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Liquid Ejecting Head And Liquid Ejecting Apparatus

Abstract

A liquid ejecting head includes multiple head modules to eject a liquid in a first direction, multiple metallic sub-holders each holding at least one of the head modules, and a metallic holder to which the multiple sub-holders are fixed in a detachably-attached manner. Each sub-holder includes a first alignment portion. The holder includes multiple second alignment portions each of which is inserted into or receives one of the first alignment portions, thereby positioning the multiple sub-holders with respect to the holder.

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Background/Summary

[0001] The present application is based on, and claims priority from JP Application Serial Number 2024-022228, 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 fixed to the fixating plate with an adhesive. The fixing plate is fixed to the holder with an adhesive.

[0005] For a case where one or some of the multiple head modules are broken, there is a demand to repair the liquid ejecting head by removing and replacing only the broken head modules with new head modules.

[0006] However, in the related art, it is necessary to detach the fixing plate from the holder in order to remove one or some of the head modules from the holder. For this reason, there is a risk of a disorder occurring in the alignment of the multiple head modules with the fixing plate. Therefore, in work of repairing a liquid ejecting head by replacing one or some of multiple modules included in the liquid ejecting head, there is a demand for a mechanism enabling the multiple head modules to be aligned with each other.

SUMMARY

[0007] 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; a plurality of metallic sub-holders each of which holds at least one head module among the plurality of head modules; and a metallic holder to which the plurality of sub-holders are fixed in a detachably-attached manner. Each of the plurality of sub-holders 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 sub-holders with respect to the holder.

[0008] A liquid ejecting apparatus according to an aspect of the present disclosure includes a plurality of the liquid ejecting heads and a unit base which holds the plurality of liquid ejecting heads.

[0009] In the liquid ejecting head according to the aspect of the present disclosure, the holder includes a fourth alignment portion which is inserted into or receives one of a plurality of third alignment portions provided to a unit base which holds a plurality of the liquid ejecting heads, thereby positioning the liquid ejecting head with respect to the unit base.

[0010] A liquid ejecting apparatus according to an aspect of the present disclosure includes a plurality of the liquid ejecting heads and a unit base which includes the plurality of third alignment portions and holds the plurality of liquid ejecting heads.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a schematic diagram illustrating a structural example of a liquid ejecting apparatus according to a first embodiment.

[0012] FIG. **2** is a plan view illustrating a liquid ejecting head illustrated in FIG. **1**.
[0013] FIG. **3** is a perspective cross-sectional view of the liquid ejecting head illustrated in FIG. **2**.
[0014] FIG. **4** is a cross-sectional view of the liquid ejecting head illustrated in FIG. **3** viewed in a direction along an X axis.
[0015] FIG. **5** is a cross-sectional view of the liquid ejecting head illustrated in FIG. **3** viewed in a direction along a Y axis.
[0016] FIG. **6** is an underside view of the liquid ejecting head illustrated in FIG. **3**.
[0017] FIG. **7** is a cross-sectional view of a chip included in a head module illustrated in FIG. **4**.
[0018] FIG. **8** is a topside view of channel orifice forming members included in the head modules illustrated in FIG. **5**.
[0019] FIG. **9** is an underside view of common channel members illustrated in FIG. **5**.
[0020] FIG. **10** is a topside view of the common channel members illustrated in FIG. **5**.
[0021] FIG. **11** is a topside view of seal members illustrated in FIG. **5**.
[0022] FIG. **12** is a topside view of sub-holders illustrated in FIG. **5**.
[0023] FIG. **13** is a topside view of an upper portion of a holder illustrated in FIG. **5**.
[0024] FIG. **14** is a view illustrating a lower portion of the holder illustrated in FIG. **5**.
[0025] FIG. **15** is a cross-sectional view of a part of a liquid ejecting head in a first modification.
[0026] FIG. **16** is a cross-sectional view of a part of the liquid ejecting head in the first modification.
[0027] FIG. **17** is a topside view of the liquid ejecting head in the first modification.
[0028] FIG. **18** is a cross-sectional view of a part of a liquid ejecting head in a second modification.
[0029] FIG. **19** is a cross-sectional view of a part of the liquid ejecting head in the second modification.
[0030] FIG. **20** is a cross-sectional view of a part of a liquid ejecting head in a third modification.
[0031] FIG. **21** is a cross-sectional view of a part of the liquid ejecting head in the third modification.
[0032] FIG. **22** is a view illustrating a second member included in a holder in the third modification.
[0033] FIG. **23** is a cross-sectional view of a part of a liquid ejecting head in a fifth modification.
[0034] FIG. **24** is a cross-sectional view illustrating a seal member and its surrounding area in a sixth modification.
[0035] FIG. **25** is a cross-sectional view of a part of a liquid ejecting head in the sixth modification.
[0036] FIG. **26** is a cross-sectional view illustrating a seal member and its surrounding area in a seventh modification.
[0037] FIG. **27** is a cross-sectional view illustrating a first alignment portion and a second alignment portion in an eighth modification.

DESCRIPTION OF EMBODIMENTS

[0038] 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 γ” 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**

[0039] 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 X1 direction, and the direction opposite to the X1 direction is referred to as an X2 direction. Similarly, one of directions along the Y axis is referred to as a Y1 direction, and the direction opposite to the Y1 direction is referred to as a Y2 direction. One of directions along the Z axis is referred to as a Z1 direction, and the direction opposite to the Z1 direction is referred to as a Z2 direction. The Z1 direction is equivalent to a “first direction”. The Z2 direction is equivalent to “a second direction opposite to the first direction”. A side in the Z1 direction relative to a certain point in is referred to as a “lower side or underside”, whereas a side in the Z2 direction relative to the certain point is referred to as an “upper side or topside”. A view seen in the Z1 direction or the Z2 direction is referred to as a “plan view”.

[0040] 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**.

[0041] 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.

[0042] 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**.

[0043] 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 Y1 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.

[0044] 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 X1 and X2 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 Z1 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**.

[0045] 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**

[0046] 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 1.
[0047] 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.
[0048] 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.
[0049] 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** pass through the unit base **11** along the thickness direction.
[0050] 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 Z1 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 Z1 direction.
[0051] Here, the mounting holes **101** do not have to pass through the unit base **11** in the thickness direction. Likewise, the third alignment portions **102** may pass through 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.
[0052] 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 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**
[0053] FIG. **3** is a perspective cross-sectional view of the liquid ejecting head **1** illustrated in FIG. **2**. FIG. **4** is a cross-sectional view of the liquid ejecting head **1** illustrated in FIG. **3** viewed in the direction along the X axis. FIG. **5** is a cross-sectional view of the liquid ejecting head **1** illustrated in FIG. **3** viewed in the direction along the Y axis. As illustrated in FIG. **5**, in the present embodiment, the liquid ejecting head **1** has a structure approximately symmetrical about a central imaginary plane A10 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 A10. In FIG. **3**, partition walls **63** of a holder **6** to be described later are omitted from the illustration.
[0054] As illustrated in any of FIGS. **3** to **5**, the liquid ejecting head **1** includes multiple head modules **2**, two common channel members **3**, seal members **4**, multiple sub-holders **5**, the holder **6**, multiple wiring substrates **7**, and a relay substrate **70**. In the present embodiment, one sub-holder **5** is provided for each head module **2**. As illustrated in FIG. **4**, each head module **2** and the

corresponding sub-holder **5** form a sub-unit **15**.

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

[0055] In the example in FIG. **4**, 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.

[0056] In the present embodiment, the multiple head modules **2** are next to each other along the X axis. As illustrated in FIGS. **3** and **5**, each head module **2** is long along the Y axis. Each head module **2** ejects the ink in the Z1 direction. Each head module **2** includes a chip **20** and a channel orifice forming member **25**. The chip **20** is arranged in the Z1 direction relative to the channel orifice forming member **25**.

[0057] FIG. **6** is an underside view of the liquid ejecting head **1** illustrated in FIG. **3**. As illustrated in FIG. **6**, 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 Z1 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 Z1 direction.

1-3Aa. Chip **20**

[0058] FIG. **7** is a cross-sectional view of the chip **20** included in the head module **2** illustrated in FIG. **4**. 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.

[0059] As illustrated in FIG. **7**, 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**.

[0060] 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 Z2 direction. The nozzle plate **201** and the cover **206** are provided on a surface of the communication plate **202** facing in the Z1 direction. For example, these members are fixed to each other with an adhesive.

[0061] 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 Z1 direction in the head module **2**. A surface of the nozzle plate **201** facing in the Z1 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.

[0062] In the communication plate **202**, multiple narrowed portions R1, multiple communication channels R2, a communication space Ra, and a common channel Rb are formed. Each of the narrowed portions R1 and the communication channels R2 is a through hole extended in the Z1 direction and formed for each nozzle N. The communication channels R2 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 communicates with the multiple narrowed portions R1. The communication space Ra

communicates with a space Rc included in the channel orifice forming member **25**.
[0063] 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.
[0064] 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.
[0065] 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.
[0066] 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. **7**, but are actually stacked in a single silicon substrate.
[0067] 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.
[0068] 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**.
[0069] 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.
[0070] 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.
[0071] 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.

[0072] 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**

[0073] As illustrated in FIGS. **5** and **7**, 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**.

[0074] 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** may contain a resin or a metal.

[0075] 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 D2 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 Z1 direction. In other words, the chip **20** is thinner than the channel orifice forming member **25**. In addition, as illustrated in FIG. **5**, the channel orifice forming member **25** includes a surface **251** facing in the Z1 direction and a surface **252** facing in the Z2 direction.

[0076] FIG. **8** is a topside view of the channel orifice forming members **25** of the head modules **2** illustrated in FIG. **5**. As illustrated in FIG. **8**, 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 Z1 direction, the chip **20** is smaller in outer profile than the channel orifice forming member **25**. As viewed in the Z1 direction, the channel orifice forming member **25** is arranged so as to overlap the chip **20** and cover the chip **20**.

[0077] As illustrated in FIGS. **5** and **8**, the channel orifice forming member **25** includes a flange portion **250** to be fixed to the sub-holder **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 sub-holder **5** to be described later. A surface of the flange portion **250** facing in the Z1 direction is a supported surface **2511** supported by the sub-holder **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. As illustrated in FIG. **8**, the supported surface **2511** is located in the Z2 direction relative to the chip **20**. Accordingly, the supported surface **2511** is located in the Z2 direction relative to the nozzle plate **201**.

[0078] In addition, as illustrated in FIG. **8**, 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. The through hole **25**H coincides with the through hole **20**H of the sealing substrate **205** in the plan view.

[0079] As illustrated in FIGS. **5** and **7**, 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. **7**, 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.

[0080] As illustrated in FIG. **5**, 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 Z2 direction. As illustrated in FIGS. **5** and **8**, 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 Z1 direction. In the present embodiment, two channel orifices **251**H are provided for each nozzle array L.

1-3B. Common channel member **3**

[0081] As illustrated in FIGS. **3** to **5**, the common channel members **3** are arranged in the Z2 direction relative to the multiple head modules **2**. Each common channel member **3** includes a single channel **3**R. The channel **3**R supplies the ink to the head modules **2** and distributes the ink to the head modules **2**. The channel **3**R is a common channel provided in common to the multiple head modules **2**. The common channel member **3** is also a supply channel member to supply the ink to the head modules **2**, and includes a common portion **3**RA extended along the X axis and multiple branched portions **3**RB branched off from the common portion **3**RA and extended in the Z1 direction. Although not illustrated, the common channel member **3** is provided with a channel joint for connecting to a supply channel outside the liquid ejecting head **1** in order that the common channel member **3** 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**.

[0082] Instead, the common channel member **3** may include multiple channels **3**R communicating with the multiple head modules **2**. Specifically, instead of the channel **3**R including the common portion **3**RA communicating with the multiple head modules **2**, the common channel member **3** may include the multiple channels **3**R communicating with the respective multiple head modules **2**.

[0083] As illustrated in FIG. **5**, channel orifices **31**H are provided on the head module **2** side of each channel **3**R, that is, the downstream side of the channel **3**R. Each channel orifice **31**H is a cavity end of the channel **3**R in the Z1 direction. The channel orifices **31**H are provided corresponding to the foregoing channel orifices **251**H.

[0084] FIG. **9** is an underside view of the common channel members **3** illustrated in FIG. **5**. FIG. **10** is a topside view of the common channel members **3** illustrated in FIG. **5**. As illustrated in FIGS. **9** and **10**, each common channel member **3** is a long member extended in the X axis direction. As illustrated in FIG. **9**, the two common channel members **3** are arranged inside the dented portion **610** of the holder **6** to be described later. The two common channel members **3** are arranged so as to sandwich the relay substrate **70** to be described later as viewed in the Z2 direction. The multiple channel orifices **31**H included in each of the common channel members **3** are spaced out from each other and arrayed along the X axis.

[0085] As illustrated in FIG. **10**, each common channel member **3** overlaps the multiple head modules **2** as viewed in the Z1 direction. Each common channel member **3** is provided in common to the multiple head modules **2**. Specifically, as viewed in the Z1 direction, each common channel member **3** overlaps the flange portions **250** of the multiple channel orifice forming members **25**. As viewed in the Z1 direction, the multiple channel orifices **31**H coincide with the foregoing multiple channel orifices **251**H on a one-to-one basis. In addition, each common channel member **3** is

arranged at a position different from the multiple chips **20** so as not to overlap the chips **20** as viewed in the Z1 direction. As viewed in the Z1 direction, each common channel member **3** overlaps some of the multiple seal members **4** to be described below.

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

[0086] As illustrated in FIGS. **3** to **5**, the seal members **4** are provided between the head modules **2** and the common channel members **3** in the Z1 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 common channel member **3**. The seal member **4** is squeezed between the head module **2** and the common channel member **3**.

[0087] FIG. **11** is a topside view of the seal members **4** illustrated in FIG. **5**. 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 Z1 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 Z1 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 Z1 direction. In other words, the seal members **4** do not overlap the chips **20** as viewed in the Z1 direction.

[0088] As illustrated in FIGS. **5** and **11**, each seal member **4** includes two communication orifices **4**H. As illustrated in FIG. **5**, 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 **31**H of the common channel members **3**. As illustrated in FIG. **11**, the communication orifice **4**H coincides with both the channel orifice **31**H and the channel orifice **251**H as viewed in the Z1 direction. As illustrated in FIG. **5**, 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 **3**R via the channel orifice **31**H. Thus, the channel **25**R and the channel **3**R communicate with each other through the communication orifice **4**H. Specifically, the channel **25**R and the channel **3**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 common channel member **3**.

[0089] The seal member **4** including such communication orifices **4**H is a member for liquid-tightly connecting the channel orifices **251**H of the head module **2** and the channel orifices **31**H of the common channel member **3**. The ink flowing in the channels **3**R of the common channel members **3** 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.

[0090] 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 common channel member **3** and is held between the channel orifice forming member **25** and the common channel member **3**. The seal area **4**S is an area squeezed with application of a load from the channel orifice forming member **25** and the common channel member **3** so as to liquid-tightly connect the channel orifices **251**H and the channel orifices **31**H. In other words, even an area of the seal member **4** located between the channel orifice forming member **25** and the common channel member **3** 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 **31**H.

[0091] As illustrated in FIG. **11**, the seal members **4** are provided at the positions different from the chips **20** as viewed in the Z1 direction, and accordingly the seal areas **4**S are provided at the

positions different the chips **20** as viewed in the Z1 direction. In other words, the seal areas **4**S do not overlap the chip **20** as viewed in the Z1 direction. Since the seal areas **4**S do not overlap the chips **20** as viewed in the Z1 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.

[0092] As described above, the channel **25**R and the channel **3**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 common channel member **3**. 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.

[0093] In the present embodiment, the seal areas **4**S of the seal members **4** do not overlap the chips **20** as viewed in the Z1 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.

[0094] As illustrated in FIG. **10**, none of the communication orifices **4**H, the channel orifices **251**H, and the channel orifices **31**H overlaps the chips **20** as viewed in the Z1 direction. All of the communication orifices **4**H, the channel orifices **251**H, and the channel orifices **31**H are arranged outside the chips **20** as viewed in the Z1 direction. Specifically, the communication orifices **4**H and the channel orifices **251**H and **31**H are arranged on both longitudinal sides of each chip **20** as viewed in the Z1 direction. For this reason, the seal areas **4**S of the seal members **4** which liquid-tightly seal the channels **25**R and **3**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**.

[0095] In addition, each of the seal areas **4**S is arranged in the Y1 direction or the Y2 direction, which is a longitudinal direction of the head module **2**, relative to the chip **20** as viewed in the Z1 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.

[0096] 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. Sub-Holder **5**

[0097] The sub-holder **5** illustrated in FIGS. **4** to **6** is a member that supports each head module **2**. The sub-holders **5** are provided for the head modules **2** on a one-to-one basis. The sub-holder **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 sub-holder **5** is arranged in the Z1 direction relative to the channel orifice forming member **25**. The sub-holder **5** is a member that sandwiches the seal members **4** and the channel orifice forming member **25** between itself and the common channel members **3**. As illustrated in FIG. **5**, the sub-holder **5** includes a surface **511** facing in the Z1 direction and a surface **512** facing in the Z2 direction. The sub-holder **5** is a member that does not include any channel through which the ink flows.

[0098] Each sub-holder **5** and the corresponding head module **2** are fixed to each other with an adhesive. The sub-holder **5** and the head module **2** are fixed in such a relative position that the sub-

holder **5** and the nozzles N of the nozzle plate **201** are aligned with each other with high precision. The sub-unit **15** including each sub-holder **5** is fixed to the holder **6** to be described later in a detachably-attached manner. Specifically, the sub-holder **5** is not bonded with an adhesive or the like. For this reason, the sub-units **15** are replaceable on a per-sub-unit **15** basis. The sub-holder **5** and the head module **2** are fixed to each other with an adhesive.

[0099] For this reason, for example, in the case where one or some of the multiple head modules **2** included in the head unit **10** are broken, the sub-units **15** including the broken head modules **2** are replaced with other sub-units **15** including unbroken head modules **2**, so that the liquid ejecting head **1** can be recycled.

[0100] Further, the channel-forming connections between the head module **2** and the common channel members **3** described above are not made with an adhesive, but are made with the seal members **4**. For this reason, in the above-described replacement of the head module **2**, the channel-forming connections between the head module **2** and the common channel members **3** can be disconnected easily. This facilitates the replacement of the head module **2**.

[0101] Here, it is preferable to fix each sub-holder **5** and the corresponding head module **2** to each other with an adhesive, but the head module **2** may be configured to be detachable from the sub-holder **5** with decomposition of the adhesive.

[0102] The sub-holder **5** is made of, for example, a metal. For example, the sub-holder **5** is made of a metal such as aluminum or stainless steel. The sub-holder **5** has stiffness sufficient to support the head module **2**.

[0103] The sub-holder **5** is provided with the opening **5**H. The opening **5**H is a hole passing through the sub-holder **5** in the thickness direction. The opening **5**H is provided for exposing a part of the head module **2** to the outside. Specifically, as illustrated in FIG. **6**, the chip **20** is exposed from the opening **5**H. Accordingly, the multiple nozzles N are exposed from the opening **5**H.

[0104] FIG. **12** is a topside view of the sub-holders **5** illustrated in FIG. **5**. As illustrated in FIGS. **5** and **12**, the sub-holder **5** includes a support surface **5**S. The support surface **5**S is a part of the surface **512** of the sub-holder **5** facing in the Z2 direction. In FIG. **12**, the support surfaces **5**S are hatched for facilitating understanding. In the example of FIG. **12**, each support surface **5**S has a rectangular frame shape as viewed in the Z1 direction.

[0105] As illustrated in FIG. **5**, the support surface **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 surface **5**S is in contact with the supported surface **2511** of the channel orifice forming member **25**. As illustrated in FIG. **12**, the support surface **5**S includes areas S50 coinciding with the seal areas **4**S as viewed in the Z1 direction.

[0106] Since the support surface **5**S includes the areas S50 coinciding with the seal areas **4**S as viewed in the Z1 direction, the sub-holder **5** vertically receives the reaction force of the seal members **4**. Therefore, the sub-holder **5** can firmly support the seal areas **4**S of the seal members **4** between itself and the common channel members **3**. Accordingly, the sub-holder **5** can particularly effectively alleviate the reaction force of the seal members **4**.

[0107] Moreover, a part of the above-described surface **251** of the channel orifice forming member **25** facing in the Z1 direction includes the supported surface **2511**. The supported surface **2511** is supported by being in contact with the sub-holder **5** while surrounding the opening **5**H of the sub-holder **5** as viewed in the Z1 direction. Specifically, as described above, the flange portion **250** of the channel orifice forming member **25** includes the supported surface **2511**, and the head module **2** is held by the sub-holder **5** with the supported surface **2511** put in contact with the support surface **5**S of the sub-holder **5**. When the channel orifice forming member **25** is supported by the sub-holder **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.

[0108] Here, the contact between the supported surface **2511** and the support surface **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 sub-holder **5** or may be in indirect contact with the sub-holder **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 Y1 and Y2 directions relative to the opening **5**H in the plan view.

[0109] Moreover, as illustrated in FIG. **5**, the thickness D5 of the sub-holder **5** in the Z1 direction is greater than the thickness D2 of the chip **20** in the Z1 direction. This can reduce a risk of the sub-holder **5** being deformed due to the reaction force of the seal members **4**.

[0110] The thickness D5 of the sub-holder **5** is preferably two or more times and more preferably three or more times greater than the thickness D2 of the chip **20**. This can further reduce the risk of the sub-holder **5** being deformed due to the reaction force of the seal members **4**. However, the thickness D5 may be equal to or smaller than the thickness D2.

[0111] From the same viewpoint, the thickness D5 of the sub-holder **5** is preferably 1 mm or greater and more preferably 2 mm or greater. In order to further enhance the strength of the sub-holder **5**, the thickness D5 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 D5 of the sub-holder **5** is preferably 10 mm or smaller, and more preferably 7 mm or smaller.

[0112] As illustrated in FIG. **5**, in addition to the chip **20**, the part of the channel orifice forming member **25** is arranged in the opening **5**H of the sub-holder **5**. In other words, the part of the channel orifice forming member **25** is inserted in the opening **5**H of the sub-holder **5**. In the case where the sub-holder **5** exists, the paper gap may increase depending on how great the thickness D5 of the sub-holder **5** is. Specifically, if the thickness D5 of the sub-holder **5** is excessively great, the surface of the chip **20** facing in the Z1 direction may be retracted in the Z2 direction from the surface of the sub-holder **5** facing in the Z1 direction. The increase in the above distance may result in a decrease in the accuracy of ink impact positions on the medium **90**.

[0113] 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 D5 of the sub-holder **5** is increased in order to further enhance the strength of the sub-holder **5**, the paper gap may be prevented from increasing.

[0114] Further, the surface of the nozzle plate **201** facing in the Z1 direction, namely, the nozzle surface SN, in the chip **20** is approximately flush with the surface **511** of the sub-holder **5** facing in the Z1 direction. In other words, the nozzle surface SN and the surface **511** of the sub-holder **5** facing in the Z1 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 Z2 direction from the surface **511** of the sub-holder **5** facing in the Z1 direction. Moreover, it is easy to collectively wipe the surface **511** of the sub-holder **5** facing in the Z1 direction and the nozzle surface SN.

[0115] The nozzle surface SN and the surface **511** of the sub-holder **5** facing in the Z1 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.

[0116] Instead, the nozzle surface SN and the surface **511** of the sub-holder **5** facing in the Z1 direction do not have to be approximately flush with each other. The nozzle surface SN and the surface **511** of the sub-holder **5** facing in the Z1 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 sub-holder **5** facing in the Z1 direction is preferably 100 μm or smaller and preferably 50 μm or smaller.

[0117] The sub-holder **5** described above is fixed to the holder **6** to be described later in a

detachably-attached manner. For example, when the sub-holder **5** is detached from the holder **6**, the head module **2** and the wiring substrate **7** to be described later are detached together with the sub-holder **5** from the holder **6**. The liquid ejecting head **1** in the present embodiment is configured such that the precision of alignment of the multiple head modules **2** may not decrease in the case where each head module **2** is detached from and reattached to the holder **6**.

[0118] As illustrated in FIGS. **5** and **12**, each sub-holder **5** has two first alignment portions **502** and two first fixing slots **501**. The first alignment portions **502** are used for the purpose of positioning the sub-holder **5** with respect to the holder **6** or other purposes. The first fixing slots **501** are used for fixing the sub-holder **5** to the holder **6**.

[0119] The first alignment portions **502** are provided in the surface **512** of the sub-holder **5** facing in the Z2 direction. In the present embodiment, the first alignment portions **502** are bottomed slots opened in the surface **512** of the sub-holder **5** facing in the Z2 direction. Each first alignment portion **502** is a dented portion provided in the surface **512** of the sub-holder **5** facing in the Z2 direction and may be regarded as a recess formed in the surface **512**. The two first alignment portions **502** are provided on both sides of the opening **5**H in the longitudinal direction of the sub-holder **5**. One of the two first alignment portions **502** is located in the Y1 direction relative to the opening **5**H, whereas the other is located in the Y2 direction relative to the opening **5**H.

[0120] The first fixing slots **501** are provided in the surface **512** of the sub-holder **5** facing in the Z2 direction. The first fixing slots **501** are bottomed slots provided in the surface **512** of the sub-holder **5** facing in the Z2 direction. Each first fixing slot **501** is a dented portion provided in the surface **512** of the sub-holder **5** facing in the Z2 direction and may be regarded as a recess formed in the surface **511**. The two first fixing slots **501** are provided on both sides of the opening **5**H in the longitudinal direction of the sub-holder **5**. One of the two first fixing slots **501** is located in the Y1 direction relative to the opening **5**H, whereas the other is located in the Y2 direction relative to the opening **5**H.

[0121] Each of the first fixing slots **501** is provided away from the corresponding first alignment portion **502** and the opening **5**H. Each first fixing slot **501** located in the Y1 direction relative to the opening **5**H is closer to the opening **5**H than the first alignment portion **502** located in the Y1 direction relative to the opening **5**H is. Similarly, each first fixing slot **501** located in the Y2 direction relative to the opening **5**H is closer to the opening **5**H than the first alignment portion **502** located in the Y2 direction relative to the opening **5**H is. The first alignment portions **502**, the first fixing slots **501**, and the opening **5**H are arranged along the longitudinal direction of the sub-holder **5**.

[0122] The minimum distance between the first fixing slot **501** and the opening **5**H is shorter than the minimum distance between the first alignment portion **502** and the opening **5**H, but may be longer than the latter distance. Further, the first alignment portions **502**, the first fixing slots **501**, and the opening **5**H do not have to be arranged along the longitudinal direction of the sub-holder **5**. For example, the first alignment portions **502** may be provided on both sides of the opening **5**H along the X axis.

1-3E. Holder **6**

[0123] As illustrated in FIGS. **3** to **5**, the holder **6** is a case where to store the multiple head modules **2** and the common channel members **3**. The holder **6** has a box shape having a dented portion **610** opened in the Z1 direction. The multiple head modules **2** and the common channel members **3** are arranged in a storage space in the dented portion **610** of the holder **6**. To put it differently, the holder **6** and the multiple sub-holders **5** form the storage space for storing the module head modules **2** and the common channel members **3**.

[0124] The relay substrate **70** is arranged on a bottom surface of the dented portion **610** of the holder **6**. The bottom surface is a surface of the dented portion **610** of the holder **6** facing in the Z1 direction. The holder **6** is made of a metal such, for example, as aluminum or stainless steel. 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.

[0125] The holder **6** includes a flat plate portion **61**, a sidewall **62**, multiple partition walls **63**, and two flange portions **64**. The flat plate portion **61**, the sidewall **62**, the multiple partition walls **63**, and the two flange portions **64** are formed integrally. The flat plate portion **61** is a flat plate-shaped portion along an X-Y plane. The flat plate portion **61** is located in the Z2 direction relative to the common channel members **3**. The sidewall **62** is a portion extended in the Z1 direction from an outer edge of the flat plate portion **61**. A planar shape of the sidewall **62** is a rectangular frame shape. The multiple partition walls **63** are arranged between the multiple head modules **2**. Each partition wall **63** extends along the Y axis. The partition walls **63** and the head modules **2** are alternately arranged along the X axis.

[0126] FIG. **13** is a topside view of an upper portion of the holder **6** illustrated in FIG. **5**. FIG. **14** is a view illustrating a lower portion of the holder **6** illustrated in FIG. **5**. As illustrated in FIGS. **4** and **13**, the multiple partition walls **63** are not provided in the upper portion of the holder **6**. In contrast, as illustrated in FIGS. **4** and **14**, the multiple partition walls **63** are provided in the lower portion of the holder **6**. A portion of the holder **6** provided with the multiple partition walls **63** may be regarded as the lower portion of the holder **6**, whereas a portion of the holder **6** not provided with the multiple partition walls **63** may be regarded as the upper portion of the holder **6**.

[0127] As illustrated in FIG. **4**, the multiple partition walls **63** exist in an area where the multiple head modules **2** are provided. The multiple partition walls **63** are located in the Z1 direction relative to the Z-axial center of the holder **6**. A portion of the holder **6** extended in the Z2 direction from the Z-axial center is not provided with the multiple partition walls **63** so as to allow the common channel members **3** arranged therein.

[0128] As illustrated in FIGS. **5** and **14**, for each sub-holder **5**, the holder **6** includes two second alignment portions **602** and two first fixing holes **61**H. As described above, the sub-holder **5** can be detachably attached to the holder **6**. The second alignment portions **602** are used for the purpose of positioning the sub-holder **5** with respect to the holder **6** or other purposes. The first fixing holes **61**H are used to fix the sub-holder **5** to the holder **6**.

[0129] The second alignment portions **602** are provided in a surface **605** of the holder **6** facing in the Z1 direction. In the present embodiment, the second alignment portions **602** are protrusions protruding in the Z1 direction from the surface **605** of the holder **6** facing in the Z1 direction. As illustrated in FIG. **13**, each second alignment portions **602** is provided in the Y1 direction or the Y2 direction relative to the dented portion **610** as viewed in the Z1 direction. The two second alignment portions **602** are provided corresponding to the foregoing two first alignment portions **502** and coincide with the first alignment portions **502** as viewed in the Z1 direction. Accordingly, the multiple second alignment portions **602** are provided for the multiple first alignment portions **502** on a one-to-one basis.

[0130] Each first fixing hole **61**H is a hole passing through the holder **6** in the Z1 direction. Each first fixing hole **61**H is provided in the Y1 direction or the Y2 direction relative to the dented portion **610** as viewed in the Z1 direction. The two first fixing holes **61**H are provided corresponding to the foregoing two first fixing slots **501** and coincide with the two first fixing slots **501** as viewed in the Z1 direction.

[0131] Each first fixing hole **61**H located in the Y1 direction relative to the dented portion **610** is closer to the dented portion **610** than the second alignment portion **602** located in the Y1 direction relative to the dented portion **610** is. Similarly, each first fixing hole **61**H located in the Y2 direction relative to the dented portion **610** is closer to the dented portion **610** than the first alignment portion **502** located in the Y2 direction relative to the dented portion **610** is. Each first fixing hole **61**H and its adjacent second alignment portion **602** are spaced out and arranged along the Y axis.

[0132] The minimum distance between the first fixing hole **61**H and the dented portion **610** is

shorter than the minimum distance between the second alignment portion **602** and the dented portion **610**, but may be longer than the latter distance. Further, the second alignment portion **602** and the first fixing hole **61**H do not have to be arranged along the longitudinal direction of the sub-holder **5**.

[0133] The second alignment portions **602** are press-fitted into the foregoing first alignment portions **502** to position the sub-holder **5** with respect to the holder **6**. The first alignment portions **502** and the second alignment portions **602** are provided on a per-sub-holder **5** basis, in other words, for each head module **2** held by the sub-holder **5**.

[0134] The provision of the first alignment portions **502** and the second alignment portions **602** described above enables easy positioning for attaching each sub-holder **5** to the holder **6**. Moreover, since the first alignment portions **502** and the second alignment portions **602** are provided on the per-sub-holder **5** basis, the alignment of the multiple sub-holders **5** with the holder **6** can be made with high precision.

[0135] As described above, each sub-holder **5** holds the head module **2**. Accordingly, the provision of the first alignment portions **502** and the second alignment portions **602** enables each head module **2** fixed to the sub-holder **5** to be positioned with respect to the holder **6**. Further, since the first alignment portions **502** and the second alignment portions **602** are provided on the per-sub-holder **5** basis, the alignment of the multiple head modules **2** with the holder **6** can be made with high precision. That is, the alignment of the multiple head modules **2** with the holder **6** can be made on the per-sub-holder **5** basis. 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**.

[0136] Moreover, the multiple head modules **2** can be aligned with each other with high precision in the simple method including press-fitting the second alignment portions **602** into the first alignment portions **502**. This allows only a desired head module **2** to be replaced easily among the multiple head module **2**. Since each of the head modules **2** can be replaced as described above, the liquid ejecting head **1** is easy to repair.

[0137] 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 **502** is in contact with the corresponding second alignment portion **602** in at least two or more points, when the first alignment portion **502** is completely inserted into the second alignment portion **602**. 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 second alignment portion **602** serving as an alignment pin is greater than the diameter of the largest circle inscribed in the first alignment portion **502** 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.

[0138] The multiple second alignment portions **602** are arranged on the surface **605** of the holder **6** facing in the Z1 direction. As described above, the first alignment portions **502** are arranged in the surface **512** of the sub-holder **5** facing in the Z2 direction opposite to the Z1 direction. Then, each head module **2** is supported by the surface **512** of the sub-holder **5** facing in the Z2 direction.

[0139] The arrangement of the first alignment portions **502**, the second alignment portions **602**, and the head module **2** as described above enables easy attachment and detachment from below the holder **6** for replacing only the sub-unit **15** including the sub-holder **5** and the head module **2** as a replacement target. In order to attach a sub-unit **15** to the holder **6** again as a replacement for a sub-unit **15** of a replacement target, it is only necessary to make the channel-forming connections between the head module **2** as the replacement and the common channel members **3**, and to electrically connect the wiring substrate **7** attached to the head module **2** as the replacement to the relay substrate **70**. Therefore, there is no need to make the channel-forming connections between the head modules **2** other than the replacement target and the common channel members **3**, and to electrically connect their wiring substrates **7** to the relay substrate **70**. Thus, the attachment and detachment work for repairing the liquid ejecting head **1** can be simplified.

[0140] Here, the surface **512** may be stepped such that the surface **512** in which first alignment portions **502** are arranged and the surface **512** that supports the head module **2** are located at different positions in the direction along the Z axis.
[0141] Moreover, the common channel members **3** and the wiring substrates **7** are arranged on the bottom surface of the dented portion **610** of the holder **6** and the sub-holders **5** holding the head modules **2** are arranged so as to cover the opening of the dented portion **610**. This makes it easy to shorten the distance between the head modules **2** and the common channel members **3**, and also makes it easy to shorten the length of the wiring substrates **7**.
[0142] In the present embodiment, the first alignment portions **502** are the bottomed slots provided in the surface of the sub-holder **5** facing in the Z2 direction and recessed in the Z1 direction as described above. For this reason, the first alignment portions **502** are not exposed to the outside of the sub-holder **5**. For example, the first alignment portions **502** are not provided in the surface of the sub-holder **5** facing in the Z1 direction. Therefore, it is possible to prevent mist or the like of the ink ejected from the nozzles N from adhering to the first alignment portions **502**.
[0143] The above-described common channel members **3** are arranged in the Z2 direction relative to the multiple head modules **2**, and overlap the multiple head modules **2** as viewed in the Z1 direction. In the structure in which the multiple head modules **2** are arranged below the common channel members **3**, the first alignment portions **502** are provided in the surface of the sub-holder **5** facing in the Z2 direction. This structure enables easy attachment and detachment for only a sub-unit **15** of a replacement target from below the holder **6** and the common channel members **3**. Therefore, there is no need to disconnect the channel-forming connections between the sub-units **15** other than the replacement target and the common channel members **3**, which simplifies the attachment and detachment work.
[0144] Here, the holder **6** and the common channel members **3** are separate members but may be integrated. Instead, a part of each of the common channel members **3** may be a part of the holder **6**.
[0145] A first fixing member **151** is inserted into the first fixing hole **61**H and the first fixing slot **501**. The sub-holder **5** is fixed to the holder **6** with the first fixing members **151**. As illustrated in FIGS. **3** and **13**, the first fixing members **151** are provided on a per-sub-holder **5** basis. In the present embodiment, two first fixing members **151** are provided for one sub-holder **5**.
[0146] The multiple first fixing members **151** fix each of the multiple sub-holders **5** to the holder **6** in a detachably-attached manner. Thus, the first fixing members **151** can be considered to fix each of the head modules **2** to the common channel members **3** by fixing the corresponding sub-holder **5** to the holder **6**.
[0147] Specifically, each first fixing member **151** is inserted in the Z1 direction into the first fixing hole **61**H as a through hole and the first fixing slot **501** as a recess in this order. Thus, a part of the first fixing member **151** is exposed from a surface **606** of the holder **6** facing in the Z2 direction, but the first fixing member **151** is not exposed from the surface **511** of the sub-holder **5** facing in the Z1 direction. Thus, the first fixing member **151** is protected from adhesion and solidification of ink mist. This makes it possible to prevent the first fixing member **151** from becoming difficult to remove from the holder **6** and the sub-holder **5** due to the adhesion of the mist.
[0148] The depth D61 of the first fixing hole **61**H is greater than the depth D51 of the first fixing slot **501**. Each of the first fixing hole **61**H and the first fixing slot **501** is formed along the Z1 direction. The depths D61 and D51 are defined as depths along the Z1 direction.
[0149] The sub-unit **15** is small in size and difficult for some user to grasp. The depth D61 of the first fixing hole **61**H is greater than the depth D51 of the first fixing slot **501**, in other words, the depth D51 of the first fixing slot **501** is smaller than the depth D61 of the first fixing hole **61**H, so that even if the sub-unit **15** is difficult to grasp, the press-fit of the sub-unit **15** in the holder **6** can be easily released.
[0150] For example, after the first fixing members **151** are removed from the first fixing holes **61**H, long rod-shaped members are inserted into the first fixing holes **61**H and the sub-holder **5** is

pressed in the Z1 direction by these members. As a result, the press-fit of the sub-holder **5** in the holder **6** can be released easily. The use of the first fixing holes **61**H as holes for releasing the press-fit makes it possible to easily release the press-fit of the sub-holder **5** in the holder **6**. In the case where the depth D6 of the holder **6** is greater than the depth D5 of the sub-holder **5**, the sub-holder **5** can be more easily detached from the holder **6** than in the case where the depth D6 is smaller than the depth D5.

[0151] A distance L51 from the bottom surface of the first fixing slot **501** to the surface **511** of the sub-holder **5** facing in the Z1 direction is greater than the depth D51 of the first fixing slot **501**. In the case where the distance L51 is greater than the depth D51, the sub-holder **5** is less likely to be deformed in the process of releasing the press-fit of the sub-holder **5** in the holder **6** than in the case where the distance L51 is smaller than the depth D51.

[0152] However, the distance L51 may be smaller than the depth D51. In this case, the distance L51 is made as small as possible while the depth D51 necessary for positioning is reserved, so that the thickness D5 of the sub-holder **5** can be easily reduced. When the thickness D5 is reduced, an increase in the paper gap can be suppressed.

[0153] In the present embodiment, the first fixing members **151** are screws. Accordingly, female threads are formed on inner circumferential wall surfaces forming the first fixing slots **501**. When the first fixing members **151** are the screws, the fixing of the sub-holder **5** to the holder **6** can be easily released by rotating and unscrewing the screws. When the first fixing members **151** are the screws, the sub-holder **5** can be fixed to the holder **6** in the detachably-attached manner without using an adhesive.

[0154] However, the first fixing member **151** may be a member other than the screw. For example, the first fixing member **151** may include an L-shaped or T-shaped pin with its tip end in the Z1 direction bent at a right angle and an elastic member such as a leaf spring or coil spring, and may be configured to fix the sub-holder **5** to the holder **6** by using the elastic force of the elastic member.

[0155] As described above, the first fixing member **151** may have any structure as long as the first fixing member **151** can fix the holder **6** and the sub-holder **5** to each other.

[0156] Moreover, as illustrated in FIGS. **5** and **14**, for example, the two first fixing members **151** are provided for each sub-holder **5**. As viewed in the Z1 direction, the first fixing members **151** are arranged so as not to overlap the chip **20** and so as to sandwich the seal areas **4**S between the chip **20** and the first fixing members **151**.

[0157] In the case where the first fixing members **151** do not overlap the chip **20** as viewed in the Z1 direction, the load generated for fixing with the first fixing members **151** is less likely to be applied to the chip **20** than in the case where the first fixing members **151** overlap the chip **20**. Moreover, as viewed in the Z1 direction, the seal member **4** is arranged between the first fixing member **151** and the chip **20**, so that the distance of the chip **20** from the first fixing member **151** can be increased by the dimension of the seal member **4**. This also makes the load generated for fixing with the first fixing members **151** unlikely to be applied to the chip **20**.

[0158] As illustrated in FIG. **13**, the holder **6** includes multiple fourth alignment portions **642**. The multiple fourth alignment portions **642** are provided in the flange portions **64**. As illustrated in FIG. **5**, the fourth alignment portions **642** are protrusions protruding in the Z2 direction from surfaces of the flange portions **64** facing in the Z2 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.

[0159] 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**.

[0160] In addition, 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 Z2 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**.

1-3F. Wiring Substrate **7**, Relay Substrate **70**, and Connector **71**

[0161] As illustrated in FIG. **4**, 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 Z2 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** facing in the Z1 direction of the flat plate portion **61** of the holder **6**. 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 **502** are provided on the surface of the sub-holder **5** facing in the Z2 direction. This arrangement enables easy attachment and detachment for only the sub-unit **15** 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 sub-units **15** other than the replacement target, which simplifies the attachment and detachment work.

[0164] In the process of attaching only the sub-unit **15** 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

[0165] As illustrated in FIG. **4**, bushings **521** are provided between the multiple sub-holders **5**. Each bushing **521** fills a gap formed between the adjacent sub-holders **5**. For example, as viewed in the Z1 direction, the bushing **521** has a shape long along the Y axis between the adjacent sub-holders **5**. As illustrated in FIG. **5**, bushings **522** are arranged between the holder **6** and the sub-holder **5**. Specifically, the bushings **522** are arranged between the holder **6** and both longitudinal ends of the sub-holder **5**. Each of the bushings **521** and **522** contains, for example, an elastic resin material.

[0166] The provision of the bushings **521** 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 embodiment described above as the example may be modified in various manners. Examples of specific modifications applicable to the above-described 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] FIGS. **15** and **16** are cross-sectional views of parts of a liquid ejecting head **1** in a first modification. FIG. **17** is a topside view of the liquid ejecting head **1** in the first modification.

[0169] In the first modification illustrated in FIG. **15**, bushings **523** are provided. Although not illustrated in details, each bushing **523** has a rectangular frame shape along an outer periphery of the sub-holder **5** as viewed in the Z1 direction. These bushings **523** can prevent ink mist or the like from entering the space in the dented portion **610** of the holder **6**. Here, the multiple bushings **523** may be integrally formed as a common member provided in common to the multiple sub-holders **5**.

[0170] As illustrated in FIG. **16**, in the first modification, the sub-holder **5** and the head module **2** are sealed with molds formed of adhesives **531** and **532**. The adhesive **531** forms the mold that seals the channel orifice forming member **25** and the sub-holder **5**. The adhesive **531** overlaps the seal member **4** as viewed in the Z1 direction. The adhesive **532** forms the mold that seals the chip **20** and the sub-holder **5**. Although not illustrated in details, the adhesive **531** is provided in a rectangular frame shape surrounding the opening **5**H as viewed in the Z1 direction. The adhesive **532** is provided along an inner peripheral wall of the opening **5**H. These adhesives **531** and **532** can prevent ink mist or the like from entering the space in the dented portion **610** of the holder **6**.

[0171] The holder **6** of the liquid ejecting head **1** in the first modification includes a first member **691** and a second member **692**. The first member **691** and the second member **692** are formed as separate members. The first member **691** is equivalent to the upper portion of the holder **6** in the first embodiment described above. Accordingly, the first member **691** includes the flat plate portion **61** and a part of the sidewall **62**. The second member **692** is equivalent to the lower portion of the holder **6** in the first embodiment described above. The second member **692** includes a part of the sidewall **62** and the multiple partition walls **63**.

[0172] The first member **691** is provided with multiple fixing holes **611**H and **612**H. The second member **692** is provided with multiple fixing slots **613** and multiple fixing holes **614**H. The multiple fixing slots **613** and **614**H correspond to the multiple fixing holes **611**H on a one-to-one basis, and coincide with the multiple fixing holes **611**H as viewed in the Z1 direction. The fixing holes **611**H and **612**H are holes passing through the first member **691** in the thickness direction. The fixing holes **611**H do not overlap the dented portion **610** as viewed in the Z1 direction. The fixing holes **612**H overlap the dented portion **610** as viewed in the Z1 direction. The fixing holes **614**H pass through the second member **692** in the thickness direction. The fixing holes **614**H do not overlap the dented portion **610** as viewed in the Z1 direction. The fixing holes **614**H are provided for each sub-holder **5**. The fixing slots **613** are bottomed slots opened on a surface of the second member **692** facing in the Z2 direction.

[0173] In the first modification, each common channel member **3** is provided with fixing slots **321**. The fixing slots **321** are bottomed slots opened in a surface of the common channel member **3** facing in the Z2 direction. The fixing slot **321** is provided for each fixing hole **612**H and coincides with the fixing hole **612**H as viewed in the Z1 direction.

[0174] In the first modification, the sub-holder **5** is provided with fixing slots **504**. The fixing slots **504** are bottomed slots opened in the surface **512** of the sub-holder **5** facing in the Z2 direction. The fixing slot **504** is provided for each fixing hole **614**H and coincides with the fixing hole **614**H as viewed in the Z1 direction.

[0175] The liquid ejecting head **1** in the first modification includes a fixing member group **150**. The fixing member group **150** includes multiple fixing members **152**, **153**, and **154**.

[0176] The fixing member **152** is inserted into the fixing hole **611**H and the fixing slot **613** in this order. The fixing member **152** fixes the first member **691** and the second member **692** to each other. The fixing member **153** is inserted into the fixing hole **612**H and the fixing slot **321** in this order. The fixing member **153** fixes the first member **691** and the common channel member **3** to each other. The fixing member **154** is inserted into the fixing hole **614**H and the fixing slot **504** in this order. The fixing member **154** fixes the second member **692** and the sub-holder **5** to each other.
[0177] As illustrated in FIG. **17**, for example, the multiple fixing members **152** are provided near the corners of the holder **6** having a rectangular shape as viewed in the Z1 direction. For example, the multiple fixing members **153** are provided near the corners of the holder **6** having the rectangular shape as viewed in the Z1 direction. The fixing members **154** are provided on a per-sub-holder **5** basis.
[0178] The fixing member group **150** fixes the sub-holders **5** to the holder **6**, and indirectly fixes the multiple head modules **2** to the holder **6**. With the multiple fixing members **153** provided, the common channel members **3** are not bonded to the holder **6** but are fixed to the holder **6** in a detachably-attached manner. Thus, in addition to the sub-units **15**, the common channel members **3** are also replaceable.
[0179] The fixing members **152**, **153**, and **154** are, for example, screws, but may be other members such as L-shaped or T-shaped pins described above.
[0180] It is preferable that the fixing member **152** be longer than the fixing member **154** and that the fixing member **152** and the fixing member **154** have male threads with the same outer profile and the same pitch. First, the fixing members **152** are removed from the fixing slots **613**, and thereby the first member **691** is detached from the second member **692**. Next, the fixing members **154** are removed from the fixing slots **504**. After that, the fixing members **152**, which are longer than the fixing members **154**, are fastened to the fixing slots **504**, so that the sub-holder **5** can be moved in the Z1 direction relative to the second member **692**. Therefore, the press-fit of the second alignment portions **602** in the first alignment portions **502** can be easily released.

2-2. Second Modification

[0181] FIGS. **18** and **19** are cross-sectional views of parts of a liquid ejecting head **1** in a second modification. The liquid ejecting head **1** in the second modification in FIGS. **18** and **19** includes a cover **85**. The cover **85** is fixed to the flange portions **64** of the holder **6**.
[0182] The cover **85** is provided in common to the multiple sub-holders **5**, and covers parts of the multiple sub-holders **5** except for the openings **5**H. The cover **85** is a plate-shaped member and is made of, for example, a metal. The cover **85** is located in the Z1 direction relative to the multiple sub-holders **5**, and is in contact with the multiple sub-holders **5**. The cover **85** includes multiple opening portions **85**H. The multiple opening portions **85**H are provided for the nozzle surfaces SN of the multiple head modules **2** on a one-to-one basis, and expose the nozzle surfaces SN.
[0183] Moreover, the cover **85** covers sidewall surfaces of the multiple sub-holders **5**. A part of the cover **85** includes a flange **851** in contact with a surface of each flange portion **64** facing in the Z2 direction. In the flange **851**, a through hole to which a mounting screw **156** is to be inserted is formed. In the flange portion **64**, a thread slot **643** is formed which coincides with the above through hole as viewed in the Z1 direction. The thread slot **643** is a bottomed slot opened in the surface of the flange portion **64** facing in the Z1 direction. The cover **85** is fixed to the flange portions **64** with the mounting screws **156** inserted and tightened in the thread slots **643** in a state where the cover **85** is in contact with the multiple sub-holder **5**.
[0184] The cover **85** thus provided reduces the entry of ink mist into the dented portion **610** of the holder **6**.

2-3. Third Modification

[0185] FIGS. **20** and **21** are cross-sectional views of parts of a liquid ejecting head **1** in a third modification. FIG. **22** is a view illustrating the second member **692** included in the holder **6** in the third modification. Hereinafter, mainly different points from those in the first modification will be

described.
[0186] In the third modification illustrated in FIG. **20**, bushings **524** are provided. Although not illustrated in details, each bushing **524** has a rectangular frame shape surrounding the opening **5**H of the sub-holder **5** as viewed in the Z1 direction. These bushings **524** can prevent ink mist or the like from entering the space in the dented portion **610** of the holder **6**.
[0187] As illustrated in FIGS. **21** and **22**, each channel orifice forming member **25** in the third modification includes flanges **209**. The flanges **209** are provided in the Y1 direction and the Y2 direction relative to the chip **20** as viewed in the Z1 direction. As illustrated in FIG. **21**, each flange **209** is provided with a fixing hole **211**H. The sub-holder **5** is provided with a fixing slot **505** corresponding to the fixing hole **211**H. The fixing slot **505** is a bottomed slot opened in the surface of the sub-holder **5** facing in the Z2 direction. The fixing slot **505** is provided corresponding to the fixing hole **211**H and coincides with the fixing hole **211**H as viewed in the Z1 direction.
[0188] The fixing member group **150** in the third modification includes multiple fixing members **155**, **152**, and **154**. The fixing member **155** is inserted into the fixing hole **211**H and the fixing slot **505** in this order. The fixing member **155** fixes the channel orifice forming member **25** and the sub-holder **5** to each other. The fixing members **155** are provided on a per-sub-holder **5** basis.
[0189] The fixing member group **150** fixes the sub-holders **5** to the holder **6** and fixes the head modules **2** to the sub-holders **5**, thereby indirectly fixing the multiple head modules **2** to the holder **6**. Since the multiple fixing members **155** are provided, each head module **2** is fixed to the sub-holder **5** without using an adhesive or the like. For this reason, the head module **2** can be easily attached to and detached from the sub-holder **5**. If the fixing members **155** are screws in particular, the head module **2** can be particularly easily attached to and detached from the sub-holder **5**. However, the fixing members **155** may be, for example, L-shaped or T-shaped pins or the like. In the case where the head module **2** is fixed to the sub-holder **5** with the fixing members **155**, misalignment of the multiple head modules **2** can be reduced as compared to the case of the fixing with an adhesive.
[0190] The bushing **524**, the sub-holder **5**, the head module **2**, and the seal member **4** described above overlap each other as viewed in the Z1 direction. This structure reduces the risk of the flange **209** being deformed due to the reaction force of the seal member **4** as compared with the case where they do not overlap each other.

2-5. Fifth Modification

[0191] FIG. **23** is a cross-sectional view of a part of a liquid ejecting head **1** in a fifth modification. In the liquid ejecting head **1** in the fifth modification illustrated in FIG. **23**, a first alignment portion **502***a* is a pin protruding in the Z2 direction from the surface of the sub-holder **5** facing in the Z2 direction. A second alignment portion **602***a* is a bottomed slot opened in the surface of the holder **6** facing in the Z1 direction. The second alignment portion **602***a* is a dented portion, in other words, a recess, formed in the holder **6** in the Z1 direction. In the second alignment portion **602***a*, the first alignment portion **502***a* is press-fitted to position the sub-holder **5** with respect to the holder **6**.
[0192] Even such first alignment portion **502***a* and second alignment portion **602***a* also enable easy positioning for attaching each sub-holder **5** to the holder **6** as in the first embodiment. Moreover, the alignment of the multiple sub-holders **5** with the holder **6** can be made with high precision. Thus, 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**.
[0193] As described in the first embodiment and the fifth 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 **602** or the first alignment portions **502** into the other alignment portions.
[0194] The fourth alignment portion **642***a* is a bottomed slot opened in the surface of the flange portion **64** facing in the Z2 direction. The fourth alignment portion **642***a* is a dented portion, in

other words, a recess, formed in the flange portion **64** in the Z1 direction. Although not illustrated, a third alignment portion **102** in this case is formed as a protrusion 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 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**.

2-6. Sixth Modification

[0195] FIG. **24** is a cross-sectional view of a seal member **4** and its surrounding area in a sixth modification. FIG. **25** is a cross-sectional view of a part of a liquid ejecting head **1** in the sixth modification. In the sixth modification illustrated in FIG. **24**, the thickness of the seal member **4** is not constant. The seal member **4** in the sixth modification includes a thick portion **41** and a thin portion **42**. The thick portion **41** is located near an inner wall surface forming an orifice H**4** and is thicker than the thin portion **42**. The thin portion **42** is located outside the thick portion **41**.

[0196] In the case of the sixth 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 common channel member **3**, and is held between the channel orifice forming member **25** and the common channel member **3**.

[0197] As illustrated in FIG. **25**, the first fixing member **151** for fixing the head module **2** and the common channel member **3** is arranged so as not to overlap the chip **20** and so as to sandwich the seal area **4**S between the first fixing member **151** and the chip **20** as viewed in the Z1 direction. Moreover, the support surface **5**S includes an area S55 arranged between the seal area **4**S and the chip **20** as viewed in the Z1 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 surface **5**S does not include the area S55.

2-7. Seventh Modification

[0198] FIG. **26** is a cross-sectional view of a seal member **4** and its surrounding area in a seventh modification. In the seventh modification illustrated in FIG. **26**, the seal member **4** includes a portion out of contact with both the common channel member **3** and the channel orifice forming member **25**. In the seventh 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 common channel member **3** and the channel orifice forming member **25**, the seal member **4** may include a portion that is out of contact with both the common channel member **3** and the channel orifice forming member **25** and that is not held between the common channel member **3** and the channel orifice forming member **25**. In the seal member **4**, the portion held between the common channel member **3** and the channel orifice forming member **25** serves as the seal area **4**S.

2-8. Eighth Modification

[0199] FIG. **27** is a cross-sectional view illustrating a first alignment portion and a second alignment portion in an eighth modification. In the eighth modification illustrated in FIG. **27**, one sub-holder **5***a* holds multiple head modules **2**. In this way, one sub-holder **5***a* does not necessarily have to hold one head module **2**. In this case, one sub-holder **5***a* includes multiple openings **5**H corresponding to the multiple head modules **2**. In this case, the sub-holder **5***a* serves as a reference for positioning the multiple head modules **2**. In the example illustrated, one sub-holder **5***a* supports three head modules **2**. In other words, the sub-holder **5***a* is provided for every three head modules **2**. Two first alignment portions **502** are provided for each sub-holder **5***a*. Thus, the two first alignment portions **502** are provided in common to the three head modules **2**. The sub-holder **5***a* serves as the reference for positioning the three head modules **2**. Two first fixing slots **501** are also provided for each sub-holder **5***a*. Thus, the two first fixing slots **501** are provided in common to the three head modules **2**.

[0200] In the eighth modification, one sub-holder **5***a* holds multiple head modules **2**. In other words, one sub-holder **5***a* holds two or more head modules **2**. For example, two or more head modules **2** to be replaced at similar timings are held by one sub-holder **5***a*. Thus, the two or more

head modules **2** to be replaced at the similar timings may be collectively replaced, which facilitates the replacement work.

[0201] In the eighth modification, for example, the sub-holder **5***a* 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** to eject a type of liquid whose ejection frequency is high (for example, a black ink, a white ink, a pre-treatment liquid such as a reaction liquid to coagulate pigments contained in an ink, a post-treatment liquid such as an overcoat liquid, or the like). As a result, the workability for replacement is improved. However, the two or more head modules **2** held by one sub-holder **5***a* 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.

2-9. Other Modifications

[0202] 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**.

[0203] 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 **502** and the second alignment portions **602**. For example, the above through hole may be a hole that passes through the holder **6** in directions in which the first alignment portions **502** are inserted into and removed from the second alignment portions **602** and that has a larger opening area than the opening area of the first fixing hole **61**H.

[0204] 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.

[0205] 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.

Claims

1. A liquid ejecting head comprising: a plurality of head modules each of which ejects a liquid in a first direction; a plurality of metallic sub-holders each of which holds at least one head module among the plurality of head modules; and a metallic holder to which the plurality of sub-holders are fixed in a detachably-attached manner, wherein each of the plurality of sub-holders includes a first alignment portion, and 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 sub-holders with respect to the holder.

2. The liquid ejecting head according to claim 1, wherein the plurality of second alignment portions are arranged in a surface of the holder facing in the first direction, the first alignment portion is arranged in a surface of the sub-holder facing in a second direction opposite to the first direction, and the at least one head module is supported by the surface of the sub-holder facing in the second direction.

3. The liquid ejecting head according to claim 2, wherein each of the head modules includes a nozzle plate having a plurality of nozzles that eject the liquid, and a supported surface located in

the second direction relative to the nozzle plate and facing in the first direction, each of the sub-holders includes an opening from which the plurality of nozzles of the head module are exposed to outside, and a support surface facing in the second direction, and the head module is held by the sub-holder with the supported surface put in contact with the support surface.

4. The liquid ejecting head according to claim 3, wherein each of the head modules includes a channel orifice forming member which includes the supported surface and in which a channel is formed, and a part of the channel orifice forming member is inserted in the opening of the sub-holder.

5. The liquid ejecting head according to claim 3, wherein a surface of the sub-holder facing in the first direction and a surface of the nozzle plate facing in the first direction are approximately flush with each other.

6. The liquid ejecting head according to claim 1, further comprising a common channel member including one or more channels which communicate with the plurality of head modules, wherein 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 sub-holder facing in the second direction.

7. The liquid ejecting head according to claim 1, further comprising a relay substrate which 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 sub-holder facing in the second direction.

8. The liquid ejecting head according to claim 1, wherein each of the plurality of sub-holders holds two or more of the head modules.

9. The liquid ejecting head according to claim 8, wherein each of the sub-holders holds two or more head modules which eject the same type of liquid among the plurality of head modules.

10. The liquid ejecting head according to claim 2, wherein the first alignment portion is a bottomed slot provided in the surface of the sub-holder facing in the second direction and recessed in the first direction, or a pin protruding in the second direction from the surface of the sub-holder facing in the second direction.

11. The liquid ejecting head according to claim 1, further comprising a plurality of first fixing members that fix the plurality of sub-holders to the holder in a detachably-attached manner, wherein each of the plurality of sub-holders includes a first fixing slot in a dented shape having a bottom surface, the holder includes a plurality of first fixing holes which pass through the holder in 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.

12. The liquid ejecting head according to claim 11, wherein 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 sub-holder facing in a second direction opposite to the first direction, and a depth of the first fixing hole is greater a depth of the first fixing slot.

13. The liquid ejecting head according to claim 12, wherein a distance from the bottom surface of the first fixing slot to a surface of the sub-holder facing in the first direction is greater than the depth of the first fixing slot.

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

15. 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.

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

17. A liquid ejecting apparatus comprising: a plurality of the liquid ejecting heads according to claim **16**; and a unit base which includes the plurality of third alignment portions and holds the plurality of liquid ejecting heads.