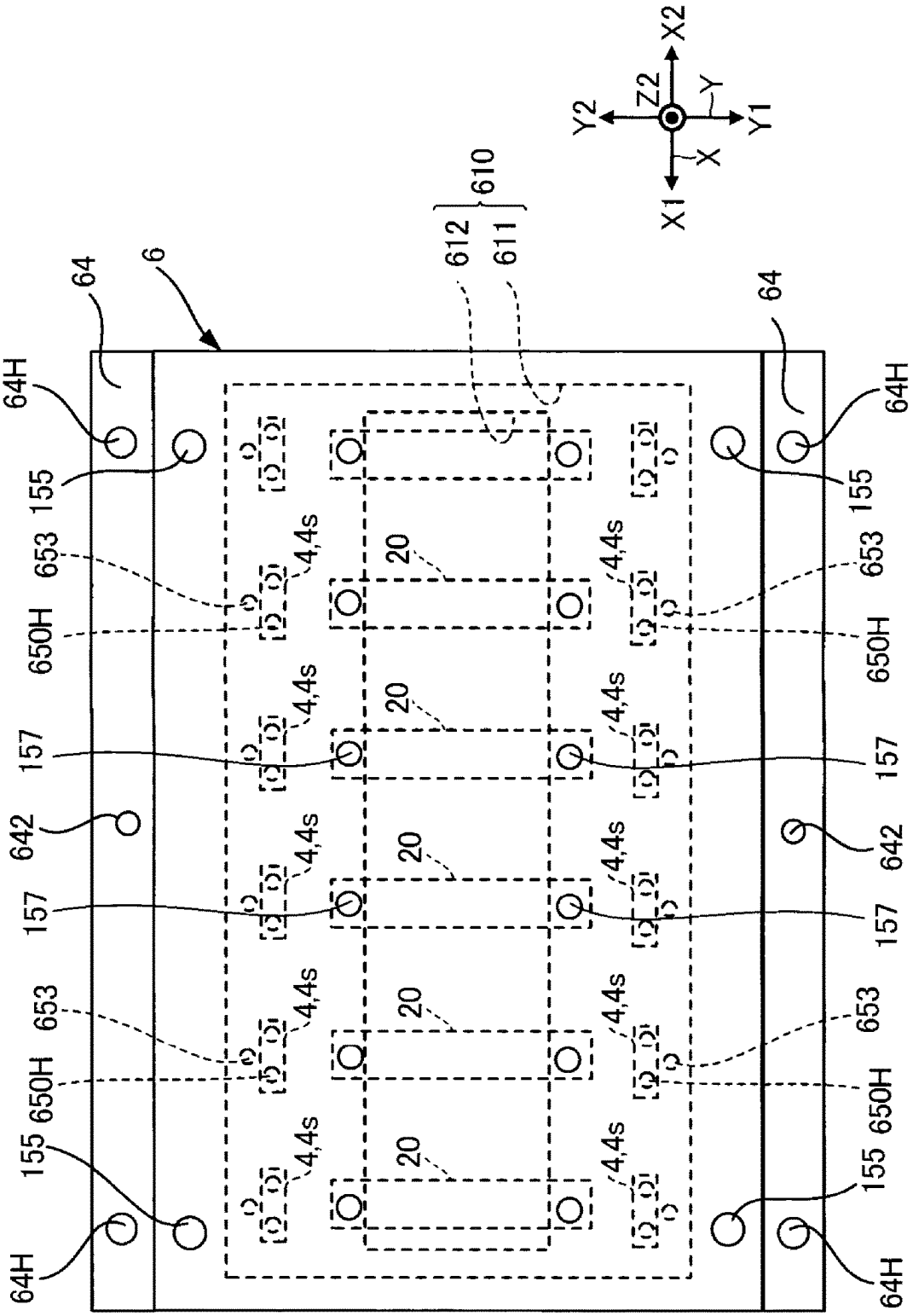
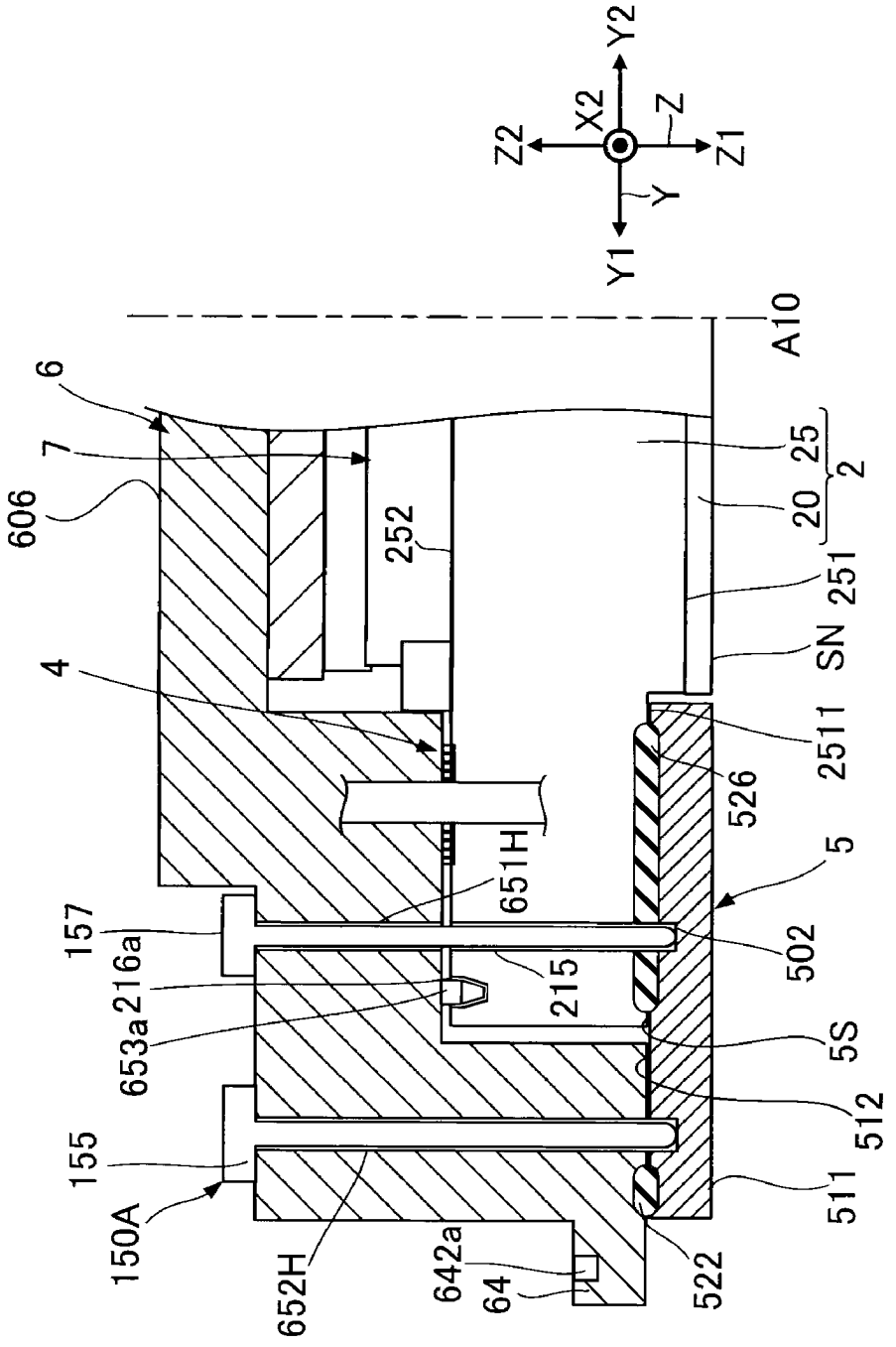


FIG. 22


Y2
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A10
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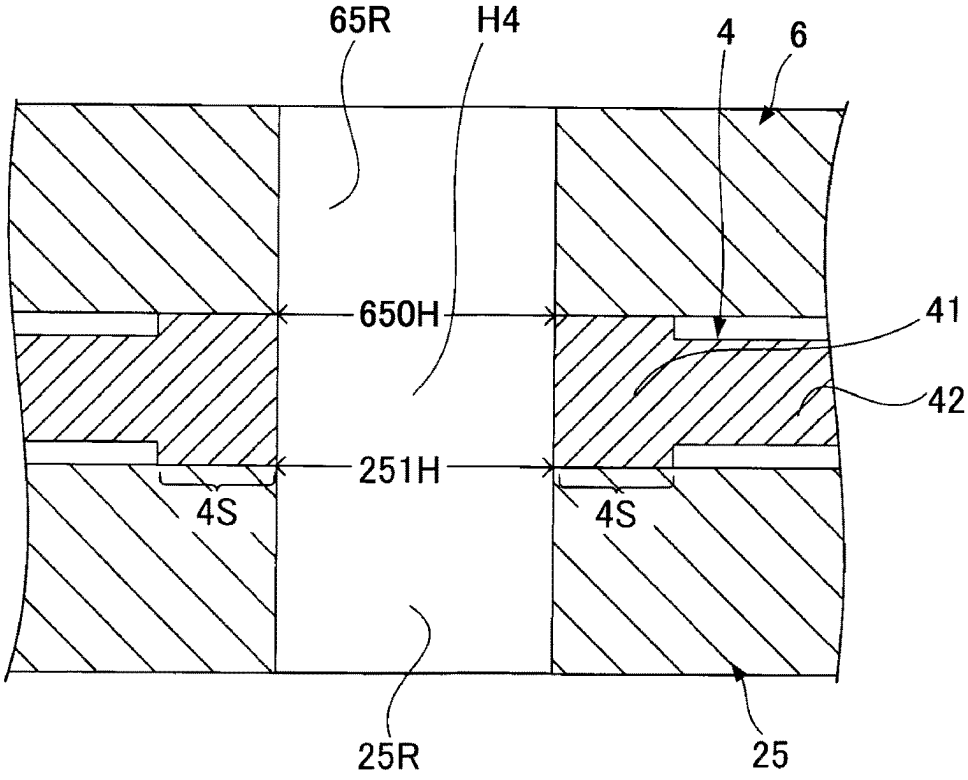
652H
642a
64
522
511

FIG. 23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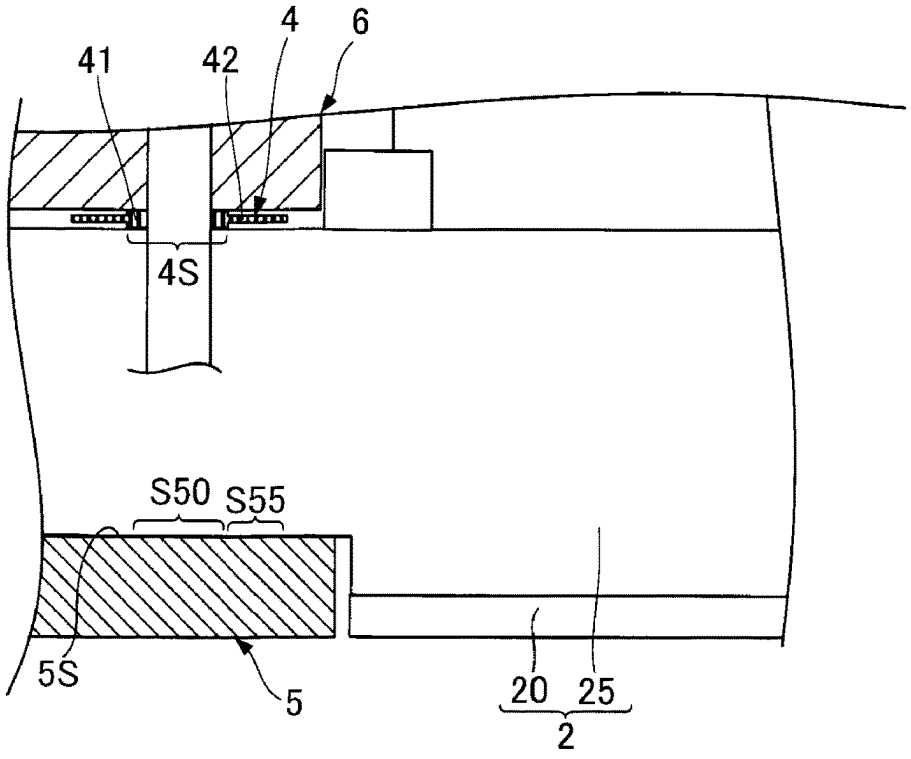
4S
4S
25R
25

FIG. 24


4
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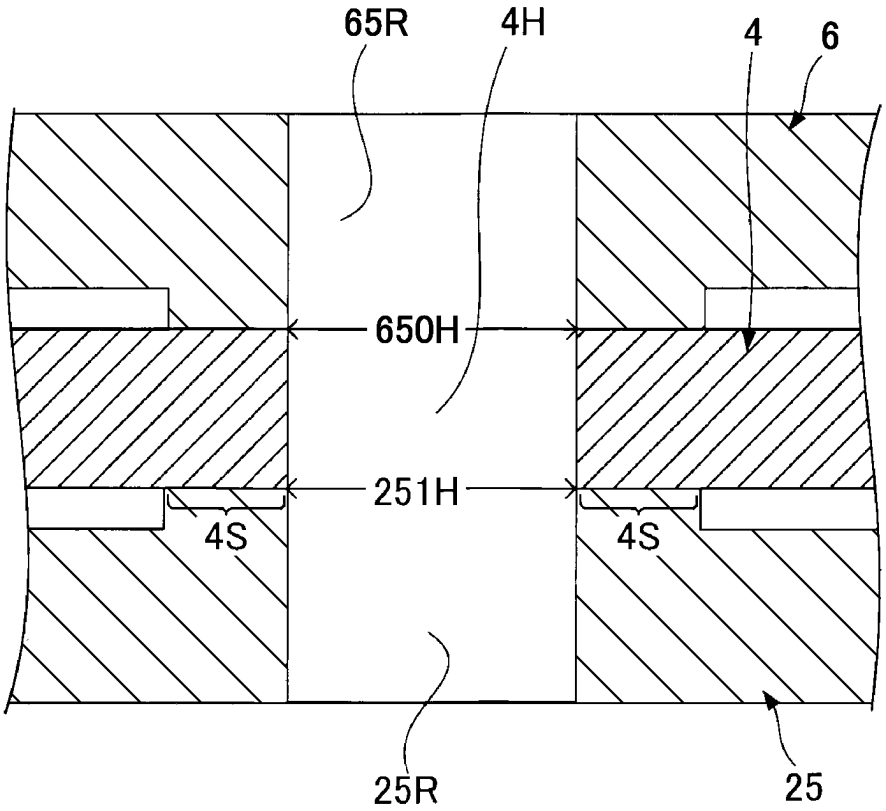
42
4S
S50
S55
5S
5
20
25
2

FIG. 25



LIQUID EJECTING HEAD AND LIQUID EJECTING APPARATUS

[0001] The present application is based on, and claims priority from JP Application Serial Number 2024-022209, filed Feb. 16, 2024, the disclosure of which is hereby incorporated by reference herein in its entirety.

BACKGROUND

1. Technical Field

[0002] The present disclosure relates to a liquid ejecting head and a liquid ejecting apparatus.

2. Related Art

[0003] Heretofore, there have been proposed liquid ejecting apparatuses each including a liquid ejecting head to eject liquids such as inks to media such as print sheets.

[0004] A liquid ejecting head described in JP-A-2022-42753 includes multiple head chips (head modules), a fixing plate, and a holder. The multiple head chips are stored in a space surrounded by the fixing plate and the holder. The multiple head chips are aligned with the fixing plate and is fixed to the fixing plate with an adhesive. The fixing plate is fixed to the holder with the adhesive.

[0005] There is a demand to repair a liquid ejecting head, when one or some of the multiple head modules are broken, by detaching only the broken head modules and replacing them with new head modules. However, in the related art, in order to detach a head module from the holder, it is necessary to detach the fixing plate from the holder. This may result in disorder in the alignment of the multiple head modules with the fixing plate used as a reference. Therefore, there is a demand for a mechanism enabling multiple head modules included in a liquid ejecting head to be easily aligned in work of repairing the liquid ejecting head by replacing some of the multiple head modules.

SUMMARY

[0006] A liquid ejecting head according to an aspect of the present disclosure includes a plurality of head modules each of which ejects a liquid in a first direction, and a metallic holder to which the plurality of head modules are fixed in a detachably-attached manner. Each of the plurality of head modules includes a metallic channel orifice forming member in which a channel is defined, and which includes a first alignment portion. The holder includes a plurality of second alignment portions which are inserted into or receive a plurality of the first alignment portions in a press-fit manner, thereby positioning the plurality of head modules with respect to the holder. A channel orifice formed in the holder and configured to make a channel-forming connection to each of the head modules and a channel orifice formed in the channel orifice forming member of the head module and configured to make the channel-forming connection to the holder coincide with each other as viewed in a direction in which either of the first alignment portions and the second alignment portions are press-fitted into the other alignment portions.

[0007] A liquid ejecting apparatus according to an aspect of the present disclosure includes a plurality of the liquid ejecting heads and a unit base that holds the plurality of liquid ejecting heads.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is a schematic diagram illustrating a structural example of a liquid ejecting apparatus according to a first embodiment.

[0009] FIG. **2** is a plan view illustrating a liquid ejecting head illustrated in FIG. **1**.

[0010] FIG. **3** is a cross-sectional view of the liquid ejecting head illustrated in FIG. **2** viewed along an X-axis direction.

[0011] FIG. **4** is a cross-sectional view of the liquid ejecting head illustrated in FIG. **2** viewed in a direction along a Y axis.

[0012] FIG. **5** is an underside view of the liquid ejecting head illustrated in FIG. **3**.

[0013] FIG. **6** is a cross-sectional view of a chip included in a head module illustrated in FIG. **3**.

[0014] FIG. **7** is a topside view of a channel orifice forming member included in the head module illustrated in FIG. **4**.

[0015] FIG. **8** is an underside view of a holder and a relay substrate illustrated in FIG. **4**.

[0016] FIG. **9** is a topside view of a holder illustrated in FIG. **4**.

[0017] FIG. **10** is a plan view of a lower side of the holder illustrated in FIG. **4**.

[0018] FIG. **11** is a topside view of seal members illustrated in FIG. **4**.

[0019] FIG. **12** is a topside view of support members illustrated in FIG. **4**.

[0020] FIG. **13** is a cross-sectional view of a part of a liquid ejecting head in a first modification.

[0021] FIG. **14** is a cross-sectional view of a part of a liquid ejecting head in a second modification.

[0022] FIG. **15** is a cross-sectional view of a part of a liquid ejecting head in a third modification.

[0023] FIG. **16** is a cross-sectional view of a part of a liquid ejecting head in a fourth modification.

[0024] FIG. **17** is a cross-sectional view of a part of a liquid ejecting head in a fifth modification.

[0025] FIG. **18** is a cross-sectional view of a part of a liquid ejecting head in a seventh modification.

[0026] FIG. **19** is a topside view of the liquid ejecting head in the seventh modification.

[0027] FIG. **20** is a cross-sectional view of a part of a liquid ejecting head in an eighth modification.

[0028] FIG. **21** is a topside view of the liquid ejecting head in the eighth modification.

[0029] FIG. **22** is a cross-sectional view of a part of a liquid ejecting head in a ninth modification.

[0030] FIG. **23** is a cross-sectional view illustrating a seal member and its surrounding area in a tenth modification.

[0031] FIG. **24** is a cross-sectional view of a part of a liquid ejecting head in the tenth modification.

[0032] FIG. **25** is a cross-sectional view illustrating a seal member and its surrounding area in an eleventh modification.

DESCRIPTION OF EMBODIMENTS

[0033] Hereinafter, preferred embodiments of the present disclosure will be described with reference to the accompanying drawings. In the drawings, the dimensions and scale of each component are illustrated differently from actual ones as appropriate, and some parts of the drawings are

schematically illustrated to facilitate understanding. The scope of the present disclosure is not limited to the following embodiments unless particularly limited in the following description. A phrase "an element β on an element Y" means not only a structure in which the element γ and the element β are in direct contact with each other, but also a structure in which the element γ and the element β are out of direct contact with each other. A phrase "an element γ and an element β are equal to each other" means that the element γ and the element β are substantially equal to each other, including a measurement error, a manufacturing error, or the like. A phrase "an element γ and an element β are the same as each other" means that the element γ and the element β are substantially the same as each other, including a measurement error, a manufacturing error, or the like.

1. First Embodiment

1-1. Overall Structure of Liquid Ejecting Apparatus **100**

[0034] FIG. **1** is a schematic diagram illustrating a structural example of a liquid ejecting apparatus **100** according to a first embodiment. The following description will be given by using an X axis, a Y axis, and a Z axis, which are orthogonal to each other, as needed for convenience of description. Moreover, one of directions along the X axis is referred to as an X**1** direction, and the direction opposite to the X**1** direction is referred to as an X**2** direction. Similarly, one of directions along the Y axis is referred to as a Y**1** direction, and the direction opposite to the Y**1** direction is referred to as a Y**2** direction. One of directions along the Z axis is referred to as a Z**1** direction, and the direction opposite to the Z**1** direction is referred to as a Z**2** direction. The Z**1** direction is equivalent to a "first direction". The Z**2** direction is equivalent to "a second direction opposite to the first direction". A side in the Z**1** direction relative to a certain point in is referred to as a "lower side or underside", whereas a side in the Z**2** direction relative to the certain point is referred to as an "upper side or topside". A view seen in the Z**1** direction or the Z**2** direction is referred to as a "plan view".

[0035] As illustrated in FIG. **1**, the liquid ejecting apparatus **100** includes a liquid reservoir section **9**, a control unit **91**, a transport section **92**, a head unit **10**, and a movement mechanism **40**.

[0036] The liquid reservoir section **9** is a container for storing the ink. Examples of specific modes of the liquid reservoir section **9** include a cartridge removably mounted on the liquid ejecting apparatus **100**, a bag-shaped ink pack formed of a flexible film, an ink tank refillable with the ink, and so on. The type of the ink stored in the liquid reservoir section **9** is not particularly limited and may be any type of ink.

[0037] The control unit **91** controls operations of elements in the liquid ejecting apparatus **100**. The control unit **91** includes, for example, a processor circuit such as a central processing unit (CPU) or a field programmable gate array (FPGA) and a storage circuit such as a semiconductor memory, and controls the operations of the elements in the liquid ejecting apparatus **100**.

[0038] The transport section **92** transports a medium **90** in a direction DM under the control of the control unit **91**. In the present embodiment, the direction DM is the Y**1** direction. In the example illustrated in FIG. **1**, the transport section **92** includes a transport roller that is long along the X axis, and a motor that rotates the transport roller. The transport section **92** is not limited to a structure using the transport roller, and may have a structure using, for example, a drum or an endless belt that transports the medium **90** while adsorbing the medium **90** on its outer circumferential surface by electrostatic force or the like.

[0039] The movement mechanism **40** includes a transport belt to which a unit base **11** of the head unit **10** is fixed, and reciprocates the head unit **10** in the X**1** and X**2** directions under the control of the control unit **91**. The head unit **10** ejects the ink supplied from the liquid reservoir section **9** to the medium **90** in the Z**1** direction from each of multiple nozzles N under the control of the control unit **91**. As a result of concurrent operations of the head unit **10** ejecting the ink and the movement mechanism **40** moving the head unit **10**, an image is formed with the ink on a surface of the medium **90**.

[0040] The number and layout of the multiple liquid ejecting heads **1** included in the head unit **10** are not limited to those in the example illustrated in FIG. **1** and may be determined as needed. In a case where the head unit **10** is configured to be able to circulate the ink, the head unit **10** may be connected to the liquid reservoir section **9** via a circulation mechanism for circulating the ink in the head unit **10**.

1-2. Head Unit **10**

[0041] FIG. **2** is a plan view illustrating the head unit **10** illustrated in FIG. **1**. As illustrated in FIG. **2**, the head unit **10** includes the unit base **11** and the multiple liquid ejecting heads **1**. The multiple liquid ejecting heads **1** are fixed to the unit base **11**. The unit base **11** is a member that holds the multiple liquid ejecting heads **1**. In the example illustrated, the number of liquid ejecting heads **1** for the unit base **11** is not particularly limited and may be any number equal to or more than 2.

[0042] The unit base **11** is, for example, a plate-shaped member whose thickness direction is a direction along the z axis. The unit base **11** is provided with a dented portion **111**. The dented portion **111** is a recess provided in the unit base **11**. The bottom surface of the dented portion **111** is provided with multiple through holes **11**H. The planar shape of each through hole **11**H is, for example, a rectangular shape. The through hole **11**H is provided for each liquid ejecting head **1**. A part of the liquid ejecting head **1** is inserted into each through hole **11**H. In FIG. **2**, one of the liquid ejecting heads **1** arranged in the unit base **11** is omitted from the illustration for the purpose of presenting the through hole **11**H.

[0043] The unit base **11** is also provided with four mounting holes **101** and two third alignment portions **102** for each through hole **11**H. The four mounting holes **101** and the two third alignment portions **102** are provided outside the through hole **11**H in the plan view. Here, the numbers and the layout of the mounting holes **101** and the third alignment portions **102** are not limited to those illustrated in FIG. **2**, but may be determined as needed.

[0044] The mounting holes **101** are provided, for example, near four corners of the through hole **11**H in the plan view. The mounting holes **101** are used to mount the liquid ejecting head **1** on the unit base **11**. For example, the mounting holes **101** penetrate the unit base **11** along the thickness direction.

[0045] For example, each of the third alignment portions **102** is provided between the two mounting holes **101**

arranged in the direction along the X axis while being apart from these mounting holes **101**. The third alignment portions **102** are used to position each liquid ejecting head **1** in mounting the liquid ejecting head **1** onto the unit base **11**. Each third alignment portion **102** is, for example, a bottomed slot opened in a surface of the unit base **11** facing in the Z**1** direction. Each third alignment portion **102** may be regarded as a dented portion formed in the surface of the unit base **11** facing in the Z**1** direction.

[0046] Here, the mounting holes **101** do not have to penetrate the unit base **11** in the thickness direction. Likewise, the third alignment portions **102** may penetrate the unit base **11** in the thickness direction. The shape of the unit base **11** is not limited to the plate shape, and may be a box shape.

[0047] As described above, the liquid ejecting apparatus **100** includes the multiple liquid ejecting heads **1** and the unit base **11** to which the multiple liquid ejecting heads **1** are fixed. Such liquid ejecting apparatus **100** includes the liquid ejecting heads **1** to be described later. As will be described later, the multiple liquid ejecting heads **1** can be each detachably mounted on the unit base **11**, and are configured such that the alignment of the multiple liquid ejecting heads **1** with high precision can be achieved. For this reason, even if any of the multiple liquid ejecting heads **1** is replaced, the liquid ejecting apparatus **100** is capable of keeping the print quality from deteriorating.

1-3. Liquid Ejecting Head **1**

[0048] FIG. **3** is a cross-sectional view of the liquid ejecting head **1** illustrated in FIG. **2** viewed in the direction along the X axis. FIG. **4** is a cross-sectional view of the liquid ejecting head **1** illustrated in FIG. **2** viewed in the direction along the Y axis. As illustrated in FIG. **4**, in the present embodiment, the liquid ejecting head **1** has a structure approximately symmetrical about a central imaginary plane A**10** along an X-Z plane. However, the liquid ejecting head **1** may have a structure other than the structure symmetrical about the central imaginary plane A**10**.

[0049] As illustrated in any of FIGS. **3** and **4**, the liquid ejecting head **1** includes multiple head modules **2**, seal members **4**, multiple covers **5**, the holder **6**, multiple wiring substrates **7**, and a relay substrate **70**.

[0050] In the liquid ejecting head **1**, the cover **5**, the holder **6**, and the multiple head modules **2** can be detachably attached to each other. After the cover **5** is detached from the holder **6**, each of the head modules **2** can be individually detached from the holder **6**. Since each head module **2** can be detached from the holder **6**, each head module **2** is replaceable.

1-3A. Head Module **2**

[0051] In the example in FIG. **3**, the multiple head modules **2** are six head modules **2**. The number of head modules **2** is not limited to six, but may be any number of two to five or seven or more.

[0052] In the present embodiment, the multiple head modules **2** are next to each other along the X axis. As illustrated in FIG. **4**, each head module **2** is long along the Y axis. Each head module **2** ejects the ink in the Z**1** direction. Each head module **2** includes a chip **20** and a channel orifice forming member **25**. The chip **20** is arranged in the Z**1** direction relative to the channel orifice forming member **25**.

[0053] FIG. **5** is an underside view of the liquid ejecting head **1** illustrated in FIG. **3**. As illustrated in FIG. **5**, each head module **2** includes multiple nozzles N to eject the ink. The multiple nozzles N are arrayed along the Y axis. The multiple nozzles N are divided into a nozzle array La and a nozzle array Lb arranged side by side while being spaced out along the X axis. Each of the nozzle array La and the nozzle array Lb is a set of multiple nozzles N arrayed linearly along the Y axis. A surface of the head module **2** in which the orifices of the multiples nozzles N are formed is referred to as a nozzle surface SN. The nozzle surface SN is a surface of the chip **20** of the head module **2** facing in the Z**1** direction. Alternatively, for example, the multiple nozzles N may be arrayed in a direction crossing the X axis and the Y axis as viewed in the Z**1** direction.

1-3Aa. Chip **20**

[0054] FIG. **6** is a cross sectional view of the chip **20** included in the head module **2** illustrated in FIG. **3**. The chip **20** has a structure in which elements related to the nozzles N of the nozzle array La are arranged in plane symmetry with elements related to the nozzles N of the nozzle array Lb. In the following description, the elements for the nozzle array La will be mainly described and description of the elements for the nozzle array Lb will be omitted if unnecessary. In addition, the nozzle array La and the nozzle array Lb will be referred to as a nozzle array L below if there is no need to distinguish between them.

[0055] As illustrated in FIG. **6**, the chip **20** of each head module **2** includes, for example, a communication plate **202**, a pressure chamber substrate **203**, a vibration plate **204**, a nozzle plate **201**, a cover **206**, multiple driver elements E, and a sealing substrate **205**.

[0056] Each of the communication plate **202**, the pressure chamber substrate **203**, the vibration plate **204**, the nozzle plate **201**, and the cover **206** is a plate-shaped member that is long along the Y axis. The pressure chamber substrate **203** is provided on a surface of the communication plate **202** facing in the Z**2** direction. The nozzle plate **201** and the cover **206** are provided on a surface of the communication plate **202** facing in the Z**1** direction. For example, these members are fixed to each other with an adhesive.

[0057] The nozzle plate **201** is a plate-shaped member in which the multiple nozzles N are formed. The nozzle plate **201** is the outermost member in the Z**1** direction in the head module **2**. A surface of the nozzle plate **201** facing in the Z**1** direction serves as the nozzle surface SN. Each of the multiple nozzles N is a circular through hole to eject the ink. For example, the nozzle plate **201** is produced by processing a single crystal substrate of silicon (Si) with semiconductor manufacturing techniques such as photolithography and etching.

[0058] In the communication plate **202**, multiple narrowed portions R**1**, multiple communication channels R**2**, a communication space Ra, and a common channel Rb are formed. Each of the narrowed portions R**1** and the communication channels R**2** is a through hole extended in the Z**1** direction and formed for each nozzle N. The communication channels R**2** coincide with the respective nozzles N in the plan view. The communication space Ra is a cavity formed in a shape long along the Y axis. The communication space Ra extends along the Y axis. The common channel Rb communicates with the communication space Ra and overlaps the communication space Ra in the plan view. The common channel Rb extends along the Y axis. The common channel Rb com-

municates with the multiple narrowed portions R1. The communication space Ra communicates with a space Rc included in the channel orifice forming member **25**.

[0059] The communication space Ra, the common channel Rb, and the space Rc form a common space R provided in common to the multiple nozzles N. The common space R functions as a reservoir of the ink. The ink stored in the common space R is distributed to the narrowed portions R1 and is supplied to and filled in multiple pressure chambers C concurrently.

[0060] In the pressure chamber substrate **203**, the multiple pressure chambers C are formed. Each of the pressure chambers C is a space located between the communication plate **202** and the vibration plate **204** and formed by wall surfaces of the pressure chamber substrate **203**. One pressure chamber C is formed for each nozzle N. The pressure chamber C is a long space extended in the X1 direction. The multiple pressure chambers C are arrayed along the Y axis.

[0061] The communication plate **202** and the pressure chamber substrate **203** are each produced by, for example, processing a semiconductor substrate such as a single crystal substrate of silicon.

[0062] The vibration plate **204** elastically deformable is mounted on top of the pressure chamber C. The vibration plate **204** is stacked on the pressure chamber substrate **203** and is in contact with a surface of the pressure chamber substrate **203** opposite to the communication plate **202**. The vibration plate **204** is a rectangular plate-shaped member that is long along the Y axis in the plan view. The pressure chamber C communicates with the nozzle N through the communication channel R2 and communicates with the communication space Ra through the narrowed portion R1. Therefore, the pressure chamber C communicates with the nozzle N via the communication channel R2 and communicates with the communication space Ra via the narrowed portion R1. A channel dedicated to each nozzle N is formed by the nozzle N, the communication channel R2, the pressure chamber C, and the narrowed portion R1. For convenience of description, the pressure chamber substrate **203** and the vibration plate **204** are drawn as separate substrates in FIG. **6**, but are actually stacked in a single silicon substrate.

[0063] The driver element E for each pressure chamber C is formed on a surface of the vibration plate **204** opposite to the pressure chamber C. The driver element E is a piezoelectric element in a shape long along the X axis in the plan view. The driver element E includes, for example, a pair of electrodes and a piezoelectric body provided between the pair of electrodes. Instead, the driver element E may be an electrothermal transducer element to generate thermal energy.

[0064] The sealing substrate **205** is a structural body to protect the multiple driver elements E. The sealing substrate **205** is fixed to a surface of the vibration plate **204** with, for example, an adhesive. The multiple driver elements E are stored inside a dented portion formed in a surface of the sealing substrate **205** facing the vibration plate **204**. Moreover, a through hole **20**H into which the wiring substrate **7** to be described later is to be inserted is provided in the sealing substrate **205**.

[0065] The cover **206** is a thin metallic plate forming a wall surface of the common channel Rb. The cover **206** has a thickness approximately equal to the thickness of the nozzle plate **201**. The planar shape of the cover **206** is, for example, a frame shape surrounding the nozzle plate **201**. A mold **207** made of a resin is provided between the cover **206** and the nozzle plate **201**. The surface of the cover **206** facing in the Z1 direction constitutes a part of the nozzle surface SN.

[0066] In this chip **20**, when the driver element E contracts due to energization, the vibration plate **204** is bent and deflected in the direction that reduces the volume of the pressure chamber C, and the pressure in the pressure chamber C increases, causing an ink droplet to be ejected from the nozzle N. In this process, the pressure is also transmitted toward the narrowed portion R1 from the pressure chamber C, and the ink also flows into the common channel Rb through the narrowed portion R1. After ink ejection, the driver element E returns to its original position. At this time, the ink in the region from the nozzle N to the common channel Rb also vibrates. Then, as soon as the meniscus of the nozzle N is restored, the ink is supplied from the narrowed portion R1. Through the above series of operations, the ink is ejected from the nozzle N.

[0067] Although the chip **20** in the present embodiment includes all the elements illustrated in FIG. **3**, the chip **20** may include only some of the elements or may include additional elements.

[0068] The chip **20** has, for example, a monolithic structure, is a member thinner than the channel orifice forming member **25**, and is, for example, a component having a thickness of smaller than 3000 μm. The chip **20** may be a component having a thickness of 1500 μm or smaller or 1000 μm or smaller. The thickness of the chip **20** may be ⅕ or smaller of the length of the short side of the chip **20** as viewed in the direction along the Z axis, which is the thickness direction of the chip **20**. The chip **20** may include only at least one component among from the nozzle plate **201**, the pressure chamber substrate **203**, the communication plate **202** or the driver elements E, and the sealing substrate **205**. The chip **20** preferably includes at least the nozzle plate **201**, more preferably further includes the pressure chamber substrate **203**, and particularly preferably further includes the communication plate **202**. Furthermore, at least one component among from the nozzle plate **201**, the pressure chamber substrate **203**, the communication plate **202** or the pressure chamber substrate **203** on which the driver elements E are stacked, and the sealing substrate **205** may be regarded as the chip **20**. The chip **20** may be not only a stack of silicon substrates manufactured by MEMS, but also a stack of ceramic sheets or thin plates made of metals or the like, or a stack in which thin plate-shaped members made of the aforementioned materials are stacked.

1-3Ab. Channel Orifice Forming Member **25**

[0069] As illustrated in FIGS. **4** and **6**, the channel orifice forming member **25** is arranged in the Z2 direction relative to the chip **20**. The channel orifice forming member **25** and the chip **20** are fixed to each other with, for example, an adhesive. The channel orifice forming member **25** and the chip **20** are aligned with each other with high precision in advance. The channel orifice forming member **25** includes, for example, a channel for supplying the ink to the chip **20**.

[0070] For example, the channel orifice forming member **25** is preferably a member having a thickness of 3000 μm or greater, more preferably a member having a thickness of 5000 μm or greater, and even more preferably a member having a thickness of 8000 μm or greater. The channel orifice forming member **25** may be formed of a single member or

a stack of multiple members. The channel orifice forming member **25** is made of a metal herein, but may be made of a thermosetting resin. When the channel orifice forming member **25** is made of a thermosetting resin, the cost may be reduced. In the case where the channel orifice forming member **25** is made of a metal, the same metal material as in the holder **6** to be described later may be used. However, in the case where the channel orifice forming member **25** is made of a metal, the channel orifice forming member **25** is easy to reuse after the head module **2** is replaced. In addition, the channel orifice forming member **25** made of a metal can be positioned with respect to the holder **6** with higher precision than in the case where a resin is used.

[0071] As illustrated in FIG. **4**, a length of the channel orifice forming member **25** in the direction along the Z axis, that is, the thickness of the channel orifice forming member **25**, is greater than a thickness D**2** of the chip **20**. The thickness of the channel orifice forming member **25** mentioned herein is a thickness at a position coinciding with a seal area **4**S to be described later, as viewed in the Z**1** direction. In other words, the chip **20** is thinner than the channel orifice forming member **25**. The channel orifice forming member **25** includes a surface **251** facing in the Z**1** direction and a surface **252** facing in the Z**2** direction.

[0072] FIG. **7** is a topside view of the channel orifice forming members **25** of the head modules **2** illustrated in FIG. **4**. As illustrated in FIG. **7**, the planar shape of the channel orifice forming member **25** is larger than the planar shape of the chip **20**. In other words, as viewed in the Z**1** direction, the chip **20** is smaller in outer profile than the channel orifice forming member **25**. As viewed in the Z**1** direction, the channel orifice forming member **25** is arranged so as to overlap the chip **20** and cover the chip **20**.

[0073] As illustrated in FIGS. **4** and **7**, the channel orifice forming member **25** includes a flange portion **250** to be fixed to the cover **5** to be described later. The planar shape of the flange portion **250** is a rectangular frame shape surrounding an opening **5**H of the cover **5** to be described later. As illustrated in FIG. **4**, a surface of the flange portion **250** facing in the Z**1** direction is a supported surface **2511** supported by the cover **5** to be described later. Since the planar shape of the flange portion **250** is the rectangular frame shape surrounding the opening **5**H, the planar shape of the supported surface **2511** is similarly a rectangular frame shape surrounding the opening **5**H. The supported surface **2511** is located in the Z**2** direction relative to the chip **20**. Accordingly, the supported surface **2511** located in the Z**2** direction relative to the nozzle plate **201**.

[0074] In addition, as illustrated in FIG. **7**, a through hole **25**H is provided to the channel orifice forming member **25**. The wiring substrate **7** to be described later is to be inserted into the through hole **25**H. The through hole **25**H is provided at a central portion of the channel orifice forming member **25** in the plan view. In reference to FIG. **6**, the through hole **25**H coincides with the through hole **20**H of the sealing substrate **205** in the plan view.

[0075] As illustrated in FIGS. **4** and **6**, a channel **25**R is formed inside the channel orifice forming member **25**. The channel **25**R is provided to supply the ink to the chip **20**. As illustrated in FIG. **6**, the space Rc is formed on the chip **20** side of the channel **25**R, that is, downstream of the channel **25**R. The channel **25**R and the space Rc communicate with each other.

[0076] As illustrated in FIG. **4**, multiple channel orifices **251**H are provided on the side of the channel **25**R of the channel orifice forming member **25**, the side opposite to the chip **20**, that is, the upstream side of the channel **25**R. Each of the channel orifices **251**H is a cavity end of the channel **25**R in the Z**2** direction. The channel orifice **251**H is an orifice for a channel-forming connection between the channel **25**R of the channel orifice forming member **25** of the head module **2** and a channel **6**R of the holder **6** to be described later. As illustrated in FIGS. **4** and **7**, the multiple channel orifices **251**H are provided in the flange portion **250** of the channel orifice forming member **25**. The channel orifices **251**H are arranged outside the chip **20** as viewed in the Z**1** direction. In the present embodiment, two channel orifices **251**H are provided for each nozzle array L.

[0077] As illustrated in FIGS. **4** and **7**, each channel orifice forming member **25** is provided with two fixing slots **215** and two first alignment portions **216**. The head module **2** including the channel orifice forming member **25** can be detachably attached to the holder **6**. The first alignment portions **216** are used for the purpose of positioning the head module **2** with respect to the holder **6** or other purposes. The fixing slots **215** are used to fix the head module **2** to the holder **6**.

[0078] The first alignment portions **216** are provided on a surface **252** of the channel orifice forming member **25** facing in the Z**2** direction. The surface **252** is also a surface of the head module **2** facing in the Z**2** direction. In the present embodiment, the first alignment portions **216** are protrusions protruding in the Z**2** direction from the surface **252** of the channel orifice forming member **25** facing in the Z**2** direction. The two first alignment portions **216** are provided on both longitudinal sides of the channel orifice forming member **25** across the opening **5**H of the cover **5**. One of the two first alignment portions **216** is located in the Y**1** direction relative to the opening **5**H, whereas the other is located in the Y**2** direction relative to the opening **5**H.

[0079] The fixing slots **215** are provided in the surface **252** of the channel orifice forming member **25** facing in the Z**2** direction. The fixing slots **215** are bottomed slots opened in the surface **252** of the channel orifice forming member **25** facing in the Z**2** direction. Each fixing slot **215** is a dented portion provided in the surface **252** of the channel orifice forming member **25** facing in the Z**2** direction and may be regarded as a recess formed in the surface **252**. The two fixing slots **215** are provided on both longitudinal sides of the channel orifice forming member **25** across the through hole **25**H, that is, both longitudinal sides thereof across the opening **5**H of the cover **5**. One of the two fixing slots **215** is located in the Y**1** direction relative to the opening **5**H, whereas the other is located in the Y**2** direction relative to the opening **5**H.

[0080] Each fixing slot **215** located in the Y**1** direction relative to the opening **5**H is closer to the opening **5**H than the first alignment portion **216** located in the Y**1** direction relative to the opening **5**H is. Similarly, each fixing slot **215** located in the Y**2** direction relative to the opening **5**H is closer to the opening **5**H than the first alignment portion **216** located in the Y**2** direction relative to the opening **5**H is. The first alignment portions **216** and the fixing slots **215** do not overlap the opening **5**H as viewed in the Z**1** direction. The distance from the opening **5**H increases in the order of the two channel orifices **251**H, the fixing slot **215**, and the first

alignment portion **216**. Among them, the two channel orifices **251**H are located closest to the opening **5**H.

[0081] The minimum distance between the fixing slot **215** and the opening **5**H is shorter than the minimum distance between the first alignment portion **216** and the opening **5**H, but may be longer than the latter distance. Further, the first alignment portions **216**, the fixing slots **215**, and the opening **5**H are arranged along the longitudinal direction of the cover **5**, but do not have to be arranged along the longitudinal direction. For example, the first alignment portions **216** may be provided on both sides of the opening **5**H along the X axis.

1-3B. Holder **6**

[0082] As illustrated in FIGS. **3** and **4**, the holder **6** holds and stores the multiple head modules **2** and includes a common channel to supply and distribute the ink to the multiple head modules **2**. The holder **6** is provided in common to the multiple head modules **2**.

[0083] As illustrated in FIG. **4**, the holder **6** in the present embodiment includes a member in which both of one channel **6**R and multiple second alignment portions **653** are formed. The channel **6**R supplies the ink to each of the head modules **2** and distributes the ink to the head modules **2**. The holder **6** includes a supply channel member including the channel **6**R serving as the common channel. The channel **6**R is the common channel provided in common to the multiple head modules **2** and includes a common portion **6**RA extended along the X axis and multiple branched portions **6**RB branched off from the common portion **6**RA and extended in the Z**1** direction. Although not illustrated, the holder **6** is provided with a channel joint for connecting to a supply channel outside the liquid ejecting head **1** so that channel **6**R can communicate with the liquid reservoir section **9**. This channel joint not illustrated is exposed to outside of the liquid ejecting head **1** through, for example, a not-illustrated opening formed in the holder **6**.

[0084] The holder **6** may include multiple channels **6**R communicating with the multiple head modules **2**. Specifically, instead of the channel **6**R including the common portion **6**RA communicating with the multiple head modules **2**, the holder **6** may include the multiple channels **6**R communicating with the respective multiple head modules **2**.

[0085] A head module **2** side, in other words, a downstream side of the channel **6**R is provided with channel orifices **650**H. Each channel orifice **650**H is a cavity end of the channel **6**R in the Z**1** direction. The channel orifices **650**H are provided corresponding to the channel orifices **251**H of the head module **2**. Each channel orifice **650**H is an orifice for a channel-forming connection between the channel **25**R of the head module **2** and the channel **6**R of the holder **6**.

[0086] FIG. **8** is an underside view illustrating the holder **6** and the relay substrate **70** illustrated in FIG. **4**. As illustrated in FIGS. **3**, **4**, and **8**, the holder **6** has a box shape including a dented portion **610** opened in the Z**1** direction. The multiple head modules **2** are arranged in a storage space inside the dented portion **610** of the holder **6**. To put it differently, the holder **6** and the cover **5** form the storage space for storing the module head modules **2**. The holder **6** is made of, for example, a metal such as aluminum, titanium, stainless steel, **42** alloy, or invar.

[0087] As illustrated in FIGS. **4** and **8**, the dented portion **610** includes a first dented portion **611** and a second dented portion **612**. As illustrated in FIG. **4**, the second dented portion **612** is formed in a bottom surface of the first dented portion **611**. The first dented portion **611** is located in the Z**1** direction relative to the Z-axial center of the holder **6**. The second dented portion **612** is located in the Z**2** direction relative to the Z-axial center of the holder **6**. The opening area of the second dented portion **612** is smaller than the opening area of the first dented portion **611**. Accordingly, the dented portion **610** includes a step surface.

[0088] The relay substrate **70** is bonded to the bottom surface of the dented portion **610**, more specifically, on the bottom surface of the second dented portion **612** with, for example, an adhesive. Although not illustrated in detail, the holder **6** is provided with an opening to which a wiring member outside the liquid ejecting head **1** for electrically connecting the relay substrate **70** to the control unit **91** is to be inserted.

[0089] As illustrated in FIG. **3**, the holder **6** includes a flat plate portion **61**, a sidewall **62**, and two flange portions **64**. The flat plate portion **61**, the sidewall **62**, and the two flange portions **64** are formed integrally.

[0090] FIG. **9** is a topside view of the holder **6** illustrated in FIG. **3**. FIG. **10** is a plan view of a lower portion of the holder **6** illustrated in FIG. **3**. As illustrated in FIG. **3**, **4**, or **9**, the flat plate portion **61** is a portion in a flat plate shape along an X-Y plane, and is located in the Z**2** direction relative to the channel **6**R. The sidewall **62** is a portion extended in the Z**1** direction from an outer edge of the flat plate portion **61**. A planar shape of the sidewall **62** is a rectangular frame shape. The above step surface is provided on an inner wall surface of the sidewall **62**.

[0091] The first dented portion **611** is provided at a lower portion of the holder **6**, and the second dented portion **612** is provided at an upper portion of the holder **6**.

[0092] As illustrated in FIG. **4**, the holder **6** includes multiple fixing holes **651**H, multiple fixing holes **652**H, and multiple second alignment portions **653**. The fixing holes **651**H are used to fix the head module **2** to the holder **6**. The fixing holes **652**H are used to fix the cover **5** to the holder **6**. The second alignment portions **653** are used to position the head module **2** with respect to the holder **6**.

[0093] Each fixing hole **651**H is a hole passing through the holder **6** in the Z**1** direction. Two fixing holes **651**H are provided for each head module **2**. Each fixing hole **651**H is provided in the Y**1** direction or the Y**2** direction relative to the second dented portion **612** as viewed in the Z**1** direction. The two fixing holes **651**H are provided corresponding to the above-described two fixing slots **215** and coincide with the two fixing slots **215** as viewed in the Z**1** direction. The fixing holes **651**H do not overlap the chip **20** but overlap the channel orifice forming member **25** as viewed in the Z**1** direction. A hole end of each fixing hole **651**H in the Z**1** direction is opened on the bottom surface of the first dented portion **611** as viewed in the Z**1** direction.

[0094] Each fixing hole **652**H is a hole passing through the holder **6** in the Z**1** direction. As illustrated in FIG. **10**, the multiple fixing holes **652**H are, for example, four fixing holes **652**H, and are respectively provided at four corners of the rectangular holder **6** as viewed in the Z**1** direction. As illustrated in FIG. **4**, the fixing holes **652**H are provided corresponding to the fixing slots **503** of the cover **5**. The fixing holes **652**H coincide with the fixing slots **503** as

viewed in the Z1 direction. None of the fixing holes **652**H overlaps the dented portion **610** as viewed in the Z1 direction.

[0095] The second alignment portions **653** are provided in a surface **605** of the holder **6** facing in the Z1 direction. TWO second alignment portions **653** are provided for each head module **2**. In the present embodiment, the second alignment portions **653** are bottomed slots opened in the surface **605** of the holder **6** facing in the Z1 direction, specifically, the bottom surface of the first dented portion **611**. Each second alignment portion **653** is a dented portion formed in the surface **605** of the holder **6** facing in the Z1 direction, specifically, the bottom surface of the first dented portion **611**. Each second alignment portion **653** is provided in the Y1 direction or the Y2 direction relative to the second dented portion **612** as viewed in the Z1 direction. The two second alignment portions **653** are provided corresponding to the above-described two first alignment portions **216** and coincide with the first alignment portions **216** as viewed in the Z1 direction. Accordingly, the multiple second alignment portions **653** are provided for the multiple first alignment portions **216** on a one-to-one basis.

[0096] In the second alignment portions **653**, the first alignment portions **216** are press-fitted to position the cover **5** with respect to the holder **6**. The first alignment portions **216** and the second alignment portions **653** are provided on a per-head module **2** basis.

[0097] As viewed in the Z1 direction, the fixing holes **651**H are closest to the opening **5**H and the fixing holes **652**H are farthest from the opening **5**H among the fixing holes **651**H, the second alignment portions **653**, and the fixing holes **652**H. The distances from the opening **5**H to the fixing holes **651**H, the second alignment portions **653**, and the fixing holes **652**H may be equal to or different from each other.

[0098] The first alignment portions **216** included in the foregoing channel orifice forming member **25** are press-fitted into the foregoing second alignment portions **653** to position the head module **2** with respect to the holder **6**. The first alignment portions **216** and the second alignment portions **653** are provided on the per-head module **2** basis.

[0099] The provision of the first alignment portions **216** and the second alignment portions **653** described above enables easy positioning for attaching each head module **2** to the holder **6**. Moreover, since the first alignment portions **216** and the second alignment portions **653** are provided for each head module **2**, it is possible to align the multiple head modules **2** with each other with high precision. For this reason, in order to replace only some of the multiple head modules **2**, there is no need to realign all the head modules **2**.

[0100] Moreover, the multiple head modules **2** can be aligned with each other with high precision in the simple method including press-fitting the first alignment portions **216** into the second alignment portions **653**. This allows only a desired head module **2** to be replaced easily among the multiple head module **2**. This makes it easy to recycle the liquid ejecting head **1**.

[0101] Here, a press-fit refers to a tight fit or a transition fit. A press-fit state is defined as a state where each first alignment portion **216** is in contact with the corresponding second alignment portion **653** in at least two points, when the first alignment portion **216** is completely inserted in the second alignment portion **653**. As viewed in the direction along the Z axis, before a press-fit, the length of the longest line segment connecting two points on the outer circumference of the first alignment portion **216** serving as an alignment pin is greater than the diameter of the largest circle inscribed in the second alignment portion **653** serving as an alignment slot. Moreover, in the press-fit state, the head module **2** is fitted to the holder **6** to such an extent that a force applied by the press-fit may prevent the head module **2** from falling down due to its own weight.

[0102] The channel orifices **650**H and the channel orifices **251**H correspond to each other as described above. Specifically, the channel orifices **650**H and the channel orifices **251**H coincide with each other in the direction in which the first alignment portions **216** or the second alignment portions **653** are press-fitted into the other alignment portions, namely, in the direction along the Z axis. In other words, the direction in which the channel orifices **650**H and the channel orifices **251**H coincide with each other is the same as the direction in which the first alignment portions **216** are press-fitted into the second alignment portions **653**. For this reason, in the process of attaching the head module **2** to the holder **6**, the channel-forming connections between the channel **6**R and the channels **25**R can be easily made with high precision.

[0103] Moreover, the multiple second alignment portions **653** are arranged in the surface **605** of the holder **6** facing in the Z1 direction, specifically, the bottom surface of the first dented portion **611**. The first alignment portions **216** are arranged on the surface **252** of the channel orifice forming member **25** facing in the Z2 direction opposite to the Z1 direction.

[0104] This arrangement of the first alignment portions **216** and the second alignment portions **653** makes it possible to easily attach or detach only a head module **2** of a replacement target from below the holder **6**. Therefore, in order to attach an unbroken head module **2** to the holder **6** as a replacement for a head module **2** of a replacement target, it is only necessary to make the channel-forming connections between the head module **2** as the replacement and the holder **6**. Thus, there is no need to make the channel-forming connections between the head modules **2** other than the replacement target and the holder **6**. Accordingly, the attachment and detachment work for repairing the liquid ejecting head **1** can be simplified.

[0105] The holder **6** is regarded as including the common channel member including one or more channels **6**R communicating with the multiple head modules **2** as described above. The holder **6** including the common channel members is arranged in the Z2 direction relative to the multiple head modules **2** and overlaps the multiple head modules **2** as viewed in the Z1 direction. The first alignment portions **216** are provided on the surface **252** of the channel orifice forming member **25** facing in the Z2 direction. This structure enables easy attachment and detachment for only the head module **2** of the replacement target from below. Therefore, there is no need to disconnect the channel-forming connections between the holder **6** and the head modules **2** other than the replacement target, which simplifies the attachment and detachment work.

[0106] In addition, as described above, the first alignment portions **216** are provided on the surface of the channel orifice forming member **25** opposite to the surface provided with the chip **20**, that is, the surface **252** facing in the Z2 direction. The first alignment portions **216** do not overlap the

chip **20** as viewed in the Z**1** direction. This arrangement of the first alignment portions **216** makes it possible to, in the process of press-fitting the first alignment portions **216** into the second alignment portions **653** of the holder **6**, prevent the load due to the press-fit from acting on the chip **20**.

[0107] As described above, the holder **6** includes the multiple fourth alignment portions **642**. The multiple fourth alignment portions **642** are provided in the flange portions **64**. As illustrated in FIG. **4**, the fourth alignment portions **642** are protrusions protruding in the Z**2** direction from surfaces of the flange portions **64** facing in the Z**2** direction. The multiple fourth alignment portions **642** are provided corresponding to the multiple third alignment portions **102** included in the unit base **11** illustrated in FIG. **2** on a one-to-one basis.

[0108] Each of the fourth alignment portions **642** is press-fitted into one of the multiple third alignment portions **102** provided to the unit base **11**, thereby positioning the liquid ejecting head **1** with respect to the unit base **11**. This makes it possible to improve the precision of alignment of the multiple liquid ejecting heads **1** with the unit base **11**.

[0109] In addition, as illustrated in FIG. **9**, the flange portions **64** are provided with mounting slots **64**H. The mounting slots **64**H correspond to the mounting holes **101** of the unit base **11**. Each of the mounting slots **64**H is a bottomed slot opened in the surface of the flange portion **64** facing in the Z**2** direction and is, for example, a screw slot for mounting the liquid ejecting head **1** to the unit base **11** with a member such as a screw. The flange portions **64** are fixed to the unit base **11** with not-illustrated members such as screws inserted into the mounting holes **101** and the mounting slots **64**H in this order and then tightened. As a result, the liquid ejecting head **1** is fixed to the unit base **11**.

1-3C. Seal Member **4**

[0110] As illustrated in FIGS. **3** and **4**, the seal members **4** are provided between the head modules **2** and the holder **6** in the Z**1** direction. The seal members **4** are provided for each head module **2**. The seal members **4** are elastic. The seal members **4** are made of an elastic material such as elastomer, for example. In the present embodiment, the length of the seal member **4** along the Z axis, that is, the thickness of the seal member **4**, is constant. The thickness of the seal member **4** is smaller than the thicknesses of the channel orifice forming member **25** and the holder **6**. The seal member **4** is squeezed between the head module **2** and the holder **6**.

[0111] FIG. **11** is a topside view of the seal members **4** illustrated in FIG. **4**. In the example illustrated in FIG. **11**, two seal members **4** are provided for each head module **2**. The two seal members **4** are provided at both longitudinal ends of one head module **2**. Each seal member **4** has a rectangular shape as viewed in the Z**1** direction. Each seal member **4** overlaps the flange portion **250** included in the channel orifice forming member **25** of the head module **2** as viewed in the Z**1** direction. On the other hand, in the present embodiment, the seal members **4** are provided at positions different from the chips **20** as viewed in the Z**1** direction. In other words, the seal members **4** do not overlap the chips **20** as viewed in the Z**1** direction.

[0112] As illustrated in FIGS. **4** and **11**, each seal member **4** includes two communication orifices **4**H. As illustrated in FIG. **4**, each communication orifice **4**H is provided corresponding to one of the channel orifices **251**H of the channel orifice forming members **25** and one of the channel orifices **650**H of the holder **6**. As illustrated in FIG. **11**, the communication orifice **4**H coincides with both the channel orifice **650**H and the channel orifice **251**H as viewed in the Z**1** direction. As illustrated in FIG. **4**, the communication orifice **4**H is connected to the channel **25**R via the channel orifice **251**H. The communication orifice **4**H is connected to the channel **6**R via the channel orifice **650**H. Thus, the channel **25**R and the channel **6**R communicate with each other through the communication orifice **4**H. Specifically, the channel **25**R and the channel **6**R communicate with each other through the communication orifice **4**H with the seal member **4** squeezed between the channel orifice forming member **25** and the holder **6**.

[0113] Such a seal member **4** is a member for liquid-tightly connecting the channel orifices **251**H of the head module **2** and the channel orifices **650**H of the holder **6**. The ink flowing in the channel **6**R of the holder **6** flows into the channels **25**R of the channel orifice forming members **25** via the communication orifices **4**H and is supplied to the dedicated channels included in the chips **20** via the common spaces R.

[0114] As illustrated in FIG. **11**, the seal member **4** has a seal area **4**S. In the present embodiment, the entire area of the seal member **4** serves as the seal area **4**S. The seal area **4**S is an area of the seal member **4** that is in contact with both the channel orifice forming member **25** and the holder **6** and held between the channel orifice forming member **25** and the holder **6**. The seal area **4**S is an area squeezed with application of a load from the channel orifice forming member **25** and the holder **6** so as to liquid-tightly connect the channel orifices **251**H and the channel orifices **650**H. In other words, even an area of the seal member **4** located between the channel orifice forming member **25** and the holder **6** is not included in the seal area **4**S if the area is not squeezed with application of the load from both members, and does not actually contribute to the liquid-tight connection between the channel orifice **251**H and the channel orifice **610**H.

[0115] As illustrated in FIG. **11**, the seal members **4** are provided at the positions different from the chips **20** as viewed in the Z**1** direction, and accordingly the seal areas **4**S are provided at the positions different the chips **20** as viewed in the Z**1** direction. In other words, the seal areas **4**S do not overlap the chip **20** as viewed in the Z**1** direction. Since the seal areas **4**S do not overlap the chips **20** as viewed in the Z**1** direction, the reaction force of the seal members **4** is less likely to act on the chips **20** than if they overlap the chips **20**. As a result, the reliability of the head modules **2** can be improved.

[0116] As described above, the channel **25**R and the channel **6**R communicate with each other through the communication orifices **4**H with the seal member **4** squeezed between the channel orifice forming member **25** and the holder **6**. The reaction force of the squeezed seal member **4** may apply stress to the chip **20**, and cause warping or the like of the chip **20**. In this way, if the reaction force of the seal member **4** acts on the chip **20**, the reliability of the head module **2** may deteriorate due to the occurrence of an undesirable phenomenon such, for example, as displacement of the nozzles N as a result of deformation of the nozzle plate **201**, a change in ejection characteristics as a result of deformation of the pressure chamber substrate **203** and the

communication plate **202**, or a breakage of any of members constituting the chip **20** if the members include a silicon substrate or ceramic sheet.

[0117] In the present embodiment, the seal areas **4**S of the seal members **4** do not overlap the chips **20** as viewed in the Z**1** direction. For this reason, it is possible to keep the reaction force of the seal members **4** from acting on the chips **20** while keeping the sealing performance of the seal members **4** from decreasing. Thus, the reliability of the head modules **2** can be improved.

[0118] Further, the seal members **4** corresponding to the multiple head modules **2** included in the liquid ejecting head **1** do not overlap the chips **20** as viewed in the Z**1** direction. As a result, in the multiple head modules **2**, it is possible to keep the reaction force of the seal members **4** from acting on the chips **20** while keeping the sealing performance of the seal members **4** from decreasing. Thus, the reliability of the liquid ejecting head **1** can be improved.

[0119] As illustrated in FIG. **11**, none of the communication orifices **4**H, the channel orifices **251**H, and the channel orifices **650**H overlaps the chips **20** as viewed in the Z**1** direction. All of the communication orifices **4**H, the channel orifices **251**H, and the channel orifices **650**H are arranged outside the chips **20** as viewed in the Z**1** direction. Specifically, the communication orifices **4**H and the channel orifices **251**H and **650**H are arranged on both longitudinal sides of each chip **20** as viewed in the Z**1** direction. For this reason, the seal areas **4**S of the seal members **4** which liquid-tightly seal the channels **25**R and **6**R as described above can be arranged outside the chips **20**. Accordingly, as described above, the reaction force of the seal members **4** can be kept from affecting the chips **20**.

[0120] In addition, each of the seal areas **4**S is arranged in the Y**1** direction or the Y**2** direction, which is a longitudinal direction of the head module **2**, relative to the chip **20** as viewed in the Z**1** direction. Since the seal areas **4**S are arranged in the longitudinal directions relative to the chips **20**, none of the seal areas **4**S is arranged between the adjacent chips **20**. This can avoid an increase in the distance between the adjacent chips **20** due to the seal area **4**S if provided. For this reason, the print quality is less likely to be affected.

[0121] However, the seal areas **4**S may be arranged, relative to the chips **20**, in directions in which the multiple head modules **2** are arrayed, that is, the short side directions of the head modules **2**. The seal members **4** may be provided, relative to the chips **20**, in the directions in which the multiple head modules **2** are arrayed, that is, the short-side directions of the head modules **2**.

1-3D. Cover **5**

[0122] The cover **5** illustrated in FIGS. **3** and **4** is a support member that supports the multiple head modules **2**. The cover **5** is provided in common to the multiple head modules **2** but may be individually provided for the respective multiple head modules **2**. The cover **5** is a plate-shaped member that is long along the Y axis while a thickness direction thereof is a direction along the Z axis. The cover **5** is arranged in the Z**1** direction relative to the channel orifice forming member **25**. The cover **5** is a member that sandwiches the seal members **4** and the channel orifice forming member **25** between itself and the holder **6**. As illustrated in FIG. **4**, the cover **5** includes a surface **511** facing in the Z**1** direction and a surface **512** facing in the Z**2** direction. The cover **5** is a member that does not include any channel through which the ink flows.

[0123] The cover **5** is fixed to the holder **6** to be described later in a detachably-attached manner. Specifically, the cover **5** is not bonded to with an adhesive or the like. The cover **5** can be detachably attached to the holder **6**. For this reason, the cover **5** can be detached from the holder **6**. The cover **5** may be regarded as a sub-holder of the holder **6**.

[0124] In the present embodiment, the cover **5** holds each of the head modules **2** in a detachably attached manner. Therefore, each head module **2** can be detached from the cover **5**.

[0125] Here, it is preferable to fix the head modules **2** to the cover **5** with an adhesive, and each head module **2** may be configured to be detachable from the cover **5** with decomposition of the adhesive.

[0126] The cover **5** is made of, for example, a metal. The cover **5** is made of a metal such, for example, as aluminum or stainless steel. The cover **5** has stiffness sufficient to support the multiple head modules **2**.

[0127] As illustrated in FIGS. **4** and **5**, the cover **5** is provided with multiple openings **5**H. Each opening **5**H is a hole passing through the cover **5** in the thickness direction. Each opening **5**H is provided for exposing a part of the corresponding head module **2** to outside. Specifically, the chip **20** is exposed from the opening **5**H. Accordingly, the multiple nozzles N are exposed from the opening **5**H.

[0128] FIG. **12** is a topside view of the cover **5** illustrated in FIG. **4**. As illustrated in FIGS. **4** and **12**, the cover **5** includes multiple support areas **5**S. Each support area **5**S is a part of the surface **512** of the cover **5** facing in the Z**2** direction. In FIG. **12**, the support areas **5**S are hatched for facilitating understanding. In the example of FIG. **12**, each support area **5**S has a rectangular frame shape as viewed in the Z**1** direction.

[0129] As illustrated in FIG. **4**, the support area **5**S is an area that is in contact with the channel orifice forming member **25** and directly supports the channel orifice forming member **25**. The support area **5**S is in contact with the supported surface **2511** of the channel orifice forming member **25**. The support area **5**S includes areas S**50** coinciding with the seal areas **4**S as viewed in the Z**1** direction. In FIG. **12**, the areas S**50** are dotted.

[0130] Since the support area **5**S includes the areas S**50** coinciding with the seal areas **4**S as viewed in the Z**1** direction, the cover **5** vertically receives the reaction force of the seal members **4**. Therefore, the cover **5** can firmly support the seal areas **4**S of the seal members **4** between itself and the holder **6**. Accordingly, the cover **5** can particularly effectively alleviate the reaction force of the seal members **4**.

[0131] Moreover, a part of the above-described surface **251** of the channel orifice forming member **25** facing in the Z**1** direction includes the supported surface **2511**. The supported surface **2511** is supported by being in contact with the cover **5** while surrounding the opening **5**H of the cover **5** as viewed in the Z**1** direction. Specifically, the head module **2** is held by the cover **5** with the supported surface **2511** put in contact with the support area **5**S of the cover **5**. When the channel orifice forming member **25** is supported by the cover **5** as described above, the load of the seal members **4** can be distributed. As a result, the channel orifice forming member **25** can be made less likely to be broken.

[0132] Here, the contact between the supported surface **2511** and the support area **5**S means not only a direct contact between them and but also a connection between them via an adhesive, an elastic bushing, or the like. Accordingly, the channel orifice forming member **25** may be in direct contact with the cover **5** or may be in indirect contact with the cover **5** via another member such as an adhesive or a bushing. The flange portion **250** may have a shape other than the rectangular frame shape in the plan view. For example, the flange portions **250** in rectangular shapes may be provided in both of the Y**1** and Y**2** directions relative to the opening **5**H in the plan view.

[0133] The thickness of the flange portion **250**, that is, the length along the Z**1** direction, is preferably greater than the thickness of the part of the channel orifice forming member **25** arranged inside the opening **5**H. In addition, the thickness of the flange portion **250** is preferably ½ or greater of the maximum thickness of the channel orifice forming member **25**. Such a thickness relationship keeps the strength of the flange portion **250** from decreasing, and makes it easier for the flange portion **250** to ensure the strength in receiving the reaction force of the seal members **4**.

[0134] Moreover, the thickness D**5** of the cover **5** in the Z**1** direction is greater than the thickness D**2** of the chip **20** in the Z**1** direction, the thickness D**5** is greater than the thickness D**2**. This can reduce a risk of the cover **5** being deformed due to the reaction force of the seal members **4**.

[0135] The thickness D**5** of the cover **5** is preferably two or more times and more preferably three or more times greater than the thickness D**2** of the chip **20**. This can further reduce the risk of the cover **5** being deformed due to the reaction force of the seal members **4**. However, the thickness D**5** may be equal to or smaller than the thickness D**2**.

[0136] From the same viewpoint, the thickness D**5** of the cover **5** is preferably 1 mm or greater and more preferably 2 mm or greater. In order to further enhance the strength of the cover **5**, the thickness D**5** may be 3 mm or greater, 5 mm or greater, or 6 mm or greater. On the other hand, from the viewpoint of an increase in the distance between the medium **90** and the nozzle surface SN, that is, a paper gap, the thickness D**5** of the cover **5** is preferably 10 mm or smaller, and more preferably 7 mm or smaller.

[0137] As illustrated in FIG. **4**, in addition to the chip **20**, the part of the channel orifice forming member **25** is arranged in the opening **5**H of the cover **5**. In other words, the part of the channel orifice forming member **25** is inserted in the opening **5**H of the cover **5**. In the case where the cover **5** exists, the paper gap may increase depending on how great the thickness D**5** of the cover **5** is. Specifically, if the thickness D**5** of the cover **5** is excessively great, the surface of the chip **20** facing in the Z**1** direction may be retracted in the Z**2** direction from the surface of the cover **5** facing in the Z**1** direction. An increase in the above distance may result in a decrease in the accuracy of ink impact positions on the medium **90**.

[0138] In the present embodiment, as described above, in addition to the chip **20**, the part of the channel orifice forming member **25** is arranged in the opening **5**H. Thus, even if the thickness D**5** of the cover **5** is increased in order to further enhance the strength of the cover **5**, the paper gap may be prevented from increasing.

[0139] Further, the surface of the nozzle plate **201** facing in the Z**1** direction, namely, the nozzle surface SN, in the chip **20** is approximately flush with the surface **511** of the cover **5** facing in the Z**1** direction. In other words, the nozzle surface SN and the surface **511** of the cover **5** facing in the Z**1** direction are located at the same Z-axial position. In this case, the paper gap can be kept from increasing as compared with the case where the nozzle surface SN is retracted in the Z**2** direction from the surface **511** of the cover **5** facing in the Z**1** direction. Moreover, it is easy to collectively wipe the surface **511** of the cover **5** facing in the Z**1** direction and the nozzle surface SN.

[0140] The nozzle surface SN and the surface **511** of the cover **5** facing in the Z**1** direction being approximately flush with each other means not only a case where they are completely flush with each other, but also a case where they have a step formed in between to the extent including a manufacturing error or the like.

[0141] Instead, the nozzle surface SN and the surface **511** of the cover **5** facing in the Z**1** direction do not have to be approximately flush with each other. The nozzle surface SN and the surface **511** of the cover **5** facing in the Z**1** direction may be located at different Z-axial positions or may have a step formed in between. In this case, from the viewpoint of ease of wiping, the distance between the nozzle surface SN and the surface **511** of the cover **5** facing in the Z**1** direction is preferably 100 μm or smaller and more preferably 50 μm or smaller.

[0142] As illustrated in FIG. **4**, the cover **5** includes multiple fixing slots **503**. The fixing slots **503** are used to fix the cover **5** to the holder **6**. As illustrated in FIG. **4**, the fixing slots **503** are provided in the surface **512** of the cover **5** facing in the Z**2** direction. Each fixing slot **503** is a bottomed slot provided in the surface **512** of the cover **5** facing in the Z**2** direction. Each fixing slot **503** is a dented portion provided in the surface **512** of the cover **5** facing in the Z**2** direction and may be regarded as a recess formed in the surface **512**. The multiple fixing slots **503** correspond to the foregoing multiple fixing holes **652**H on a one-to-one basis, and coincide with the fixing holes **652**H as viewed in the Z**1** direction.

[0143] The cover **5** is fixed in contact with an outer peripheral wall of the dented portion **610**, specifically, the surface **605** of the holder **6** facing in the Z**1** direction. Specifically, the holder **6** and the cover **5** are fixed to each other with fixing members **157** to be described later inserted into the fixing holes **652**H and the fixing slots **503**. Then, the cover **5** includes the multiple openings **5**H for exposing the respective multiple head modules **2** to the outside as described above.

[0144] When the cover **5** is thus provided, the cover **5** allows the nozzle surfaces SN serving as the ink ejection surfaces to be exposed and prevents ink mist from entering the inside of the dented portion **610** of the holder **6**.

[0145] Although one cover **5** is provided for one holder **6**, multiple covers **5** may be provided. For example, a cover **5** that holds three head modules **2** among the six head modules **2** and a cover **5** that holds the remaining three head modules **2** may be provided.

[0146] For example, two or more head modules **2** to be replaced at similar timings are held by one cover **5**. Thus, the two or more head modules **2** to be replaced at the similar timings may be collectively replaced, which facilitates the replacement work.

[0147] Specifically, for example, the cover **5** preferably holds multiple head modules **2** to eject the same type of liquid among the multiple head modules **2**. This makes it

possible to collectively replace head modules **2** having similar life spans, such as head modules **2** for a color whose ejection frequency is high. As a result, the workability for replacement is improved. However, the two or more head modules **2** held by one cover **5** may eject different types of inks. One head module **2** may be capable of ejecting one type of ink or two or more types of inks.

1-3E. Fixing Member Group **150**

[0148] As illustrated in FIG. **4**, a fixing member group **150** includes multiple fixing members **155** and multiple fixing members **157**.

[0149] The fixing members **155** fix the cover **5** to the holder **6**. Each fixing member **155** is inserted into the fixing hole **652**H as the through hole and the fixing slot **503** as the dented portion in this order. For this reason, the fixing member **155** is not exposed to the nozzle surface SN side. Meanwhile, a part of the fixing member **155** is exposed from the surface **606** of the holder **6** facing in the Z**2** direction.

[0150] For example, after the fixing members **155** are removed from the fixing holes **652**H, long rod-shaped members are inserted into the fixing holes **652**H and the cover **5** is pressed in the Z**1** direction by these members. In this way, the press-fit of the cover **5** in the holder **6** can be released easily. More specifically, the press-fit of the cover **5** in the holder **6** can be easily released by using the fixing holes **652**H as holes for releasing the press-fit.

[0151] The fixing members **157** directly fix the head module **2** to the holder **6**. Each fixing member **157** is inserted into the fixing hole **651**H as the through hole and the fixing slot **215** as the dented portion in this order. For this reason, the fixing member **157** is not exposed to the surface of the liquid ejecting head **1** facing in the Z**1** direction, specifically, the nozzle surface SN side. Meanwhile, a part of the fixing member **157** is exposed from the surface **606** of the holder **6** facing in the Z**2** direction. Since the fixing members **157** are not exposed on the nozzle surface SN side, the fixed members **157** are protected from adhesion and solidification of ink mist. This makes it possible to prevent the fixing members **157** from becoming difficult to remove from the holder **6** and the head module **2** due to the adhesion of the mist.

[0152] For example, after the fixing members **157** are removed from the fixing holes **651**H, long rod-shaped members are inserted into the fixing holes **651**H, and the head module **2** is pressed in the Z**1** direction by these members. In this way, the press-fit of the head module **2** in the holder **6** can be released easily. More specifically, the press-fit of the head module **2** in the holder **6** can be easily released by using the fixing holes **651**H as holes for releasing the press-fit.

[0153] The fixing member **157** is equivalent to a "first fixing member". The fixing hole **651**H is equivalent to a "first fixing hole". The fixing slot **215** is equivalent to a "first fixing slot".

[0154] A depth D**66** of the fixing hole **651**H is greater than a depth D**26** of the fixing slot **215**. In the case where the depth D**66** is greater than the depth D**26**, the channel orifice forming member **25** is detached from the holder **6** more easily than in the case where the depth D**66** is smaller than the depth D**26**.

[0155] As illustrated in FIG. **9**, for example, the multiple fixing members **155** are provided near the corners of the rectangular holder **6** as viewed in the Z**1** direction. The multiple fixing members **157** are provided on the per-head module **2** basis. Specifically, two fixing members **157** are provided for each head module **2**. One of the two fixing members **157** is located in the Y**1** direction relative to the head module **2**, whereas the other is located in the Y**2** direction relative to the head module **2** as viewed in the Z**1** direction.

[0156] Both the fixing members **155** and **157** are preferably screws. Accordingly, for example, female threads are formed on inner circumferential wall surfaces forming the fixing holes **651**H, the fixing holes **652**H, the fixing slots **215**, and the fixing slots **503**. When the fixing members **155** and **157** are the screws, the fixing of the cover **5** and the multiple head modules **2** to the holder **6** can be easily released by rotating and unscrewing the screws. When the fixing members **155** and **157** are the screws, the multiple head modules **2** and the cover **5** can be attached to and detached from the holder **6** as needed without using an adhesive.

[0157] The fixing members **155** and **157** may be members other than the screws, and may each include, for example, an L-shaped or T-shaped pin with its tip end in the Z**1** direction bent at a right angle and an elastic member such as a leaf spring or coil spring, and be configured to fix the cover **5** to the holder **6** by using the elastic force of the elastic member.

[0158] As described above, the fixing member **155** may have any structure as long as the fixing member **155** can fix the holder **6** and the cover **5** to each other. The fixing member **157** may have any structure as long as the fixing member **157** can fix the holder **6** and the head module **2** to each other.

[0159] As viewed in the Z**1** direction, the fixing members **155** and **157** are arranged so as not to overlap the chip **20** and so as to sandwich the seal member **4** between the chip **20** and the fixing members **155** and **157**.

[0160] In the case where the fixing members **155** and **157** do not overlap the chip **20** as viewed in the Z**1** direction, the load generated for fixing with the fixing members **155** and **157** is less likely to be applied to the chip **20** than in the case where the fixing members **155** and **157** overlap the chip **20**. Moreover, as viewed in the Z**1** direction, the seal member **4** is arranged between the fixing members **155** and **157** and the chip **20**, so that the distances of the chip **20** from the fixing members **155** and **157** can be made longer by the dimension of the seal member **4**. This also makes the load generated for fixing with the fixing members **155** and **157** unlikely to be applied to the chip **20**.

1-3F. Wiring Substrate **7**, Relay Substrate **70**, and Connector

[0161] As illustrated in FIG. **3**, the wiring substrate **7** is provided for each head module **2**. The wiring substrate **7** is inserted into the through hole **20**H of the chip **20** and the through hole **25**H of the channel orifice forming member **25**. The wiring substrate **7** is joined to the vibration plate **204**. The wiring substrate **7** protrudes from the vibration plate **204** in the Z**2** direction. The wiring substrate **7** is a mounting component in which multiple wiring lines for electrically connecting the chip **20** and the relay substrate **70** are formed. The wiring substrate **7** is, for example, a flexible substrate such as a flexible printed circuit (FPC) or a chip on film (COF), or a rigid substrate. From the wiring substrate **7**, each driver element E is supplied with a driving signal and a reference voltage for driving the driver element E.

[0162] The relay substrate **70** is fixed to the bottom surface of the dented portion **610** in the surface **605** of the flat plate portion **61** of the holder **6** facing in the Z1 direction. The relay substrate **70** has a flat plate shape, and is fixed to the holder **6** with an adhesive or the like. The relay substrate **70** is electrically connected to the control unit **91**. Multiple connectors **71** are equipped in the relay substrate **70**. The multiple connectors **71** are provided for the multiple wiring substrates **7** on a one-to-one basis. An end portion of the wiring substrate **7** provided with multiple terminals is inserted into each connector **71** in a removably-inserted manner. In other words, it is preferable that wiring substrate **7** be formed of a rigid body in order to facilitate insertion and removal of the end portion of the wiring substrate **7** into and from the connector **71**. In the case where the wiring substrate **7** is formed of a flexible substrate, it is desirable to bond a rigid body to the flexible substrate to support the flexible substrate. When the end portion of the wiring substrate **7** is inserted into the connector **71**, the wiring substrate **7** is electrically connected to the control unit **91** via the relay substrate **70**.

[0163] The relay substrate **70** is electrically connected to the multiple head modules **2**. The relay substrate **70** is arranged in the Z2 direction, which is opposite to the Z1 direction, relative to the multiple head modules **2**, and overlaps the multiple head modules **2** as viewed in the Z1 direction. The first alignment portions **216** are provided on the surface of the cover **5** facing in the Z2 direction. This arrangement enables easy attachment and detachment for only the head module **2** of the replacement target from below the holder **6** and the relay substrate **70**. Therefore, there is no need to disconnect the electric connections of the head modules **2** other than the replacement target, which simplifies the attachment and detachment work.

[0164] Moreover, as described above, the wiring substrate **7** is arranged on the bottom surface of the dented portion **610** of the holder **6**. In this case, a length of the head module **2** and the wiring substrate **7** can be more easily reduced than in the case where the wiring substrate **7** is arranged on the surface **606** of the holder **6** facing in the Z2 direction.

[0165] In the process of attaching only the head module **2** as a replacement to the holder **6** from below the holder **6** as described above, the wiring substrate **7** is moved in the Z2 direction from below the connector **71** to the connector **71**. Then, the wiring substrate **7** is inserted into the connector **71**. As a result, the wiring substrate **7** is electrically connected to the relay substrate **70**.

1-3G. Bushing

[0166] As illustrated in FIG. **4**, bushings **526** are provided between the channel orifice forming member **25** and the cover **5**. Although not illustrated in detail, for example, the bushings **526** are provided in the Y1 direction and the Y2 direction relative to each channel orifice forming member **25** as viewed in the Z1 direction. In addition, a bushing **522** is provided between the holder **6** and the cover **5**. Although not illustrated in detail, the busing **522** is arranged in a rectangular frame shape along the outer edge of the holder **6** as viewed in the Z1 direction. The bushings **526** and **522** are each made of an elastic resin material. The provision of the bushings **526** and **522** makes it possible to reduce a risk of ink mist or the like entering the storage space inside the dented portion **610** of the holder **6** from the outside of the liquid ejecting head **1**.

2. Modifications

[0167] The first embodiment described above as the example may be modified in various manners. Examples of specific modifications applicable to the above-described first embodiment will be described below. Any two or more modifications selected from the following examples may be combined as appropriate unless they are mutually inconsistent.

2-1. First Modification

[0168] FIG. **13** is a cross-sectional view of a part of a liquid ejecting head **1** in a first modification. The fixing member **157** in the first modification illustrated in FIG. **13** fixes the cover **5** in addition to the holder **6** and the head module **2**. In the first modification, the fixing members **155** are omitted. According to the first modification, the number of fixing members can be reduced as compared with the first embodiment. Thus, according to the first modification, the head module **2** can be attached to and detached from the holder **6** by using a smaller number of fixing members than in the first embodiment. In addition, in the first modification, since an adhesive is not used to fix the head module **2** to the cover **5**, the head module **2** is easily attached to and detached from the cover **5**.

2-2. Second Modification

[0169] FIG. **14** is a cross-sectional view of a part of a liquid ejecting head **1** in a second modification. In the second modification illustrated in FIG. **14**, the holder **6** does not include the second dented portion **612**. In other words, the dented portion **610** of the holder **6** in the second modification does not have the step surface. The dented portion **610** is a storage space for storing the relay substrate **70**.

[0170] The cover **5** in the second modification includes a bottom plate portion **51** and a sidewall **52**. The bottom plate portion **51** has a plate shape and has the same structure as the cover **5** in the first embodiment. The sidewall **52** is a frame-shaped portion protruding from an outer edge of the bottom plate portion **51** in the Z2 direction. The cover **5** has a dented portion **510**. An inside of the dented portion **510** forms a storage space for storing the multiple head modules **2**.

[0171] The shapes of the holder **6** and the cover **5** are not particularly limited as described above, but may be any shapes as appropriate. One or both of the holder **6** and the cover **5** form the space for storing the head modules **2**.

[0172] In addition, the cover **5** in the second embodiment includes flange portions **54**. The flange portions **54** are the same as the flange portions **64** included in the holder **6** in the first embodiment. However, the flange portions **54** are provided not to the holder **6** but to the cover **5**. Each of the flange portions **54** includes a fourth alignment portion **542**. The fourth alignment portion **542** has the same structure as the fourth alignment portion **642** in the first embodiment, and is press-fitted into the third alignment portion **102** of the unit base **11**.

[0173] For example, each head module **2** is fixed to the cover **5** with an adhesive or the like. The head module **2** can be detached from the holder **6** by removing the fixing members **155**. In the case where the head module **2** is fixed to the cover **5** with the adhesive, it can be considered that the head module **2** is fixed to the cover **5** in the detachably-

attached manner if, for example, the head module **2** can be separated from the cover **5** by melting the adhesive with heat.

2-3. Third Modification

[0174] FIG. **15** is a cross-sectional view of a part of a liquid ejecting head **1** in a third modification. In the third modification illustrated in FIG. **15**, the cover **5** is omitted. According to the third modification, the number of components can be reduced as compared with the first embodiment. Since the cover **5** is omitted, the head module **2** can be attached to and detached from the holder **6** more easily than in the first embodiment.

2-4. Fourth Modification

[0175] FIG. **16** is a cross-sectional view of a part of a liquid ejecting head **1** in a fourth modification. The liquid ejecting head **1** in the fourth modification illustrated in FIG. **16** includes a holder **8**. The holder **8** includes a first holder **81** and a second holder **82**. The first holder **81** is the same as the holder **6** in the first embodiment except that the flange portions **64** are omitted.

[0176] The second holder **82** is the same as the cover **5** in the first embodiment except for the following elements. As viewed in the Z**1** direction, the second holder **82** includes a portion extended more in the Y**1** direction or the Y**2** direction than the first holder **81**. The extended portion is provided with a fourth alignment portion **824**. The fourth alignment portion **824** has the same structure as the fourth alignment portion **642** in the first embodiment, and is press-fitted into the third alignment portion **102** of the unit base **11**.

[0177] The second holder **82** also includes multiple fixing slots **821** and multiple second alignment portions **822**. Two fixing slots **821** are provided for each head module **2**. One of the two fixing slots **821** is located in the Y**1** direction relative the chip **20**, whereas the other is located in the Y**2** direction relative to the chip **20** as viewed in the Z**1** direction. Each fixing slot **821** is a slot opened in a surface **512** of the second holder **82** facing in the Z**2** direction. The fixing slot **821** may be referred to as a dented portion formed in the surface **512** of the second holder **82** facing in the Z**2** direction. The head module **2** includes fixing holes **218**H corresponding to the fixing slots **821**. Each fixing hole **218**H is a hole passing through the channel orifice forming member **25** of the head module **2**.

[0178] Two second alignment portions **822** are provided for each head module **2**. Although not illustrated in detail, one of the two second alignment portions **822** is located in the Y**1** direction relative to the chip **20**, whereas the other is located in the Y**2** direction relative to the chip **20** as viewed in the Z**1** direction. Each second alignment portion **822** is a slot opened in the surface **512** of the second holder **82** facing in the Z**2** direction. The second alignment portion **822** is a dented portion formed in the surface **512** of the second holder **82** facing in the Z**2** direction and may be regarded as a recess formed in the surface **512**.

[0179] In addition, the head module **2** includes first alignment portions **217** corresponding to the second alignment portions **822**. The first alignment portions **217** are protrusions protruding in the Z**1** direction from the surface **251** of the channel orifice forming member **25** facing in the Z**1** direction. The first alignment portions **217** are press-fitted into the second alignment portions **822**. Thus, the head module **2** is positioned with respect to the holder **8** including the second holder **82**.

[0180] A fixing member **158** is inserted into the fixing hole **218**H and the fixing slot **821** in this order. The fixing member **158** is equivalent to a "first fixing member". The fixing member **158** is, for example, a screw, and female threads are formed on inner wall surfaces forming the fixing hole **218**H and the fixing slot **821**. The head module **2** is fixed to the second holder **82** with the fixing members **158** inserted and screwed in the fixing holes **218**H and the fixing slots **821**. The first holder **81** and the second holder **82** are fixed to each other with the fixing members **155** as in the case of the cover **5** and the holder **6** in the first embodiment.

[0181] The second holder **82** of the holder **8** includes multiple openings **5**H as in the cover **5**. From the multiple openings **5**H, the respective multiple head modules **2** are exposed to the outside. Then, a part of the channel orifice forming member **25** is inserted into each of the openings **5**H. For this reason, with the second holder **82** including the multiple openings **5**H, an increase in the paper gap can be suppressed as in the case of the cover **5** in the first embodiment. In addition, there is no need to reduce the thickness of the second holder **82** in order to suppress the increase in the paper gap. Accordingly, the stiffness of the second holder **82** can be kept from decreasing.

2-5. Fifth Modification

[0182] FIG. **17** is a cross-sectional view of a part of a liquid ejecting head **1** in a fifth modification. In the fifth modification illustrated in FIG. **17**, the fixing holes **218**H, the fixing slots **821**, and the fixing members **158** are omitted as compared with the fourth modification. In the fifth modification, each head module **2** is fixed to the second holder **82** with an adhesive or the like. In the case where the head module **2** is fixed to the second holder **82** with the adhesive, it can be considered that the head module **2** is fixed to the second holder **82** in the detachably-attached manner if the head module **2** can be separated from the second holder **82** by, for example, melting the adhesive with heat.

2-7. Seventh Modification

[0183] FIG. **18** is a cross-sectional view of a part of a liquid ejecting head **1** in a seventh modification. FIG. **19** is a topside view of the liquid ejecting head **1** in the seventh modification. In the seventh modification illustrated in FIG. **18**, a positional relationship of the fixing members **157** and the seal members **4** with the chip **20** is different. The minimum distance between the fixing member **157** and the chip **20** is shorter than the minimum distance between the seal member **4** and he chip **20**.

[0184] As illustrated in FIG. **19**, the fixing members **157** are arranged between the chips **20** and the seal areas **4**S so as not to overlap the chips **20** as viewed in the Z**1** direction. This arrangement is likely to generate the reaction force outside the fixing members **157** as viewed from the chips **20**. Therefore, the reaction force of the seal members **4** can be made particularly unlikely to be transmitted to the chips **20**.

2-8. Eighth Modification

[0185] FIG. **20** is a cross-sectional view of a part of a liquid ejecting head **1** in an eighth modification. FIG. **21** is a topside view of the liquid ejecting head **1** in the eighth

modification. In the eighth modification illustrated in FIGS. **20** and **21**, the fixing members **157** overlap the chips **20** as viewed in the Z**1** direction. Even when the fixing members **157** overlap the chips **20** as viewed in the Z**1** direction, the presence of the cover **5** may reduce the influence of the reaction force of the seal members **4** on the chips **20** as compared with the case where the cover **5** is absent.

2-9. Ninth Modification

[0186] FIG. **22** is a cross-sectional view of a part of a liquid ejecting head **1** in a ninth modification. In the liquid ejecting head **1** in the ninth modification illustrated in FIG. **22**, a first alignment portion **216***a* is a bottomed slot opened in the Z**2** direction of the head module **2**. The first alignment portion **216***a* may be regarded as a dented portion formed in the Z**2** direction of the head module **2**. A second alignment portion **653***a* is a protrusion protruding in the Z**1** direction from the surface of the holder **6** facing in the Z**1** direction. The second alignment portion **653***a* is press-fitted into the first alignment portion **216***a* to position the head module **2** with respect to the holder **6**.

[0187] Even such first alignment portion **216***a* and second alignment portion **653***a* also enable easy positioning for attaching each head module **2** to the holder **6** as in the first embodiment. Moreover, the alignment of the multiple head modules **2** with the holder **6** can be made with high precision. In addition, in order to replace only some of the multiple head modules **2**, there is no need to realign all the head modules **2**.

[0188] As described in the first embodiment and the ninth modification, the multiple head modules **2** can be aligned with each other with high precision in the simple method including press-fitting either the second alignment portions **653***a* or the first alignment portions **216***a* into the other alignment portions.

[0189] The fourth alignment portion **642***a* is a bottomed slot opened in the surface of the flange portion **64** facing in the Z**2** direction. The fourth alignment portion **642***a* is a dented portion, in other words, a recess, formed in the flange portion **64** in the Z**1** direction. Although not illustrated, a third alignment portion **102** in this case is formed as a protruding pin provided to the unit base **11**. In the fourth alignment portion **642***a*, the above third alignment portion **102** is press-fitted to position the liquid ejecting head **1** with respect to the unit base **11**. Therefore, it is possible to improve the precision of alignment of the multiple liquid ejecting heads **1** with the unit base **11**.

2-10. Tenth Modification

[0190] FIG. **23** is a cross-sectional view illustrating a seal member **4** and its surrounding area in a tenth modification. FIG. **24** is a cross-sectional view of a part of a liquid ejecting head **1** in the tenth modification. In the tenth modification illustrated in FIG. **23**, the thickness of the seal member **4** is not constant. The seal member **4** in the tenth modification includes a thick portion **41** and a thin portion **42**. The thick portion **41** is located near an inner wall surface forming the communication orifice **4**H and is thicker than the thin portion **42**. The thin portion **42** is located outside the thick portion **41**.

[0191] In the case of the tenth modification, the thick portion **41** in the seal member **4** has the seal area **4**S. The thick portion **41** is in contact with the channel orifice forming member **25** and the holder **6**, and is held between the channel orifice forming member **25** and the holder **6**.

[0192] As illustrated in FIG. **24**, the support area **5**S includes an area S**55** arranged between the seal area **4**S and the chip **20** as viewed in the Z**1** direction. This structure can reduce the influence of the reaction force of the seal member **4** on the chip **20** as compared with the case where the support area **5**S does not include the area S**55**.

[0193] However, the area S**55** does not have to be provided. The support area **5**S and the seal area **4**S may be located at completely the same position in the plan view.

2-11. Eleventh Modification

[0194] FIG. **25** is a cross-sectional view illustrating a seal member **4** and its surrounding area in an eleventh modification. In the eleventh modification illustrated in FIG. **25**, the seal member **4** includes a portion out of contact with both the holder **6** and the channel orifice forming member **25**. In the eleventh modification, a portion of the seal member **4** near the communication orifice **4**H serves as the seal area **4**S. As described above, depending on the shapes of the holder **6** and the channel orifice forming member **25**, the seal member **4** may include a portion that is out of contact with both the holder **6** and the channel orifice forming member **25** and that is not held between the holder **6** and the channel orifice forming member **25**. In the seal member **4**, the portion held between the holder **6** and the channel orifice forming member **25** serves as the seal area **4**S.

2-12. Other Modifications

[0195] In addition, for example, the holder **6** may be provided with a through hole formed only for use to release the press-fits between the first alignment portions **216** and the second alignment portions **653**. For example, the above through hole may be a hole that passes through the holder **6** in directions in which the first alignment portions **216** are inserted into and removed from the second alignment portions **653** and that has a larger opening area than the opening area of the fixing hole **651**H.

[0196] In the above description, the seal members **4** are provided for each head module **2**, but a single seal member **4** may be provided in common to the multiple head modules **2**.

[0197] The "first alignment portion" and the "second alignment portion" are not limited to the structures described in the above embodiments and modifications, as long as one of these portions is press-fitted into the other.

[0198] The "liquid ejecting apparatus" may be used in a variety of apparatuses, including facsimile machines and copy machines, in addition to apparatuses dedicated to printing. The use of the liquid ejecting apparatus is not limited to printing. For example, a liquid ejecting apparatus to eject a solution of a pigment may be used as a manufacturing apparatus to form color filters of display devices such as liquid display panels. Instead, a liquid ejecting apparatus to eject a solution of a conductive material may be used as a manufacturing apparatus to form wiring and electrodes for relay substrates. Alternatively, a liquid ejecting apparatus to eject a solution of an organic substance related to living organisms may be used as a manufacturing apparatus to produce, for example, bio chips.

[0199] The present disclosure is described above based on the preferred embodiments, but should not be limited to the

above embodiments. The structure of each component of the present disclosure may be replaced with any structure having the same function as in the above embodiments, or any structure may be added as needed.

What is claimed is:

1. A liquid ejecting head comprising:

a plurality of head modules each of which ejects a liquid in a first direction; and

a metallic holder to which the plurality of head modules are fixed in a detachably-attached manner, wherein

each of the plurality of head modules includes a metallic channel orifice forming member in which a channel is defined, and which includes a first alignment portion,

the holder includes a plurality of second alignment portions which are inserted into or receive a plurality of the first alignment portions in a press-fit manner, thereby positioning the plurality of head modules with respect to the holder, and

a channel orifice formed in the holder and configured to make a channel-forming connection to each of the head modules and a channel orifice formed in the channel orifice forming member of the head module and configured to make the channel-forming connection to the holder coincide with each other as viewed in a direction in which either of the first alignment portions and the second alignment portions are press-fitted into the other alignment portions.

2. The liquid ejecting head according to claim **1**, wherein the holder includes a member in which both of the plurality of second alignment portions and one or more channels which communicate with the plurality of head modules are formed.

3. The liquid ejecting head according to claim **1**, wherein each of the plurality of head modules includes one nozzle plate.

4. The liquid ejecting head according to claim **1**, wherein

the first alignment portion is provided in a surface of the channel orifice forming member facing in a second direction opposite to the first direction, and

the plurality of second alignment portions are provided in a surface of the holder facing in the first direction.

5. The liquid ejecting head according to claim **4**, wherein

each of the head modules includes a chip arranged in the first direction relative to the channel orifice forming member, and

the first alignment portion does not overlap the chip as viewed in the first direction.

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

the holder includes a dented portion whose bottom surface is the surface in which the plurality of second alignment portions are arranged, and

the liquid ejecting head further comprises a cover that is fixed in contact with an outer peripheral wall of the dented portion and that includes a plurality of openings from which the plurality of head modules are respectively exposed to outside.

7. The liquid ejecting head according to claim **1**, wherein

the holder includes a common channel member including one or more channels that communicate with the plurality of head modules,

the common channel member is arranged in a second direction relative to the plurality of head modules, the second direction being opposite to the first direction, and overlaps the plurality of head modules as viewed in the first direction, and

the first alignment portion is provided in a surface of the channel orifice forming member facing in the second direction.

8. The liquid ejecting head according to claim **1**, further comprising a relay substrate that is electrically connected to the plurality of head modules, wherein

the relay substrate is arranged in a second direction relative to the plurality of head modules, the second direction being opposite to the first direction, and overlaps the plurality of head modules as viewed in the first direction, and

the first alignment portion is provided in a surface of the channel orifice forming member facing in the second direction.

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

the first alignment portion is arranged in a surface of the channel orifice forming member facing in the first direction,

the second alignment portions are arranged in a surface of the holder facing in a second direction opposite to the first direction,

the holder includes a plurality of openings from which the plurality of head modules are respectively exposed to outside, and

a part of the channel orifice forming member is inserted in each of the openings of the holder.

10. The liquid ejecting head according to claim **1**, further comprising a plurality of first fixing members that fix the plurality of head modules to the holder in a detachably-attached manner, wherein

the holder includes a plurality of first fixing holes that pass through the holder in the first direction,

the channel orifice forming member includes a first fixing slot in a dented shape having a bottom surface,

the plurality of second alignment portions are arranged in a surface of the holder facing in the first direction,

the first alignment portion is provided in a surface of the channel orifice forming member facing in a second direction opposite to the first direction, and

each of the first fixing members is inserted in the first direction into one of the first fixing holes and one of the first fixing slots in this order.

11. The liquid ejecting head according to claim **10**, wherein a depth of the first fixing hole is greater than a depth of the first fixing slot.

12. The liquid ejecting head according to claim **10**, wherein the first fixing member is a screw.

13. A liquid ejecting apparatus comprising:

a plurality of the liquid ejecting heads according to claim **1**; and

a unit base which holds the plurality of liquid ejecting heads.

14. The liquid ejecting head according to claim **1**, wherein the holder includes a plurality of fourth alignment portions each of which is inserted into or receives one of a plurality of third alignment portions provided to a unit base which holds the plurality of liquid ejecting heads, thereby positioning the liquid ejecting head with respect to the unit base.

15. A liquid ejecting apparatus comprising:
a plurality of the liquid ejecting heads according to claim **14**; and
a unit base which includes the plurality of third alignment portions and holds the plurality of liquid ejecting heads.

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