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Mizusaki

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(54) **INKJET PRINTER**

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B41J 2/135 (2006.01)
B41J 19/14 (2006.01)

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(58) **Field of Classification Search**
CPC B41J 2/135; B41J 25/316; B41J 19/142
See application file for complete search history.

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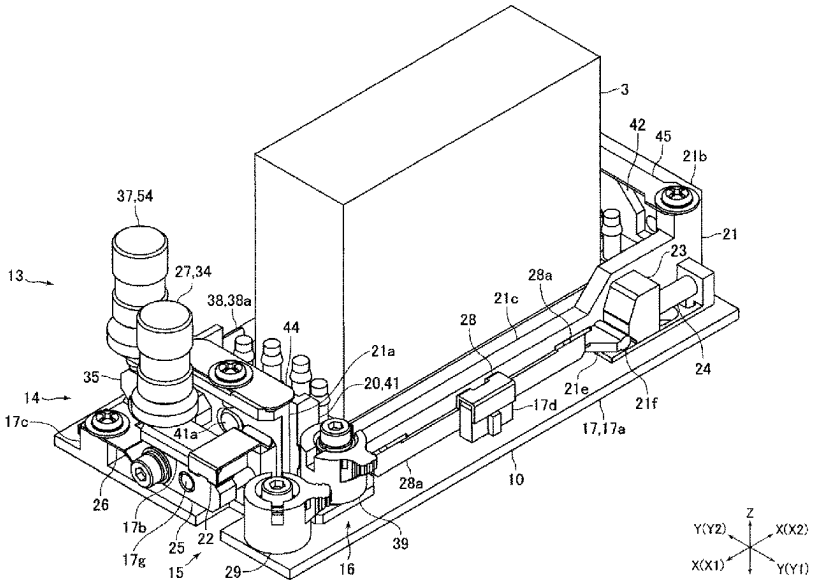
(57) **ABSTRACT**

Provided is an inkjet printer capable of suppressing variations in landing positions of inks ejected from a plurality of inkjet heads mounted on a carriage for each inkjet head. In this inkjet printer, a plurality of inkjet heads **3** are mounted on a carriage. This inkjet printer includes at least one of a first inclination adjustment mechanism (**13**) for adjusting the inclination of each of the inkjet heads (**3**) with respect to the carriage in a pivoting direction having a sub scanning direction as an axial direction of pivoting, and a second inclination adjustment mechanism (**14**) for adjusting the inclination of each of the inkjet heads (**3**) with respect to the carriage in a pivoting direction having a main scanning direction as an axial direction of pivoting.

2 Claims, 10 Drawing Sheets



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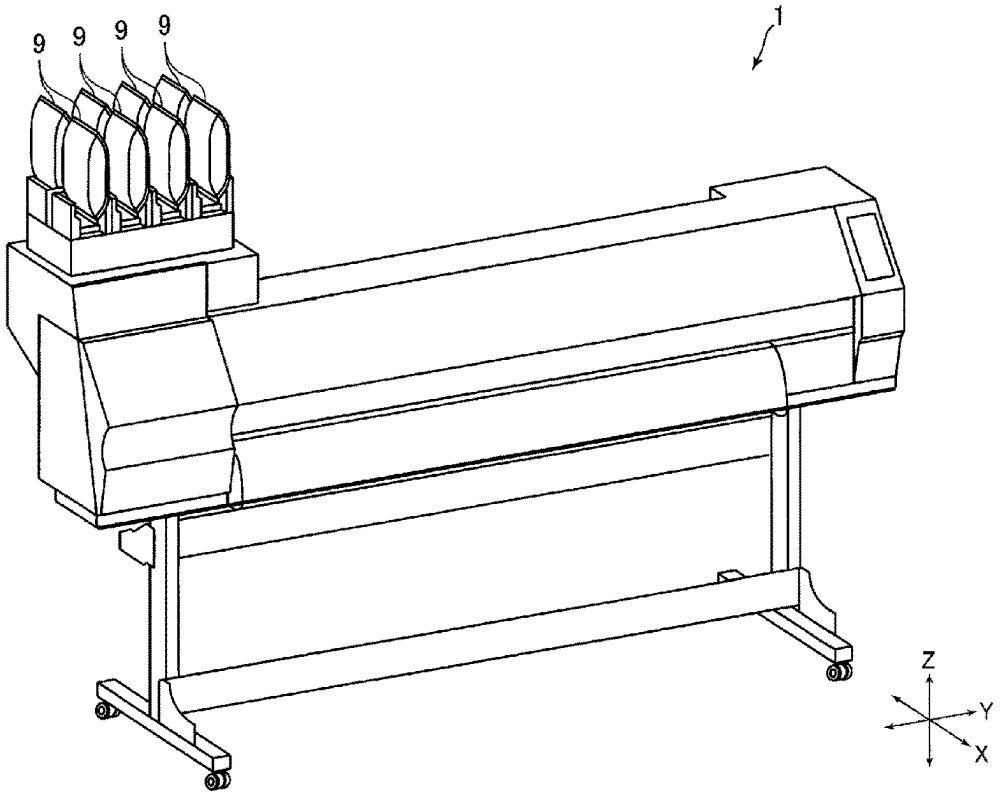
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9
Z
Y
X

FIG. 1

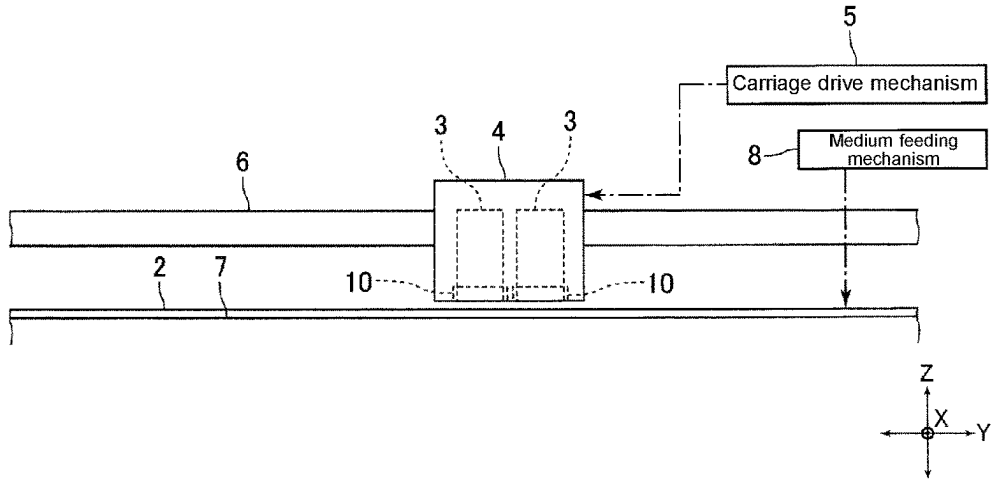
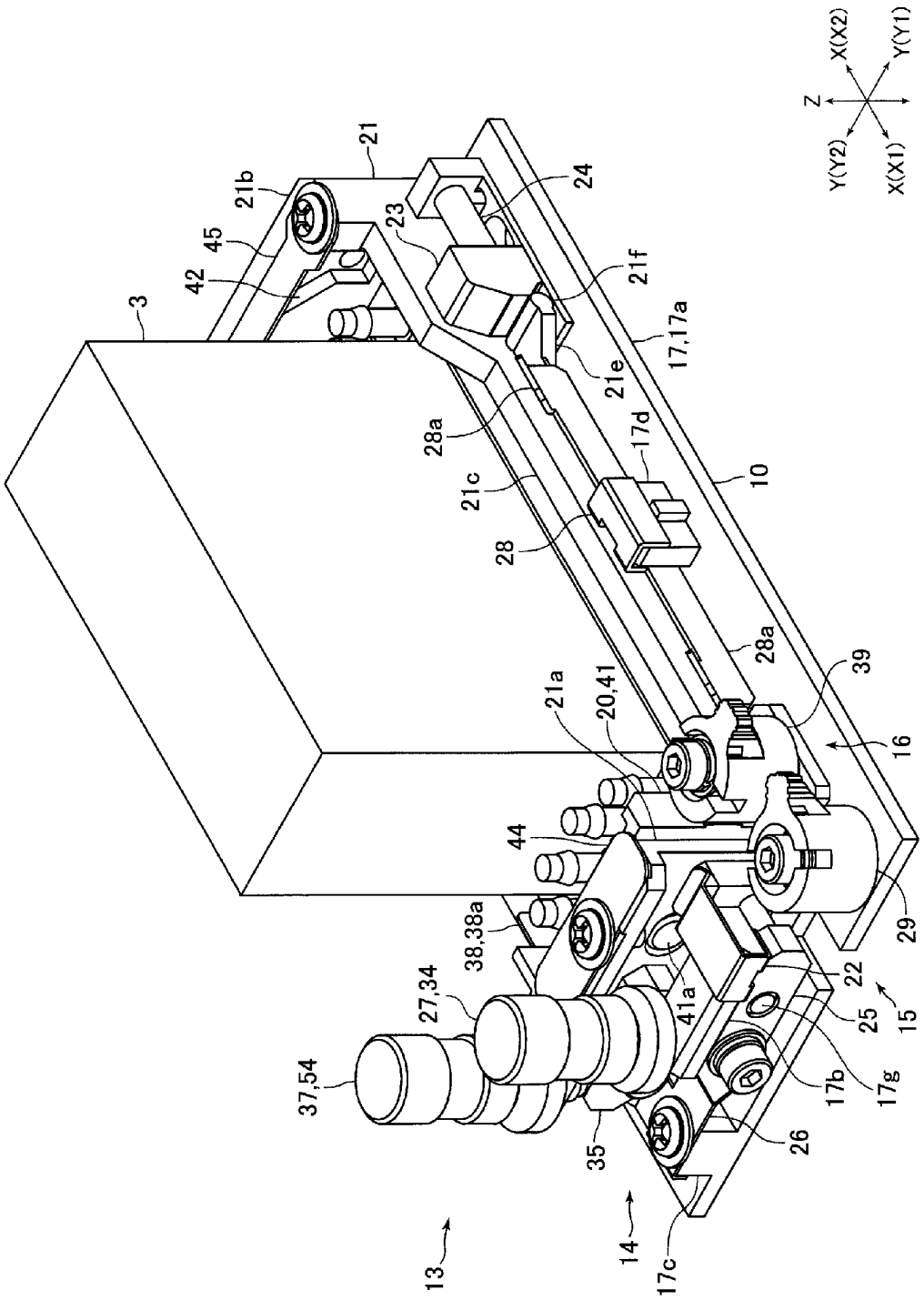

5
Carriage drive mechanism
3
4
3
8
Medium feeding mechanism
6
2
7
10
10
Z
X
Y

FIG. 2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X(X2)
Y(Y1)
Y(Y2)
X(X1)
3
21
21b
45
42
23
24
21f
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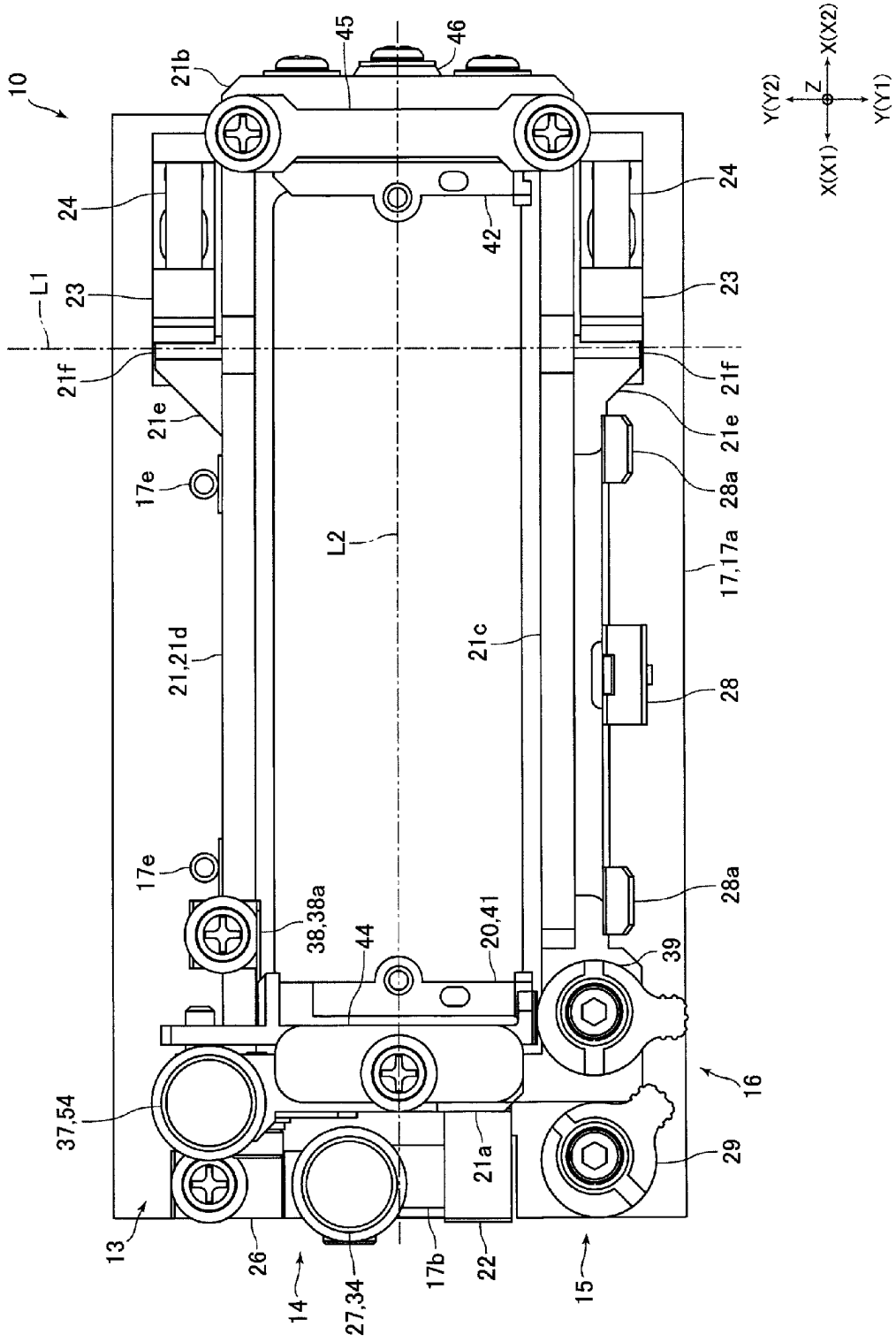
21e
28a
17d
21c
10
28
28a
39
21a
20,41
16
44
38,38a
29
27,34
22
41a
25
15
37,54
17b
17g
35
26
13
14
17c

FIG. 3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21b
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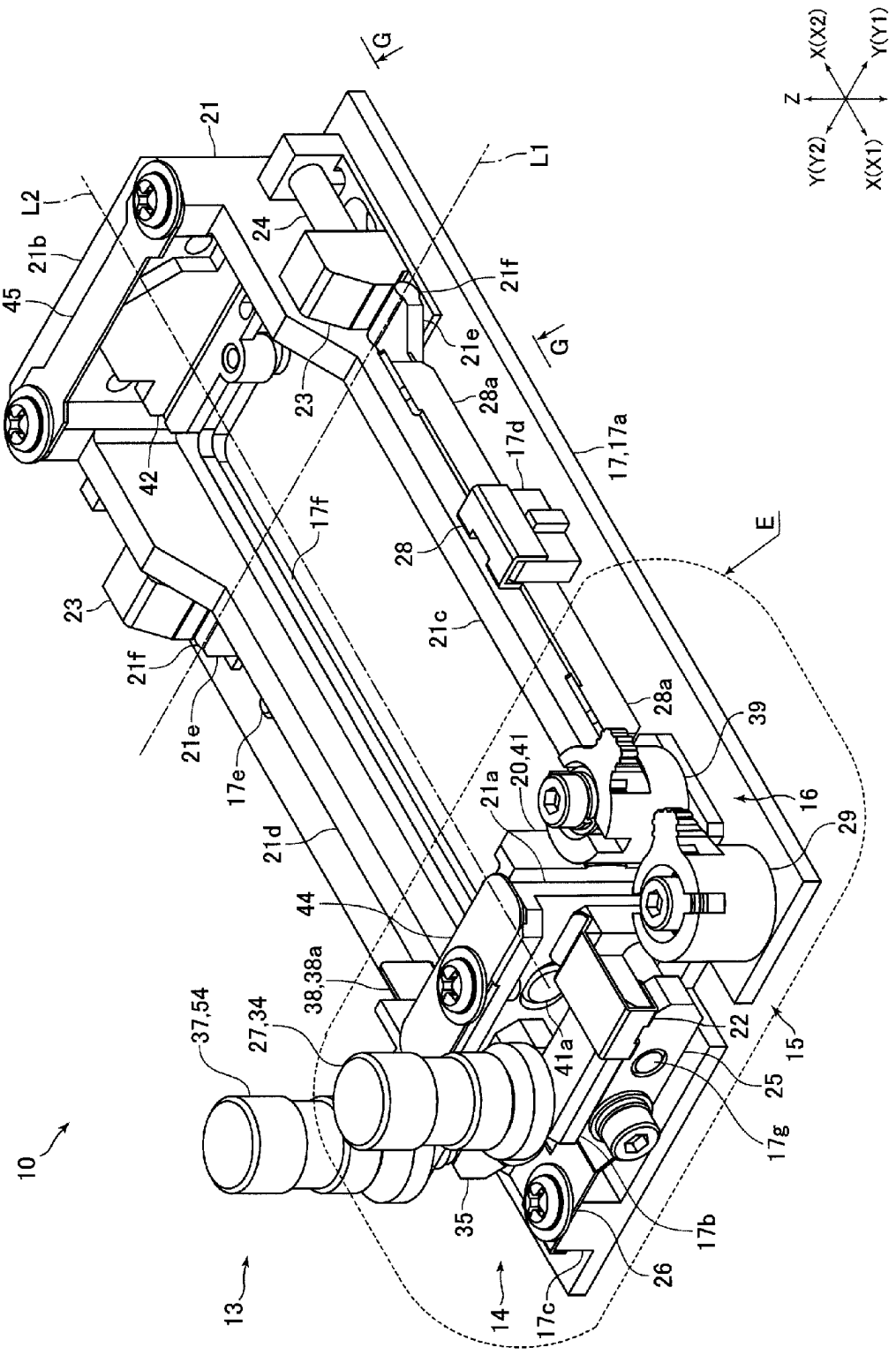
42
L1
23
21f
21e
17e
L2
21,21d
21c
17,17a
28a
28
38,38a
44
20,41
39
16
37,54
21a
29
13
26
14
27,34
17b
22
15
Y(Y2)
Z
X(X2)
Y(Y1)
X(X1)

FIG. 4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17g
17e
17f
17d
17,17a
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16
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21c
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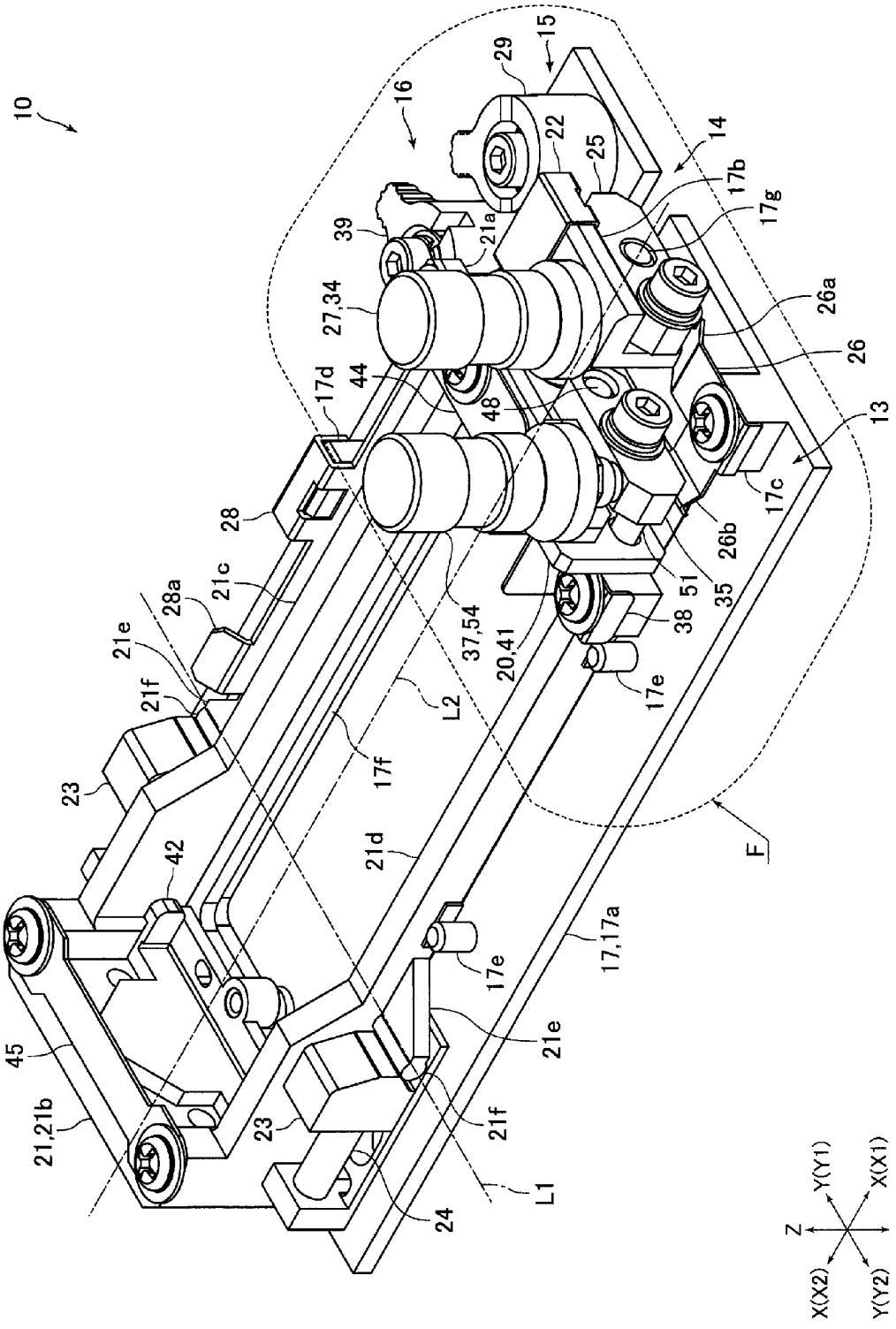
21f
21a
22
23
24
25
26
27,34
28
28a
29
35
37,54
38,38a
39
41a
42
44
45
20,41
L1
L2
E
G
G
Z
X(X2)
Y(Y1)
Y(Y2)
X(X1)

FIG. 5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16
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29
14
22
25
17b
17g
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21a
27,34
26a
26
44
17d
48
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28
17c
26b
51
35
38
28a
21c
21e
37,54
20,41
17e
21f
L2
17f
23
42
21d
F
17,17a
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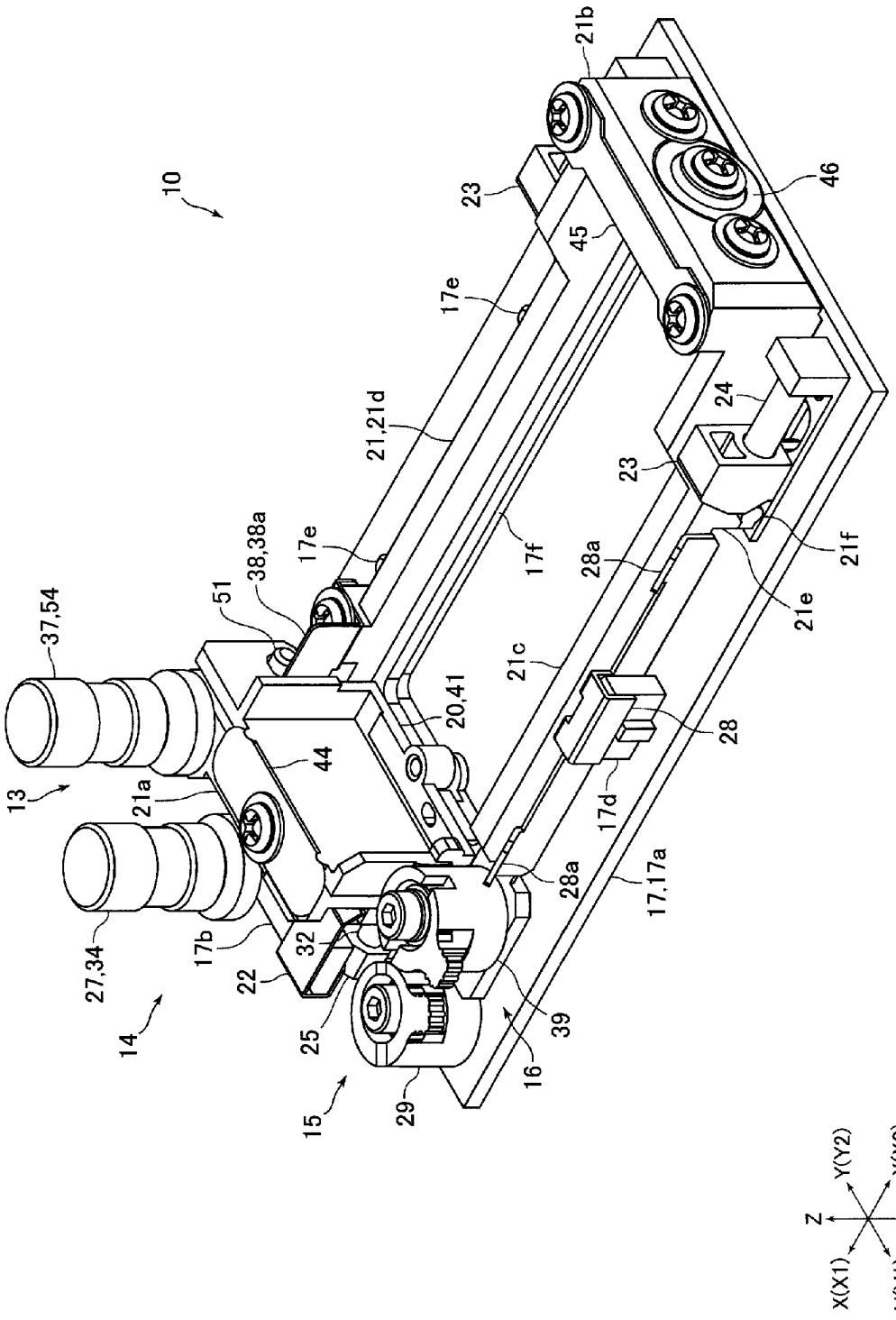
21,21b
24
L1
Z
Y(Y1)
X(X1)
X(X2)
Y(Y2)

FIG. 6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21b
21c
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21f
21,21d
22
23
24
25
27,34
28
28a
29
32
37,54
38,38a
39
44
45
46
51
Z
Y(Y2)
X(X2)
X(X1)
Y(Y1)

FIG. 7

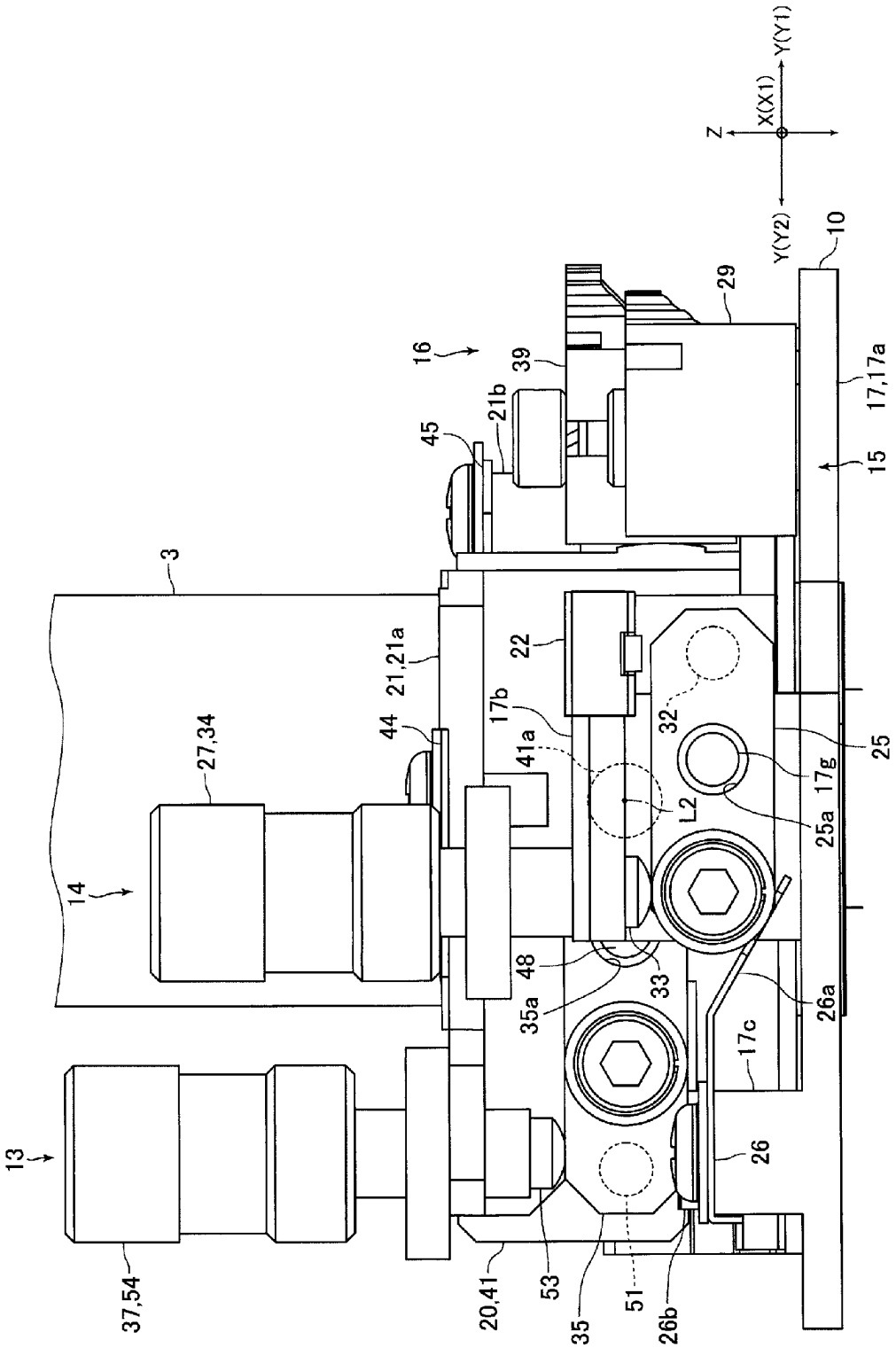
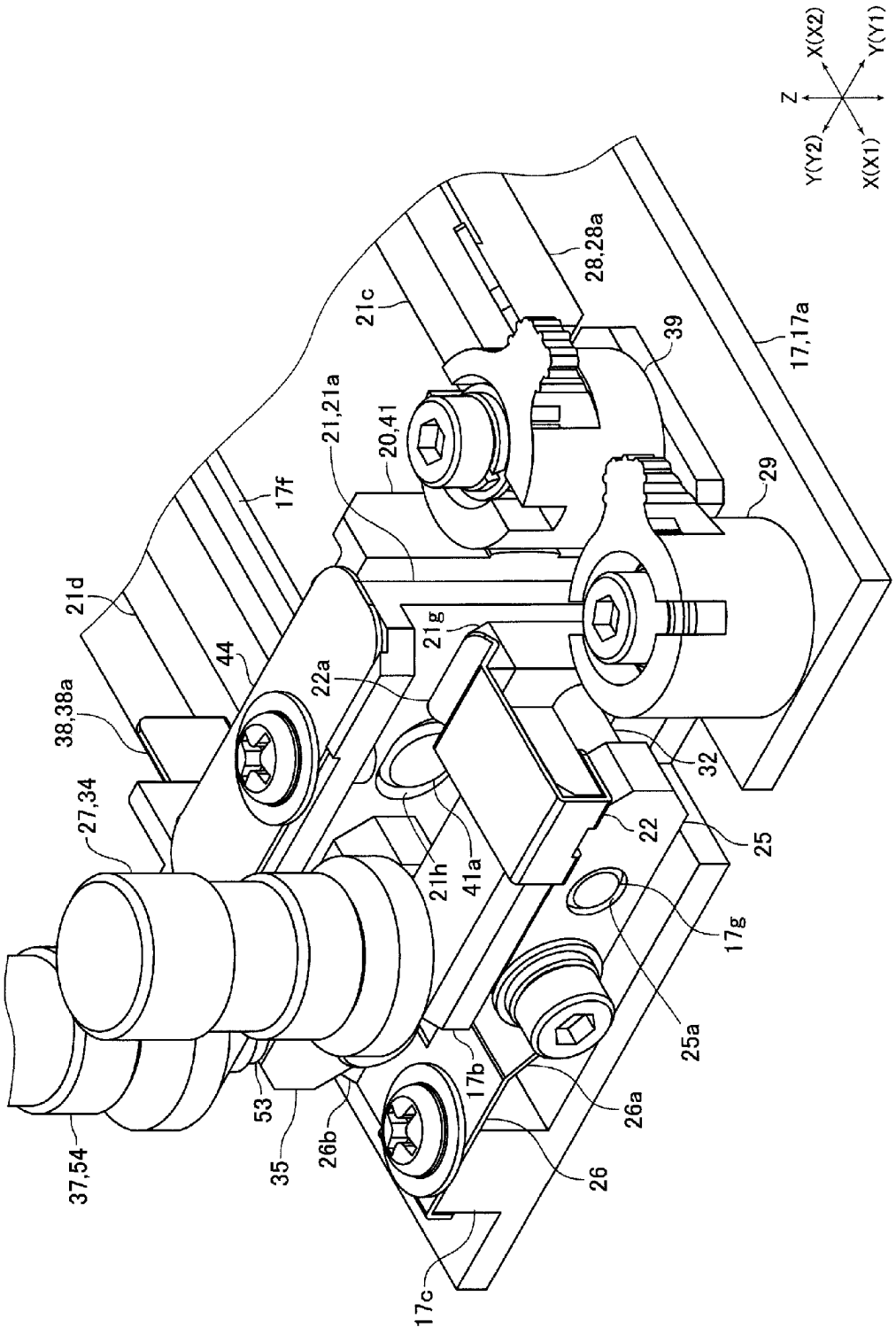

Z
X(X1)
Y(Y1)
Y(Y2)
10
29
16
39
21b
45
17,17a
15
3
21,21a
22
44
17b
41a
32
25
27,34
17g
L2
25a
14
48
33
35a
26a
17c
13
26
37,54
20,41
53
35
51
26b

FIG. 8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X(X2)
Y(Y1)
Y(Y2)
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28,28a
21c
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17,17a
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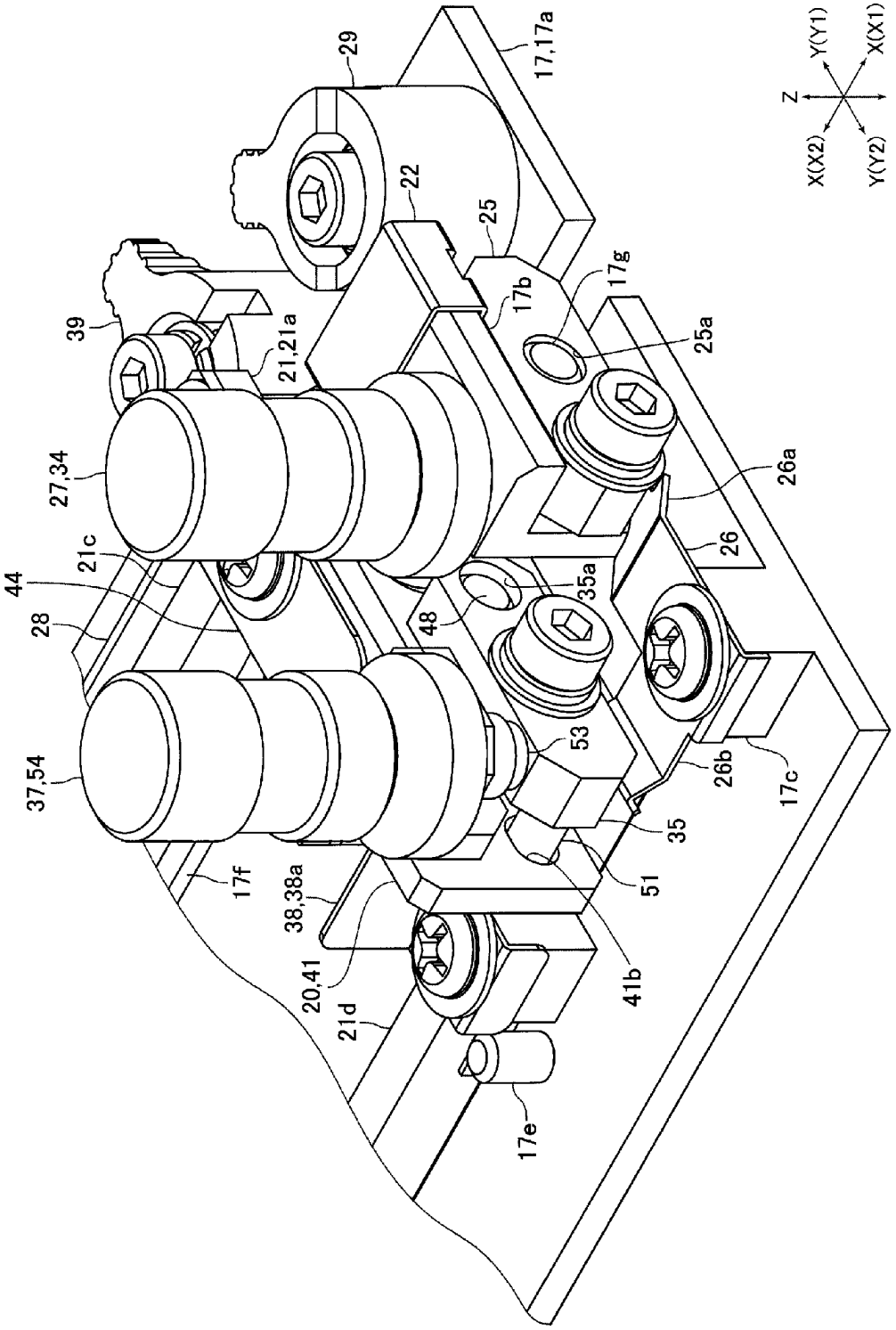
20,41
17f
29
21d
21g
44
22a
38,38a
32
27,34
22
25
21h
41a
17g
25a
17b
26a
53
26b
35
26
37,54
17c

FIG. 9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17,17a
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17b
17g
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21,21a
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26a
21c
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44
35a
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53
37,54
26b
17c
35
51
17f
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41b
21d
17e
Z
Y(Y1)
X(X1)
X(X2)
Y(Y2)

FIG. 10

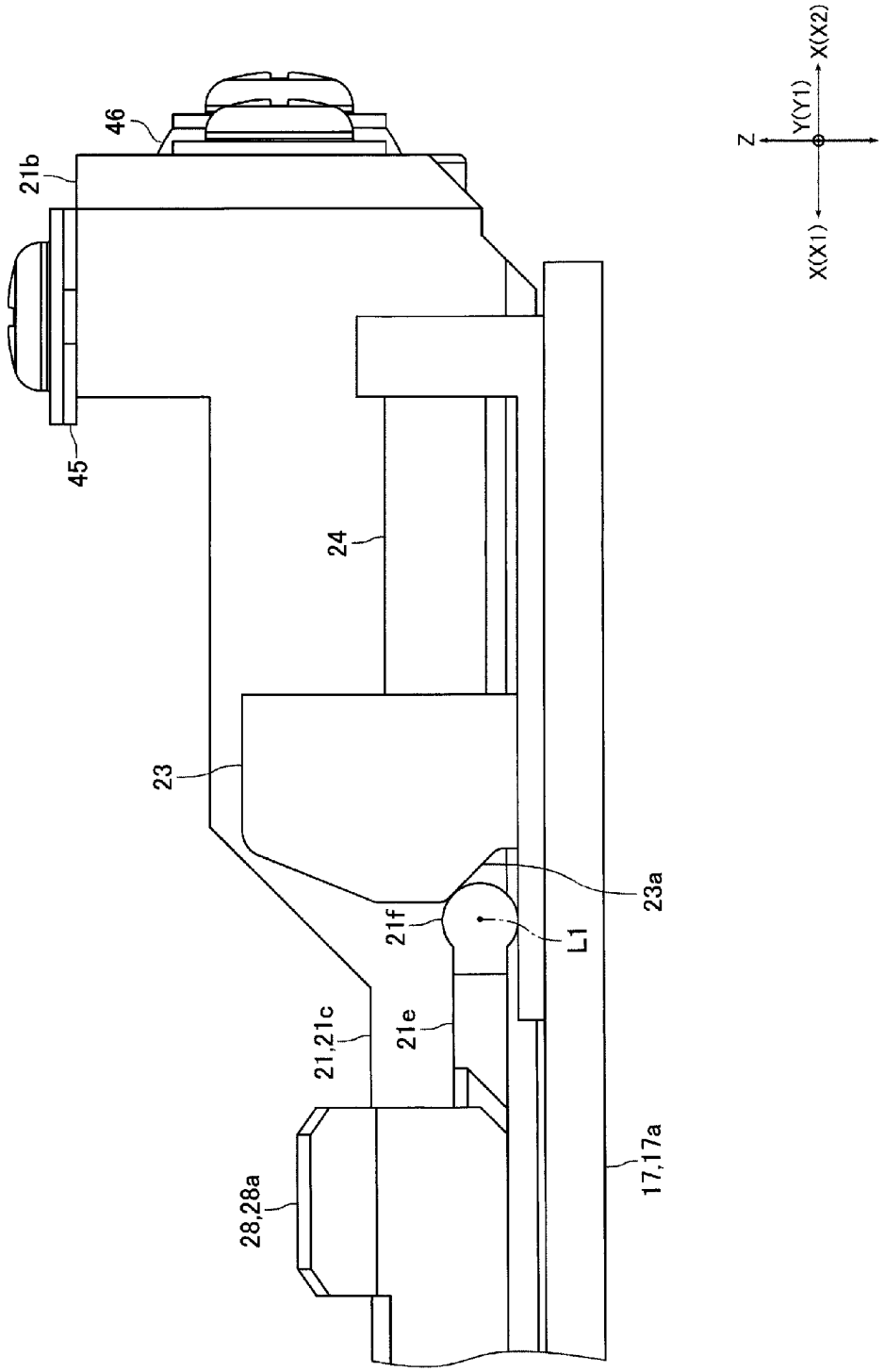

FIG. 11

INKJET PRINTER

CROSS-REFERENCE TO RELATED APPLICATION

This application is a 371 application of the International PCT application serial no. PCT/JP2022/000291, filed on Jan. 7, 2022, which claims the priority benefits of Japan Patent Application No. 2021-007259, filed on Jan. 20, 2021. The entirety of each of the above-mentioned patent applications is hereby incorporated by reference herein and made a part of this specification.

TECHNICAL FIELD

The present invention relates to an inkjet printer that performs printing by ejecting ink.

BACKGROUND ART

Conventionally, an inkjet printer (inkjet apparatus) that performs printing by ejecting ink onto a medium is known (see e.g., Patent Literature 1). The inkjet printer described in Patent Literature 1 includes a plurality of inkjet heads that eject ink toward a medium, a carriage on which the plurality of inkjet heads are mounted, and a guide mechanism for moving the carriage in a main scanning direction. The carriage includes a rear surface portion forming a rear surface of the carriage, a bottom surface portion forming a bottom surface of the carriage, and two side surface portions forming side surfaces of the carriage in the main scanning direction. The rear surface portion is fixed to a portion driven by the guide mechanism. A plurality of inkjet printers are mounted on the bottom surface portion.

In the inkjet printer described in Patent Literature 1, the carriage includes a bottom surface height position adjustment unit for adjusting the inclination of the bottom surface portion in a pivoting direction in which a sub scanning direction orthogonal to the main scanning direction and the up-down direction is an axial direction of pivoting, and a θ angle adjustment unit for adjusting the inclination of the bottom surface portion in the pivoting direction in which the main scanning direction is the axial direction of pivoting. Therefore, in this inkjet printer, the inclination in the pivoting direction having the sub scanning direction as the axial direction of pivoting and the inclination in the pivoting direction having the main scanning direction as the axial direction of pivoting of the plurality of inkjet heads mounted on the carriage can be collectively adjusted.

CITATION LIST

Patent Literature

Patent Literature 1: Japanese Unexamined Patent Publication No. 2013-119216

SUMMARY OF INVENTION

Technical Problems

However, in the inkjet printer described in Patent Literature 1, even if the inclination in the pivoting direction having the sub scanning direction as the axial direction of pivoting of the plurality of inkjet heads mounted on the carriage varies for each inkjet head, the inclination of the plurality of inkjet heads in the pivoting direction having the sub scanning direction as the axial direction of pivoting cannot be adjusted for each inkjet head. Furthermore, in this inkjet printer, even if the inclination in the pivoting direction having the main scanning direction as the axial direction of pivoting of the plurality of inkjet heads mounted on the carriage varies for each inkjet head, the inclination in the pivoting direction having the main scanning direction as the axial direction of pivoting of the plurality of inkjet heads cannot be adjusted for each inkjet head.

Therefore, in the inkjet printer described in Patent Literature 1, if the inclination in the pivoting direction having the sub scanning direction as the axial direction of pivoting of the plurality of inkjet heads mounted on the carriage varies for each inkjet head, or the inclination in the pivoting direction having the main scanning direction as the axial direction of pivoting of the plurality of inkjet heads mounted on the carriage varies for each inkjet head, the landing position of the ink (ink droplet) ejected from the inkjet head and landing on the print medium may greatly vary depending on the inkjet head. Furthermore, if the landing position of the ink landing on the print medium greatly varies depending on the inkjet head, the print quality of the print medium degrades.

Therefore, the present invention provides an inkjet printer capable of suppressing a variation in landing positions of ink ejected from a plurality of inkjet heads mounted on a carriage for each inkjet head.

Solutions to Problems

In order to solve the above problems, an inkjet printer of the present invention includes a plurality of inkjet heads that eject ink, a carriage on which the plurality of inkjet heads are mounted, and a carriage drive mechanism that moves the carriage in a main scanning direction; the inkjet printer further including at least one of a first inclination adjustment mechanism for adjusting inclination of each of the inkjet heads with respect to the carriage in a pivoting direction having a sub scanning direction orthogonal to an up-down direction and the main scanning direction as an axial direction of pivoting, and a second inclination adjustment mechanism for adjusting inclination of each of the inkjet heads with respect to the carriage in a pivoting direction having the main scanning direction as an axial direction of pivoting.

The inkjet printer of the present invention includes at least one of a first inclination adjustment mechanism for adjusting the inclination of each of the inkjet heads with respect to the carriage in a pivoting direction having a sub scanning direction as an axial direction of pivoting, and a second inclination adjustment mechanism for adjusting the inclination of each of the inkjet heads with respect to the carriage in a pivoting direction having a main scanning direction as an axial direction of pivoting.

Therefore, in the present invention, at least one of the variation in the inclination in the pivoting direction having the sub scanning direction as the axial direction of pivoting of the plurality of inkjet heads mounted on the carriage for each inkjet head and the variation in the inclination in the pivoting direction having the main scanning direction as the axial direction of pivoting of the plurality of inkjet heads mounted on the carriage for each inkjet head can be suppressed. Therefore, in the present invention, the variation in the landing position of the ink ejected from the plurality of inkjet heads mounted on the carriage for each inkjet head can be suppressed.

Note that even if the inclination in the pivoting direction having the sub scanning direction as the axial direction of

pivoting of the plurality of inkjet heads mounted on the carriage varies for each inkjet head, or the inclination in the pivoting direction having the main scanning direction as the axial direction of pivoting of the plurality of inkjet heads mounted on the carriage varies for each inkjet head, the variation in the landing position of the ink ejected from the plurality of inkjet heads mounted on the carriage for each inkjet head can be suppressed by adjusting the ink ejection timing for each inkjet head.

However, in this case, for example, when the thickness of the print medium on which printing is performed by the inkjet head is changed, the distance between the upper surface of the print medium and the inkjet head changes, and thus, the ink ejection timing needs to be readjusted for each inkjet head when the thickness of the print medium is changed. On the other hand, in the present invention, even if the thickness of the print medium on which printing is performed is changed, readjustment is not necessary. Furthermore, for example, when the surface of the print medium has irregularities, it becomes difficult to suppress the variation in the landing position of the ink ejected from the plurality of inkjet heads for each inkjet head even if the ink ejection timing is adjusted for each inkjet head, but in the present invention, even if the surface of the print medium has irregularities, the variation in the landing position of the ink ejected from the plurality of inkjet heads for each inkjet head can be suppressed.

In the present invention, the inkjet printer preferably includes a first inclination adjustment mechanism and a second inclination adjustment mechanism. According to such configuration, both the variation in the inclination in the pivoting direction having the sub scanning direction as the axial direction of pivoting of the plurality of inkjet heads mounted on the carriage for each inkjet head and the variation in the inclination in the pivoting direction having the main scanning direction as the axial direction of pivoting of the plurality of inkjet heads mounted on the carriage for each inkjet head can be suppressed. Therefore, the variation in the landing position of the ink ejected from the plurality of inkjet heads mounted on the carriage for each inkjet head can be effectively suppressed.

In the present invention, for example, the first inclination adjustment mechanism includes a head fixing member to which the inkjet head is fixed; the second inclination adjustment mechanism includes a holding member that holds the head fixing member; the holding member is pivotable with respect to the carriage with a main scanning direction as an axial direction of pivoting; and the head fixing member is pivotable with respect to the holding member with a sub scanning direction as an axial direction of pivoting.

In the present invention, for example, the first inclination adjustment mechanism includes a first lever member pivotably held by the holding member, a first spring member that biases the first lever member toward one side in a pivoting direction of the first lever member, and a first micrometer head or a first adjustment screw for pivoting the first lever member toward the other side in the pivoting direction of the first lever member; the second inclination adjustment mechanism includes a second lever member pivotably held by the carriage, a second spring member that biases the second lever member toward one side in a pivoting direction of the second lever member, and a second micrometer head or a second adjustment screw for pivoting the second lever member toward the other side in the pivoting direction of the second lever member; the first lever member is engaged with the head fixing member, and when the first lever member is pivoted, the head fixing member is pivoted with a sub scanning direction as an axial direction of pivoting with respect to the holding member; and the second lever member is engaged with the holding member, and when the second lever member is pivoted, the holding member is pivoted with a main scanning direction as an axial direction of pivoting with respect to the carriage.

In the present invention, the inkjet printer further includes a position adjustment mechanism for adjusting a position in a sub scanning direction of each of the inkjet heads with respect to the carriage, and a third inclination adjustment mechanism for adjusting an inclination of each of the inkjet heads with respect to the carriage in a pivoting direction having an up-down direction as an axial direction of pivoting; where the holding member constitutes a part of the position adjustment mechanism and is movable in the sub scanning direction with respect to the carriage; and the head fixing member constitutes a part of the third inclination adjustment mechanism, and is pivotable with an up-down direction as an axial direction of pivoting with respect to the holding member. According to such configuration, even if the inkjet printer includes the position adjustment mechanism and the third inclination adjustment mechanism in addition to the first inclination adjustment mechanism and the second inclination adjustment mechanism, the configuration of the inkjet printer can be simplified.

Effect of the Invention

As described above, in the inkjet printer of the present invention, the variation in the landing position of the ink ejected from the plurality of inkjet heads mounted on the carriage for each inkjet head can be suppressed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of an inkjet printer according to an embodiment of the present invention.

FIG. **2** is a schematic view for describing the configuration of the inkjet printer shown in FIG. **1**.

FIG. **3** is a perspective view of an inkjet head and an adjustment mechanism illustrated in FIG. **2**.

FIG. **4** is a plan view of the adjustment mechanism illustrated in FIG. **3**.

FIG. **5** is a perspective view of the adjustment mechanism illustrated in FIG. **3**.

FIG. **6** is a perspective view illustrating the adjustment mechanism illustrated in FIG. **3** from a direction different from that in FIG. **5**.

FIG. **7** is a perspective view illustrating the adjustment mechanism illustrated in FIG. **3** from a direction different from those in FIGS. **5** and **6**.

FIG. **8** is a front view of the inkjet head and the adjustment mechanism illustrated in FIG. **3**.

FIG. **9** is an enlarged view of a portion E in FIG. **5**.

FIG. **10** is an enlarged view of a portion F in FIG. **6**.

FIG. **11** is an enlarged side view illustrating the adjustment mechanism from the G-G direction in FIG. **5**.

DESCRIPTION OF EMBODIMENTS

Hereinafter, an embodiment of the present invention will be described with reference to the drawings.

(Schematic Configuration of Inkjet Printer)

FIG. **1** is a perspective view of an inkjet printer **1** according to an embodiment of the present invention. FIG. **2** is a schematic view for describing the configuration of the inkjet printer **1** illustrated in FIG. **1**.

The inkjet printer **1** (hereinafter referred to as "printer **1**") of the present embodiment is, for example, a business inkjet printer, and performs printing on a print medium **2**. The print medium **2** is, for example, printing paper, fabric, or the like. The printer **1** includes a plurality of inkjet heads **3** (hereinafter referred to as "heads **3**") that eject ink toward a print medium **2**, and a carriage **4** on which the plurality of heads **3** are mounted. The printer **1** of the present embodiment includes, for example, two heads **3**, and the two heads **3** are mounted on the carriage **4**.

Furthermore, the printer **1** includes a carriage drive mechanism **5** that moves the carriage **4** in a main scanning direction (Y direction in FIG. **1** etc.), a guide rail **6** for guiding the carriage **4** in the main scanning direction, a platen **7** on which the print medium **2** at the time of printing is placed, a medium feeding mechanism **8** that feeds the print medium **2** in a sub scanning direction (X direction in FIG. **1** etc.) orthogonal to the up-down direction (Z direction in FIG. **1** etc.) and the main scanning direction, and a plurality of ink tanks **9** in which ink to be supplied to the head **3** is stored.

The platen **7** is disposed on the lower side of the head **3**. The head **3** ejects ink downward. A nozzle row is formed on a lower surface of the head **3**. The nozzle row is configured by a plurality of nozzles arrayed in the sub scanning direction. The carriage drive mechanism **5** includes, for example, two pulleys, a belt that is bridged between the two pulleys and that has a part fixed to the carriage **4**, and a motor that rotates the pulleys. The medium feeding mechanism **8** includes, for example, a conveyor roller that comes into contact with the print medium **2** and feeds the print medium **2**, and a motor that rotates the conveyor roller.

The printer **1** also includes an adjustment mechanism **10** for adjusting the inclination and position of each of the heads **3** with respect to the carriage **4**. The printer **1** of the present embodiment includes two adjustment mechanisms **10** including an adjustment mechanism **10** for adjusting the inclination and position of one head **3** of the two heads **3** mounted on the carriage **4** and an adjustment mechanism **10** for adjusting the inclination and position of the other head **3** of the two heads **3**. The two adjustment mechanisms **10** are mounted on the carriage **4**. Hereinafter, the configuration of the adjustment mechanism **10** will be described.

(Configuration of Adjustment Mechanism)

FIG. **3** is a perspective view of a head **3** and an adjustment mechanism **10** illustrated in FIG. **2**. FIG. **4** is a plan view of an adjustment mechanism **10** illustrated in FIG. **3**. FIG. **5** is a perspective view of the adjustment mechanism **10** illustrated in FIG. **3**. FIG. **6** is a perspective view illustrating the adjustment mechanism **10** illustrated in FIG. **3** from a direction different from that in FIG. **5**. FIG. **7** is a perspective view illustrating the adjustment mechanism **10** illustrated in FIG. **3** from a direction different from those in FIGS. **5** and **6**. FIG. **8** is a front view of the head **3** and the adjustment mechanism **10** illustrated in FIG. **3**. FIG. **9** is an enlarged view of a portion E in FIG. **5**. FIG. **10** is an enlarged view of a portion F in FIG. **6**. FIG. **11** is an enlarged side view illustrating the adjustment mechanism **10** from the G-G direction in FIG. **5**.

In the following description, the main scanning direction (X direction) is assumed as "left-right direction" and the sub scanning direction (Y direction) is assumed as "front-back direction". Furthermore, the Y1 direction side of FIG. **3** or the like, which is one side in the left-right direction, is defined as the "right" side, the Y2 direction side of FIG. **3** or the like on the opposite side is defined as the "left" side, the X1 direction side of FIG. **3** or the like, which is one side in the front-back direction, is defined as the "front" side, and the X2 direction side of FIG. **3** or the like on the opposite side is defined as the "back" side.

The adjustment mechanism **10** includes a first inclination adjustment mechanism **13** for adjusting the inclination of each of the heads **3** with respect to the carriage **4** in a pivoting direction having the front-back direction (sub scanning direction) as an axial direction of pivoting, and a second inclination adjustment mechanism **14** for adjusting the inclination of each of the heads **3** with respect to the carriage **4** in a pivoting direction having the left-right direction (main scanning direction) as an axial direction of pivoting. The adjustment mechanism **10** includes a position adjustment mechanism **15** for adjusting the position in the front-back direction of each of the heads **3** with respect to the carriage **4**, and a third inclination adjustment mechanism **16** for adjusting the inclination of each of the heads **3** with respect to the carriage **4** in a pivoting direction having the up-down direction as an axial direction of pivoting. The adjustment mechanism **10** further includes a base member **17** fixed to the carriage **4**.

The first inclination adjustment mechanism **13** includes a head fixing member **20** to which the head **3** is fixed. The second inclination adjustment mechanism **14** includes a holding member **21** that holds the head fixing member **20**. The holding member **21** is pivotable with respect to the base member **17** with the left-right direction as an axial direction of pivoting. That is, the holding member **21** is pivotable with respect to the base member **17** fixed to the carriage **4** with the left-right direction as an axial direction of pivoting, and is pivotable with respect to the carriage **4** with the left-right direction as an axial direction of pivoting. The head fixing member **20** is pivotable with respect to the holding member **21** with the front-back direction as an axial direction of pivoting.

The holding member **21** constitutes a part of the position adjustment mechanism **15**. The holding member **21** is movable in the front-back direction with respect to the base member **17**. That is, the holding member **21** is movable in the front-back direction with respect to the base member **17** fixed to the carriage **4**, and is movable in the front-back direction with respect to the carriage **4**. The head fixing member **20** constitutes a part of the third inclination adjustment mechanism **16**. The head fixing member **20** is pivotable with respect to the holding member **21** with the up-down direction as an axial direction of pivoting.

In addition to the holding member **21**, the second inclination adjustment mechanism **14** includes a leaf spring **22** that biases the holding member **21** toward one side in the pivoting direction of the holding member **21** with respect to the base member **17**, a fulcrum portion holding member **23** that comes in contact with a fulcrum portion **21***f*, described later, formed on the holding member **21** from the back side, and a compression coil spring **24** that biases the fulcrum portion holding member **23** towards the front side. Furthermore, the second inclination adjustment mechanism **14** includes a second lever member **25** pivotably held by the carriage **4** through the base member **17**, a leaf spring **26** for biasing the second lever member **25** toward one side in a pivoting direction of the second lever member **25**, and a second micrometer head **27** (hereinafter referred to as "second micrometer head **27**") for pivoting the second lever member **25** toward the other side in the pivoting direction of the second lever member **25**.

The fulcrum portion holding member **23** and compression coil spring **24** constitute a part of position adjustment mechanism **15**. In addition to the holding member **21**, the

fulcrum portion holding member **23**, and the compression coil spring **24**, the position adjustment mechanism **15** includes a leaf spring **28** that biases the holding member **21** toward the left side, and an eccentric cam **29** for adjusting the position in the front-back direction of the holding member **21** with respect to the base member **17**.

The base member **17** includes a flat plate-shaped base plate portion **17***a* fixed to the carriage **4**, a holding portion **17***b* that holds the second lever member **25** and the second micrometer head **27**, a spring fixing portion **17***c* to which the leaf spring **26** is fixed, a spring fixing portion **17***d* to which the leaf spring **28** is fixed, and two regulation pins **17***e* that regulate the position of the holding member **21** in the left-right direction.

The base plate portion **17***a* is formed in a substantially rectangular flat plate shape. The base plate portion **17***a* is fixed to the carriage **4** in a state where the thickness direction of the base plate portion **17***a* formed in a flat plate shape coincides with the up-down direction, and in a state where the long side direction of the base plate portion **17***a* formed in a substantially rectangular shape coincides with the front-back direction. A rectangular opening **17***f* in which the lower end portion of the head **3** is disposed is formed in the base plate portion **17***a*.

The holding portion **17***b*, the spring fixing portion **17***c*, and the spring fixing portion **17***d* are formed in a block shape rising toward the upper side from the upper surface of the base plate portion **17***a*. The holding portion **17***b* and the spring fixing portion **17***c* are formed at the front end portion of the base member **17**. In addition, the holding portion **17***b* is formed at a substantially central position of the base member **17** in the left-right direction, and the spring fixing portion **17***c* is formed at a left end portion of the base member **17**.

The spring fixing portion **17***d* is formed at the right end portion of the base member **17**. Furthermore, the spring fixing portion **17***d* is formed at a substantially central position of the base member **17** in the front-back direction. The two regulation pins **17***e* are formed at the left end portion of the base member **17**. The two regulation pins **17***e* are disposed on the back side of the spring fixing portion **17***c*. The two regulation pins **17***e* are disposed at the same position in the left-right direction and are spaced apart from each other in the front-back direction.

The holding member **21** is formed in a substantially rectangular frame shape as a whole. The holding member **21** is placed on the base plate portion **17***a*. The long side direction of the holding member **21** formed in a substantially rectangular frame shape coincides with the front-back direction. The lower end portion of the head **3** is disposed on the inner peripheral side of the holding member **21**. The holding member **21** includes a front wall portion **21***a* forming a front surface of the holding member **21**, a back wall portion **21***b* forming a rear surface of the holding member **21**, a side wall portion **21***c* connecting the front wall portion **21***a* and the back wall portion **21***b* on a right side of the holding member **21**, and a side wall portion **21***d* connecting the front wall portion **21***a* and the back wall portion **21***b* on a left side of the holding member **21**. The front wall portion **21***a* is disposed on the back side of the holding portion **17***b* of the base member **17**.

A protrusion **21***e* protruding toward the right side is formed on the side wall portion **21***c*, and a protrusion **21***e* protruding toward the left side is formed on the side wall portion **21***d*. The protrusion **21***e* is disposed on the back side of the spring fixing portion **17***d*. A rear end portion of the protrusion **21***e* is a fulcrum portion **21***f* formed in a substantially columnar shape. The fulcrum portion **21***f* formed in a substantially columnar shape is disposed in a state where the axial direction of the fulcrum portion **21***f* coincides with the left-right direction. The fulcrum portion **21***f* formed on the side wall portion **21***c* and the fulcrum portion **21***f* formed on side wall portion **21***d* are disposed at the same position in the front-back direction. The two fulcrum portions **21***f* serve as fulcrums for the pivoting of the holding member **21** with respect to the carriage **4**, and the holding member **21** is pivotable with respect to the carriage **4** with an axis line L1 passing through the axial centers of the two fulcrum portions **21***f* as a center of pivoting.

The fulcrum portion holding member **23** is formed in a substantially rectangular parallelepiped block shape. The compression coil spring **24** is disposed on the back side of the fulcrum portion holding member **23** and biases the fulcrum portion holding member **23** towards the front side as described above. The fulcrum portion holding member **23** is linearly movable in the front-back direction with respect to the base member **17**. The fulcrum portion holding member **23** and the compression coil spring **24** are disposed at two locations of a right side of the side wall portion **21***c* and a left side of the side wall portion **21***d*.

An inclined surface **23***a* with which the fulcrum portion **21***f* comes into contact is formed at the lower end portion of the front surface of the fulcrum portion holding member **23** (see FIG. **11**). The inclined surface **23***a* is inclined upward toward the front side. The fulcrum portion **21***f* is restricted from moving upward and moving backward by the inclined surface **23***a*. That is, the holding member **21** is restricted from moving upward and moving backward by the fulcrum portion holding member **23**. The compression coil spring **24** biases the holding member **21** towards the front side through the fulcrum portion holding member **23**.

The leaf spring **22** is attached to the holding portion **17***b* of the base member **17**. As illustrated in FIG. **9**, the front wall portion **21***a* of the holding member **21** is formed with protrusion **21***g* protruding toward the front side, and spring portion **22***a* of the leaf spring **22** is in contact with an upper surface of the protrusion **21***g*. That is, the leaf spring **22** biases the front end portion of the holding member **21** downward.

The second lever member **25** is formed in a substantially rectangular parallelepiped shape elongated in the left-right direction. A round hole-shaped insertion hole **25***a* penetrating in the front-back direction is formed in a central portion of the second lever member **25** (see FIGS. **8** to **10**). A columnar fixed shaft **17***g* formed in the holding portion **17***b* is inserted into the insertion hole **25***a*, and a central portion of the second lever member **25** is pivotably supported by the fixed shaft **17***g*. Therefore, the second lever member **25** is pivotable with respect to the base member **17** with the front-back direction as an axial direction of pivoting. At a right end portion of the second lever member **25**, an engagement pin **32** is formed or fixed in a columnar shape protruding toward the back side (see FIG. **9**). The back end portion of the engagement pin **32** is inserted into an engagement hole formed in the protrusion **21***g* of the holding member **21**.

The leaf spring **26** is fixed to the spring fixing portion **17***c*. The leaf spring **26** includes a second spring portion **26***a* that comes into contact with the left end portion of the second lever member **25** from the lower side (see FIGS. **8** and **10**). The second spring portion **26***a* biases the left end portion of the second lever member **25** toward the upper side. The second spring portion **26***a* of the present embodiment is a second spring member that biases the second lever member

25 toward one side in the pivoting direction of the second lever member **25**. The leaf spring **26** also constitutes a part of the first inclination adjustment mechanism **13**.

The second micrometer head **27** is attached to the holding portion **17***b*. Specifically, the second micrometer head **27** is attached to the holding portion **17***b* such that the spindle **33** of the second micrometer head **27** is disposed on the lower side (see FIG. **8**). The lower end of the spindle **33** is in contact with the upper surface of the left end portion of the second lever member **25**.

When the operator of the printer **1** turns the thimble (knob) **34** of the second micrometer head **27**, the spindle **33** moves up and down. When the spindle **33** moves up and down, the second lever member **25** pivots about the fixed shaft **17***g*. When the second lever member **25** pivots, the engagement pin **32** moves up and down together with the right end portion of the second lever member **25**, so that the front end portion of the holding member **21** moves up and down. When the front end portion of the holding member **21** moves up and down, the holding member **21** pivots about the axis line L**1**. That is, the second lever member **25** is engaged with the holding member **21** through the engagement pin **32**, and when the second lever member **25** is pivoted, the holding member **21** pivots with respect to the carriage **4** with the left-right direction as an axial direction of pivoting.

The leaf spring **28** is fixed to the spring fixing portion **17***d*, as described above. The leaf spring **28** is formed with a spring portion **28***a* that comes into contact with the holding member **21**. The spring portion **28***a* is in contact with the holding member **21** from the right side, and biases the holding member **21** toward the left side. The left surface of the side wall portion **21***d* of the holding member **21** biased to the left side is in contact with the two regulation pins **17***e*.

The eccentric cam **29** is pivotably attached to a right front end portion of the base plate portion **17***a*. The eccentric cam **29** is pivotable with the up-down direction as an axial direction of pivoting. The cam surface of the eccentric cam **29** is in contact with the right end portion of the front surface of the front wall portion **21***a* of the holding member **21**. When the operator of the printer **1** pivots the eccentric cam **29**, the holding member **21** linearly moves in the front-back direction along the two regulation pins **17***e*. That is, when the eccentric cam **29** is pivoted, the holding member **21** linearly moves in the front-back direction with respect to the carriage **4**. The fulcrum portion holding member **23** linearly moves in the front-back direction according to the movement of the holding member **21**.

As described above, the leaf spring **26** constitutes a part of the first inclination adjustment mechanism **13**. The first inclination adjustment mechanism **13** includes a first lever member **35** pivotably held by the holding member **21** in addition to the head fixing member **20** and the leaf spring **26**. A first spring portion **26***b* described later forming a part of the leaf spring **26** biases the first lever member **35** toward one side in the pivoting direction of the first lever member **35**. In addition, the first inclination adjustment mechanism **13** includes a first micrometer head **37** (hereinafter referred to as "first micrometer head **37**") for pivoting the first lever member **35** toward the other side in the pivoting direction of the first lever member **35**.

As described above, the head fixing member **20** constitutes a part of the third inclination adjustment mechanism **16**. The third inclination adjustment mechanism **16** includes, in addition to the head fixing member **20**, a leaf spring **38** that biases the head fixing member **20** toward one side in a pivoting direction of the head fixing member **20** having the up-down direction as an axial direction of pivoting, and an eccentric cam **39** for adjusting the inclination of the head fixing member **20** with respect to the holding member **21** in the pivoting direction having the up-down direction as the axial direction of pivoting.

The head fixing member **20** includes two members, that is, a first fixing member **41** to which the front end portion of the head **3** is fixed and a second fixing member **42** to which the back end portion of the head **3** is fixed. The first fixing member **41** and the second fixing member **42** are integrated by way of the head **3**. A placement portion on which the first fixing member **41** is placed is formed on the back side of the front wall portion **21***a* of the holding member **21**, and the first fixing member **41** is placed on the placement portion. A placement portion on which the second fixing member **42** is placed is formed on the front side of the back wall portion **21***b* of the holding member **21**, and the second fixing member **42** is placed on the placement portion.

The first fixing member **41** is formed with a columnar fixed shaft **41***a* protruding toward the front side. An insertion hole **21***h* into which the fixed shaft **41***a* is inserted is formed in the front wall portion **21***a* (see FIG. **9**). The insertion hole **21***h* is formed in a long hole shape with the left-right direction as the longitudinal direction. The fixed shaft **41***a* is pivotably held by the front wall portion **21***a*. A leaf spring **44** is fixed to an upper end face of the front wall portion **21***a*. The leaf spring **44** is in contact with the upper end face of the first fixing member **41** and biases the first fixing member **41** downward. Furthermore, a leaf spring **45** is fixed to an upper end face of the back wall portion **21***b*. The leaf spring **45** is in contact with the upper end face of the second fixing member **42** and biases the second fixing member **42** downward.

On the back surface of the second fixing member **42**, a to-be-supporting portion (not illustrated) protruding toward the back side is formed. The to-be-supporting portion is formed in, for example, a hemispherical shape, and is supported by a spherical bearing (spherical slide bearing) **46** fixed to the back wall portion **21***b*. The back end of the to-be-supporting portion formed in a hemispherical shape and the fixed shaft **41***a* are disposed at substantially the same position in the left-right direction. In a pivoting direction of the head fixing member **20** having the front-back direction as an axial direction of pivoting, the fixed shaft **41***a* and the to-be-supporting portion serve as a fulcrum of pivoting of the head fixing member **20** with respect to the holding member **21**, and the head fixing member **20** is pivotable with respect to the holding member **21** with an axis line L**2** passing through an axial center of the fixed shaft **41***a* and a back end of the to-be-supporting portion as a center of pivoting. That is, the head fixing member **20** is pivotable with respect to the carriage **4** with the axis line L**2** as the center of pivoting.

The to-be-supporting portion of the second fixing member **42** supported by the spherical bearing **46** serves as a fulcrum of pivoting of the head fixing member **20** with respect to the holding member **21** in a pivoting direction of the head fixing member **20** having the up-down direction as an axial direction of pivoting, and the head fixing member **20** is pivotable with respect to the holding member **21** with the to-be-supporting portion of the second fixing member **42** as a center of pivoting and with the up-down direction as an axial direction of pivoting. That is, the head fixing member **20** is pivotable with respect to the carriage **4** with the to-be-supporting portion of the second fixing member **42** as the center of pivoting. Notches for preventing interference between the head fixing member **20** and the holding member **21** when the head fixing member **20** is pivoted with respect

to the holding member **21** are formed in at least one of the head fixing member **20** and the holding member **21**.

The leaf spring **38** is attached to the front end portion of the side wall portion **21***d* of the holding member **21**. A spring portion **38***a* of leaf spring **38** is in contact with the first fixing member **41** from the left side, and biases the first fixing member **41** to the right side. The eccentric cam **39** is pivotably attached to a right front end portion of the holding member **21**. The eccentric cam **39** is pivotable with the up-down direction as an axial direction of pivoting. The cam surface of the eccentric cam **39** is in contact with the left side surface of the first fixing member **41**. When the operator of the printer **1** pivots the eccentric cam **39**, the head fixing member **20** pivots with respect to the holding member **21** about the to-be-supporting portion of the second fixing member **42**.

The first lever member **35** is formed in a substantially rectangular parallelepiped shape elongated in the left-right direction. As illustrated in FIG. **10**, a round hole-shaped insertion hole **35***a* penetrating in the front-Back direction is formed at the right end portion of the first lever member **35**. A fixed shaft **48** formed or fixed on the front wall portion **21***a* is inserted into the insertion hole **35***a*, and a right end portion of the first lever member **35** is pivotably supported by the fixed shaft **48**. Therefore, the first lever member **35** is pivotable with respect to the holding member **21** with the front-back direction as an axial direction of pivoting.

As illustrated in FIG. **10**, an engagement pin **51** is formed or fixed in a columnar shape protruding toward the back side on a left end portion of the first lever member **35**. The back end portion of the engagement pin **51** is inserted into an engagement hole **41***b* formed at the left end portion of the first fixing member **41**. The engagement hole **41***b* penetrates the first fixing member **41** in the front-back direction. Furthermore, the engagement hole **41***b* is formed in a long hole shape with the left-right direction as the longitudinal direction.

The leaf spring **26** includes a first spring portion **26***b* that comes into contact with the left end portion of the first lever member **35** from the lower side. The first spring portion **26***b* biases the left end portion of the first lever member **35** toward the upper side. The first spring portion **26***b* of the present embodiment is a first spring member that biases the first lever member **35** toward one side in the pivoting direction of the first lever member **35**.

The first micrometer head **37** is attached to the left end portion of the front wall portion **21***a*. Specifically, the first micrometer head **37** is attached to the left end portion of the front wall portion **21***a* such that the spindle **53** of the first micrometer head **37** is disposed on the lower side (see FIG. **8**). The lower end of the spindle **53** is in contact with the upper surface of the left end portion of the first lever member **35**.

When the operator of the printer **1** turns the thimble **54** of the first micrometer head **37**, the spindle **53** moves up and down. When the spindle **53** moves up and down, the first lever member **35** pivots about the fixed shaft **48**. When the first lever member **35** is pivoted, the engagement pin **51** moves up and down together with the left end portion of the first lever member **35**, so that the left end portion of the first lever member **35** moves up and down, and the first fixing member **41** pivots. That is, when the first lever member **35** is pivoted, the head fixing member **20** pivots about the axis line L**2**. As described above, the first lever member **35** is engaged with the head fixing member **20** through the engagement pin **51**, and when the first lever member **35** is pivoted, the head fixing member **20** pivots with respect to the carriage **4** with the front-back direction as an axial direction of pivoting.

Main Effect of Present Embodiment

As described above, in the present embodiment, when the thimble **54** of the first micrometer head **37** is pivoted, the head fixing member **20** pivots with respect to the carriage **4** with the front-rear direction as an axial direction of pivoting. Therefore, in the present embodiment, the inclination of each of the heads **3** with respect to the carriage **4** can be adjusted in the pivoting direction having the front-back direction as the axial direction of pivoting by pivoting the thimble **54**. Therefore, in the present embodiment, variations in the inclination of the two heads **3** mounted on the carriage **4** in the pivoting direction having the front-back direction as the axial direction of pivoting for each head **3** can be suppressed.

In addition, in the present embodiment, when the thimble **34** of the second micrometer head **27** is pivoted, the holding member **21** pivots with respect to the carriage **4** with the left-right direction as an axial direction of pivoting. Therefore, in the present embodiment, the inclination of each of the heads **3** with respect to the carriage **4** in the pivoting direction having the left-right direction as the axial direction of pivoting can be adjusted by pivoting the thimble **34**. Therefore, in the present embodiment, variations in the inclination of the two heads **3** mounted on the carriage **4** in the pivoting direction having the left-right direction as the axial direction of pivoting for each head **3** can be suppressed.

As described above, in the present embodiment, variations in the inclination of the two heads **3** mounted on the carriage **4** in the pivoting direction having the front-back direction as the axial direction of the pivoting for each head **3**, and variations in the inclination of the two heads **3** mounted on the carriage **4** in the pivoting direction having the left-right direction as the axial direction of the pivoting for each head **3** can be suppressed. Therefore, in the present embodiment, variations in the landing position of the ink ejected from the two heads **3** mounted on the carriage **4** on the print medium **2** for each head **3** can be suppressed.

Furthermore, in the present embodiment, variations in the inclination of the two heads **3** mounted on the carriage **4** in the pivoting direction having the front-back direction as the axial direction of pivoting for each head **3** and variations in the inclination of the two heads **3** mounted on the carriage **4** in the pivoting direction having the left-right direction as the axial direction of pivoting for each head **3** can be suppressed, whereby even if the thickness of the print medium **2** is changed, and even if the surface of the print medium **2** has irregularities, variations in the landing position of the ink ejected from the two heads **3** mounted on the carriage **4** on the print medium **2** for each head **3** can be suppressed.

In the present embodiment, the holding member **21** forming a part of the second inclination adjustment mechanism **14** constitutes a part of the position adjustment mechanism **15**, and the holding member **21** is movable in the front-back direction with respect to the carriage **4**. Furthermore, in the present embodiment, the head fixing member **20** forming a part of the first inclination adjustment mechanism **13** constitutes a part of the third inclination adjustment mechanism **16**, and the head fixing member **20** can pivot with respect to the holding member **21** with the up-down direction as the axial direction pivoting. Therefore, in the present embodi-

ment, even if the adjustment mechanism **10** includes the position adjustment mechanism **15** and the third inclination adjustment mechanism **16** in addition to the first inclination adjustment mechanism **13** and the second inclination adjustment mechanism **14**, the configuration of the printer **1** can be simplified.

Other Embodiments

The above-described embodiment is an example of a preferred embodiment of the present invention, but the present invention is not limited thereto, and various modifications can be made without changing the gist of the present invention.

In the embodiment described above, the first inclination adjustment mechanism **13** may include, instead of the first micrometer head **37**, a first adjustment screw for pivoting the first lever member **35** to the other side in the pivoting direction of the first lever member **35**. In this case, the first adjustment screw is attached to the left end portion of the front wall portion **21***a*, and the lower end of the first adjustment screw is in contact with the upper surface of the left end portion of the first lever member **35**. The front wall portion **21***a* is formed with a screw hole into which the first adjustment screw is screwed.

In the embodiment described above, the second inclination adjustment mechanism **14** may include, instead of the second micrometer head **27**, a second adjustment screw for pivoting the second lever member **25** to the other side in the pivoting direction of the second lever member **25**. In this case, the second adjustment screw is attached to the holding portion **17***b*, and the lower end of the second adjustment screw is in contact with the upper surface of the left end portion of the second lever member **25**. The holding portion **17***b* is formed with a screw hole into which the second adjustment screw is screwed.

In the embodiment described above, the adjustment mechanism **10** may not include the second inclination adjustment mechanism **14**. Even in this case, the first inclination adjustment mechanism **13** can suppress the variation in the inclination of the two heads **3** mounted on the carriage **4** in the pivoting direction having the front-back direction as the axial direction of pivoting for each head **3**, so that the variation in the landing position of the ink ejected from the two heads **3** mounted on the carriage **4** on the print medium **2** for each head **3** can be suppressed.

In the embodiment described above, the adjustment mechanism **10** may not include the first inclination adjustment mechanism **13**. Even in this case, the second inclination adjustment mechanism **14** can suppress the variation in the inclination of the two heads **3** mounted on the carriage **4** in the pivoting direction having the left-right direction as the axial direction of pivoting for each head **3**, so that the variation in the landing position of the ink ejected from the two heads **3** mounted on the carriage **4** on the print medium **2** for each head **3** can be suppressed.

According to the study of the inventors of the present application, it is possible to suppress the variation of the landing position of the ink ejected from the two heads **3** mounted on the carriage **4** on the print medium **2** for each head **3** by suppressing the variation of the inclination of the two heads **3** mounted on the carriage **4** in the pivoting direction having the front-back direction as the axial direction of pivoting for each head **3** rather than suppressing the variation of the inclination of the two heads **3** mounted on the carriage **4** in the pivoting direction having the left-right direction as the axial direction of pivoting for each head **3**, and hence the adjustment mechanism **10** preferably includes the first inclination adjustment mechanism **13**.

In the embodiment described above, the holding member **21** may be pivotable with the front-back direction as the axial direction of pivoting with respect to the carriage **4**, and the head fixing member **20** may be pivotable with the left-right direction as the axial direction of pivoting with respect to the holding member **21**. Furthermore, in the embodiment described above, the holding member **21** may not constitute a part of the position adjustment mechanism **15**. The head fixing member **20** may not constitute a part of the third inclination adjustment mechanism **16**. Furthermore, in the embodiment described above, the adjustment mechanism **10** may not include the position adjustment mechanism **15** or may not include the third inclination adjustment mechanism **16**.

In the embodiment described above, the number of heads **3** mounted on the carriage **4** may be three or more. In this case, the printer **1** includes the adjustment mechanism **10** of a number corresponding to the number of heads **3** mounted on the carriage **4**. In the embodiment described above, instead of the platen **7** and the medium feeding mechanism **8**, the printer **1** may include a table on which the print medium **2** is placed and a table feeding mechanism that feeds the table in the sub scanning direction (front-back direction), or may include a table on which the print medium **2** is placed and a Y bar feeding mechanism that feeds a Y bar to which the guide rail **6** is fixed in the sub scanning direction (front-back direction). In addition, in the embodiment described above, the printer **1** may be a 3D printer.

The invention claimed is:

1. An inkjet printer including:

a plurality of inkjet heads that eject ink;

a carriage on which the plurality of inkjet heads are mounted;

a carriage drive mechanism that moves the carriage in a main scanning direction;

a first inclination adjustment mechanism for adjusting inclination of each of the inkjet heads with respect to the carriage in a pivoting direction having a sub scanning direction orthogonal to an up-down direction and the main scanning direction as an axial direction of pivoting; and

a second inclination adjustment mechanism for adjusting inclination of each of the inkjet heads with respect to the carriage in a pivoting direction having the main scanning direction as an axial direction of pivoting,

wherein

the first inclination adjustment mechanism includes a head fixing member to which the inkjet head is fixed;

the second inclination adjustment mechanism includes a holding member that holds the head fixing member;

the holding member is pivotable with respect to the carriage with a main scanning direction as an axial direction of pivoting; and

the head fixing member is pivotable with respect to the holding member with a sub scanning direction as an axial direction of pivoting,

wherein

the first inclination adjustment mechanism includes a first lever member pivotably held by the holding member, a first spring member that biases the first lever member toward one side in a pivoting direction of the first lever member, and a first micrometer head or a first adjustment screw for pivoting the first lever member toward the other side in the pivoting direction of the first lever member;

the second inclination adjustment mechanism includes a second lever member pivotably held by the carriage, a second spring member that biases the second lever member toward one side in a pivoting direction of the second lever member, and a second micrometer head or a second adjustment screw for pivoting the second lever member toward the other side in the pivoting direction of the second lever member;

the first lever member is engaged with the head fixing member, and when the first lever member is pivoted, the head fixing member is pivoted with a sub scanning direction as an axial direction of pivoting with respect to the holding member; and

the second lever member is engaged with the holding member, and when the second lever member is pivoted, the holding member is pivoted with a main scanning direction as an axial direction of pivoting with respect to the carriage.

2. The inkjet printer as set forth in claim **1**, further comprising a position adjustment mechanism for adjusting a position in a sub scanning direction of each of the inkjet heads with respect to the carriage, and a third inclination adjustment mechanism for adjusting an inclination of each of the inkjet heads with respect to the carriage in a pivoting direction having an up-down direction as an axial direction of pivoting; wherein

the holding member constitutes a part of the position adjustment mechanism and is movable in the sub scanning direction with respect to the carriage; and

the head fixing member constitutes a part of the third inclination adjustment mechanism, and is pivotable with respect to the holding member with an up-down direction as an axial direction of pivoting.

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