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(54) **LIQUID EJECTING APPARATUS AND CONTROL METHOD OF LIQUID EJECTING APPARATUS**

(71) Applicant: **Seiko Epson Corporation**, Tokyo (JP)

(72) Inventor: **Taichi YOKOYAMA**, Shiojiri-shi (JP)

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(57) **ABSTRACT**

A liquid ejecting apparatus includes a head unit having a plurality of nozzles ejecting an ink, the head unit including a filter provided with holes through which the ink can pass, a first nozzle row formed by the plurality of nozzles, and a second nozzle row formed by the plurality of nozzles, and a mounting portion on which the head unit is detachably mounted. The nozzles forming the second nozzle row communicate with the nozzles forming the first nozzle row via the filter. A pre-operation of forming gas-liquid interfaces in the holes provided in the filter is executed before the head unit is removed from the mounting portion.

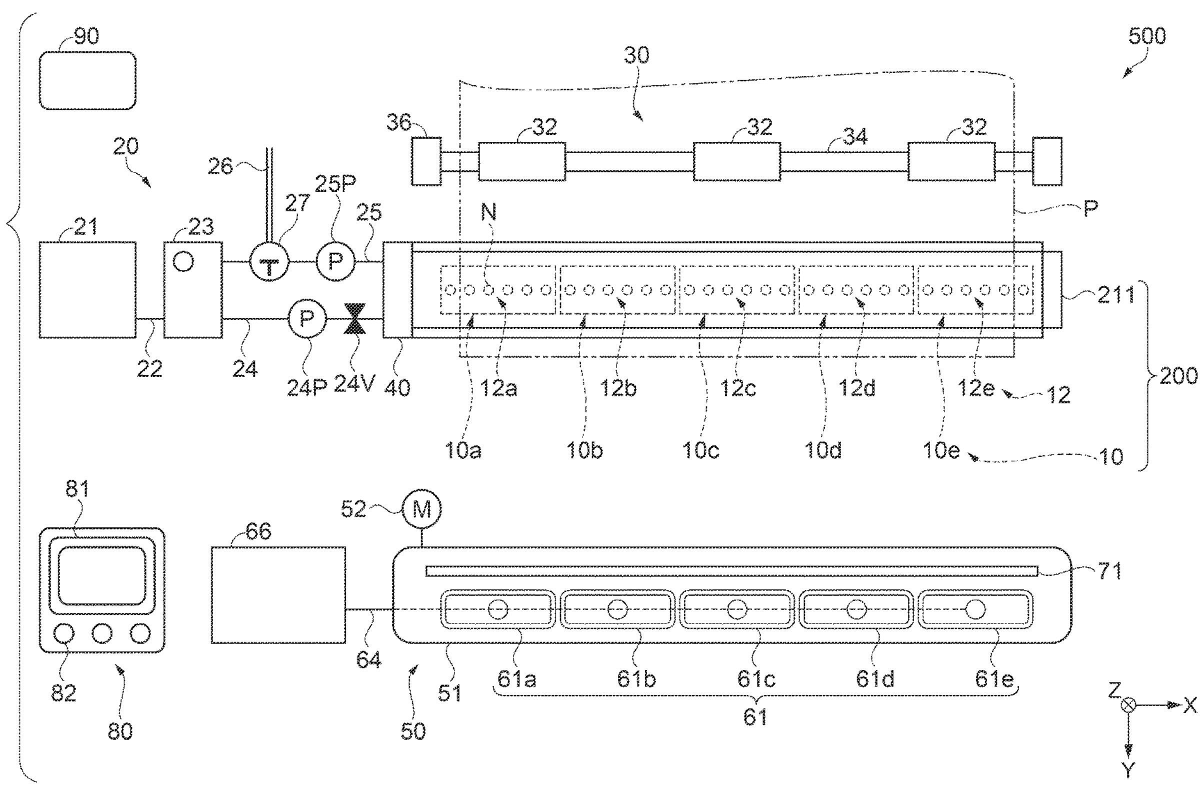
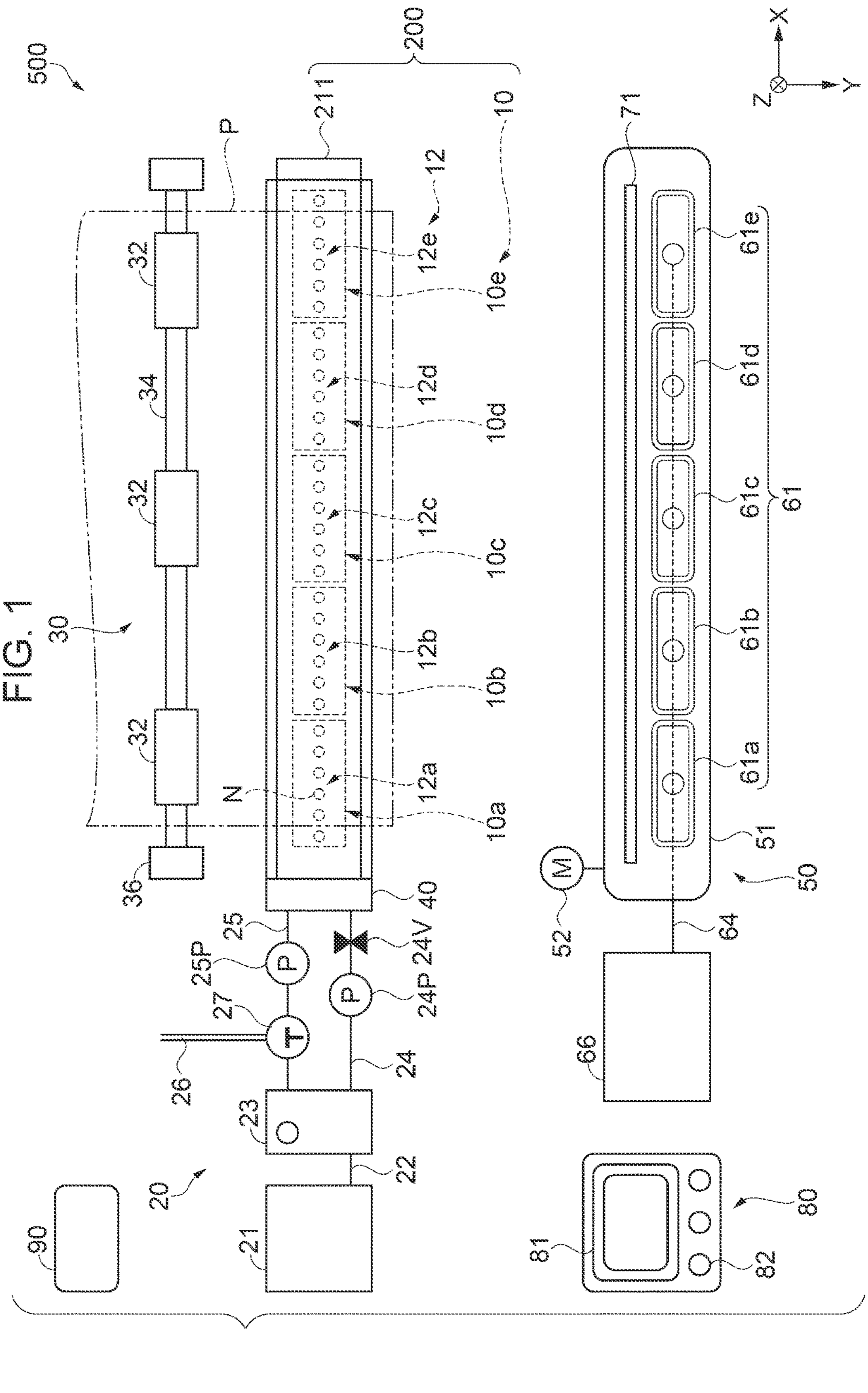


FIG. 1


500
200
211
10
P
12
12e
10e
12d
10d
12c
10c
12b
10b
12a
10a
N
30
32
34
36
40
25
25P
24V
24P
27
26
24
23
22
20
21
90
71
61e
61d
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61b
61a
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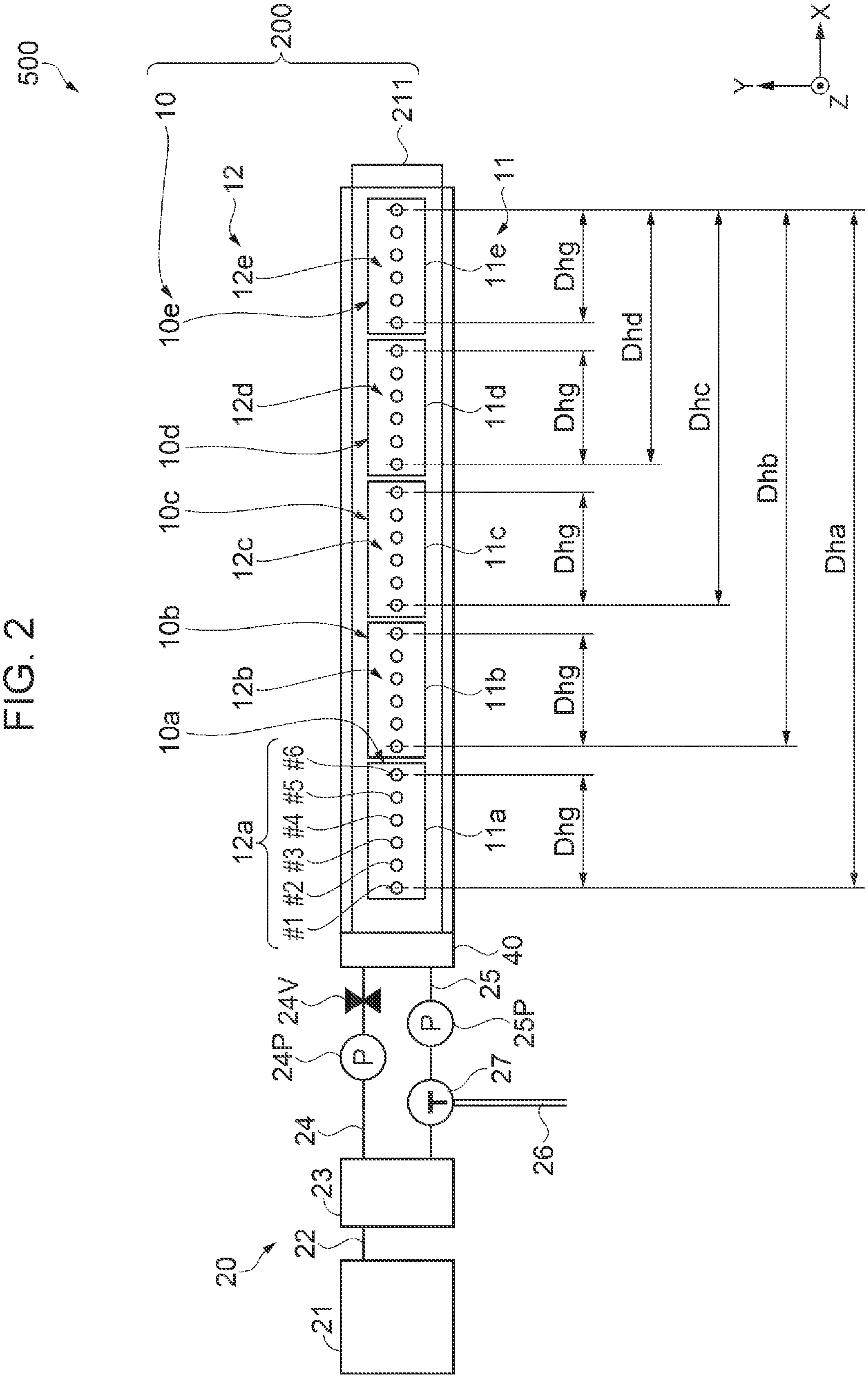
51
50
M
52
64
66
80
81
82
X
Y
Z


500
200
10
211
12
11
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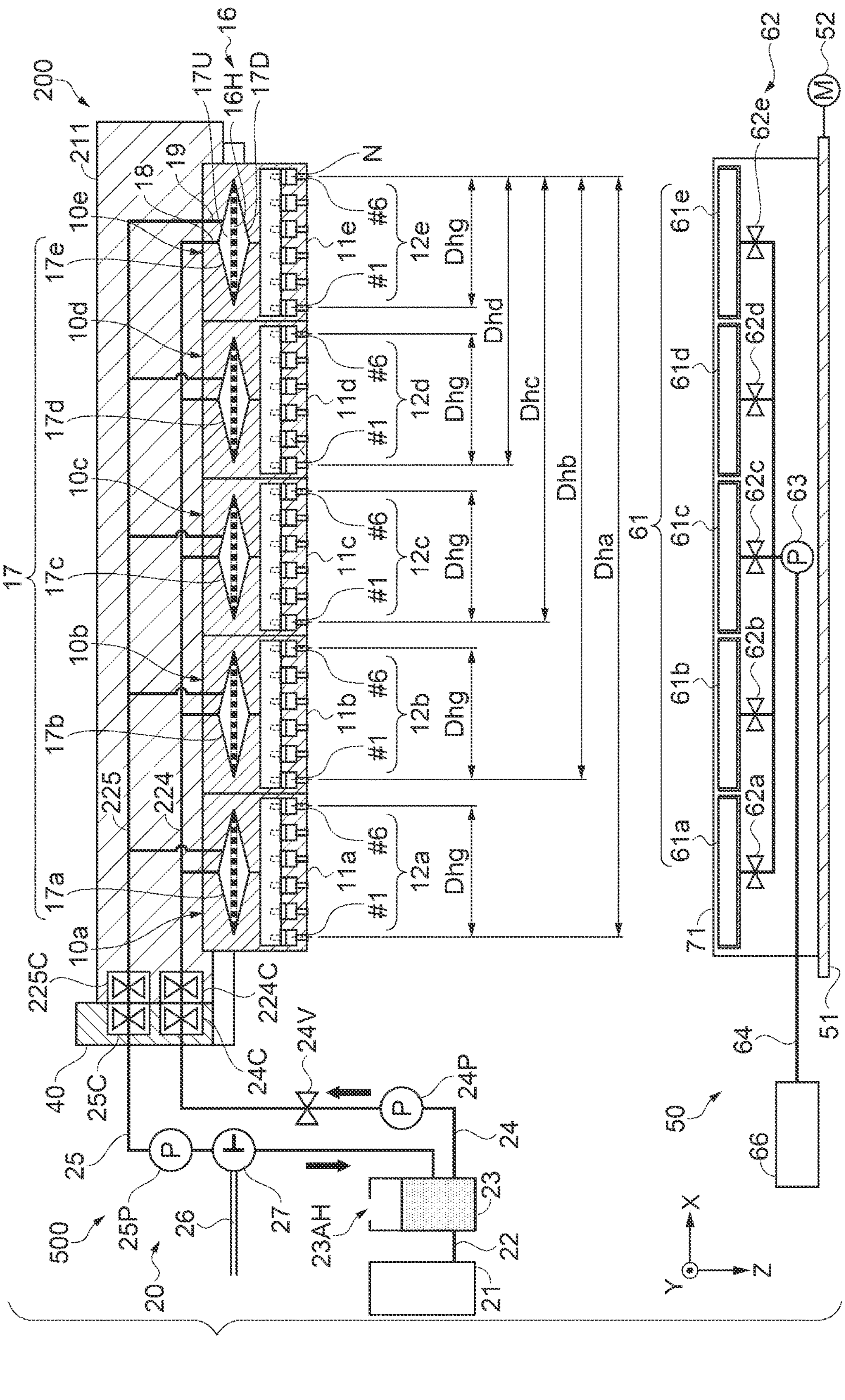
10e
11e
Dhg
Dhd
12d
10d
11d
Dhc
10c
12c
11c
Dhb
10b
12b
11b
Dha
10a
12a
#1 #2 #3 #4 #5 #6
11a
40
24V
25
24P
25P
27
24
26
23
22
20
21
X
Y
Z

FIG. 2

FIG. 3A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211
16
17U
16H
17D
18
19
N
10e
17e
10d
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10c
17c
10b
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10a
17a
17
225
224
225C
224C
25C
24C
24V
40
11a
11b
11c
11d
11e
12a
12b
12c
12d
12e
#1
#6
Dhg
Dhd
Dhc
Dhb
Dha
61
61a
61b
61c
61d
61e
62
62a
62b
62c
62d
62e
63
52
M
P
71
51
64
66
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500
20
25
25P
26
27
24
24P
23
23AH
22
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X
Y
Z

FIG. 3B

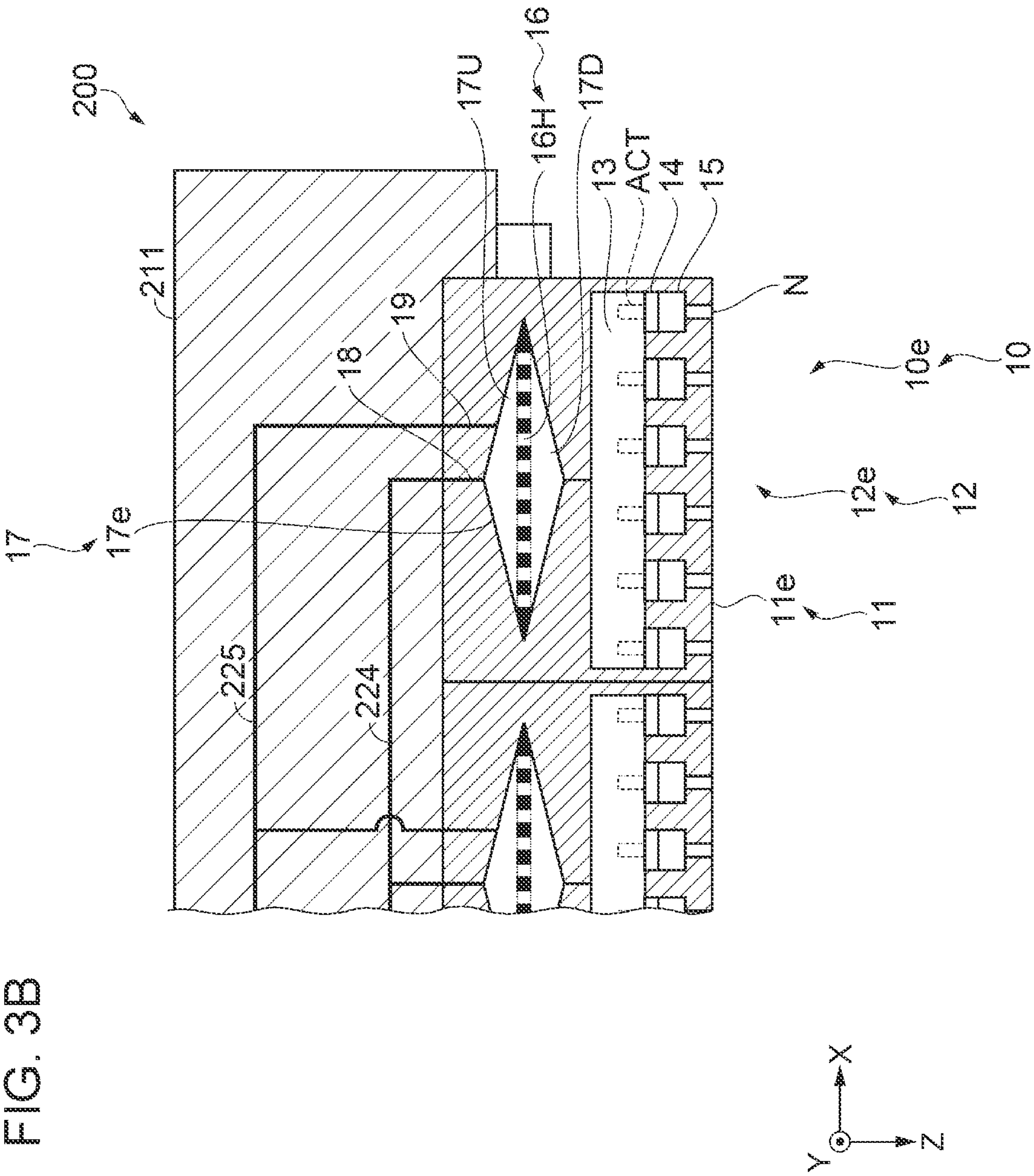
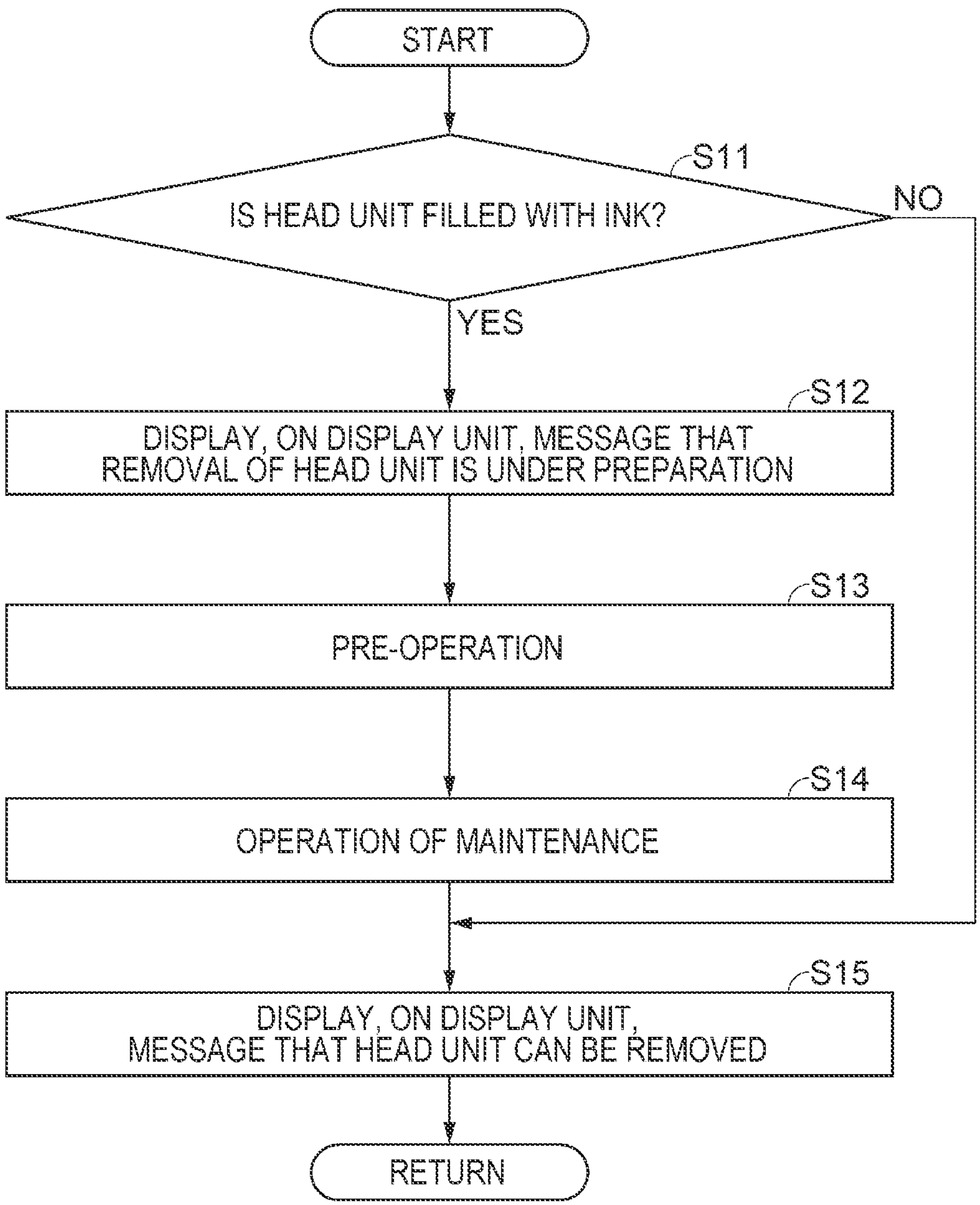
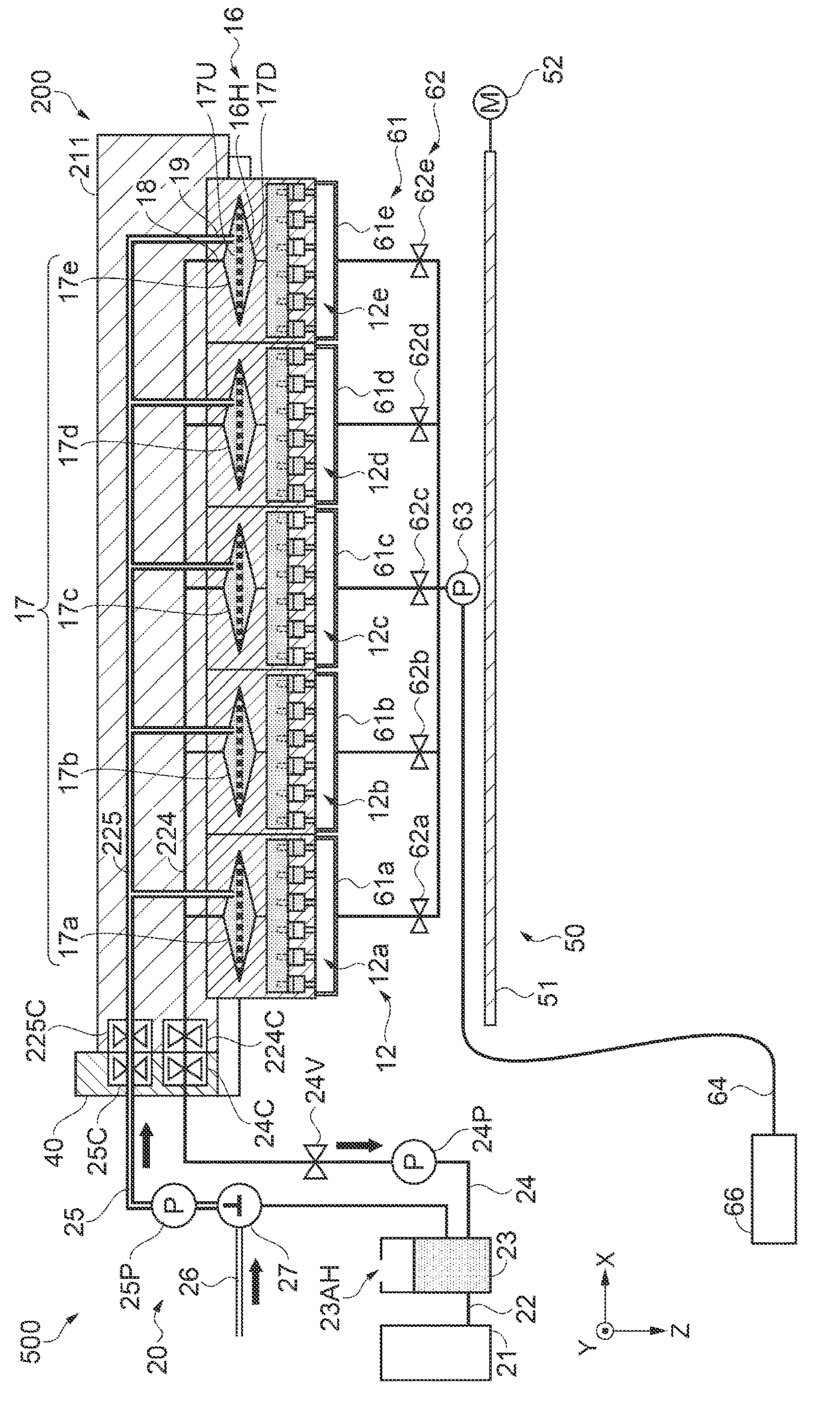

200
211
17
17e
18
19
17U
16H
16
17D
13
ACT
14
15
N
10e
10
12e
12
11e
11
225
224
X
Y
Z

FIG. 4


START
IS HEAD UNIT FILLED WITH INK?
S11
NO
YES
S12
DISPLAY, ON DISPLAY UNIT, MESSAGE THAT REMOVAL OF HEAD UNIT IS UNDER PREPARATION
S13
PRE-OPERATION
S14
OPERATION OF MAINTENANCE
S15
DISPLAY, ON DISPLAY UNIT, MESSAGE THAT HEAD UNIT CAN BE REMOVED
RETURN


200
211
16
17U
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17D
18
19
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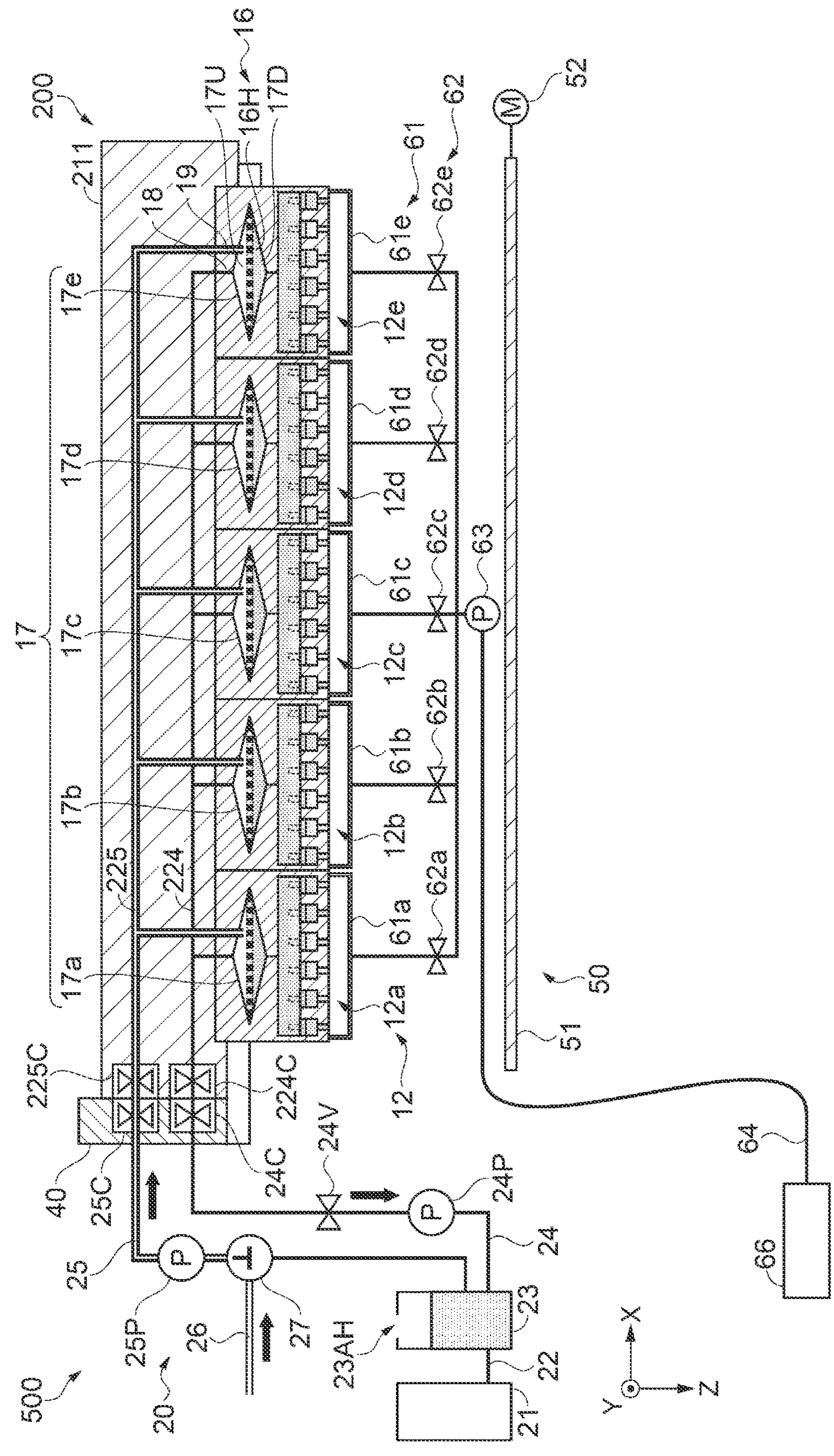
12d
12e
61
61a
61b
61c
61d
61e
62
62a
62b
62c
62d
62e
63
P
52
M
50
51
64
66
225
224
225C
224C
24C
25C
40
24V
24P
24
25
25P
26
27
23
23AH
22
21
20
500
12
X
Y
Z

FIG. 5A

FIG. 5B


200
16
17U
16H
17D
211
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18
61
62
52
M
61e
62e
17e
12e
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17a
17b
17c
17d
61a
61b
61c
61d
62a
62b
62c
62d
12a
12b
12c
12d
63
P
225
224
225C
224C
12
50
51
40
25C
24C
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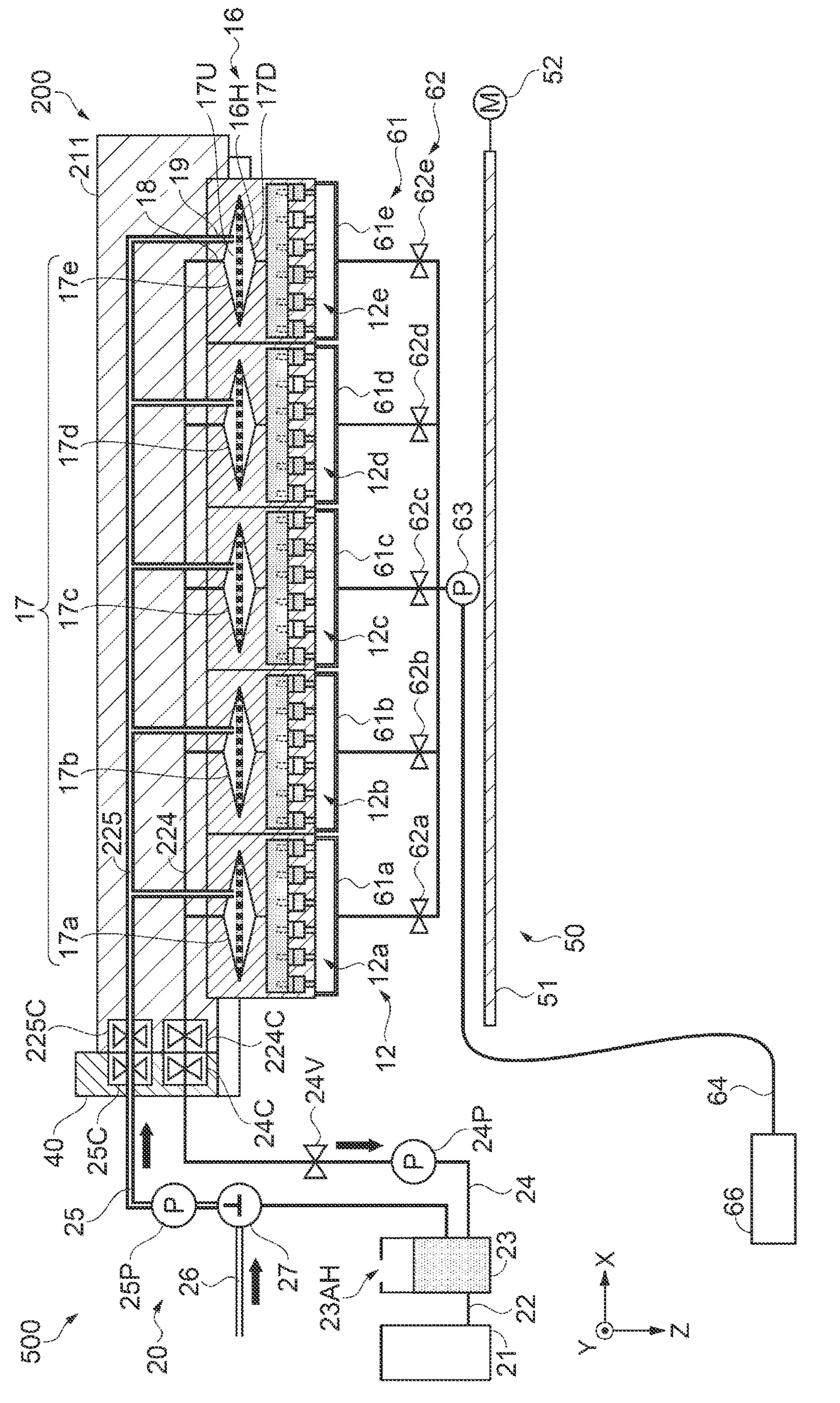
64
66
X
Y
Z



200
211
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61a
61b
61c
61d
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62a
62b
62c
62d
62e
12a
12b
12c
12d
12e
12
63
P
225
224
225C
224C
24C
25C
40
24V
24P
24
25
25P
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27
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500
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23AH
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Y
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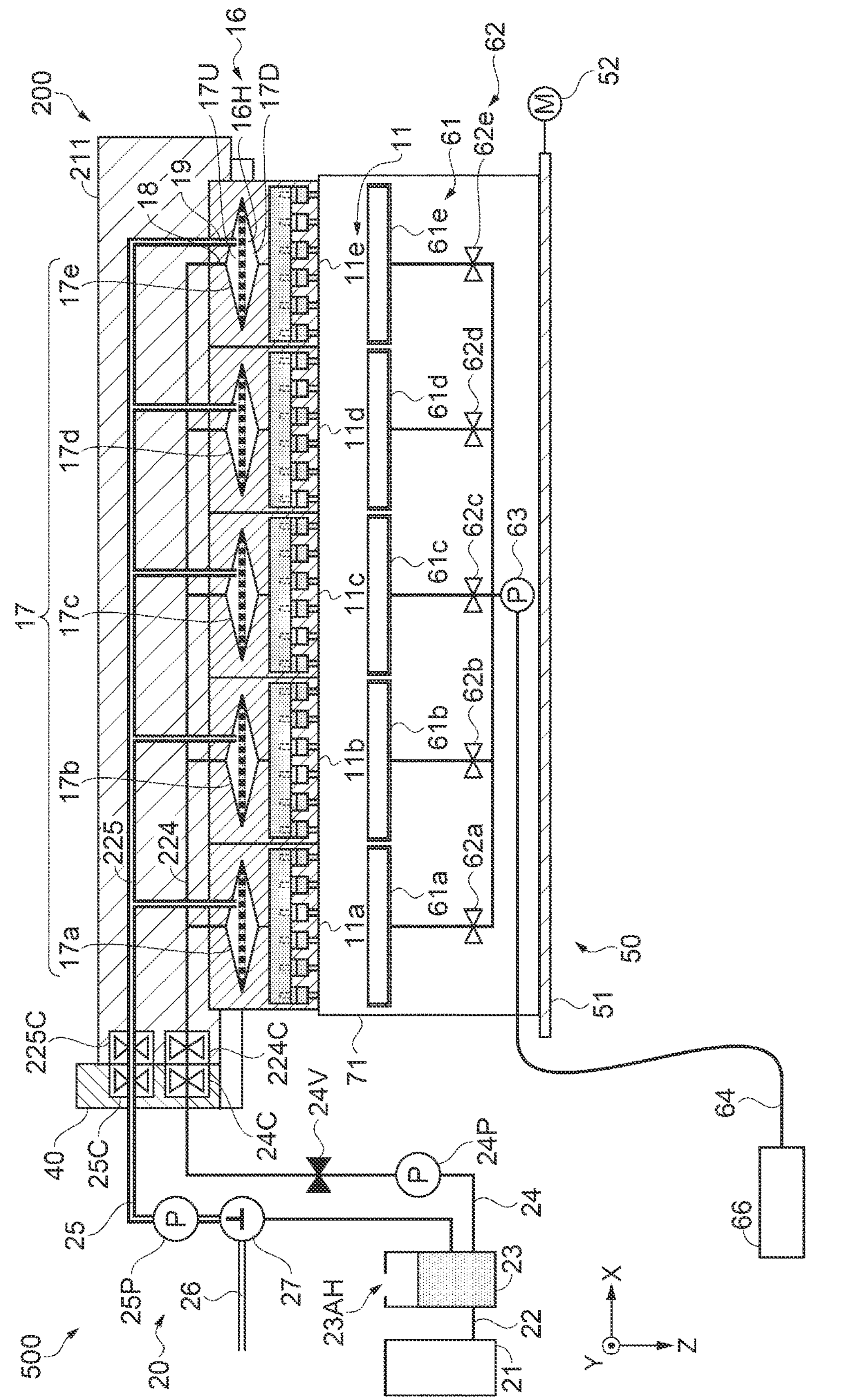
FIG. 5C

FIG. 5D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11d
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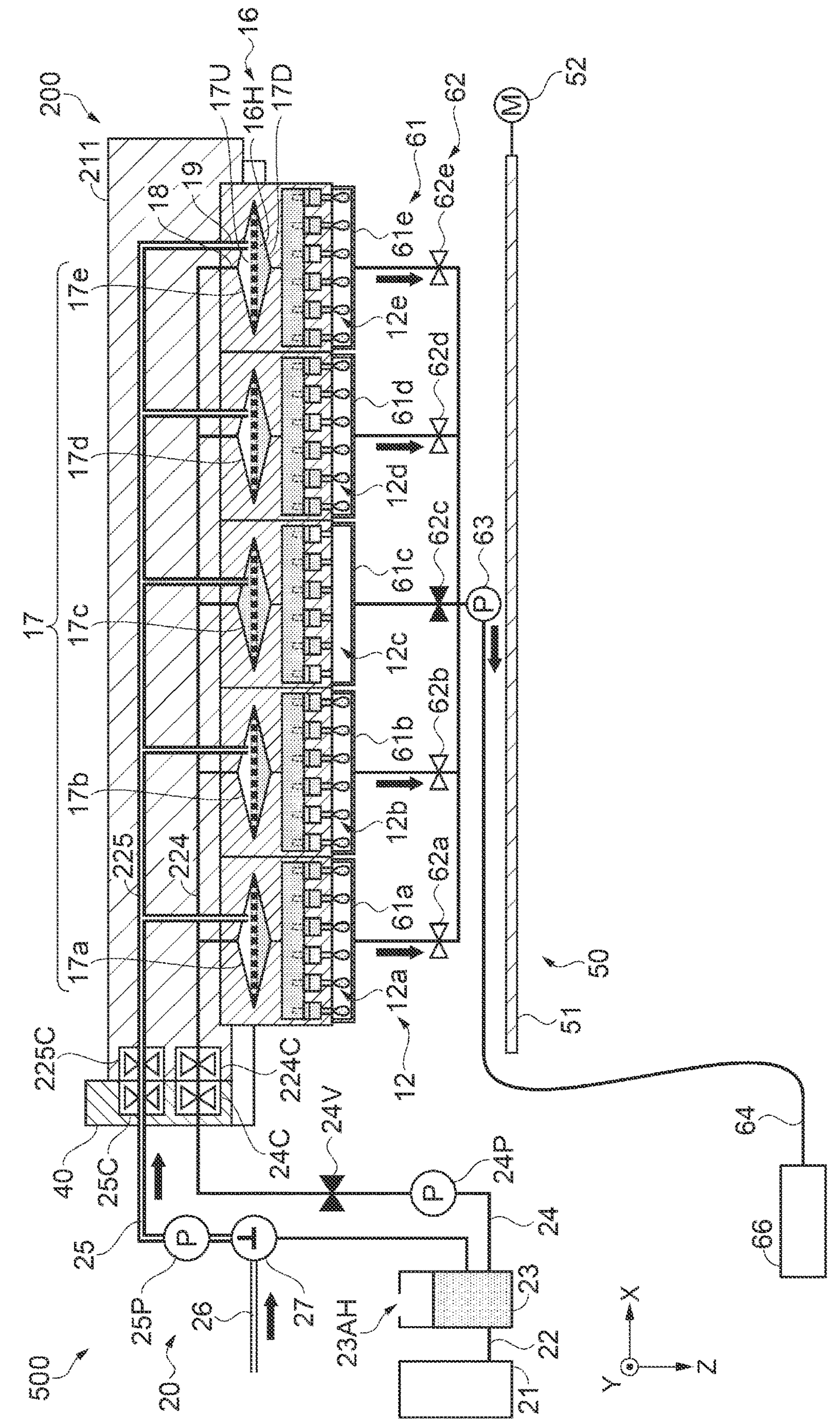
61d
61e
62
62a
62b
62c
62d
62e
63
64
66
50
51
52
M
P
71
40
224
225
224C
225C
24C
25C
24V
24P
24
25
25P
26
27
21
22
23
23AH
X
Y
Z

FIG. 6A


200
211
16
17U
16H
17D
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19
17
17a
17b
17c
17d
17e
225
224
225C
224C
25C
24C
24V
24P
24
25
25P
26
27
23
23AH
22
21
20
500
40
12
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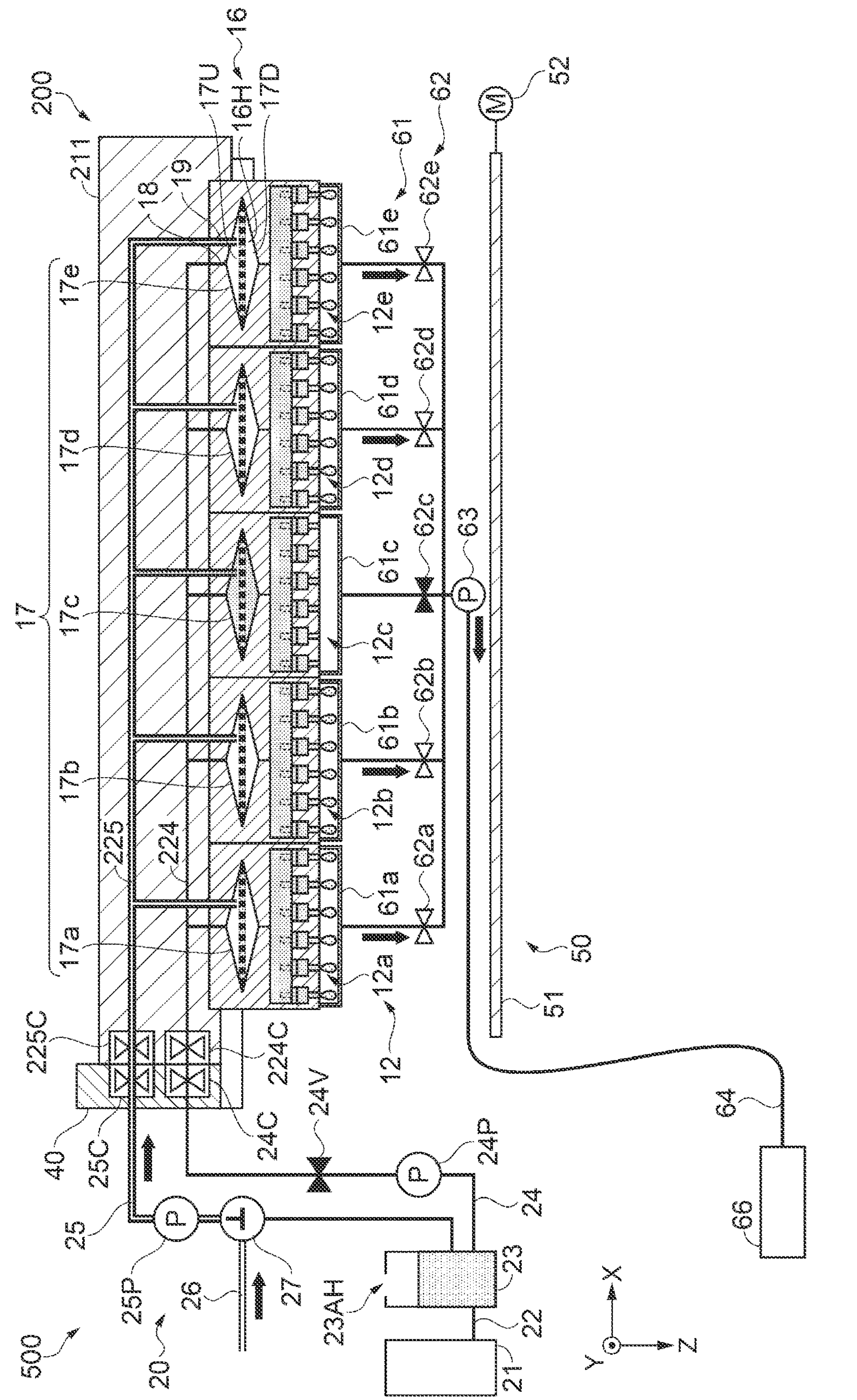
12b
12c
12d
12e
61
61a
61b
61c
61d
61e
62
62a
62b
62c
62d
62e
63
64
66
50
51
52
M
P
X
Y
Z

FIG. 6B



200
211
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62
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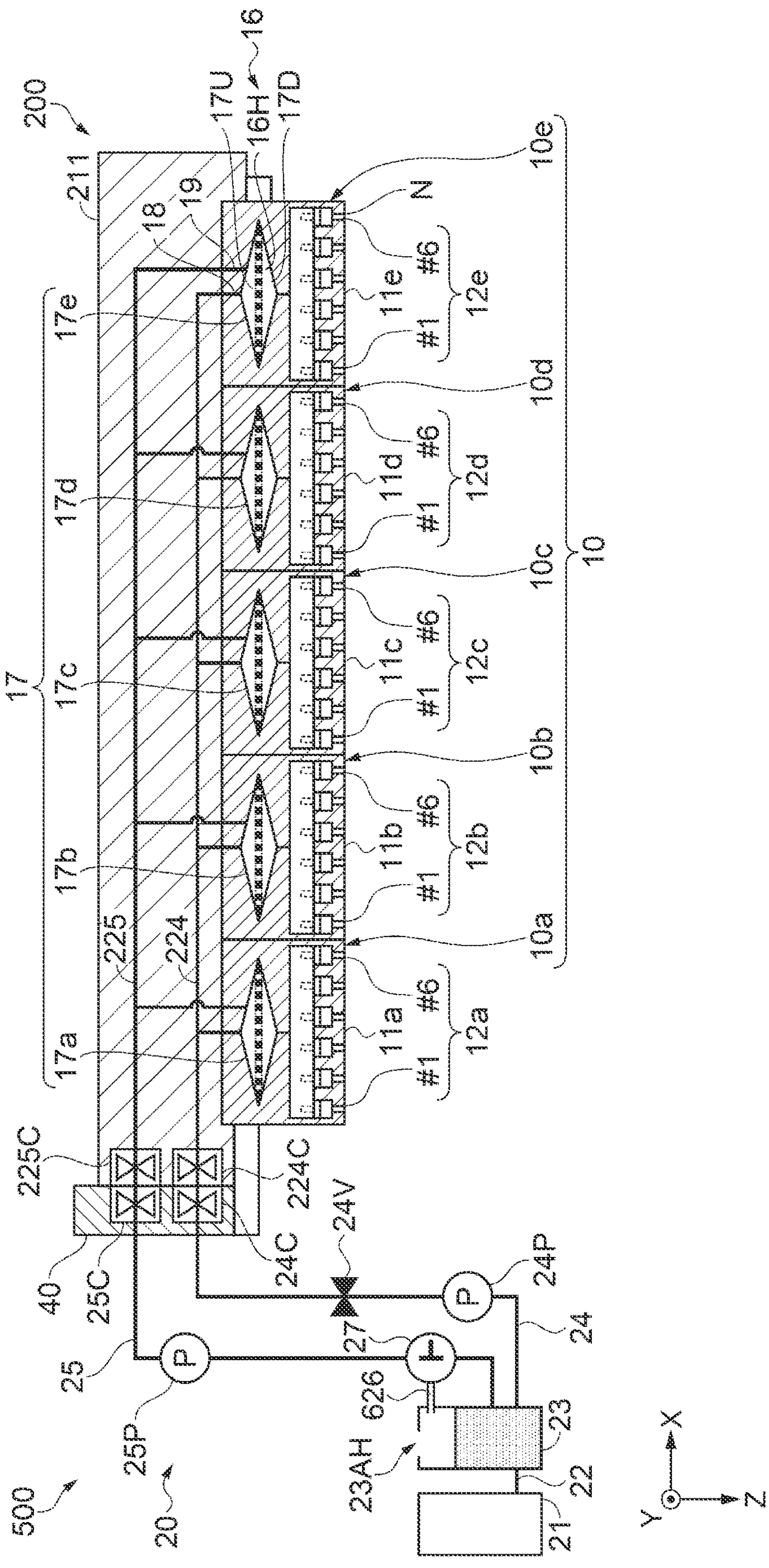
61b
61c
61d
61e
62a
62b
62c
62d
62e
12
12a
12b
12c
12d
12e
63
52
M
P
50
51
225
224
225C
224C
25C
24C
24V
24P
40
25
25P
26
27
24
23
23AH
22
21
20
500
64
66
X
Y
Z

FIG. 7


200
211
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16H
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17D
10e
N
18
19
17e
17d
17c
17b
17a
17
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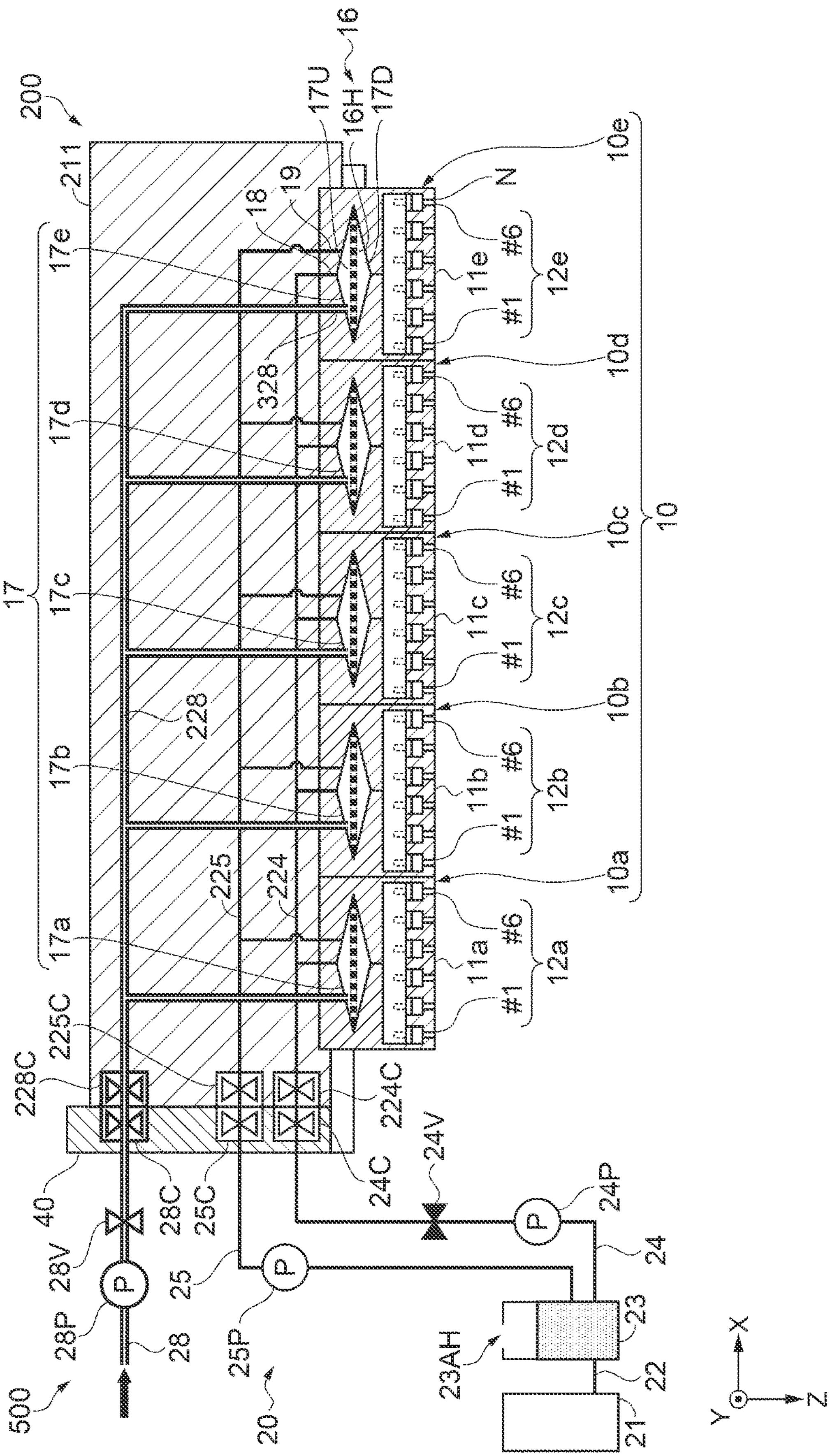
#6
11e
12e
11d
12d
11c
12c
11b
12b
11a
12a
10d
10c
10b
10a
10
225
224
225C
224C
24V
24C
25C
40
24P
P
24
27
25
626
25P
23
23AH
22
21
20
500
X
Y
Z

FIG. 8


200
211
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17a
17b
17c
17d
17e
16
16H
17U
17D
18
19
328
228
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228C
225C
224C
28C
25C
24C
24V
24P
24
40
28V
28P
28
25
25P
20
500
23
23AH
22
21
10
10a
10b
10c
10d
10e
N
11a
11b
11c
11d
11e
12a
12b
12c
12d
12e
#1
#6
P
X
Y
Z

LIQUID EJECTING APPARATUS AND CONTROL METHOD OF LIQUID EJECTING APPARATUS

[0001] The present application is based on, and claims priority from JP Application Serial Number 2021-024015, filed Feb. 18, 2021, 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 apparatus and a control method of a liquid ejecting apparatus.

2. Related Art

[0003] JP-A-2019-10860 discloses an ink jet printer that is an example of a liquid ejecting apparatus performing printing by ejecting an ink, which is an example of a liquid, on a medium. The printer includes a liquid discharging head that is an example of a head unit and a mounting portion on which the liquid discharging head is detachably mounted. The liquid discharging head has a plurality of nozzle rows that are an example of a nozzle group formed by a plurality of nozzles ejecting an ink. In addition, the plurality of nozzle rows communicate with each other via a flow path in the liquid discharging head.

[0004] However, in the liquid ejecting apparatus described in JP-A-2019-10860, the posture of the head unit changes, for example, by removing the head unit from the mounting portion, and a height difference between the plurality of nozzles occurs in some cases. In this case, the pressure of an ink in the head unit caused by the height difference between the plurality of nozzles acts on gas-liquid interfaces formed in the nozzles by the ink, and thus there is a possibility that the gas-liquid interfaces in the nozzles are broken and an ink leakage occurs.

SUMMARY

[0005] According to an aspect of the present disclosure, there is provided a liquid ejecting apparatus including a head unit having a plurality of nozzles ejecting a liquid, a filter provided with a hole through which the liquid is configured to pass, a filter chamber including an upstream chamber and a downstream chamber, which are partitioned by the filter, a first nozzle group formed by a plurality of the nozzles, and a second nozzle group formed by a plurality of the nozzles, a mounting portion on which the head unit is detachably mounted, a gas introduction unit configured to introduce a gas into the filter chamber, and a control unit, in which the nozzles forming the second nozzle group communicate with the nozzles forming the first nozzle group via the filter of the filter chamber, when a pressure difference between a pressure on a gas side and a pressure on a liquid side, at which a gas-liquid interface formed in the hole of the filter is able to be maintained, is defined as a withstand pressure Pf and a pressure difference between a pressure on the gas side and a pressure on the liquid side, at which a gas-liquid interface formed in the nozzle is able to be maintained, is defined as a withstand pressure Pn, the withstand pressure Pf is greater than the withstand pressure Pn, and the control unit executes, before the head unit is removed from the mounting portion, a pre-operation of forming the gas-liquid interface in the hole provided in the filter by controlling the gas introduction unit and introducing the gas into the filter chamber.

[0006] According to another aspect of the present disclosure, there is provided a control method of a liquid ejecting apparatus including a head unit having a plurality of nozzles ejecting a liquid, a filter provided with a hole through which the liquid is configured to pass, a first nozzle group formed by a plurality of the nozzles, and a second nozzle group formed by a plurality of the nozzles, and a mounting portion on which the head unit is detachably mounted, in which the nozzles forming the second nozzle group communicate with the nozzles forming the first nozzle group via the filter, and when a pressure difference between a pressure on a gas side and a pressure on a liquid side, at which a gas-liquid interface formed in the hole of the filter is able to be maintained, is defined as a withstand pressure Pf and a pressure difference between the pressure on the gas side and the pressure on the liquid side, at which a gas-liquid interface formed in the nozzle is able to be maintained, is defined as a withstand pressure Pn, the withstand pressure Pf is greater than the withstand pressure Pn, the control method of a liquid ejecting apparatus including executing, before the head unit is removed from the mounting portion, a pre-operation of forming the gas-liquid interface in the hole provided in the filter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a block diagram showing a schematic configuration of a liquid ejecting apparatus including a head unit which is an embodiment of the present disclosure.

[0008] FIG. **2** is a view showing a configuration around the head unit.

[0009] FIG. **3**A is a cross sectional view showing a detailed configuration of the liquid ejecting apparatus.

[0010] FIG. **3**B is a cross sectional view of main portions, which shows a detailed configuration of the head unit.

[0011] FIG. **4** is a flowchart showing an example of a control method of a liquid ejecting apparatus including a pre-operation.

[0012] FIG. **5**A is a cross sectional view showing a state where a gas has flowed into the head unit in the pre-operation.

[0013] FIG. **5**B is a cross sectional view showing a state where the gas has flowed into an upstream chamber of a filter chamber in the pre-operation.

[0014] FIG. **5**C is a cross sectional view showing a state where the gas has flowed into a downstream chamber of the filter chamber in the pre-operation.

[0015] FIG. **5**D is a cross sectional view showing an operation of maintenance.

[0016] FIG. **6**A is a cross sectional view showing a state where a gas is introduced into an upstream chamber of a filter chamber in a pre-operation in Embodiment 2.

[0017] FIG. **6**B is a cross sectional view showing a state where the gas is introduced into a downstream chamber of the filter chamber in the pre-operation in Embodiment 2.

[0018] FIG. **7** is a cross sectional view showing a liquid ejecting apparatus according to another embodiment in which a fluid flowing unit is partially changed.

[0019] FIG. **8** is a cross sectional view showing a liquid ejecting apparatus according to still another embodiment in which a fluid flowing unit and a head unit are partially changed.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0020] Hereinafter, the present disclosure will be described based on embodiments. The same members will be assigned with the same reference signs in each drawing, and redundant description will be omitted.

[0021] In addition, in each drawing, X, Y, and Z represent three spatial axes orthogonal to each other. In the present specification, directions along the axes are an X-axis direction, a Y-axis direction, and a Z-axis direction. When specifying directions, a positive/negative sign will be used together with direction notation with a positive direction written as "+", and a negative direction written as "–", and description will be made with a direction in which an arrow in each drawing is directed written as a +direction and an opposite direction of the arrow written as a –direction. In addition, a Z direction indicates a vertical direction, a +Z direction indicates a vertically downward direction, and a –Z direction indicates a vertically upward direction. Further, description will be made with the three spatial axes including X, Y, and Z, which do not limit a positive direction and a negative direction, as an X-axis, a Y-axis, and a Z-axis.

1. Embodiment 1

[0022] In the present embodiment, a liquid ejecting apparatus **500** is configured as an ink jet printer, and forms an image by ejecting an ink on printing paper P. The ink is an example of a liquid. Instead of the printing paper P, any type of medium such as a resin film and fabric may be used as an ink discharge target.

[0023] As shown in FIG. **1**, the liquid ejecting apparatus **500** includes a head unit **200**, a fluid flowing unit **20**, a transport mechanism **30**, a mounting portion **40**, a maintenance unit **50**, an input/output unit **80**, and a control unit **90**.

[0024] As shown in FIGS. **1** to **3**B, the head unit **200** has a flow path portion **211** and a liquid ejecting head **10**. As the head unit **200** is mounted on the mounting portion **40**, the flow path portion **211** is provided with a common flow path **224** through which an ink is supplied from a liquid flow path **24** of the fluid flowing unit **20**, which is to be described later, can be supplied to the liquid ejecting head **10** and a second common flow path **225** through which the ink to be discharged from the liquid ejecting head **10** is discharged to a fluid flow path **25**. The common flow path **224** has a common flow path side coupling portion **224**C that can communicate with a liquid flow path side coupling portion **24**C included in the liquid flow path **24**.

[0025] In the common flow path side coupling portion **224**C, an opening/closing valve that brings the common flow path **224** into a communication state with the liquid flow path **24** as the head unit **200** is mounted on the mounting portion **40**, and blocks communication with the outside of the common flow path side coupling portion **224**C as the head unit **200** is removed from the mounting portion **40** is provided. The second common flow path **225** has a second common flow path side coupling portion **225**C that can communicate with a fluid flow path side coupling portion **25**C included in the fluid flow path **25**. In the second common flow path side coupling portion **225**C, an opening/closing valve that brings the second common flow path **225** into a communication state with the fluid flow path **25** as the head unit **200** is mounted on the mounting portion **40**, and blocks communication with the outside of the second common flow path side coupling portion **225**C as the head unit **200** is removed from the mounting portion **40** is provided.

[0026] The liquid ejecting head **10** has a plurality of nozzles N ejecting an ink. The plurality of nozzles N form a nozzle row **12** by being arranged at equal intervals in one direction. In a state where the head unit **200** is attached to the mounting portion **40** to be described later, the nozzle row **12** follows the X-axis direction, a dimension between the nozzles N at both ends in the X-axis direction, among the plurality of nozzles N forming the nozzle row **12**, is longer than a width dimension of the printing paper P. The nozzle row **12** is an example of a nozzle group.

[0027] The head unit **200** of the present embodiment is a so-called line head that forms an image on the printing paper P by ejecting an ink in a +Z direction from the plurality of nozzles N configuring the nozzle row **12**. Although one color of a black ink is given as an example of the ejected ink in the head unit **200** of the present embodiment, four nozzle rows **12** may be provided at intervals in the Y-axis direction in the head unit **200**, and different inks, for example, in total, four colors of inks, such as black, cyan, magenta, and yellow may be ejected from each of the nozzle rows **12**.

[0028] The liquid ejecting head **10** in the present embodiment is configured by a plurality of liquid ejecting heads **10***a*, **10***b*, **10***c*, **10***d*, and **10***e*. The liquid ejecting head **10** has a nozzle surface **11**. The nozzle surface **11** is configured by nozzle surfaces **11***a*, **11***b*, **11***c*, **11***d*, and **11***e*. The liquid ejecting heads **10***a*, **10***b*, **10***c*, **10***d*, and **10***e* has the nozzle surfaces **11***a*, **11***b*, **11***c*, **11***d*, and **11***e*, respectively. Nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* formed by arranging the plurality of nozzles N in one direction are provided on the nozzle surfaces **11***a*, **11***b*, **11***c*, **11***d*, and **11***e*, respectively. The nozzle row **12** in the present embodiment is configured by the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e*. The nozzle row **12***a* is an example of a first nozzle group, the nozzle row **12***e* is an example of a second nozzle group, and the nozzle row **12***c* is an example of a third nozzle group.

[0029] Although the head unit **200** is formed by attaching the plurality of liquid ejecting heads **10***a*, **10***b*, **10***c*, **10***d*, and **10***e* to the flow path portion **211** such that the plurality of nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* form one nozzle row **12** in the present embodiment, the head unit **200** may be formed by attaching one liquid ejecting head **10** having one nozzle row **12** formed by the plurality of nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* to the flow path portion **211**. Alternatively, the head unit **200** may be in a form in which one liquid ejecting head **10** having one nozzle row **12** formed by the plurality of nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* integrally includes the flow path portion **211**.

[0030] The liquid ejecting head **10** has a filter chamber **17**. The filter chamber **17** includes a filter **16** that can filter an ink and an upstream chamber **17**U and a downstream chamber **17**D, which are partitioned by the filter **16**. A plurality of holes **16**H through which a fluid including the ink can pass are provided in the filter **16**. The upstream chamber **17**U is provided with a first filter flow path **18** that makes the upstream chamber **17**U communicate with the common flow path **224** and a second filter flow path **19** that makes the upstream chamber **17**U communicate with the second common flow path **225**. The filter chamber **17** includes a plurality of filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e*. In the present embodiment, the liquid ejecting head **10***a* has the filter chamber **17***a*, the liquid ejecting head **10***b* has the filter chamber **17***b*, the liquid ejecting head **10***c* has the filter chamber **17***c*, the liquid ejecting head **10***d* has the filter chamber **17***d*, and the liquid ejecting head **10***e* has the filter chamber **17***e*.

[0031] The filter chamber **17***a* is an example of a first filter chamber, the upstream chamber **17**U included in the filter chamber **17***a* is an example of a first upstream chamber, and the downstream chamber **17**D included in the filter chamber **17***a* is an example of a first downstream chamber. The filter chamber **17***e* is an example of a second filter chamber, the upstream chamber **17**U included in the filter chamber **17***e* is an example of a second upstream chamber, and the downstream chamber **17**D included in the filter chamber **17***e* is an example of a second downstream chamber. The filter chamber **17***c* is an example of a third filter chamber, the upstream chamber **17**U included in the filter chamber **17***c* is an example of a third upstream chamber, and the downstream chamber **17**D included in the filter chamber **17***c* is an example of a third downstream chamber.

[0032] For example, a mesh-shaped body, a porous body, and a perforated plate in which fine through-holes are formed can be used as the filter **16**. Examples of the mesh-shaped filter include wire mesh, resin mesh, a mesh filter, and metal fiber. Examples of the metal fiber filter include a felt filter obtained by making a stainless steel fine wire into a felt shape and a metal sintered filter obtained by compression-sintering a stainless steel fine wire. Examples of the perforated plate filter include an electroforming metal filter, an electron beam processed metal filter, and a laser beam processed metal filter.

[0033] The filter **16** is provided with the multiple holes **16**H through which a fluid can pass, and collects foreign substances. A filtration particle size indicating the size of the foreign substance that can be collected by the filter **16** is preferably smaller than a minimum dimension of the nozzle N, for example, the dimension of a nozzle opening of the nozzle N, which is open to the nozzle surface **11**. Accordingly, it can be difficult for foreign substances in an ink to reach the nozzles N. The minimum dimension of the nozzle opening is the diameter of the nozzle opening when the nozzle opening is a circle.

[0034] Herein, gas-liquid interfaces formed in the holes **16**H of the filter **16** in the present embodiment by the atmosphere and an ink and gas-liquid interfaces formed in the nozzles N included in the head unit **200** by the atmosphere and the ink will be compared to each other. When a pressure difference between a pressure on an ink side, at which the gas-liquid interfaces formed in the holes **16**H of the filter **16** can be maintained, and a pressure on an atmosphere side is defined as a withstand pressure Pf and a pressure difference between a pressure on the ink side, at which the gas-liquid interfaces formed in the nozzles N can be maintained, and a pressure on the atmosphere side is defined as a withstand pressure Pn, the withstand pressure Pf is greater than the withstand pressure Pn. That is, the specifications of the holes **16**H of the filter **16** in the present embodiment are set such that the withstand pressure Pf is greater than the withstand pressure Pn. The atmosphere is an example of a gas, and refers to the air of the earth. The withstand pressure Pf in the present embodiment is, for example, 5.5 kPa, and the withstand pressure Pn is, for example, 3.5 kPa.

[0035] In addition, when a maximum pressure among pressures of an ink in the head unit **200**, which are caused by a height difference between the plurality of nozzles N included in the head unit **200** and act on the gas-liquid interfaces formed in the nozzles N, is defined as a pressure Ph**1**, the specifications of the holes **16**H of the filter **16** are set such that the withstand pressure Pf is greater than the pressure Ph**1**. For example, when the posture of the head unit **200** is tilted with respect to a posture shown in FIGS. **1** to **3**A by removing the head unit **200** from the mounting portion **40**, a height difference between the plurality of nozzles N configuring the nozzle row **12** occurs. In this case, the pressure of an ink in the head unit **200** caused by the height difference between the plurality of nozzles N included in the head unit **200** acts on the gas-liquid interfaces formed in the nozzles N by the ink.

[0036] In the present embodiment, when the posture of the head unit **200** is in the Z-axis direction in which a direction in which the plurality of nozzles N configuring the nozzle row **12** are arranged is the vertical direction, the pressure of an ink in the head unit **200**, which acts on each of the nozzles N, is maximum. As shown in FIGS. **2** and **3**A, the plurality of nozzles N forming each of the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* configuring the nozzle row **12** included in the liquid ejecting head **10** will be referred to as nozzle #1, nozzle #2, nozzle #3, nozzle #4, nozzle #5, and nozzle #6 from a −X direction side in this order. That is, nozzle #1 is the nozzle N positioned in the most −X direction among the plurality of nozzles N forming a nozzle group, and nozzle #6 is the nozzle N positioned in the most +X direction among the plurality of nozzles N forming the nozzle group. Then, when the posture of the head unit **200** is in the Z-axis direction, in which the direction in which the plurality of nozzles N configuring the nozzle row **12** are arranged or a direction in which the plurality of liquid ejecting heads **10** are arranged is the vertical direction, the pressure of an ink in the head unit **200**, which acts on each of the nozzles N, is maximum.

[0037] At this time, in the nozzle row **12***a*, the nozzle N, on which the maximum pressure of the ink acts, is nozzle #1, and the pressure of the ink, which has a dimension Dha as a water head, acts thereon. When the posture of the head unit **200** is in the Z-axis direction in which the direction in which the plurality of nozzles N configuring the nozzle row **12** are arranged or the direction in which the plurality of liquid ejecting heads **10** are arranged is the vertical direction, the dimension Dha is a distance between nozzle #1 of the nozzle row **12***a* and nozzle #6 of the nozzle row **12***e* which is the farthest from nozzle #1 of the nozzle row **12***a* in the Z-axis direction, which is the vertical direction. In addition, in the nozzle row **12***b*, the nozzle N, on which the maximum pressure of the ink acts, is nozzle #1, and the pressure of the ink, which has a dimension Dhb as a water head, acts thereon. When the posture of the head unit **200** is in the Z-axis direction in which the direction in which the plurality of nozzles N configuring the nozzle row **12** are arranged or the direction in which the plurality of liquid ejecting heads **10** are arranged is the vertical direction, the dimension Dhb is a distance between nozzle #1 of the nozzle row **12***b* and nozzle #6 of the nozzle row **12***e* which is the farthest from nozzle #1 of the nozzle row **12***b* in the Z-axis direction, which is the vertical direction. In addition, in the nozzle row **12***c*, the nozzles N, on which the maximum pressure of the ink acts, are nozzle #1 and nozzle #6, and the pressure of the ink, which has a dimension Dhc as a water head, acts thereon. When the posture of the head unit **200** is in the Z-axis direction in which the direction in which the plurality of nozzles N configuring the nozzle row **12** are arranged or the direction in which the plurality of liquid ejecting heads **10** are arranged is the vertical direction, the dimension Dhc is a distance between nozzle #1 of the nozzle row **12***c* and nozzle #6 of the nozzle row **12***e* which is the farthest from nozzle #1 of the nozzle row **12***c* in the Z-axis direction, which is the vertical direction. In addition, when the posture of the head unit **200** is in the Z-axis direction in which the direction in which the plurality of nozzles N configuring the nozzle row **12** are arranged or the direction in which the plurality of liquid ejecting heads **10** are arranged is the vertical direction, the dimension Dhc is a distance between nozzle #6 of the nozzle row **12***c* and nozzle #1 of the nozzle row **12***a* which is the farthest from nozzle #6 of the nozzle row **12***c* in the Z-axis direction, which is the vertical direction. In addition, in the nozzle row **12***d*, the nozzle N, on which the maximum pressure of the ink acts, is nozzle #6, and the pressure of the ink, which has a dimension Dhb as a water head, acts thereon. When the posture of the head unit **200** is in the Z-axis direction in which the direction in which the plurality of nozzles N configuring the nozzle row **12** are arranged or the direction in which the plurality of liquid ejecting heads **10** are arranged is the vertical direction, the dimension Dhb is a distance between nozzle #6 of the nozzle row **12***d* and nozzle #1 of the nozzle row **12***a* which is the farthest from nozzle #6 of the nozzle row **12***d* in the Z-axis direction, which is the vertical direction. In addition, in the nozzle row **12***e*, the nozzle N, on which the maximum pressure of the ink acts, is nozzle #6, and the pressure of the ink, which has the dimension Dha as a water head, acts thereon. When the posture of the head unit **200** is in the Z-axis direction in which the direction in which the plurality of nozzles N configuring the nozzle row **12** are arranged or the direction in which the plurality of liquid ejecting heads **10** are arranged is the vertical direction, the dimension Dha is a distance between nozzle #6 of the nozzle row **12***e* and nozzle #1 of the nozzle row **12***a* which is the farthest from nozzle #6 of the nozzle row **12***e* in the Z-axis direction, which is the vertical direction.

[0038] Accordingly, in the present embodiment, the maximum pressure of an ink in the head unit **200**, which is caused by the posture of the head unit **200** and acts on gas-liquid interfaces formed in the nozzles N, is the pressure of the ink, which has the dimension Dha as a water head. Therefore, in the present embodiment, the withstand pressure Pn, which is a pressure difference between the pressure on the ink side, at which the gas-liquid interfaces formed in the nozzles N can be maintained, and the pressure on the atmosphere side, is smaller than the pressure Ph**1** of the ink, which has the dimension Dha as a water head. In addition, the withstand pressure Pn in the present embodiment is smaller than the pressure of an ink, which has the dimension Dhb as a water head, and is greater than the pressures of inks, which have the dimensions Dhc, Dhd, and Dhg shown in FIGS. **2** and **3**A as water heads. In the present embodiment, when Dhg is set to 0.09 m, Dhd is set to 0.19 m, Dhc is set to 0.29 m, Dhb is set to 0.4 m, Dha is set to 0.5 m, and the specific weight of the ink is set to 10 kN/m^3, the pressure of the ink, which has the dimension Dhg as a water head, is 0.9 kPa, the pressure of the ink, which has the dimension Dhd as a water head, is 1.9 kPa, the pressure of the ink, which has the dimension Dhc as a water head, is 2.9 kPa, the pressure of the ink, which has the dimension Dhb as a water head, is 4 kPa, and the pressure of the ink, which has the dimension Dha as a water head, is 5 kPa. That is, in the present embodiment, the pressure Ph**1** is 5 kPa.

[0039] When the mesh filter is adopted as the filter **16**, the mesh filter can be a twill weave filter. As the mesh filter formed by weaving stainless steel wires, mesh that is a gap between the wires is provided. In this case, the mesh, which is the gap between the wires, is called the holes **16**H.

[0040] When the perforated plate filter is adopted as the filter **16**, the minimum dimension of the hole **16**H is preferably smaller than the minimum dimension of the nozzle opening. The multiple holes **16**H penetrating the stainless steel plate are formed in the perforated plate filter. The minimum dimension of the hole **16**H is the diameter (inner diameter) of the hole **16**H when the hole **16**H is a circle. The shape of the hole **16**H is not limited to a circle, and may be a polygon, such as a square and a hexagon, and an ellipse.

[0041] As shown in FIG. **3**B, the liquid ejecting head **10** has a common liquid chamber **13**. The common liquid chamber **13** communicates with the filter chamber **17**. Each of the liquid ejecting heads **10***a*, **10***b*, **10***c*, **10***d*, and **10***e* has the common liquid chamber **13**. In the present embodiment, the common liquid chamber **13** included in the liquid ejecting head **10***a* communicates with the filter chamber **17***a*, the common liquid chamber **13** included in the liquid ejecting head **10***b* communicates with the filter chamber **17***b*, the common liquid chamber **13** included in the liquid ejecting head **10***c* communicates with the filter chamber **17***c*, the common liquid chamber **13** included in the liquid ejecting head **10***d* communicates with the filter chamber **17***d*, and the common liquid chamber **13** included in the liquid ejecting head **10***e* communicates with the filter chamber **17***e*.

[0042] The liquid ejecting head **10** has, in a manner corresponding to the plurality of nozzles N, a plurality of individual liquid chambers **15** each of which communicates with one nozzle N and a plurality of individual communication paths **14** each of which communicates with one individual liquid chamber **15**. A discharge element ACT that can eject, as liquid droplets, an ink in the individual liquid chamber **15** from the nozzle N as being driven is provided in the individual liquid chamber **15**. The discharge element ACT of the present embodiment is configured by a piezoelectric element that contracts when a drive voltage is applied. By applying and releasing the application of the drive voltage to the piezoelectric element, the ink in the individual liquid chamber **15**, of which a volume is changed, is ejected from the nozzle N as liquid droplets.

[0043] As shown in FIG. **3**A, in the present embodiment, the individual liquid chamber **15** communicating with the nozzle N included in the liquid ejecting head **10***a* communicates with the common liquid chamber **13** included in the liquid ejecting head **10***a* via the individual communication path **14**. The individual liquid chamber **15** communicating with the nozzle N included in the liquid ejecting head **10***b* communicates with the common liquid chamber **13** included in the liquid ejecting head **10***b* via the individual communication path **14**. The individual liquid chamber **15** communicating with the nozzle N included in the liquid ejecting head **10***c* communicates with the common liquid chamber **13** included in the liquid ejecting head **10***c* via the individual communication path **14**. The individual liquid chamber **15** communicating with the nozzle N included in the liquid ejecting head **10***d* communicates with the common liquid chamber **13** included in the liquid ejecting head **10***d* via the individual communication path **14**. The individual liquid chamber **15** communicating with the nozzle N included in the liquid ejecting head **10**_e_ communicates with the common liquid chamber **13** included in the liquid ejecting head **10**_e_ via the individual communication path **14**.

[0044] For this reason, in the present embodiment, the nozzles N configuring one nozzle row, among the nozzle rows **12**_a_, **12**_b_, **12**_c_, **12**_d_, and **12**_e_, and the nozzles N configuring another nozzle row communicate with each other via at least one filter **16**. For example, nozzle #1 to nozzle #6 configuring the nozzle row **12**_a_ and nozzle #1 to nozzle #6 configuring the nozzle row **12**_e_ communicate with each other via the filter **16** of the filter chamber **17**_a_ and the filter **16** of the filter chamber **17**_e_. In addition, for example, nozzle #1 to nozzle #6 configuring the nozzle row **12**_c_ and nozzle #1 to nozzle #6 configuring the nozzle row **12**_a_ communicate with each other via the filter **16** of the filter chamber **17**_c_ and the filter **16** of the filter chamber **17**_a_. In addition, for example, nozzle #1 to nozzle #6 configuring the nozzle row **12**_c_ and nozzle #1 to nozzle #6 configuring the nozzle row **12**_e_ communicate with each other via the filter **16** of the filter chamber **17**_c_ and the filter **16** of the filter chamber **17**_e_.

[0045] As shown in FIGS. **1** to **3**A, the fluid flowing unit **20** has a coupling flow path **22**, a liquid storage unit **23**, the liquid flow path **24**, the fluid flow path **25**, and an atmospheric passage **26**. An ink in a liquid accommodating portion **21** can be supplied to the liquid storage unit **23** through the coupling flow path **22** by attaching the liquid accommodating portion **21**. The liquid storage unit **23** stores the ink supplied from the liquid accommodating portion **21**. An atmosphere opening hole **23**AH is provided in an upper surface of the liquid storage unit **23**. An internal space where the liquid storage unit **23** stores the ink communicates with the atmosphere, which is an external space, through the atmosphere opening hole **23**AH. A liquid level of the ink stored in the liquid storage unit **23** is adjusted to a position in the +Z direction with respect to the nozzle surface **11** of the head unit **200**.

[0046] By coupling the liquid flow path **24** to the common flow path **224** of the head unit **200**, the upstream chamber **17**U of the filter chamber **17** and the liquid storage unit **23** can communicate with each other. The liquid flow path **24** is an example of a first passage through which the upstream chamber **17**U and the liquid storage unit **23** can communicate with each other. The liquid flow path **24** and the liquid storage unit **23** are coupled to each other on a side surface of the liquid storage unit **23**. A position where the liquid flow path **24** is coupled to the liquid storage unit **23** is positioned in the +Z direction with respect to the atmosphere opening hole **23**AH of the liquid storage unit **23**. The liquid flow path **24** is provided with a first pump **24**P, a first opening/closing valve **24**V, and the liquid flow path side coupling portion **24**C described above. The first pump **24**P can flow an ink between the liquid storage unit **23** and the head unit **200**, and for example, an ink in the liquid flow path **24** flows in a supply direction indicated as a direction of an arrow of FIG. **3**A by driving the first pump **24**P. The first opening/closing valve **24**V can switch between an open state where flow of the ink in the liquid flow path **24** is allowed and a closed state where the flow of the ink is blocked.

[0047] By coupling the fluid flow path **25** to the second common flow path **225** of the head unit **200**, the liquid storage unit **23** and the upstream chamber **17**U of the filter chamber **17** can communicate with each other. The fluid flow path **25** is an example of a second passage through which the liquid storage unit **23** and the upstream chamber **17**U can communicate with each other. The fluid flow path **25** and the liquid storage unit **23** are coupled to each other on the side surface of the liquid storage unit **23**. A position where the fluid flow path **25** is coupled to the liquid storage unit **23** is positioned in the +Z direction with respect to the atmosphere opening hole **23**AH of the liquid storage unit **23**, and is positioned in the −Z direction with respect to the position where the liquid flow path **24** is coupled to the liquid storage unit **23**. The fluid flow path **25** is provided with a second pump **25**P, a switching valve **27**, and the fluid flow path side coupling portion **25**C described above. The second pump **25**P can flow a fluid between the liquid storage unit **23** and the head unit **200**, and for example, an ink in the fluid flow path **25** flows in a return direction indicated as a direction of an arrow of FIG. **3**A by driving the second pump **25**P. The second pump **25**P is an example of an introduction pump.

[0048] In the fluid flow path **25**, the switching valve **27** is provided at a position closer to the liquid storage unit **23** than the second pump **25**P is. That is, in the fluid flow path **25**, the switching valve **27** is disposed between the second pump **25**P and the liquid storage unit **23**. The atmospheric passage **26** is coupled to the fluid flow path **25** via the switching valve **27**. The atmospheric passage **26** is an example of a gas introduction unit through which a gas can be introduced into the filter chamber **17** of the liquid ejecting head **10** by making the fluid flow path **25** communicate with the atmosphere. By driving the switching valve **27**, the state of the fluid flow path **25** can be switched between an open state where the fluid flow path **25** and the liquid storage unit **23** communicate with each other, a closed state where flow of a fluid in the fluid flow path **25** is blocked, and a communication state where the fluid flow path **25** and the atmospheric passage **26** communicate with each other. Since the fluid flow path **25** and the atmospheric passage **26** do not communicate with each other in the open state and the closed state, the open state and the closed state are non-communication states where the fluid flow path **25** and the atmospheric passage **26** do not communicate with each other. In other words, the switching valve **27** can switch between the communication state where the fluid flow path **25** and the atmospheric passage **26** communicate with each other and the non-communication states where the fluid flow path **25** and the atmospheric passage **26** do not communicate with each other.

[0049] The transport mechanism **30** transports the printing paper P in a transport direction. As shown in FIG. **1**, the transport direction in the present embodiment is a +Y direction and a −Y direction. The transport mechanism **30** includes a transport rod **34**, on which three transport rollers **32** are mounted, and a transport motor **36** rotationally driving the transport rod **34**. As the transport motor **36** rotationally drives the transport rod **34**, the plurality of transport rollers **32** rotate and the printing paper P is transported in the +Y direction that is the transport direction. The number of transport rollers **32** is not limited to three, and may be any number. In addition, a configuration where a plurality of transport mechanisms **30** are included may be adopted.

[0050] As shown in FIGS. **1** to **3**A, the head unit **200** is detachably mounted on the mounting portion **40**. An attaching/detaching direction in the present embodiment is the X-axis direction, a direction in which the head unit **200** is mounted on the mounting portion **40** is the –X direction, and a direction in which the head unit **200** is removed from the mounting portion **40** is the +X direction. As the head unit **200** is mounted on the mounting portion **40**, the common flow path **224** of the head unit **200** communicates with the liquid flow path **24**, and the second common flow path **225** communicates with the fluid flow path **25**. In addition, as the head unit **200** is mounted on the mounting portion **40**, the head unit **200** and a main body side are electrically coupled to each other, and it becomes possible to eject an ink from the nozzles N under drive-control of the discharge element ACT by the control unit **90** to be described later.

[0051] The maintenance unit **50** maintains the head unit **200**. The maintenance unit **50** has a maintenance unit holding portion **51**, a maintenance unit drive unit **52**, a cap **61**, a cap valve **62**, a suction pump **63**, a waste liquid tube **64**, a waste liquid collecting unit **66**, and a wiper **71**.

[0052] The cap **61** maintains the head unit **200** by discharging an ink from the nozzles N of the head unit **200**. By coming into contact with the nozzle surface **11** of the head unit **200**, the cap **61** forms a suction space where the plurality of nozzles N are open. The cap **61** is held by the maintenance unit holding portion **51**. By driving the maintenance unit drive unit **52**, the maintenance unit holding portion **51** holding the cap **61** moves in any one of the Y-axis direction and the Z-axis direction. By driving the maintenance unit drive unit **52**, the cap **61** moves to a non-capping position where the cap is not in contact with the nozzle surface **11** and a suctionable position where the cap is in contact with the nozzle surface **11**.

[0053] The cap **61**, via the waste liquid tube **64**, communicates with the waste liquid collecting unit **66** collecting a waste liquid. The waste liquid tube **64** is provided with the suction pump **63** for sucking the suction space where the cap **61** is formed. In addition, at a position between the cap **61** and the suction pump **63** in the waste liquid tube **64**, the cap valve **62** that can switch a coupling state between the cap **61** and the suction pump **63** between an open state where the cap **61** and the suction pump **63** communicate with each other and a closed state where the cap **61** and the suction pump **63** do not communicate with each other is provided.

[0054] The cap **61** includes a cap **61***a* that can form a suction space where the plurality of nozzles N of the nozzle row **12***a* are open by coming into contact with the nozzle surface **11***a* included in the head unit **200**, a cap **61***b* that can form a suction space where the plurality of nozzles N of the nozzle row **12***b* are open by coming into contact with the nozzle surface lib, a cap **61***c* that can form a suction space where the plurality of nozzles N of the nozzle row **12***c* are open by coming into contact with the nozzle surface **11***c*, a cap **61***d* that can form a suction space where the plurality of nozzles N of the nozzle row **12***d* are open by coming into contact with the nozzle surface **11***d*, and a cap **61***e* that can form a suction space where the plurality of nozzles N of the nozzle row **12***e* are open by coming into contact with the nozzle surface **11***e*.

[0055] The cap valve **62** includes a cap valve **62***a* that can switch a coupling state between the cap **61***a* and the suction pump **63**, a cap valve **62***b* that can switch a coupling state between the cap **61***b* and the suction pump **63**, a cap valve **62***c* that can switch a coupling state between the cap **61***c* and the suction pump **63**, a cap valve **62***d* that can switch a coupling state between the cap **61***d* and the suction pump **63**, and a cap valve **62***e* that can switch a coupling state between the cap **61***e* and the suction pump **63**.

[0056] The cap **61** of the present embodiment maintains the head unit **200** by discharging an ink from the plurality of nozzles N configuring any one of the plurality of nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e*. For example, when maintaining the nozzle row **12***a*, the plurality of suction spaces where the plurality of nozzles N configuring each of the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* are open are formed by moving the caps **61***a*, **61***b*, **61***c*, **61***d*, and **61***e* to the suctionable position.

[0057] Then, by bringing the cap valve **62***a* into the open state, bringing the other cap valves **62***b*, **62***c*, **62***d*, and **62***e* into the closed state, and driving the suction pump **63**, an ink is discharged from the plurality of nozzles N configuring the nozzle row **12***a* to the suction space. The ink discharged to the suction space is collected in the waste liquid collecting unit **66** via the waste liquid tube **64**. In addition, when maintaining the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e*, by bringing the cap valves **62***a*, **62***b*, **62***c*, **62***d*, and **62***e* into the open state and driving the suction pump **63**, an ink is discharged from the plurality of nozzles N configuring the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* to the suction spaces.

[0058] The wiper **71** maintains the head unit **200** by wiping the nozzle surface **11** of the head unit **200**. The wiper **71** is held by the maintenance unit holding portion **51**. By driving the maintenance unit drive unit **52**, the wiper **71** moves, in the Z-axis direction, between a standby position where the wiper is not in contact with the nozzle surface **11** and a wiping position where the wiper is in contact with the nozzle surface **11**. In the present embodiment, by driving the maintenance unit drive unit **52** in a state where the wiper **71** is at the wiping position, the maintenance unit holding portion **51** holding the wiper **71** is moved in the Y-axis direction, wiping the nozzle surfaces **11***a*, **11***b*, **11***c*, **11***d*, and **11***e* configuring the nozzle surface **11**.

[0059] The input/output unit **80** has a display unit **81** and an operation unit **82**. The display unit **81** is an example of a notification unit issuing notification on guidance display of an operation of the liquid ejecting apparatus **500** and information related to the liquid ejecting apparatus **500**. A user can perform various types of operations on the liquid ejecting apparatus **500** by operating the operation unit **82** while referring to content displayed on the display unit **81**. The operation unit **82** may not be provided when the display unit **81** is configured by a liquid crystal display module having a touch panel function and has a function as an operation unit performing various types of settings on the liquid ejecting apparatus **500**.

[0060] The control unit **90** controls the entire liquid ejecting apparatus **500**. For example, the control unit **90** controls an operation of flowing a fluid between the liquid storage unit **23** and the head unit **200** by the fluid flowing unit **20**, an operation of transporting the printing paper P along the transport direction, an operation of ejecting an ink from the nozzles N of the head unit **200**, an operation of maintenance of the head unit **200** by the maintenance unit **50**, and control of the liquid ejecting apparatus **500** and issuance of notification to the user based on a user instruction through the input/output unit **80**. The control unit **90** may be configured, for example, by a processing circuit, such as a central processing unit (CPU) and a field programmable gate array (FPGA), and a memory circuit such as a semiconductor memory.

[0061] The head unit **200** of the present embodiment is detachably provided on the mounting portion **40**. For example, when the posture of the head unit **200** is tilted with respect to the posture shown in FIGS. **1** to **3**A by removing the head unit **200** from the mounting portion **40**, a height difference between the plurality of nozzles N configuring the nozzle row **12** occurs. In this case, the pressure of an ink in the head unit **200** caused by the height difference between the plurality of nozzles N acts on gas-liquid interfaces formed in the nozzles N by the ink. When the pressure of the ink in the head unit **200**, which acts on the gas-liquid interfaces formed in the nozzles N by the ink, is greater than the withstand pressure Pn that is a pressure difference between a pressure on the ink side, at which the gas-liquid interfaces formed in the nozzles N can be maintained, and a pressure on the atmosphere side, there is a possibility that the gas-liquid interfaces formed in the nozzles N are broken and an ink leakage from the nozzles N occurs.

[0062] In the head unit **200** of the present embodiment, the nozzles N configuring one nozzle row, among the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e*, and the nozzles N configuring another nozzle row communicate with each other via at least one filter **16**. In addition, when a pressure difference between a pressure on the ink side, at which gas-liquid interfaces formed in the holes **16**H of the filter **16** can be maintained, and a pressure on the atmosphere side is defined as the withstand pressure Pf, the withstand pressure Pf is greater than the withstand pressure Pn. That is, the specifications of the holes **16**H of the filter **16** in the present embodiment are set such that the withstand pressure Pf is greater than the withstand pressure Pn.

[0063] Accordingly, when the pressure of an ink in the head unit **200**, which is caused by a height difference between the plurality of nozzles N, acts on gas-liquid interfaces formed in the nozzles N, an ink leakage from the nozzles N can be prevented by forming the gas-liquid interfaces in the holes **16**H of the filter **16** in the head unit **200** of the present embodiment. In addition, since the gas-liquid interfaces can be formed in the holes **16**H of the filter **16** by replacing an ink in the filter chamber **17** with the atmosphere, pre-operation time reduction, wasteful ink reduction, and reduction of usage of the waste liquid collecting unit **66** are achieved, for example, compared to a case where the ink in the head unit **200** is completely discharged in a pre-operation executed before the head unit **200** is removed.

[0064] Thus, the control unit **90** drive-controls, before the head unit **200** is removed from the mounting portion **40**, the switching valve **27** such that the atmosphere can be introduced into the filter chamber **17**, and executes the pre-operation of forming gas-liquid interfaces in the holes **16**H of the filter **16** by introducing the atmosphere into the filter chamber **17**. Herein, with reference to a flowchart shown in FIG. **4**, flow of processing executed when the control unit **90** performs control including the pre-operation in the present embodiment will be described. In the present embodiment, the flow of the processing executed when the control unit **90** performs control including the pre-operation corresponds to a control method of the liquid ejecting apparatus **500**.

[0065] When the user performs, on the input/output unit **80**, an operation for removing the head unit **200**, the control unit **90** determines, in Step S**11**, whether or not the head unit **200** is filled with an ink. When the head unit **200** is not filled with the ink in Step S**11**, it is NO in Step S**11**. When it is NO in Step S**11**, the control unit **90** takes the processing to Step S**15**, and displays, on the display unit **81**, a message that the head unit **200** can be removed. When the processing of Step S**15** is executed, the control unit **90** terminates the processing executed when control including the pre-operation is performed.

[0066] When the head unit **200** is filled with the ink in Step S**11**, it is YES in Step S**11**. The control unit **90** takes the processing to Step S**12**. In Step S**12**, the control unit **90** displays, on the display unit **81**, a message that removal of the head unit **200** is under preparation.

[0067] In Step S**13**, the control unit **90** executes the pre-operation. In the pre-operation, the control unit **90** drive-controls the switching valve **27**, bringing the switching valve **27** into the communication state. Accordingly, the fluid flow path **25** communicates with the atmospheric passage **26**, and it becomes a state where the atmosphere from the atmospheric passage **26** can be introduced into the filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e* via the fluid flow path **25**, the second common flow path **225**, and the second filter flow path **19**. In the communication state, the control unit **90** brings the first opening/closing valve **24**V into the open state, and drive-controls the second pump **25**P and the first pump **24**P such that flows of a fluid in the atmospheric passage **26**, the fluid flow path **25**, and the liquid flow path **24** are in directions of arrows of FIG. **5**A. Accordingly, as shown in FIG. **5**A, the atmosphere flows into the fluid flow path **25**, the second common flow path **225**, and each second filter flow path **19** via the atmospheric passage **26**.

[0068] An ink in the fluid flow path **25**, the second common flow path **225**, and each second filter flow path **19** flows in each first filter flow path **18**, the common flow path **224**, and the liquid flow path **24** toward the liquid storage unit **23** via the filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e*. In consideration of a possibility that the ink drops from the nozzles N during the execution of the pre-operation, the control unit **90** may drive-control the maintenance unit drive unit **52**, and move the cap **61** to the suctionable position as shown in FIG. **5**A before drive-controlling the switching valve **27**.

[0069] When the second pump **25**P and the first pump **24**P are continued to be further driven from the state shown in FIG. **5**A, the atmosphere flows into the upstream chambers **17**U of the filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e*, and an ink in each upstream chamber **17**U is replaced with the atmosphere as shown in FIG. **5**B. Accordingly, a gas-liquid interface is formed on each upstream chamber **17**U side of each of holes **16**H of the filters **16** in the filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e*. As the atmosphere flows into each upstream chamber **17**U, an ink in each upstream chamber **17**U, each first filter flow path **18**, and the common flow path **224** flows toward the liquid storage unit **23**.

[0070] When an ink in the upstream chamber **17**U is replaced with the atmosphere, the control unit **90** may control the driving of the second pump **25**P such that the inside of the upstream chamber **17**U has a higher pressure than the atmospheric pressure. For example, the control unit **90** may control the driving of the second pump **25**P such that the flow rate of a fluid depending on the second pump **25**P is higher than the flow rate of a fluid depending on the driving of the first pump **24**P. In addition, at this time, the control unit **90** may control the driving of the second pump **25**P such that a pressure in the upstream chamber **17**U is higher than a pressure in the downstream chamber **17**D and a difference between the pressure in the upstream chamber **17**U and the pressure in the downstream chamber **17**D is greater than the withstand pressure Pf.

[0071] The control unit **90** may terminate the pre-operation once gas-liquid interfaces are formed on the upstream chamber **17**U side of the holes **16**H in the filter **16**, but in the present embodiment, the atmosphere is flowed also into the downstream chamber **17**D of the filter chamber **17** in the pre-operation. When the control unit **90** continues to further drive the second pump **25**P and the first pump **24**P, the atmosphere flows into the downstream chambers **17**D of the filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e*, and an ink in each downstream chamber **17**D is replaced with the atmosphere as shown in FIG. **5**C. At this time, an ink in the holes **16**H of each filter **16** stays in the holes **16**H without being replaced with the atmosphere, and gas-liquid interfaces are formed on both sides including the upstream chamber **17**U side and a downstream chamber **17**D side by the ink staying in the holes **16**H.

[0072] When it is difficult for the atmosphere to flow into the downstream chamber **17**D, for example, the control unit **90** may control the driving of the second pump **25**P such that a pressure in the upstream chamber **17**U is higher than a pressure in the downstream chamber **17**D and a difference between the pressure in the upstream chamber **17**U and the pressure in the downstream chamber **17**D is greater than the withstand pressure Pf. At this time, even when some of the ink in the head unit **200** drops from the nozzles N, the ink can be collected by the cap **61** by moving the cap **61** to the suctionable position as shown in FIG. **5**C.

[0073] When the pre-operation is terminated in Step S**13**, the control unit **90** takes the processing to Step S**14**. In Step S**14**, the control unit **90** executes the operation of maintenance. As the operation of maintenance, the control unit **90** wipes the nozzle surfaces **11***a*, **11***b*, **11***c*, **11***d*, and **11***e* configuring the nozzle surface **11** by drive-controlling the maintenance unit drive unit **52** and moving the maintenance unit holding portion **51** holding the wiper **71** in the Y-axis direction as shown in FIG. **5**D. In addition, in the present embodiment, as shown in FIG. **5**D, an ink is accommodated in the head unit **200** even after executing the pre-operation. In this case, after the wiping, the control unit **90** may perform flushing of straightening out the state of the ink in the nozzles N by driving the discharge elements ACT and discharging the ink from the nozzles N.

[0074] When the operation of maintenance is terminated in Step S**14**, the control unit **90** takes the processing to Step S**15**. In Step S**15**, the control unit **90** displays, on the display unit **81**, a message that the head unit **200** can be removed. When the processing of Step S**15** is executed, the control unit **90** terminates the processing executed when control including the pre-operation is performed.

[0075] As described hereinbefore, with the liquid ejecting apparatus **500** and the control method of the liquid ejecting apparatus **500** according to Embodiment 1, the following effects can be obtained.

[0076] The liquid ejecting apparatus **500** includes the head unit **200** having the plurality of nozzles N ejecting an ink, the head unit **200** including the filter **16** provided with the holes **16**H through which the ink can pass, the filter chamber **17***a* including the upstream chamber **17**U and the downstream chamber **17**D, which are partitioned by the filter **16**, the nozzle row **12***a* formed by the plurality of nozzles N, and the nozzle row **12***e* formed by the plurality of nozzles N, the mounting portion **40** on which the head unit **200** is detachably mounted, the switching valve **27** that can make the atmosphere introduced into the filter chamber **17***a*, and the control unit **90**. The nozzles N forming the nozzle row **12***e* communicate with the nozzles N forming the nozzle row **12***a* via the filter **16** of the filter chamber **17***a*. When a pressure difference between a pressure on the atmosphere side and a pressure on the ink side, at which gas-liquid interfaces formed in the holes **16**H of the filter **16** can be maintained, is defined as the withstand pressure Pf and a pressure difference between the pressure on the atmosphere side and the pressure on the ink side, at which gas-liquid interfaces formed in the nozzles N can be maintained, is defined as the withstand pressure Pn, the withstand pressure Pf is greater than the withstand pressure Pn. The control unit **90** executes, before the head unit **200** is removed from the mounting portion **40**, the pre-operation of forming the gas-liquid interfaces in the holes **16**H provided in the filter **16** by controlling the switching valve **27** and introducing the atmosphere into the filter chamber **17***a*.

[0077] The posture of the head unit **200** changes due to the removal of the head unit **200**, and the pressure of an ink in the head unit **200**, which is caused by a height difference between the plurality of nozzles N occurring due to the change in the posture of the head unit **200**, acts on gas-liquid interfaces formed in the nozzles N. In this case, since the nozzles N forming the nozzle row **12***e* communicate, with the nozzles N forming the nozzle row **12***a* via the filter **16** of the filter chamber **17***a*, an ink leakage from the nozzles N can be prevented by the withstand pressure Pf of the gas-liquid interfaces formed in the holes **16**H of the filter **16**.

[0078] When a maximum pressure among pressures of an ink in the head unit **200**, which are caused by a height difference between the plurality of nozzles N included in the head unit **200** and act on gas-liquid interfaces formed in the nozzles N, is defined as the pressure Ph**1**, the withstand pressure Pf is greater than the pressure Ph**1**. An ink leakage from the nozzles N, which is caused by a change in the posture of the head unit **200** due to the withstand pressure Pf of the gas-liquid interfaces formed in the holes **16**H of the filter **16**, can be prevented.

[0079] The liquid ejecting apparatus **500** includes the liquid storage unit **23** storing an ink, the liquid flow path **24** that can make the upstream chamber **17**U and the liquid storage unit **23** communicate with each other, the fluid flow path **25** that can make the liquid storage unit **23** and the upstream chamber **17**U communicate with each other, the atmospheric passage **26** communicating with the fluid flow path **25**, the switching valve **27** that can switch, as the gas introduction unit, the atmospheric passage **26** between the communication state where the atmospheric passage communicates with the fluid flow path **25** and the non-communication state where the atmospheric passage does not communicate with the fluid flow path **25**, and the second pump **25**P provided in the fluid flow path **25**. The control unit **90** controls the switching valve **27** such that the switching valve is brought into the communication state, drives the second pump **25**P such that the atmosphere is introduced from the atmospheric passage **26** to the upstream chamber **17**U via the fluid flow path **25**, and executes the pre-operation of forming gas-liquid interfaces in the holes **16**H of the filter **16** by returning an ink in the upstream chamber **17**U to the liquid storage unit **23** via the liquid flow path **24**. According to this, it is easy to form the gas-liquid interfaces in the holes **16**H of the filter **16**.

[0080] The control unit **90** may drive the second pump **25**P such that a pressure in the upstream chamber **17**U is higher than a pressure in the downstream chamber **17**D and a pressure difference between the pressure in the upstream chamber **17**U and the pressure in the downstream chamber **17**D is greater than the withstand pressure Pf. According to this, it is easier to form gas-liquid interfaces in the holes **16**H of the filter **16**.

[0081] The head unit **200** has the filter **16**, the filter chamber **17***e* including the upstream chamber **17**U and the downstream chamber **17**D, which are partitioned by the filter **16**, and the common flow path **224** communicating with the upstream chamber **17**U of the filter chamber **17***a* and the upstream chamber **17**U of the filter chamber **17***e*. The plurality of nozzles N forming the nozzle row **12***a* and the plurality of nozzles N forming the nozzle row **12***e* eject an ink supplied via the common flow path **224**. The nozzles N forming the nozzle row **12***e* communicate with the nozzles N forming the nozzle row **12***a* via the filter **16** of the filter chamber **17***e*, the common flow path **224**, and the filter **16** of the filter chamber **17***a*. The switching valve **27** can make the atmosphere introduced into the filter chamber **17***a* and the filter chamber **17***e*. The control unit **90** forms gas-liquid interfaces in the holes **16**H provided in the filter **16** of the filter chamber **17***a* and the holes **16**H provided in the filter **16** of the filter chamber **17***e* by introducing the atmosphere into the filter chamber **17***a* and the filter chamber **17***e* in the pre-operation.

[0082] According to this, since the nozzles N forming the nozzle row **12***e* communicate with the nozzles N forming the nozzle row **12***a* via the filter **16** of the filter chamber **17***e* and the filter **16** of the filter chamber **17***a*, an ink leakage from the nozzles N can be further prevented by the withstand pressure Pf of gas-liquid interfaces formed in the holes **16**H of the filter **16**.

[0083] The control method of the liquid ejecting apparatus **500** including the head unit **200** having the plurality of nozzles N ejecting an ink, the head unit **200** including the filter **16** provided with the holes **16**H through which the ink can pass, the nozzle row **12***a* formed by the plurality of nozzles N, and the nozzle row **12***e* formed by the plurality of nozzles N and the mounting portion **40** on which the head unit **200** is detachably mounted, in which the nozzles N forming the nozzle row **12***e* communicate with the nozzles N forming the nozzle row **12***a* via the filter **16**, and when a pressure difference between a pressure on the atmosphere side and a pressure on the ink side, at which gas-liquid interfaces formed in the holes **16**H of the filter **16** can be maintained, is defined as the withstand pressure Pf and a pressure difference between the pressure on the atmosphere side and the pressure of an ink, at which gas-liquid interfaces formed in the nozzles N can be maintained, is defined as the withstand pressure Pn, the withstand pressure Pf is greater than the withstand pressure Pn. The control method of the liquid ejecting apparatus **500** includes executing, before the head unit **200** is removed from the mounting portion **40**, the pre-operation of forming the gas-liquid interfaces in the holes **16**H provided in the filter **16**.

[0084] According to this, when the pressure of an ink in the head unit **200**, which is caused by a change in the posture of the head unit **200** due to the removal of the head unit **200**, acts on the gas-liquid interfaces formed in the nozzles N, an ink leakage from the nozzles N can be prevented.

2. Embodiment 2

[0085] Next, the liquid ejecting apparatus **500** and the control method of the liquid ejecting apparatus **500** of Embodiment 2, which is an embodiment of the present disclosure, will be described. Portions common to the liquid ejecting apparatus **500** and the control method of the liquid ejecting apparatus **500** of Embodiment 1 will be assigned with the same reference signs, and description thereof will be omitted.

[0086] The specifications of the liquid ejecting apparatus **500** and the head unit **200** of the present embodiment are the same as the liquid ejecting apparatus **500** and the head unit **200** of Embodiment 1. Accordingly, caused by the posture of the head unit **200**, the pressure of an ink, which acts on the nozzles N of the nozzle row **12***a* and has the dimension Dha as a water head, the pressure of an ink, which acts on the nozzles N of the nozzle row **12***b* and has the dimension Dhb as a water head, the pressure of an ink, which acts on the nozzles N of the nozzle row **12***d* and has the dimension Dhb as a water head, and the pressure of an ink, which acts on the nozzles N of the nozzle row **12***e* and has the dimension Dha as a water head, are greater than the withstand pressure Pn of gas-liquid interfaces formed in the nozzles N. In addition, the pressure of an ink, which is caused by the posture of the head unit **200**, acts on the nozzles N of the nozzle row **12***c*, and has the dimension Dhc as a water head, is smaller than the withstand pressure Pn. For this reason, when the pressure of the ink, which has the dimension Dhc as a water head, acts on the nozzles N of the nozzle row **12***c*, gas-liquid interfaces of the nozzles N of the nozzle row **12***c* are not broken even if gas-liquid interfaces are not formed in the holes **16**H of the filter **16** in the filter chamber **17***c*.

[0087] In the pre-operation executed by the control unit **90** in Embodiment 1, as shown in FIGS. **5**A to **5**C, gas-liquid interfaces are formed also in the holes **16**H of the filter **16** in the filter chamber **17***c*. On the contrary, as shown in FIGS. **6**A and **6**B, in a pre-operation, the control unit **90** in the present embodiment forms gas-liquid interfaces in the holes **16**H of the filter **16** in the filter chambers **17***a*, **17***b*, **17***d*, and **17***e* but does not form gas-liquid interfaces in the holes **16**H of the filter **16** in the filter chamber **17***c*.

[0088] Next, flow of processing executed when the control unit **90** performs control including the pre-operation will be described in the present embodiment. In the present embodiment, the flow of the processing executed when the control unit **90** performs control including the pre-operation is the same as Embodiment 1 except Step S**13** in the flowchart shown in FIG. **4** is different. For this reason, herein, flow of processing in Step S**13** in the flowchart shown in FIG. **4** will be described.

[0089] In Step S**13**, the control unit **90** executes the pre-operation. In the pre-operation, the control unit **90** moves the cap **61** to the suctionable position. In addition, the control unit **90** brings the first opening/closing valve **24**V into the closed state. In addition, the control unit **90** brings the switching valve **27** into the communication state. In addition, the control unit brings the cap valves **62***a*, **62***b*, **62***d*, and **62***e* into the open state, and brings the cap valve **62***c* into the closed state. Then, the control unit **90** drives the suction pump **63**. At this time, the control unit **90** drives the suction pump **63** such that a pressure in downstream chamber **17**D of each of the filter chambers **17***a*, **17***b*, **17***d*, and **17***e* is lower than a pressure in the upstream chamber **17**U and a pressure difference between the pressure in the downstream chamber **17**D and the pressure in the upstream chamber **17**U is greater than the withstand pressure Pn. Accordingly, as shown in FIG. **6**A, an ink discharged from the nozzles N of the nozzle rows **12***a*, **12***b*, **12***d*, and **12***e* flows toward the waste liquid collecting unit **66**, as shown by arrows, via the caps **61***a*, **61***b*, **61***d*, and **61***e* and the waste liquid tube **64**.

[0090] Along with this, as shown by arrows, the atmosphere flows into the fluid flow path **25**, the second common flow path **225**, the second filter flow paths **19** communicating with the filter chambers **17***a*, **17***b*, **17***d*, and **17***e*, and the upstream chambers **17**U of the filter chambers **17***a*, **17***b*, **17***d*, and **17***e* via the atmospheric passage **26**, and an ink in the upstream chambers **17**U of the filter chambers **17***a*, **17***b*, **17***d*, and **17***e* is replaced with the atmosphere. Accordingly, a gas-liquid interface is formed on each upstream chamber **17**U side of each of the holes **16**H of the filters **16** in the filter chambers **17***a*, **17***b*, **17***d*, and **17***e*. On the other hand, since the atmosphere does not flow into the second filter flow path **19** communicating with the filter chamber **17***c* and the filter chamber **17***c*, gas-liquid interfaces are not formed in the holes **16**H of the filter **16** in the filter chamber **17***c*.

[0091] Once gas-liquid interfaces are formed on the upstream chamber **17**U sides of the holes **16**H in the filters **16** of the filter chambers **17***a*, **17***b*, **17***d*, and **17***e*, the control unit **90** may terminate the pre-operation, but continues to drive the suction pump **63** when gas-liquid interfaces are formed on both sides of the upstream chamber **17**U sides and the downstream chamber **17**D sides of the holes **16**H in each of the filters **16** of the filter chambers **17***a*, **17***b*, **17***d*, and **17***e*, as shown in FIG. **6**B. When it is difficult for the atmosphere to flow into the downstream chambers **17**D of the filter chambers **17***a*, **17***b*, **17***d*, and **17***e*, for example, the control unit **90** drives the suction pump **63** such that a pressure in the downstream chamber **17**D of each of the filter chambers **17***a*, **17***b*, **17***d*, and **17***e* is lower than a pressure in the upstream chamber **17**U and a pressure difference between the pressure in the downstream chamber **17**D and the pressure in the upstream chamber **17**U is greater than the withstand pressure Pf.

[0092] As described hereinbefore, with the liquid ejecting apparatus **500** according to Embodiment 2, the following effects can be obtained.

[0093] The head unit **200** has the filter **16**, the filter chamber **17***c* including the upstream chamber **17**U and the downstream chamber **17**D, which are partitioned by the filter **16**, and the nozzle row **12***c* having the plurality of nozzles N ejecting an ink supplied via the common flow path **224** communicating with the upstream chamber **17**U of the filter chamber **17***c*. The nozzles N forming the nozzle row **12***c* communicate with the nozzles N forming the nozzle row **12***a* via the filter **16** of the filter chamber **17***c*, the common flow path **224**, and the filter **16** of the filter chamber **17***a*, and communicates with the nozzles N forming the nozzle row **12***e* via the filter **16** of the filter chamber **17***c*, the common flow path **224**, and the filter **16** of the filter chamber **17***e*. When a maximum pressure among pressures of an ink in the head unit **200**, which are caused by a height difference between the plurality of nozzles N included in the head unit **200** and act on gas-liquid interfaces formed in the nozzles N of the nozzle row **12***c*, is defined as a pressure Ph**2**, the control unit **90** does not form gas-liquid interfaces in the holes **16**H provided in the filter **16** of the filter chamber **17***c* in the pre-operation in a case where the withstand pressure Pn is greater than the pressure Ph**2**.

[0094] According to this, when the pressure of an ink in the head unit **200**, which is caused by a change in the posture of the head unit **200** due to the removal of the head unit **200**, acts on gas-liquid interfaces formed in the nozzles N, an ink leakage from the nozzles N can be prevented, and the amount of an ink in the filter chamber **17** replaced with the atmosphere can be decreased.

[0095] The liquid ejecting apparatus **500** according to the embodiment of the present disclosure is based on having the configuration described hereinbefore, but it is evident that the configuration can also be partially changed or omitted without departing from the gist of the disclosure of the present application. In addition, the embodiments and other embodiments to be described below can be performed in combination with each other within a technically consistent range. Hereinafter, other embodiments will be described based.

[0096] In the pre-operation in Embodiment 2, the control unit **90** may form gas-liquid interfaces in the holes **16**H provided in the filter **16** of any one of the filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e* such that a maximum pressure among pressures of an ink in the head unit **200**, which are caused by a height difference between the plurality of nozzles N included in the head unit **200** and act on gas-liquid interfaces formed in the nozzles N, is smaller than the withstand pressure Pn of the gas-liquid interfaces formed in the nozzles N. In the head unit **200** of the embodiment, since the pressure of an ink, which has the dimension Dhc as a water head, is smaller than the withstand pressure Pn of the gas-liquid interfaces formed in the nozzles N, for example, the gas-liquid interfaces are formed in the holes **16**H provided in the filters **16** of the filter chambers **17***a* and **17***e*. In this case, in the pre-operation, the control unit **90** brings the first opening/closing valve **24**V into the closed state, brings the switching valve **27** into the communication state, brings the cap valves **62***a* and **62***e* into the open state, brings the cap valves **62***b*, **62***c*, and **62***d* into the closed state, and drives the suction pump **63**. In the pre-operation, gas-liquid interfaces are not formed in the holes **16**H provided in the filters **16** of the filter chambers **17***b*, **17***c*, and **17***d*. In addition, in the head unit **200** of the embodiment, since the pressure of the ink, which has the dimension Dhc as a water head, is smaller than the withstand pressure Pn of the gas-liquid interfaces formed in the nozzles N, for example, gas-liquid interfaces may be formed in the holes **16**H provided in the filters **16** of the filter chambers **17***a* and **17***b*, and gas-liquid interfaces may not be formed in the holes **16**H provided in the filters **16** of the filter chambers **17***c*, **17***d*, and **17***e*. In addition, for example, gas-liquid interfaces may be formed in the holes **16**H provided in the filters **16** of the filter chambers **17***d* and **17***e*, and gas-liquid interfaces may not be formed in the holes **16**H provided in the filters **16** of the filter chambers **17***a*, **17***b*, and **17***c*.

[0097] In the pre-operation in Embodiment 1, in the communication state, the control unit **90** may bring the first opening/closing valve **24**V into the open state, and drive-control any one of the second pump **25**P and the first pump **24**P such that flows of a fluid in the atmospheric passage **26**, the fluid flow path **25**, and the liquid flow path **24** are in the directions of the arrows of FIG. **5**A.

[0098] In the pre-operation in Embodiment 1, in the communication state, the control unit **90** may bring the first opening/closing valve **24**V into the closed state, make the atmosphere flow into the filter chamber **17** by drive-controlling the second pump **25**P such that flows of a fluid in the atmospheric passage **26** and the fluid flow path **25** are in the directions of the arrows of FIG. **5**A, and form gas-liquid interfaces in the holes **16**H of the filter **16**. In this case, an ink in the filter chamber **17** is discharged from the nozzles N, but the ink can be collected by the cap **61** by moving the cap **61** to the suctionable position as shown in FIG. **5**C.

[0099] In the embodiment, the liquid ejecting apparatus **500** may be able to make the atmosphere introduced into the filter chamber **17** of the liquid ejecting head **10** via the liquid flow path **24**. In this case, for example, the switching valve **27** may be provided at a position between the first pump **24**P in the liquid flow path **24** and the liquid storage unit **23**, and the atmospheric passage **26** may be coupled to the liquid flow path **24** via the switching valve **27**. In addition, in this case, in the pre-operation, the control unit **90** can make the atmosphere from the atmospheric passage **26** introduced into the filter chamber **17** via the liquid flow path **24**, the common flow path **224**, and the first filter flow path **18** by bringing the switching valve **27** into the communication state, and drives the first pump **24**P in a direction in which the atmosphere flows from the atmospheric passage **26** toward the filter chamber **17**.

[0100] In the embodiment, the liquid ejecting apparatus **500** may include an air tank accommodating the atmosphere introduced into the filter chamber **17**. In this case, the atmospheric passage **26** may couple the air tank to the fluid flow path **25** via the switching valve **27**.

[0101] In the embodiment, the liquid ejecting apparatus **500** may be able to make a gas in the liquid storage unit **23** introduced into the filter chamber **17** of the liquid ejecting head **10** by making the fluid flow path **25** communicate with a space above an ink in the liquid storage unit **23**. In this case, as shown in FIG. **7**, the fluid flowing unit **20** may have a gas passage **626** instead of the atmospheric passage **26**.

[0102] In the embodiment, the liquid ejecting apparatus **500** may not introduce the atmosphere from the atmospheric passage **26** into the filter chamber **17**. For example, by bringing the first opening/closing valve **24**V into the open state, bringing the switching valve **27** into the open state, and driving the second pump **25**P, an ink in the liquid flow path **24** flows in the supply direction, and in a state where an ink in the fluid flow path **25** flows in the return direction as shown in FIG. **3**A, the first opening/closing valve **24**V is brought into the closed state. Accordingly, the atmosphere can flow from the nozzles N into the head unit **200**, and the atmosphere can be introduced into the filter chamber **17** via the common liquid chamber **13**. In this case, the first opening/closing valve **24**V functions as the gas introduction unit that can make a gas introduced into the filter chamber **17** of the head unit **200**.

[0103] In the embodiment, the liquid ejecting apparatus **500** may not introduce the atmosphere from the atmospheric passage **26** into the filter chamber **17** via the fluid flow path **25**, the second common flow path **225**, and the second filter flow path **19**. In this case, for example, as shown in FIG. **8**, the fluid flowing unit **20** has, instead of the atmospheric passage **26** and the switching valve **27**, a gas flow path **28**, a third pump **28**P, a gas flow path opening/closing valve **28**V which is an example of the gas introduction unit, and a gas flow path side coupling portion **28**C. In the gas flow path side coupling portion **28**C, an opening/closing valve that brings the gas flow path **28** into a communication state with a third common flow path **228** as the head unit **200** is mounted on the mounting portion **40**, and blocks communication with the outside of the gas flow path side coupling portion **28**C as the head unit **200** is removed from the mounting portion **40** is provided. The head unit **200** has, in the flow path portion **211**, the third common flow path **228** communicating with a third filter flow path **328** provided in each of the upstream chambers **17**U of the filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e* and a third common flow path side coupling portion **228**C. In the third common flow path side coupling portion **228**C, an opening/closing valve that brings the third common flow path **228** into a communication state with the gas flow path **28** as the head unit **200** is mounted on the mounting portion **40**, and blocks communication with the outside of the third common flow path side coupling portion **228**C as the head unit **200** is removed from the mounting portion **40** is provided. In addition, in this case, in the pre-operation, the control unit **90** can make the atmosphere from the gas flow path **28** introduced into the filter chamber **17** via the third common flow path **228** and the third filter flow path **328** by opening the gas flow path opening/closing valve **28**V, and drives the third pump **28**P. Accordingly, as shown by an arrow in FIG. **8**, the atmosphere flows from the gas flow path **28** toward the filter chamber **17**.

[0104] An opening/closing valve may be provided in each branch flow path of the third common flow path **228** coupled to each of the third filter flow paths **328** provided in the filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e* such that the atmosphere can selectively flow from the gas flow path **28** shown in FIG. **8** into any one of the filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e*. Alternatively, the gas flow path **28** where the third pump **28**P and the gas flow path opening/closing valve **28**V which is an example of the gas introduction unit are provided may be able to be coupled to correspond to each of the third filter flow paths **328** provided in the filter chambers **17***a*, **17***b*, **17***c*, **17***d*, and **17***e*.

[0105] In the embodiment, the plurality of nozzles N that communicate with the plurality of common liquid chambers **13** included in the head unit **200** and form the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* may form a plurality of nozzle rows under a condition that a maximum pressure among pressures of an ink, which are caused by a height difference between the plurality of nozzles N communicating with one common liquid chamber **13** and act on gas-liquid interfaces formed in the nozzles N, is smaller than the withstand pressure Pn of the gas-liquid interfaces formed in the nozzles N. In this case, a plurality of nozzle rows communicating with one common liquid chamber **13** form one nozzle group.

[0106] In the embodiment, the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* included in the head unit **200** may not form a single row of nozzle rows, and for example, the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* may be disposed in a zigzag pattern.

[0107] In the embodiment, the nozzle row **12** formed by arranging the plurality of nozzles N in a single row in the X-axis direction is shown as an example of the nozzle group included in each liquid ejecting head **10** of the head unit **200**, but is not limited to this aspect. The nozzle group included in each liquid ejecting head **10** may have other configurations insofar as the nozzle group is configured by the plurality of nozzles N communicating with the downstream chamber **17**D without the filter **16** being interposed therebetween. In this case, for example, other configurations of the nozzle group included in each liquid ejecting head **10** may be, for example, a nozzle group configured by arranging, in the X-axis direction, a plurality of nozzle rows formed by arranging the plurality of nozzles N in a single row in a direction intersecting the X-axis direction.

[0108] In the embodiment, the head unit **200** may not be a line head. For example, when the head unit **200** forms an image on the printing paper P while moving in the X-axis direction, each of the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* included in the head unit **200** may follow the Y-axis direction, and the nozzle rows **12***a*, **12***b*, **12***c*, **12***d*, and **12***e* may be disposed at intervals in the X-axis direction.

What is claimed is:

1. A liquid ejecting apparatus comprising:

a head unit having a plurality of nozzles ejecting a liquid, a filter provided with a hole through which the liquid is configured to pass, a filter chamber including an upstream chamber and a downstream chamber, which are partitioned by the filter, a first nozzle group formed by a plurality of the nozzles, and a second nozzle group formed by a plurality of the nozzles;

a mounting portion on which the head unit is detachably mounted;

a gas introduction unit configured to introduce a gas into the filter chamber; and

a control unit, wherein

the nozzles forming the second nozzle group communicate with the nozzles forming the first nozzle group via the filter of the filter chamber,

when a pressure difference between a pressure on a gas side and a pressure on a liquid side, at which a gas-liquid interface formed in the hole of the filter is able to be maintained, is defined as a withstand pressure Pf and a pressure difference between a pressure on the gas side and a pressure on the liquid side, at which a gas-liquid interface formed in the nozzle is able to be maintained, is defined as a withstand pressure Pn, the withstand pressure Pf is greater than the withstand pressure Pn, and

the control unit executes, before the head unit is removed from the mounting portion, a pre-operation of forming the gas-liquid interface in the hole provided in the filter by controlling the gas introduction unit and introducing the gas into the filter chamber.

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

when a maximum pressure, among pressures of the liquid in the head unit which are caused by a height difference between the plurality of nozzles included in the head unit and act on the gas-liquid interface formed in the nozzle, is defined as a pressure Ph**1**, the withstand pressure Pf is greater than the pressure Ph**1**.

3. The liquid ejecting apparatus according to claim **1**, further comprising:

a liquid storage unit storing the liquid;

a first passage configured to make the upstream chamber and the liquid storage unit communicate with each other;

a second passage configured to make the liquid storage unit and the upstream chamber communicate with each other;

an atmospheric passage communicating with the second passage;

a switching valve that is the gas introduction unit configured to switch the atmospheric passage between a communication state where the atmospheric passage communicates with the second passage and a non-communication state where the atmospheric passage does not communicate with the second passage; and

an introduction pump provided in the second passage, wherein

the control unit executes the pre-operation of controlling the switching valve such that the atmospheric passage is brought into the communication state, introducing the gas from the atmospheric passage into the upstream chamber via the second passage by driving the introduction pump, and forming the gas-liquid interface in the hole of the filter by returning the liquid in the upstream chamber to the liquid storage unit via the first passage.

4. The liquid ejecting apparatus according to claim **2**, further comprising:

a liquid storage unit storing the liquid;

a first passage configured to make the upstream chamber and the liquid storage unit communicate with each other;

a second passage configured to make the liquid storage unit and the upstream chamber communicate with each other;

an atmospheric passage communicating with the second passage;

a switching valve that is the gas introduction unit configured to switch the atmospheric passage between a communication state where the atmospheric passage communicates with the second passage and a non-communication state where the atmospheric passage does not communicate with the second passage; and

an introduction pump provided in the second passage, wherein

the control unit executes the pre-operation of controlling the switching valve such that the atmospheric passage is brought into the communication state, introducing the gas from the atmospheric passage into the upstream chamber via the second passage by driving the introduction pump, and forming the gas-liquid interface in the hole of the filter by returning the liquid in the upstream chamber to the liquid storage unit via the first passage.

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

the control unit drives the introduction pump such that a pressure in the upstream chamber is higher than a pressure in the downstream chamber and a pressure difference between the pressure in the upstream chamber and the pressure in the downstream chamber is greater than the withstand pressure Pf.

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

the control unit drives the introduction pump such that a pressure in the upstream chamber is higher than a pressure in the downstream chamber and a pressure difference between the pressure in the upstream chamber and the pressure in the downstream chamber is greater than the withstand pressure Pf.

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

when the filter chamber is defined as a first filter chamber, the upstream chamber is defined as a first upstream chamber, and the downstream chamber is defined as a first downstream chamber, the head unit has the filter, a second filter chamber including a second upstream chamber and a second downstream chamber, which are partitioned by the filter, and a common flow path communicating with the first upstream chamber and the second upstream chamber,

the plurality of nozzles forming the first nozzle group and the plurality of nozzles forming the second nozzle group eject the liquid supplied via the common flow path, and the nozzles forming the second nozzle group communicate with the nozzles forming the first nozzle group via the filter of the second filter chamber, the common flow path, and the filter of the first filter chamber,

the gas introduction unit is configured to introduce the gas into the first filter chamber and the second filter chamber, and

the control unit forms the gas-liquid interfaces in the hole provided in the filter of the first filter chamber and the hole provided in the filter of the second filter chamber by introducing the gas into the first filter chamber and the second filter chamber in the pre-operation.

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

the head unit has the filter, a third filter chamber including a third upstream chamber and a third downstream chamber, which are partitioned by the filter, and a third nozzle group having the plurality of nozzles ejecting the liquid supplied via the common flow path communicating with the third upstream chamber,

the nozzles forming the third nozzle group communicate with the nozzles forming the first nozzle group via the filter of the third filter chamber, the common flow path, and the filter of the first filter chamber, and communicate with the nozzles forming the second nozzle group via the filter of the third filter chamber, the common flow path, and the filter of the second filter chamber, and

when a maximum pressure, among pressures of the liquid in the head unit which are caused by a height difference between the plurality of nozzles included in the head unit and act on the gas-liquid interface formed in the nozzle of the third nozzle group, is defined as a pressure Ph**2**, the control unit does not form the gas-liquid interface in the hole provided in the filter of the third filter chamber in the pre-operation in a case where the withstand pressure Pn is greater than the pressure Ph**2**.

9. A control method of a liquid ejecting apparatus including a head unit having a plurality of nozzles ejecting a liquid, a filter provided with a hole through which the liquid is configured to pass, a first nozzle group formed by a plurality of the nozzles, and a second nozzle group formed by a plurality of the nozzles, and a mounting portion on which the head unit is detachably mounted, in which the nozzles forming the second nozzle group communicate with the nozzles forming the first nozzle group via the filter, when a pressure difference between a pressure on a gas side and a pressure on a liquid side, at which a gas-liquid interface formed in the hole of the filter is able to be maintained, is defined as a withstand pressure Pf and a pressure difference between the pressure on the gas side and the pressure on the liquid side, at which a gas-liquid interface formed in the nozzle is able to be maintained, is defined as a withstand pressure Pn, the withstand pressure Pf is greater than the withstand pressure Pn, the control method of a liquid ejecting apparatus comprising:

executing, before the head unit is removed from the mounting portion, a pre-operation of forming the gas-liquid interface in the hole provided in the filter.

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