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(12) **United States Patent**
Aoki et al.

(10) **Patent No.: US 9,821,557 B2**
(45) **Date of Patent: Nov. 21, 2017**

(54) **CARTRIDGE, PRINTING MATERIAL SUPPLY SYSTEM, AND PRINTING APPARATUS**

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(72) Inventors: **Yuji Aoki**, Matsumoto (JP); **Hiroshi Satoh**, Nirasaki (JP)

(73) Assignee: **Seiko Epson Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 70 days.

(21) Appl. No.: **14/879,593**

(22) Filed: **Oct. 9, 2015**

(65) **Prior Publication Data**

US 2016/0031224 A1 Feb. 4, 2016

Related U.S. Application Data

(62) Division of application No. 13/738,347, filed on Jan. 10, 2013, now Pat. No. 9,266,337.

(30) **Foreign Application Priority Data**

Jan. 13, 2012 (JP) 2012-005347
Jan. 25, 2012 (JP) 2012-013238
Feb. 6, 2012 (JP) 2012-022819

(51) **Int. Cl.**
B41J 2/175 (2006.01)

(52) **U.S. Cl.**
CPC ***B41J 2/175*** (2013.01); ***B41J 2/1752*** (2013.01); ***B41J 2/17509*** (2013.01); ***B41J 2/17526*** (2013.01); ***B41J 2/17546*** (2013.01); ***B41J 2/17553*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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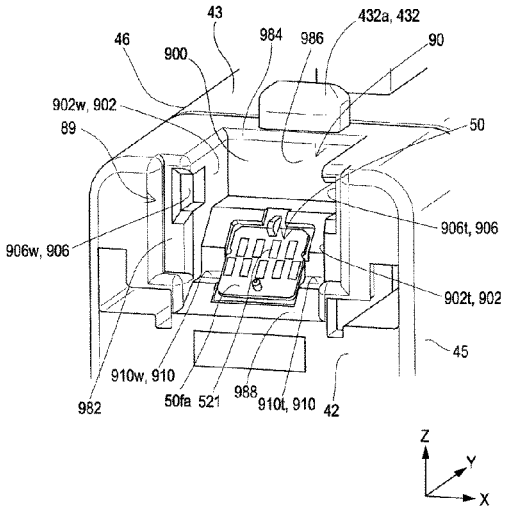
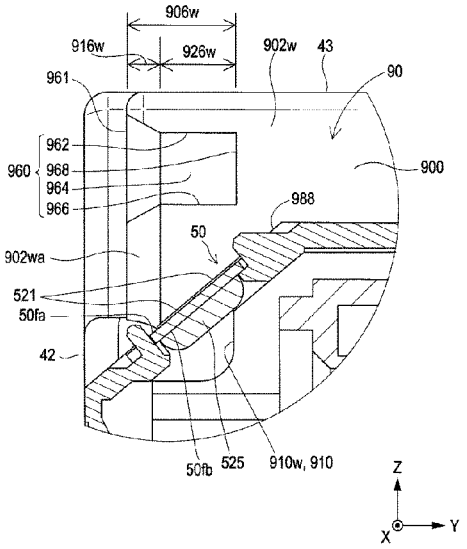
Primary Examiner — Erica Lin
(74) *Attorney, Agent, or Firm* — Foley & Lardner LLP

(57) **ABSTRACT**

A cartridge includes a concave portion. The concave portion has an opening, first and second side walls, and a bottom wall, and the bottom wall has a tilted surface tilted. The tilted surface is provided with a cartridge side terminal group. The first side wall is provided with a first restriction portion which restricts movements in a +Z axis direction and a +X axis direction of an apparatus side terminal unit, and the second side wall is provided with a second restriction portion which restricts movements in the +Z axis direction and a −X axis direction of an apparatus side terminal unit.

16 Claims, 45 Drawing Sheets





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WO	2006/082836	A	8/2006

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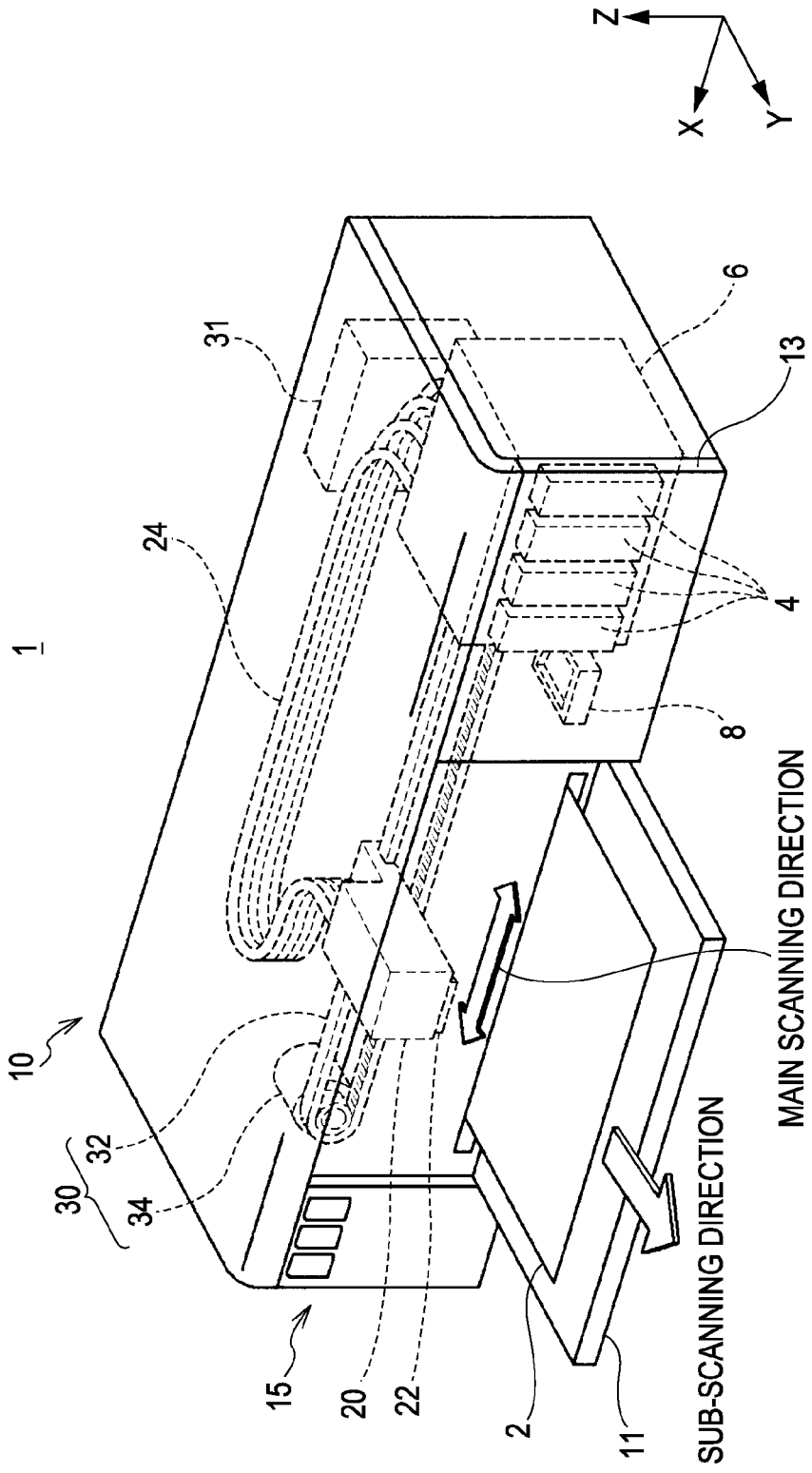
FIG. 1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Y
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10
15
20
22
2
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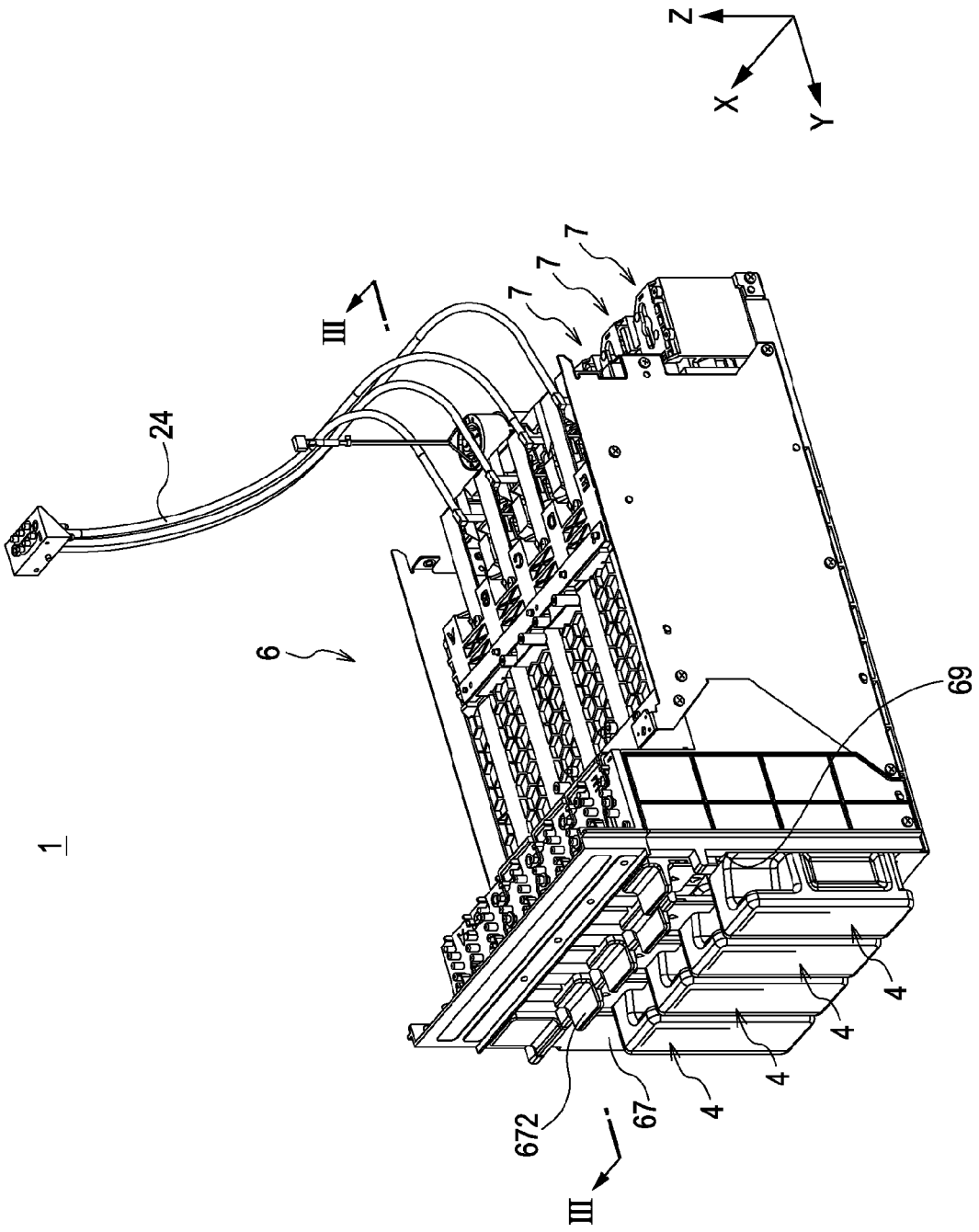
32
34
24
31
6
13
4
8
MAIN SCANNING DIRECTION
SUB-SCANNING DIRECTION

FIG. 2



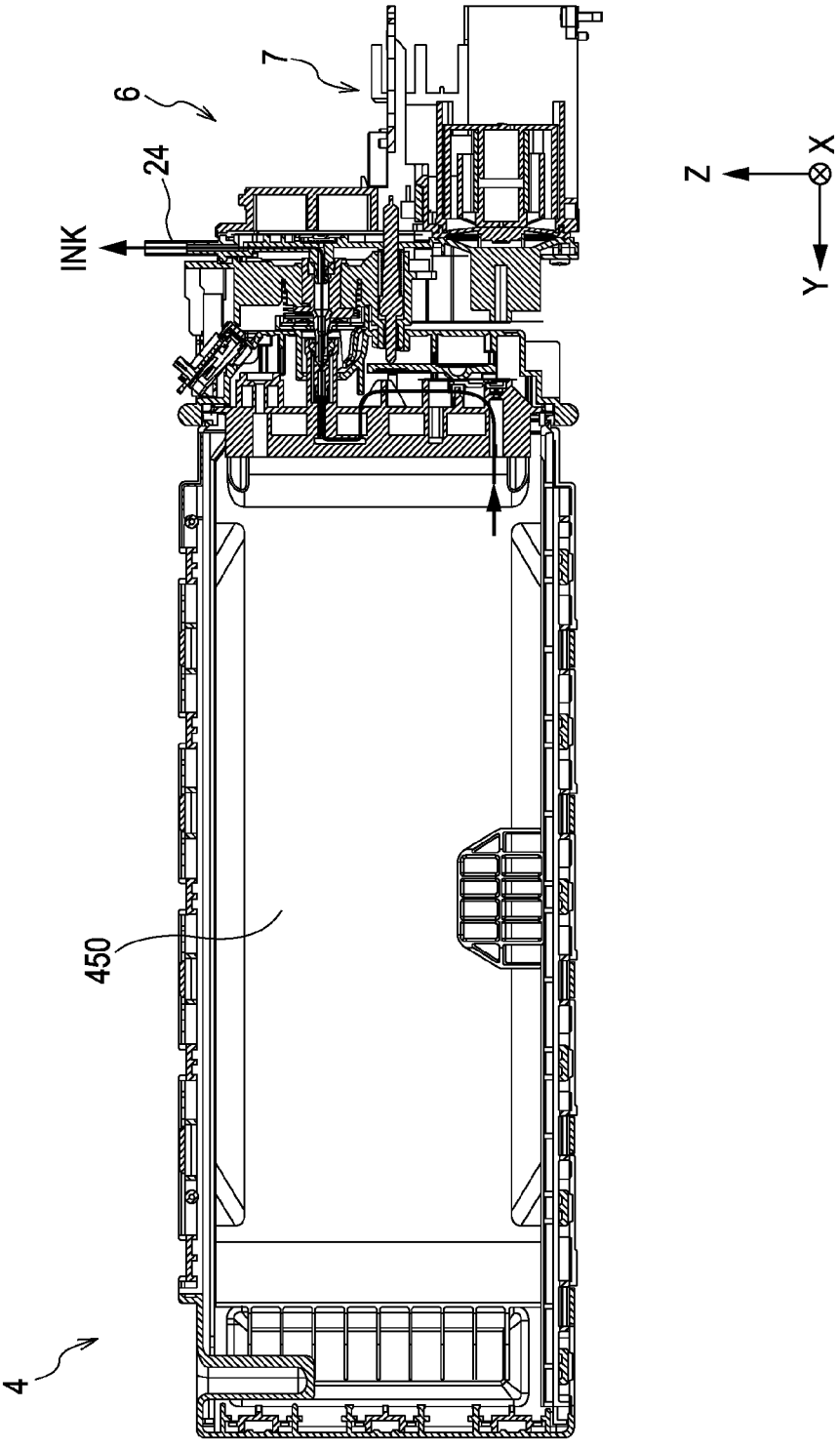


FIG. 3

FIG. 4

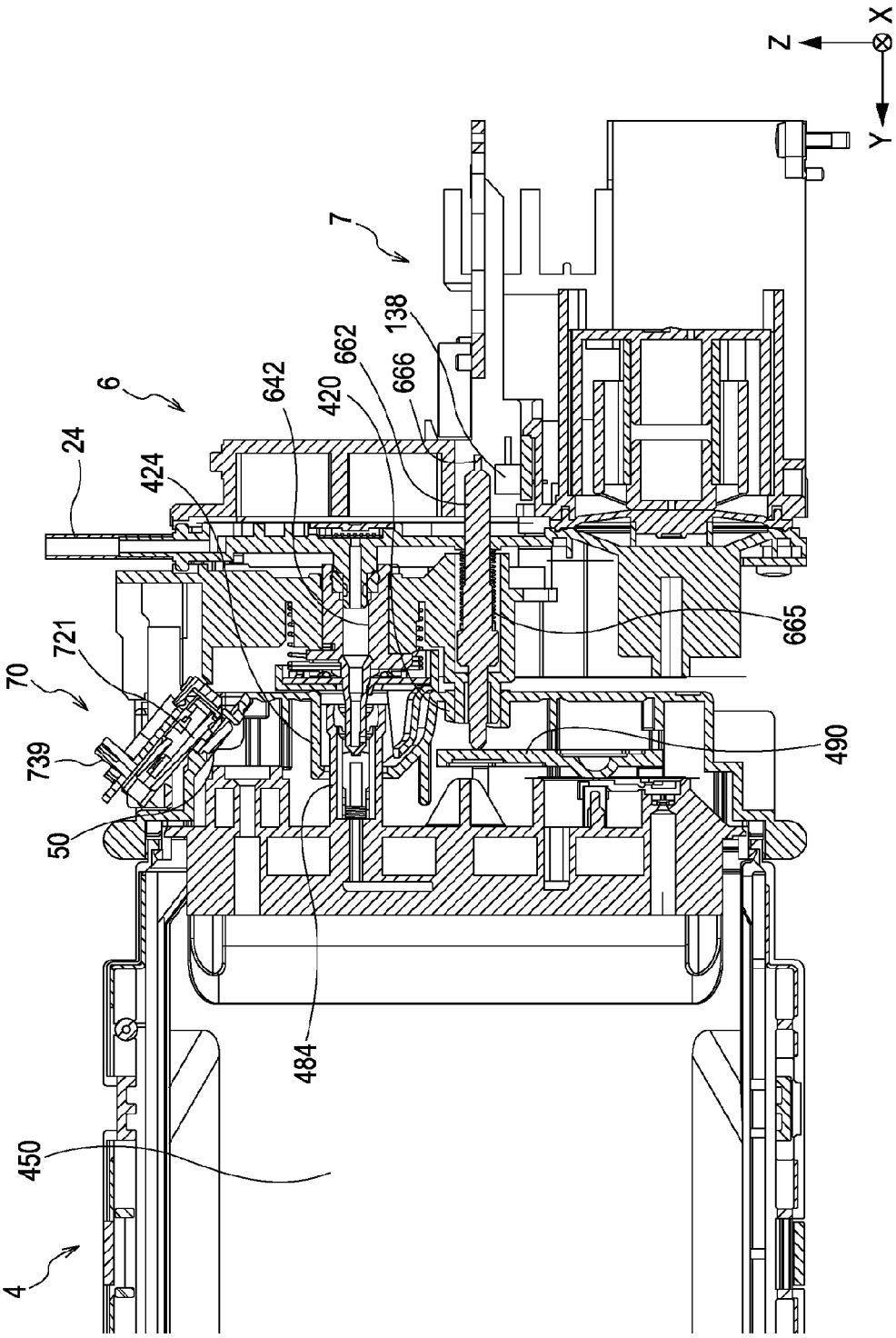


FIG. 5

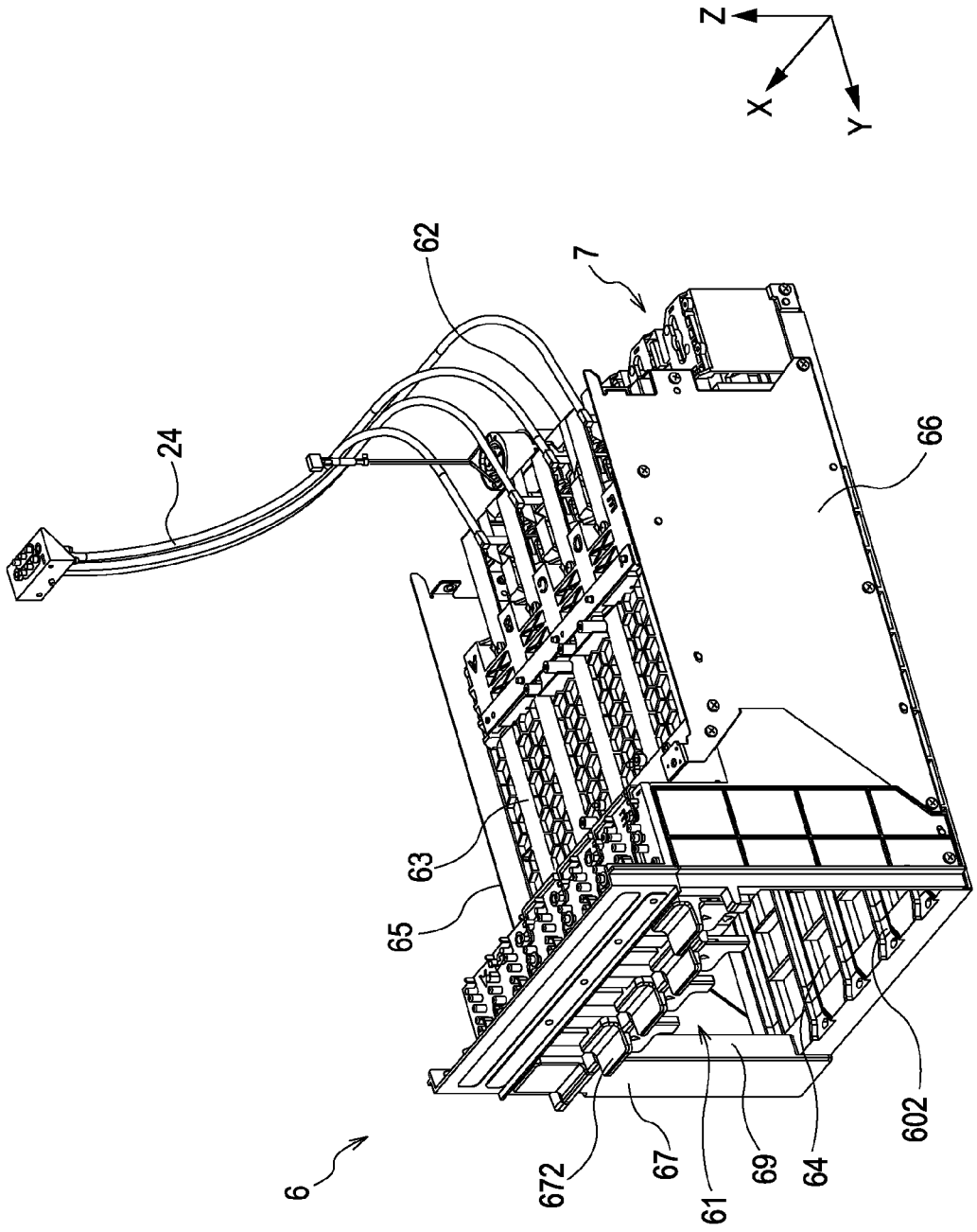
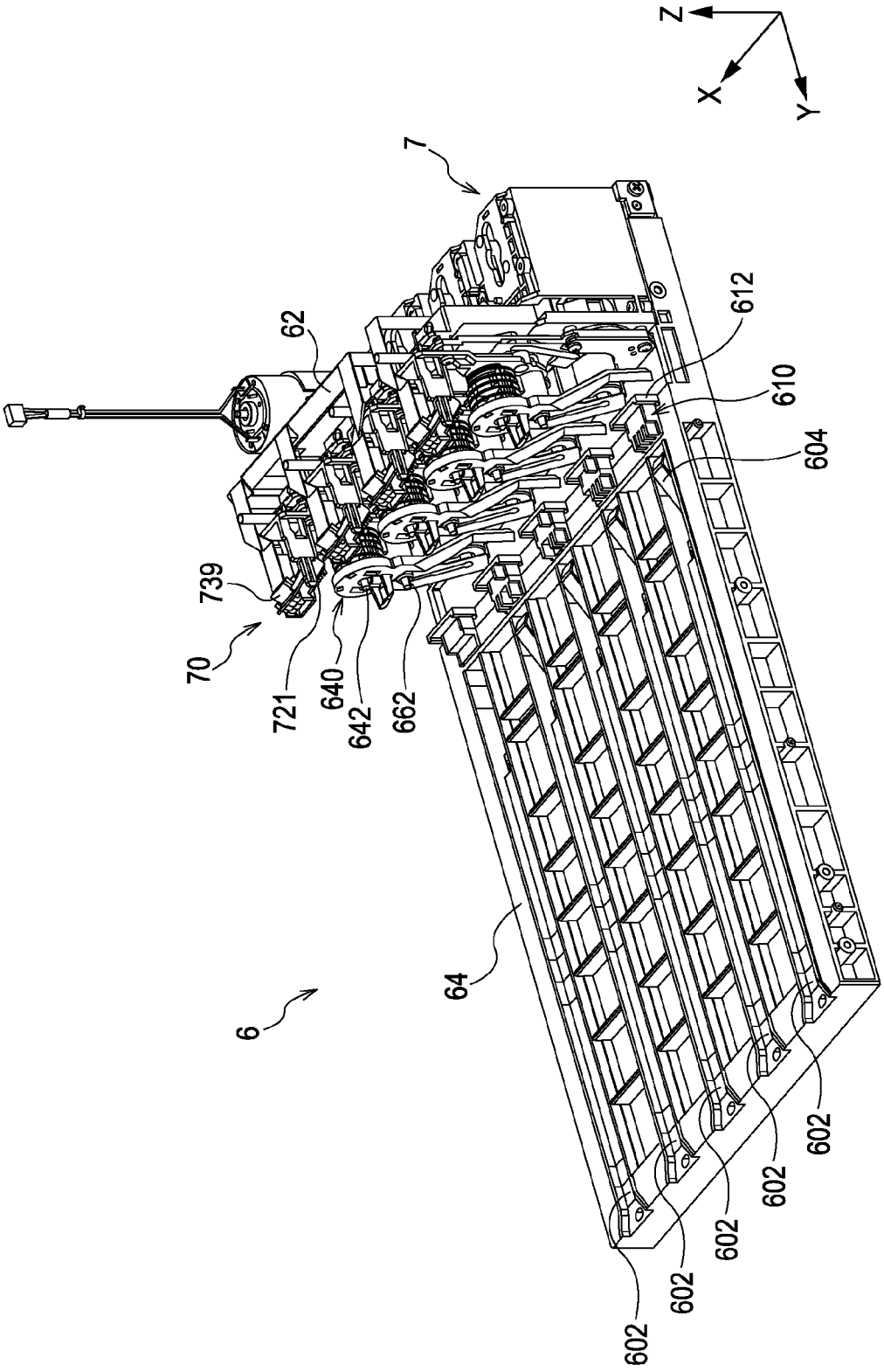


FIG. 6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X
Y
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62
612
610
604
739
70
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640
642
662
64
6
602
602
602
602
602

FIG. 7

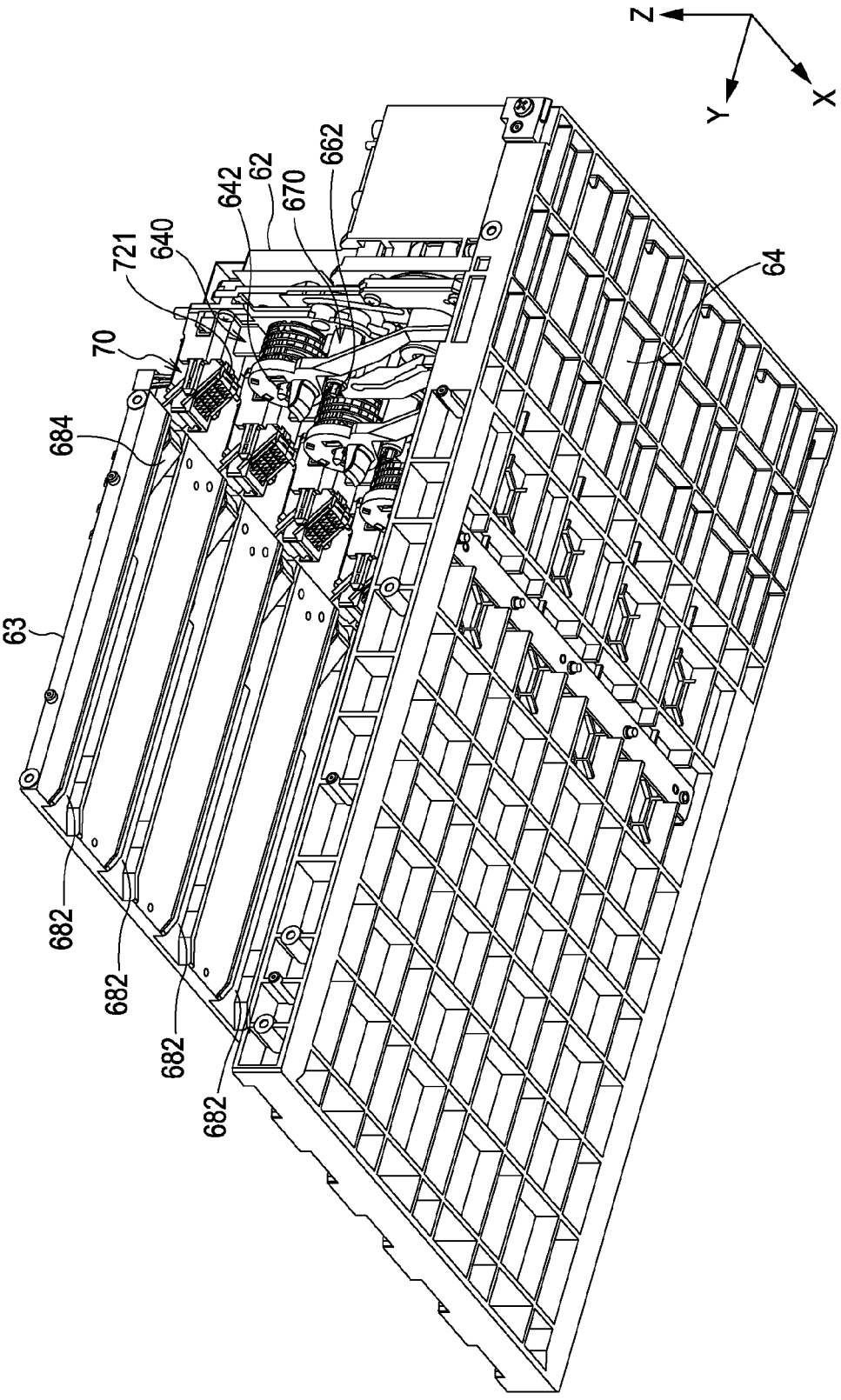


FIG. 8

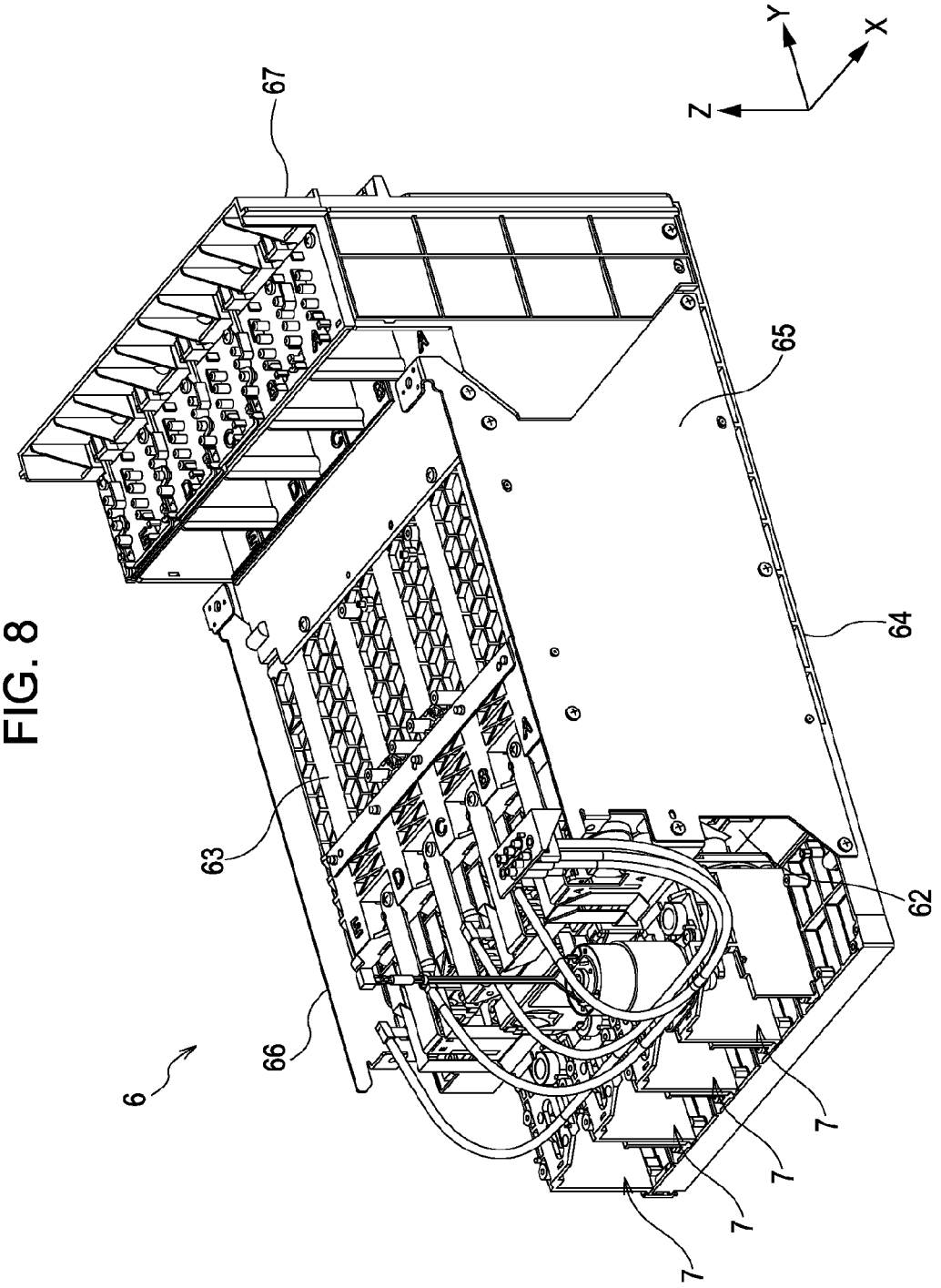


FIG. 9

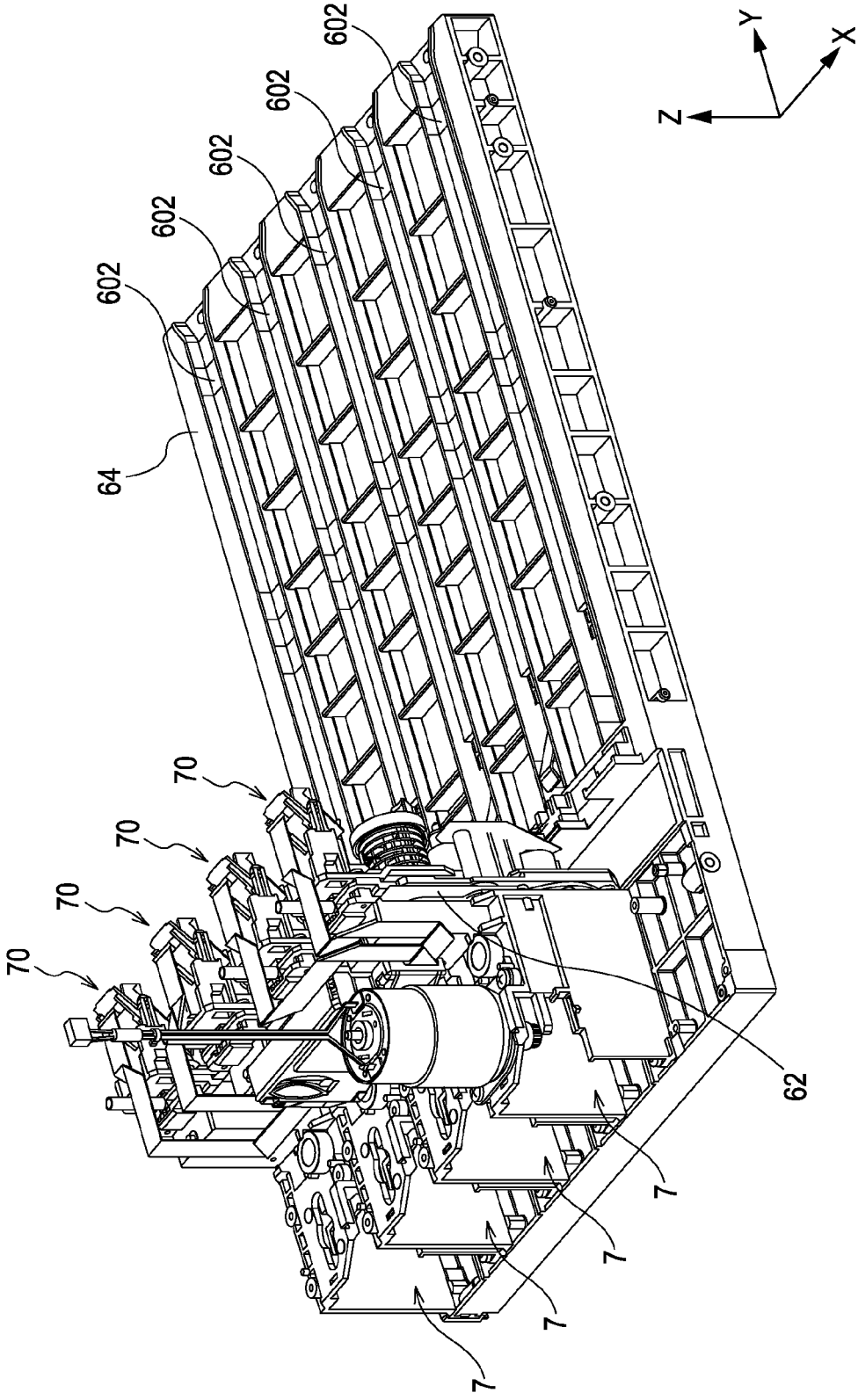
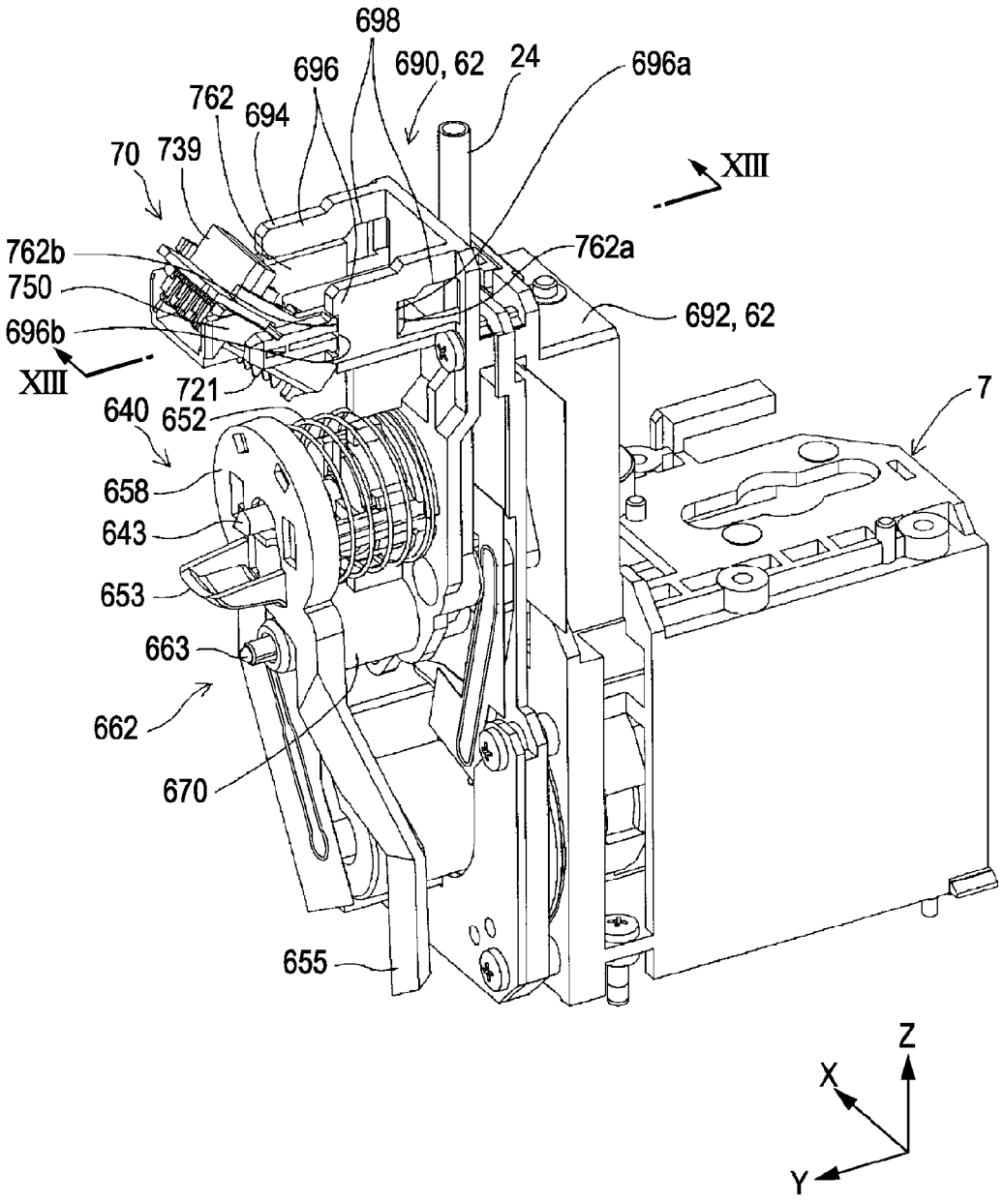


FIG. 10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739
XIII
762b
762a
750
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696b
XIII
721
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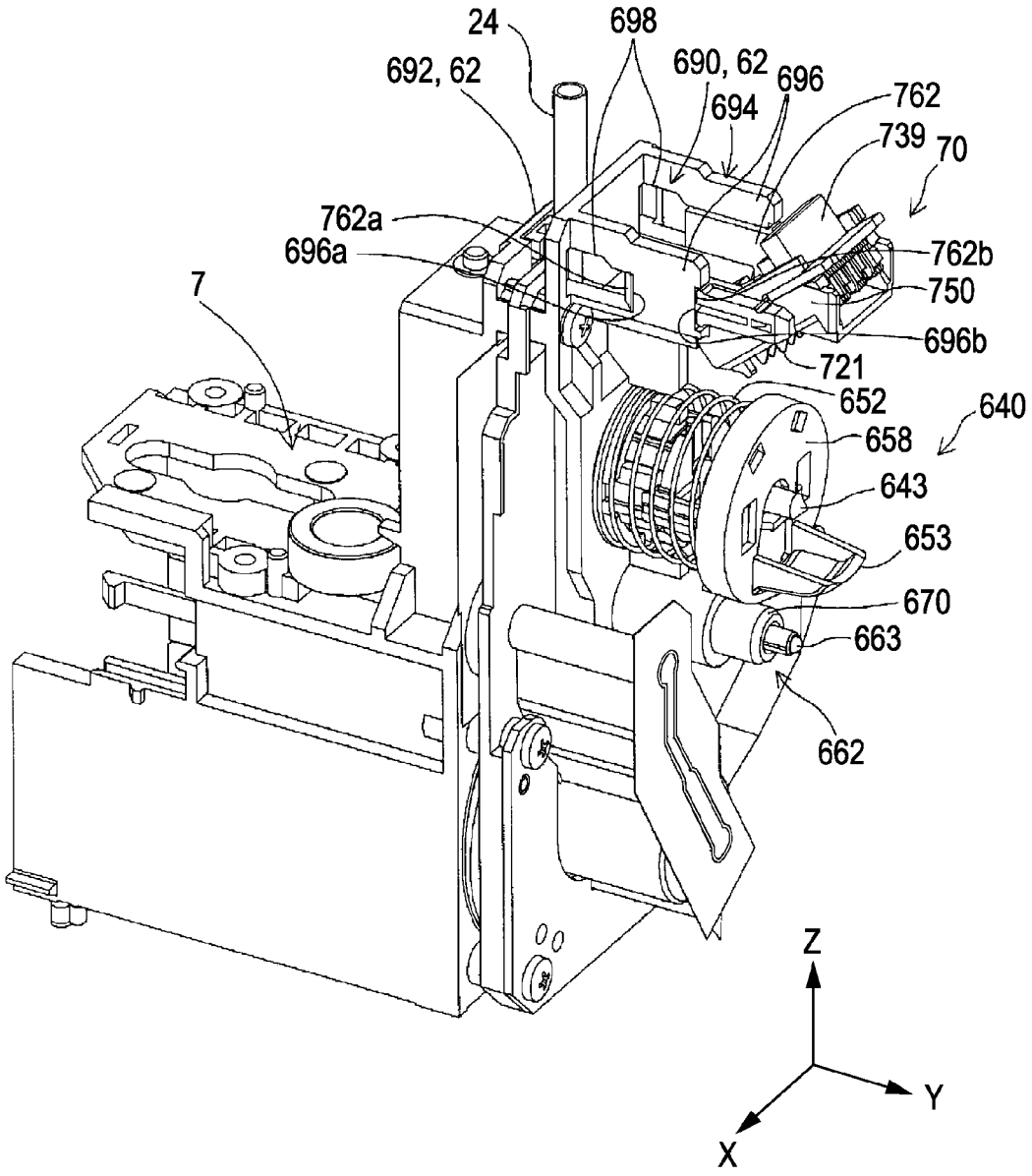
658
643
653
663
662
670
655
Z
X
Y

FIG. 11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698
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690, 62
696
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739
70
762a
696a
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652
640
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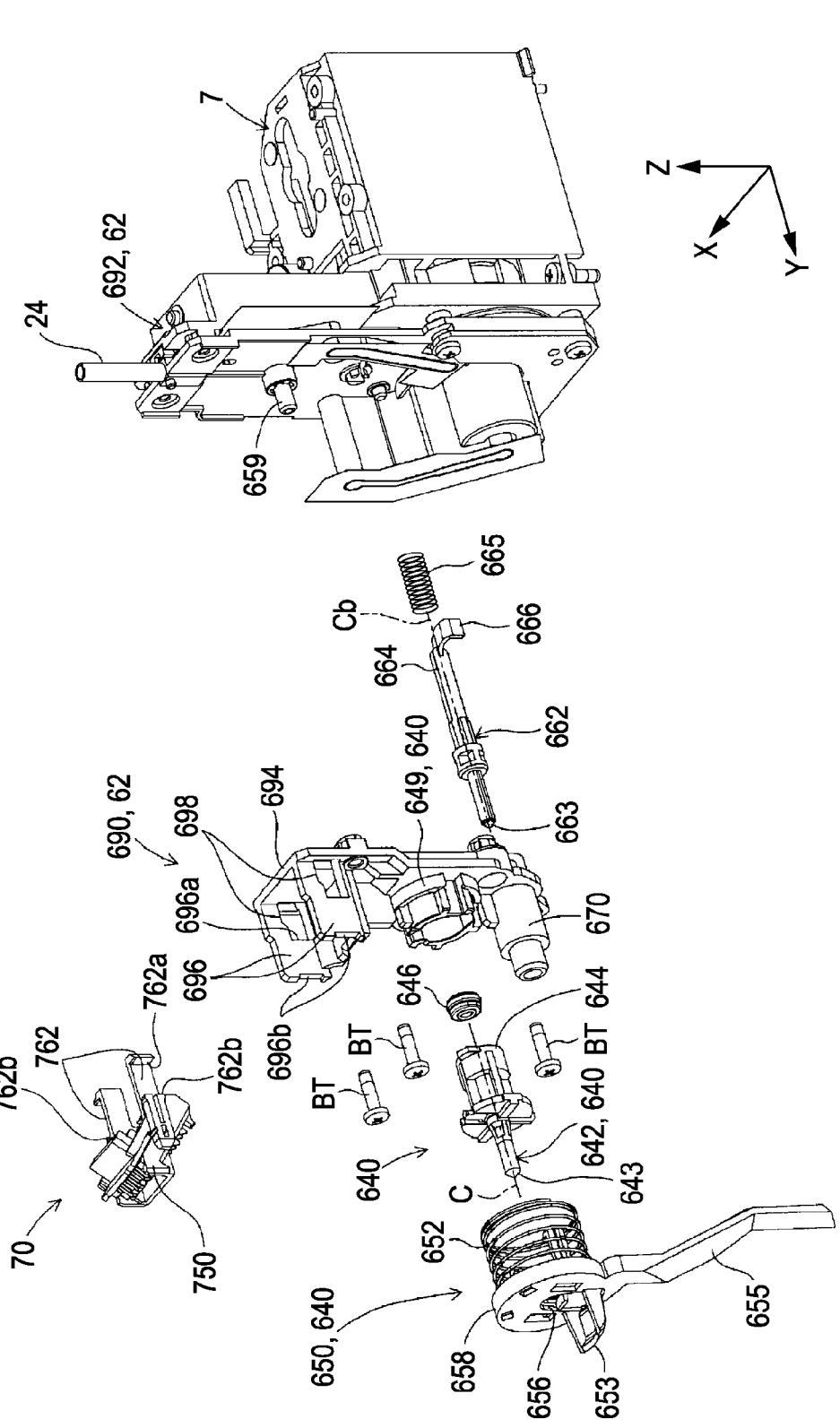
643
653
670
663
662
Z
Y
X

FIG. 12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24
659
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X
Y
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Cb
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662
649, 640
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690, 62
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762a
696
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644
762
762b
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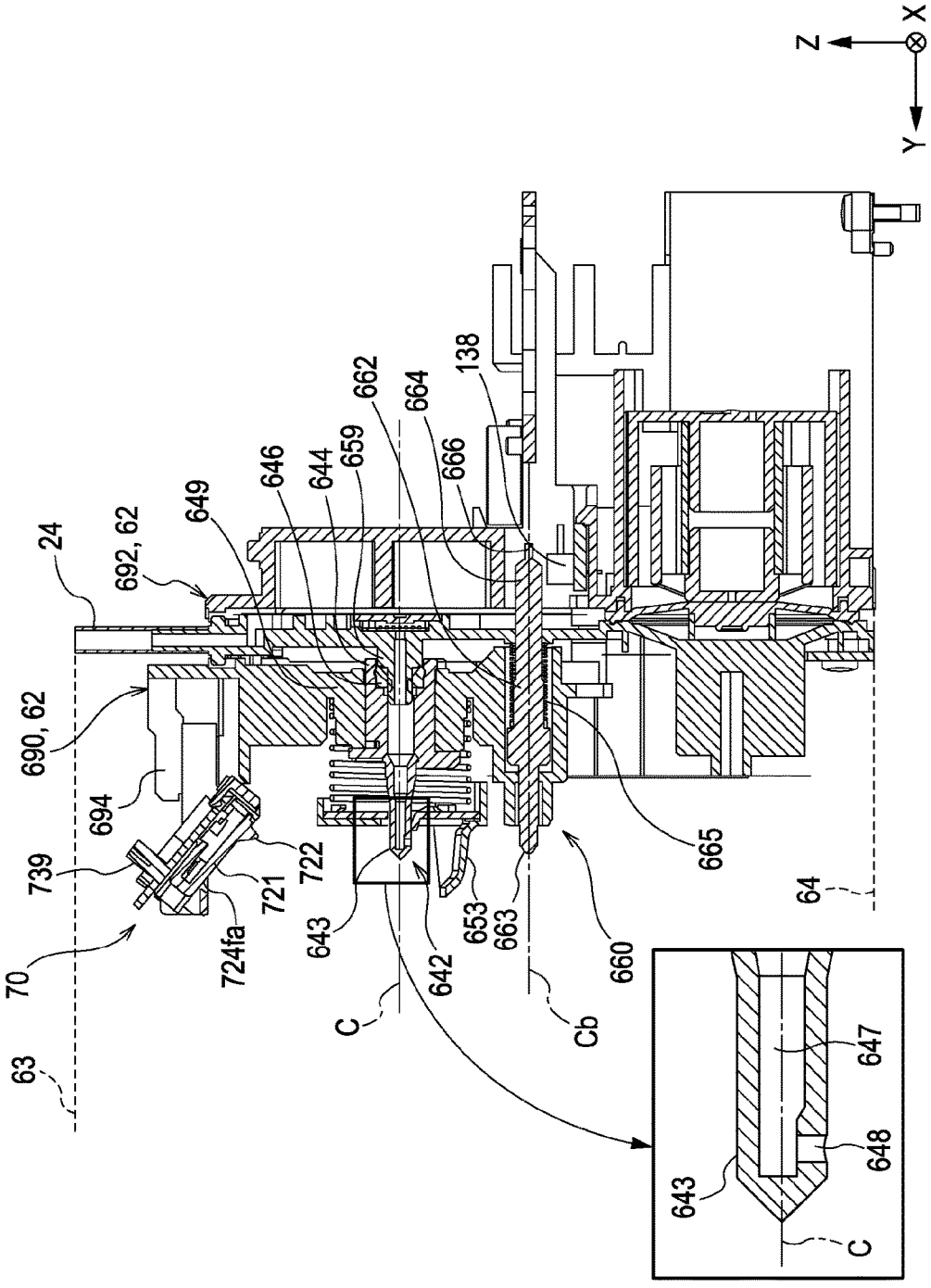
70
750
650, 640
658
656
653
655

FIG. 13


Z
X
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138
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694
739
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721
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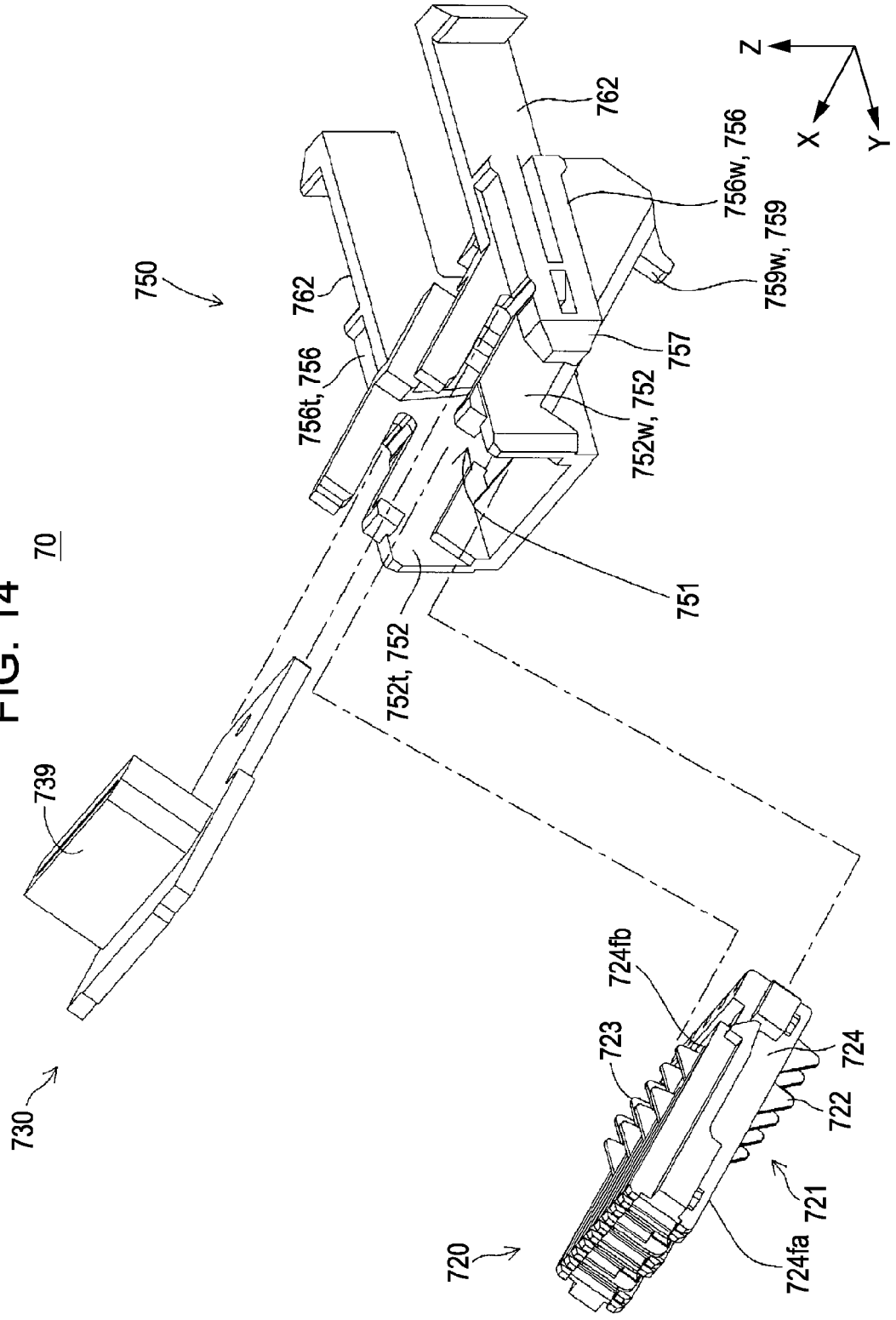
643
642
C
653
663
660
Cb
665
64
643
647
648
C

FIG. 14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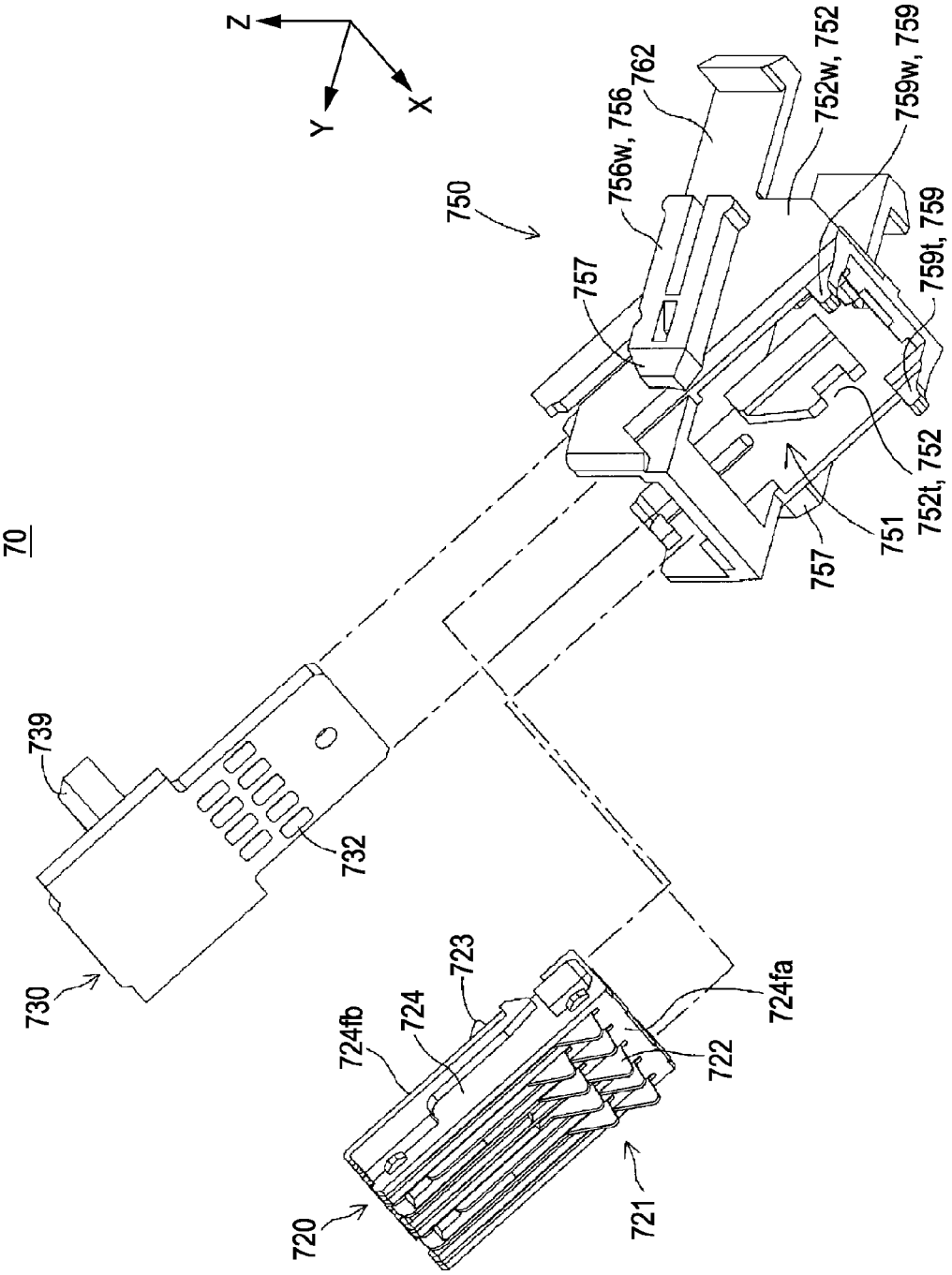
750
762
762
756w, 756
759w, 759
757
752w, 752
756t, 756
751
752t, 752
739
730
720
724fb
723
724
722
721
724fa
Z
X
Y

FIG. 15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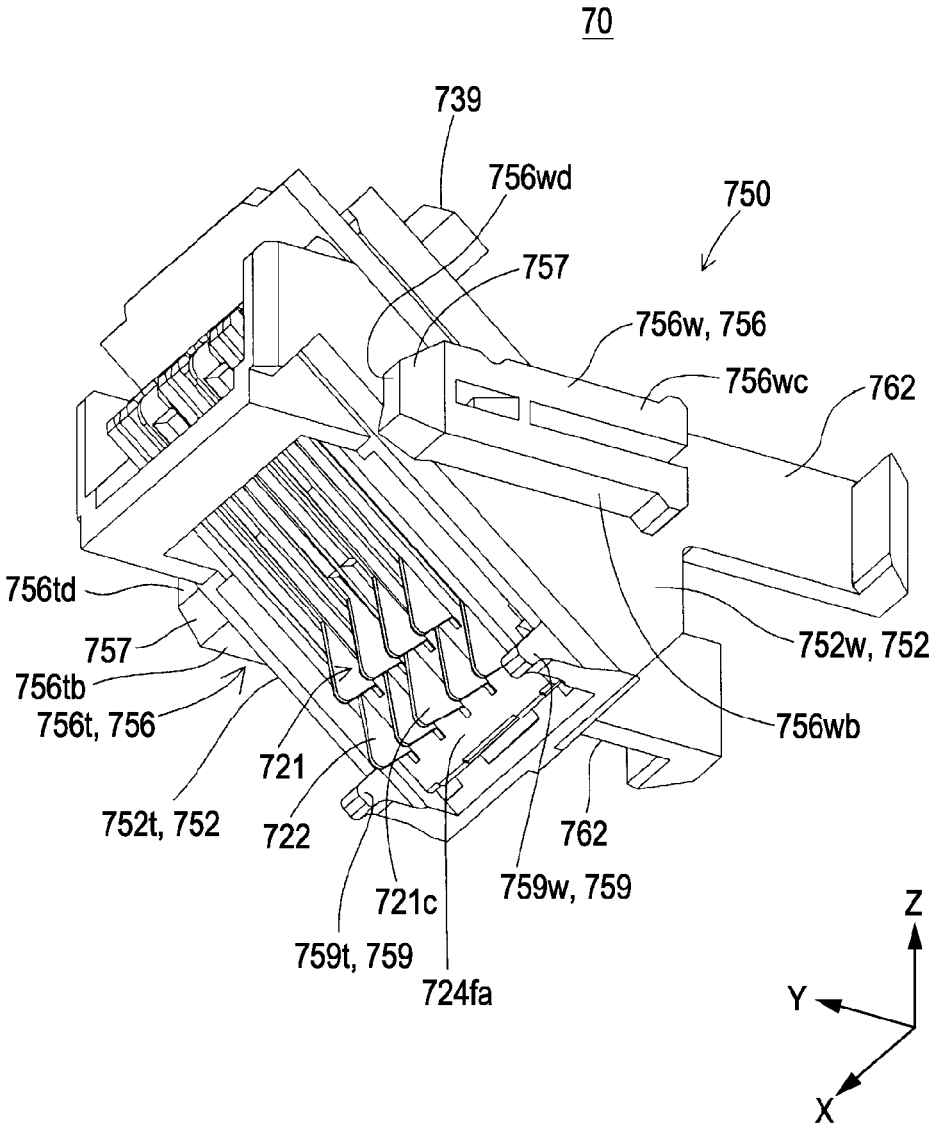
752w, 752
759w, 759
757
759t, 759
752t, 752
751
757
739
732
730
723
724fa
724fb
724
722
720
721

FIG. 16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756tb
756t, 756
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752t, 752
722
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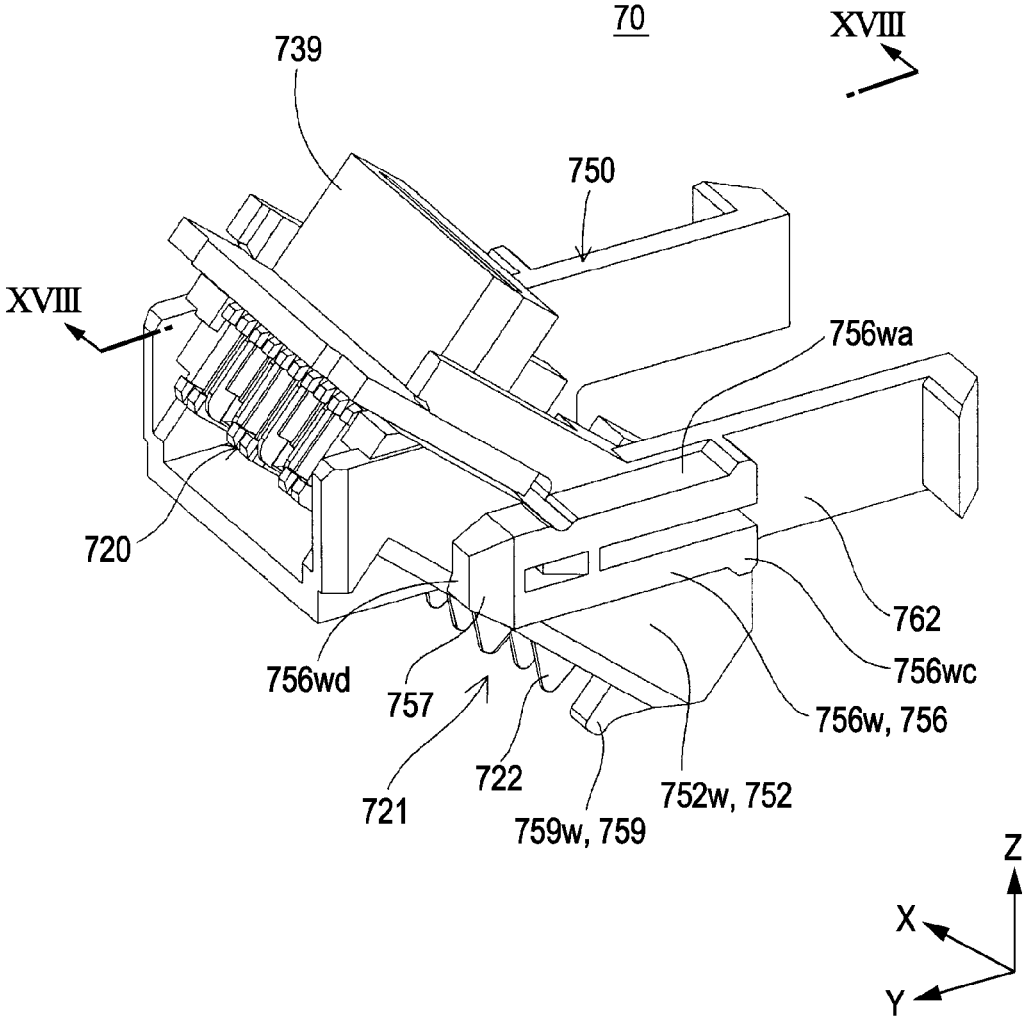
721c
759t, 759
724fa
Z
Y
X

FIG. 17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XVIII
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750
XVIII
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762
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756wd
757
756w, 756
722
721
752w, 752
759w, 759
Z
X
Y

FIG. 18

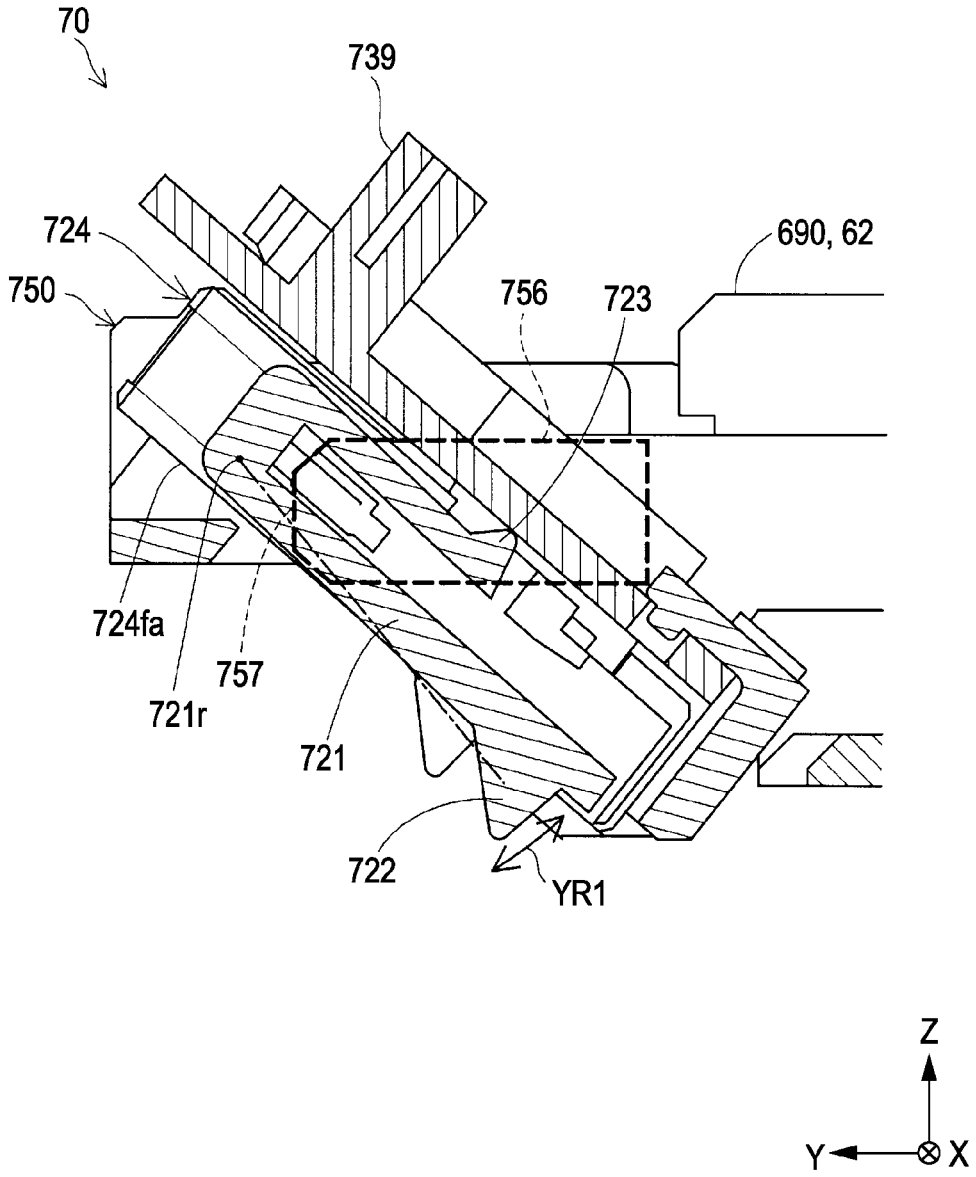
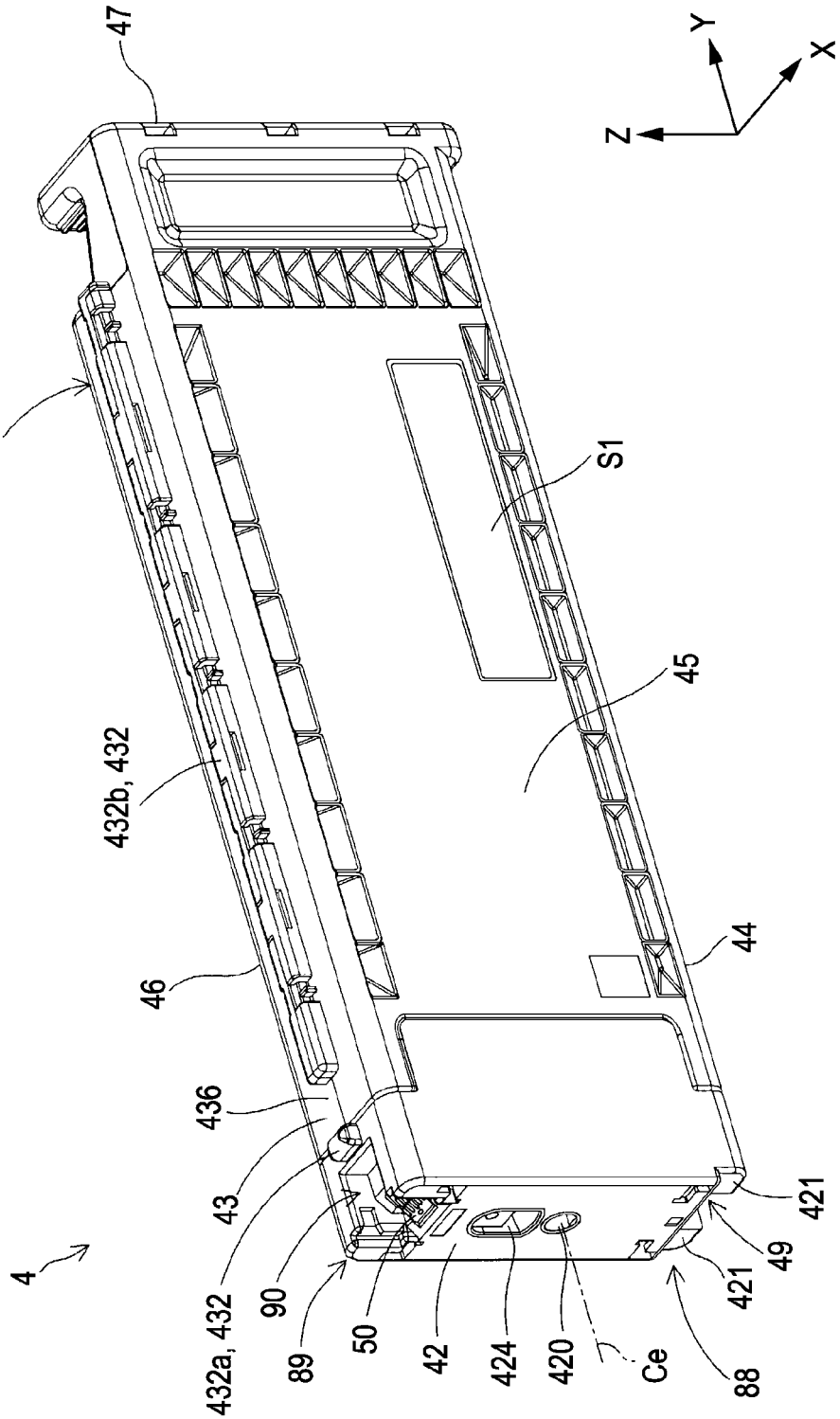


FIG. 19


47
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4
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424
420
Ce
88

FIG. 20

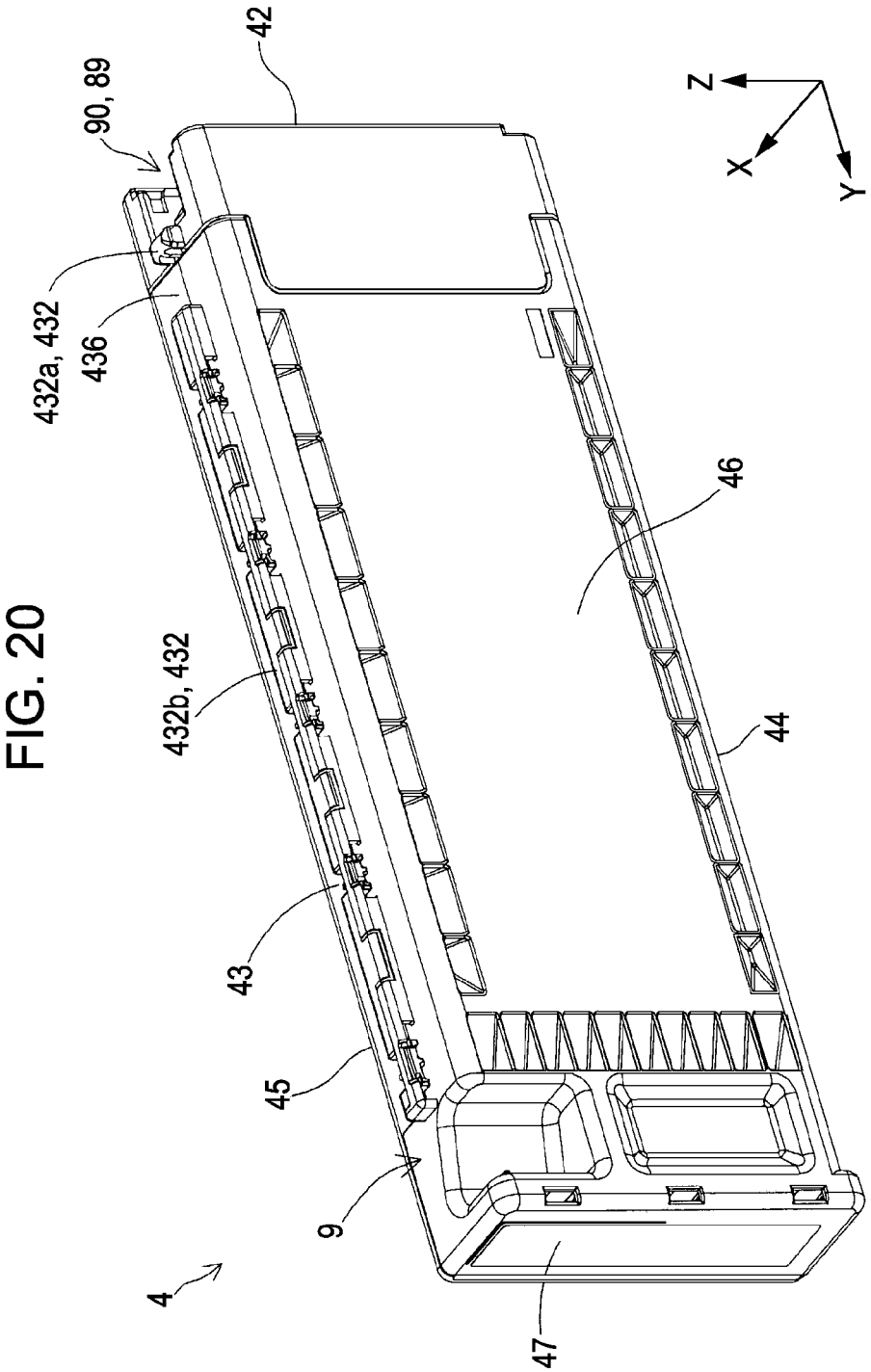
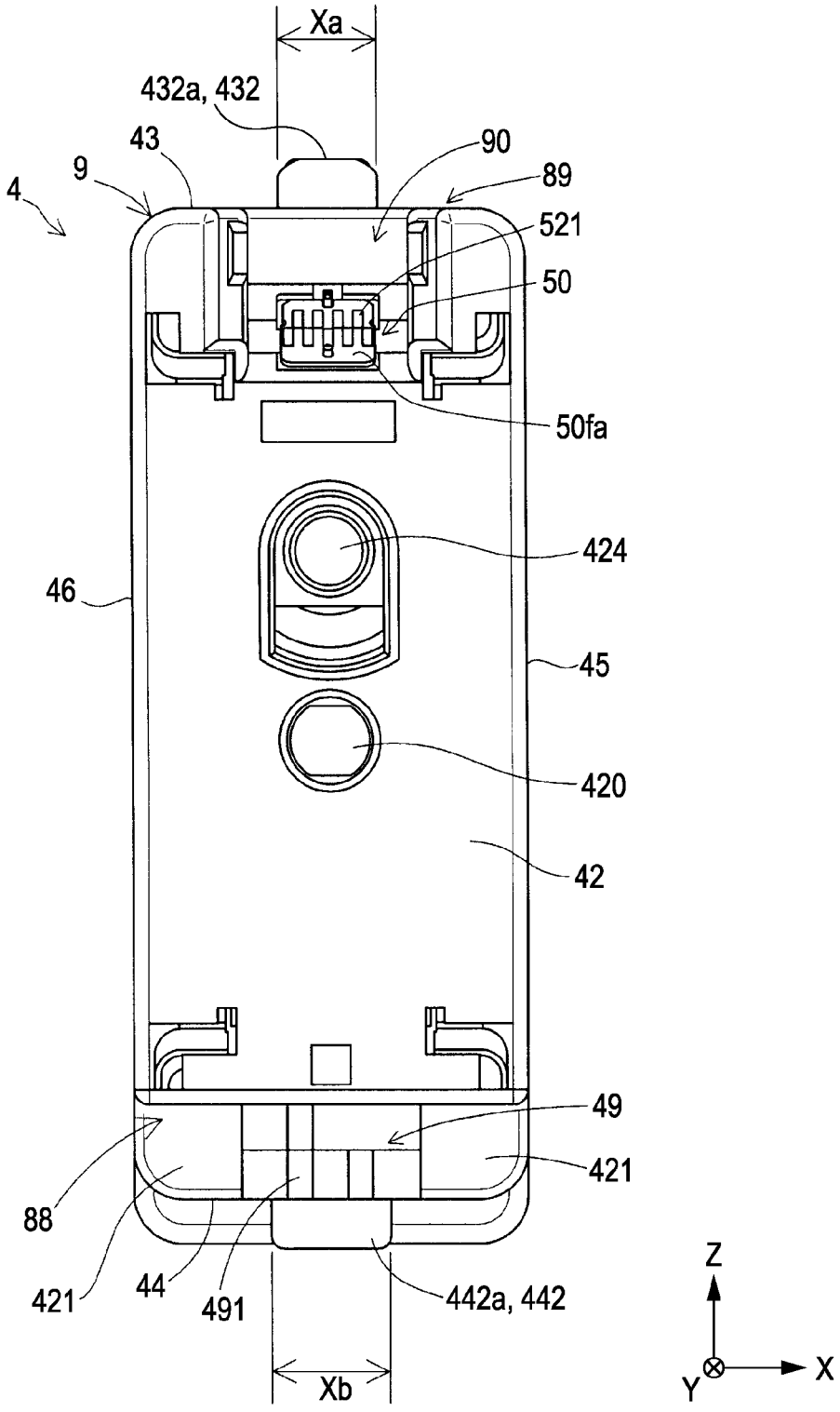


FIG. 21


Xa
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50fa
424
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421
88
421
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491
442a, 442
Xb
Z
Y
X

FIG. 22

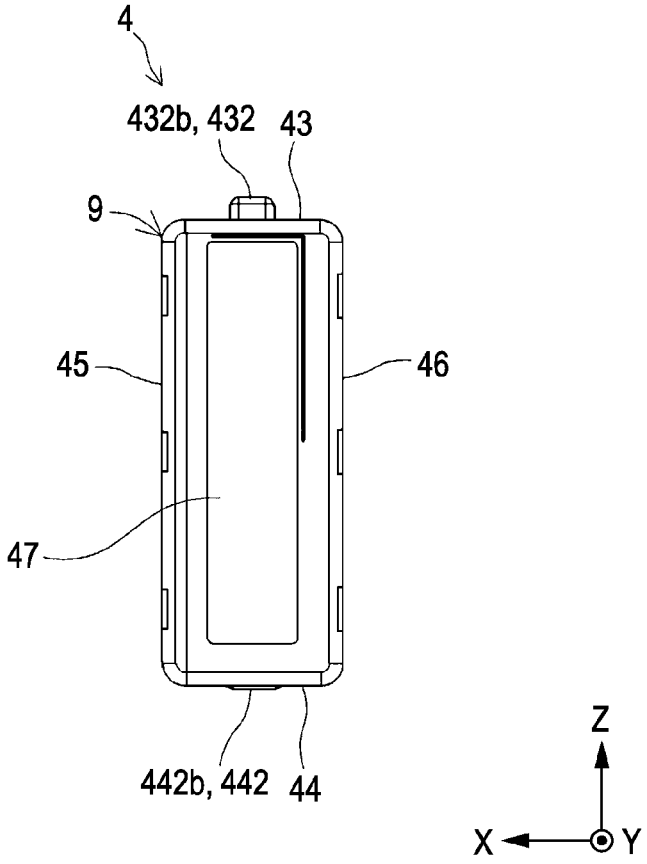


FIG. 23

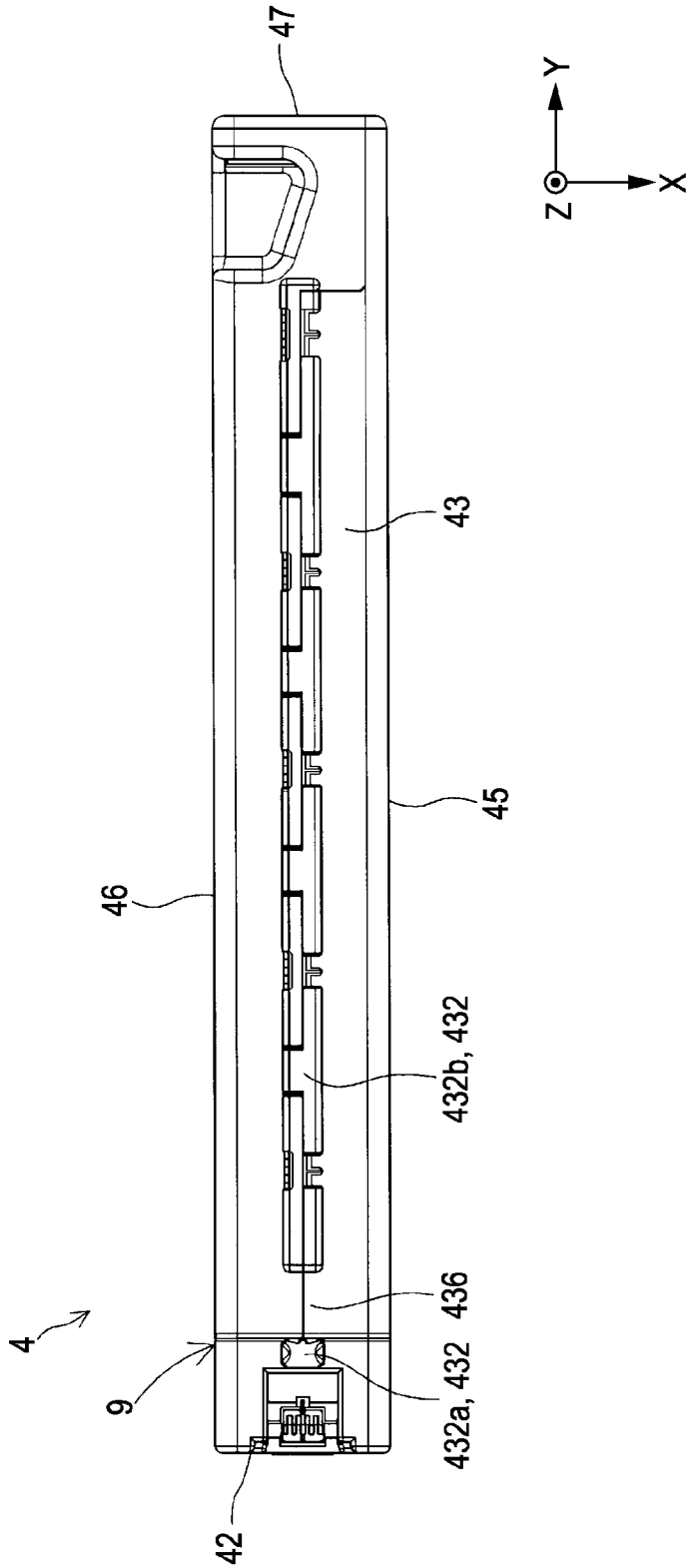


FIG. 24

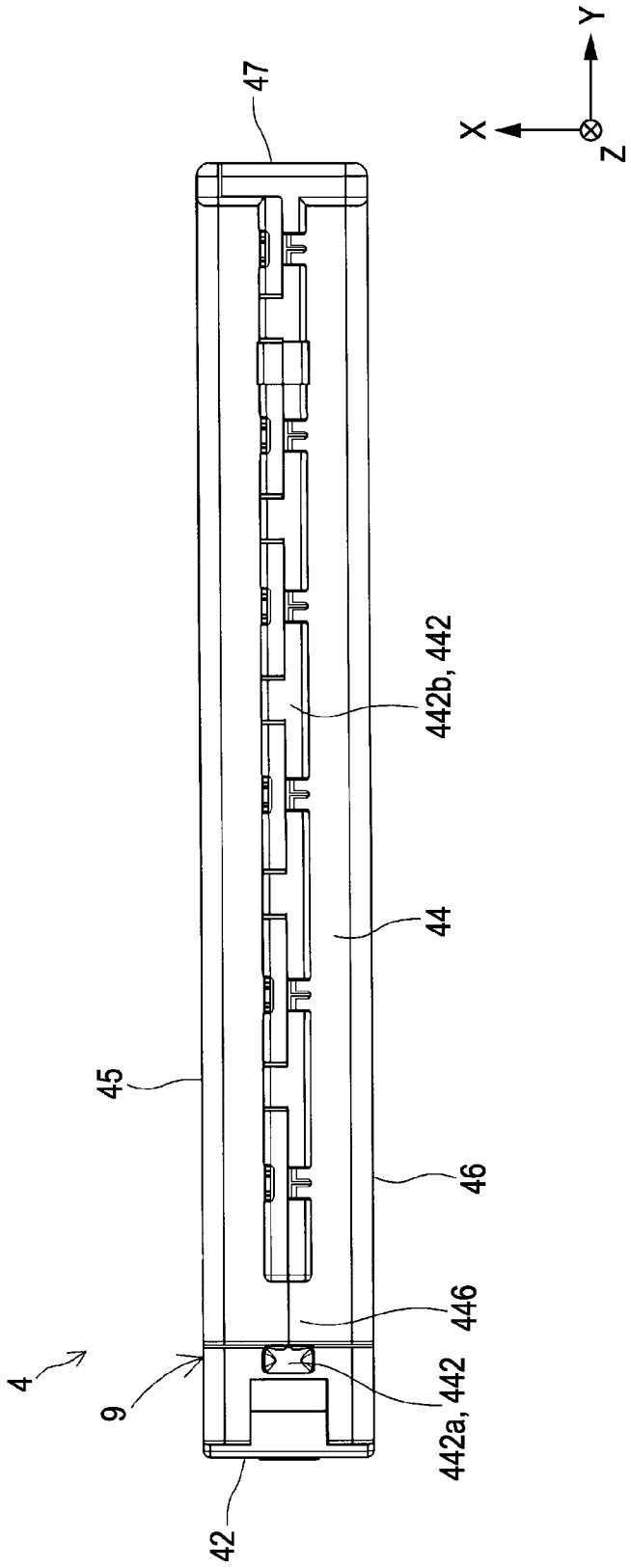


FIG. 25

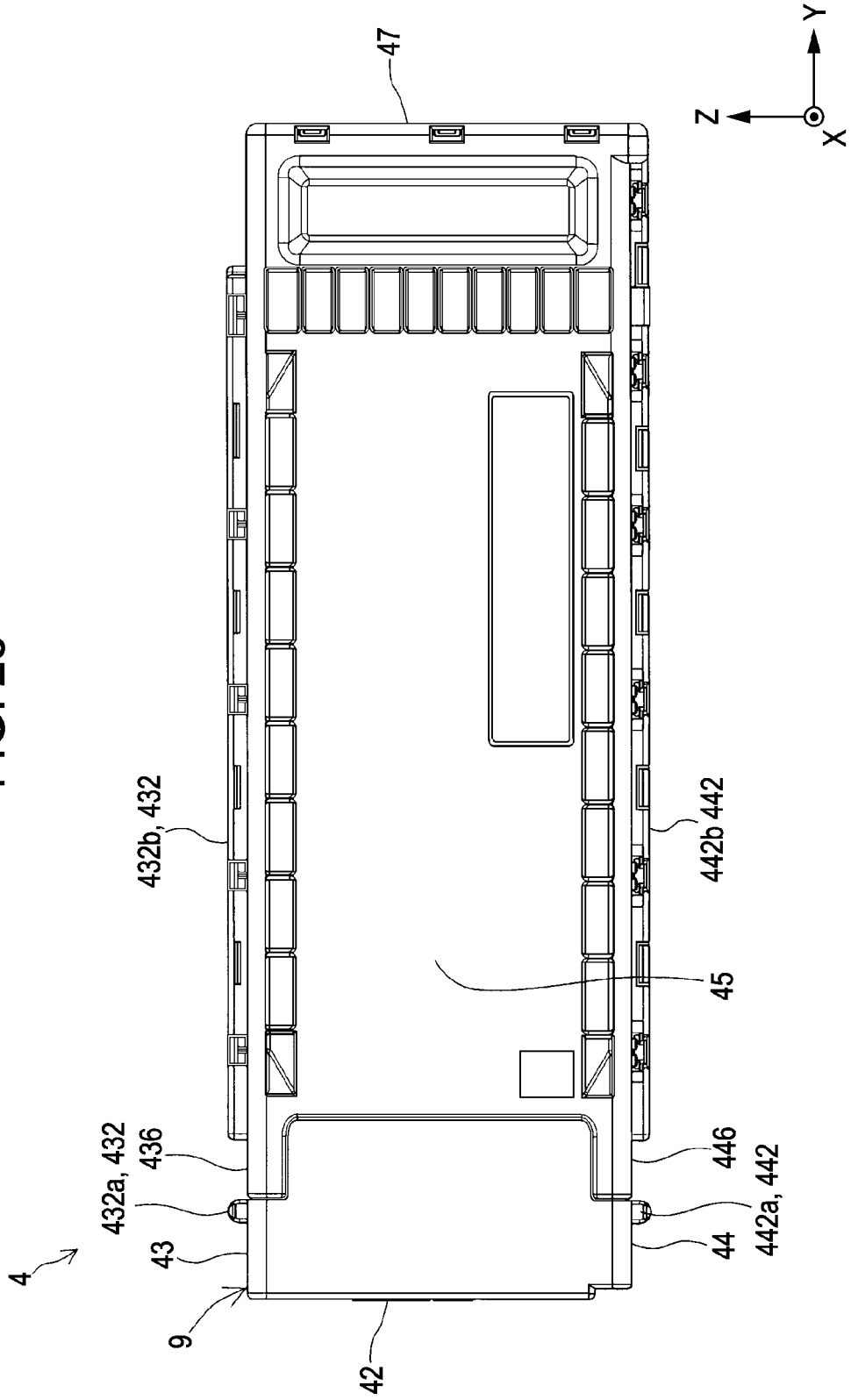


FIG. 26

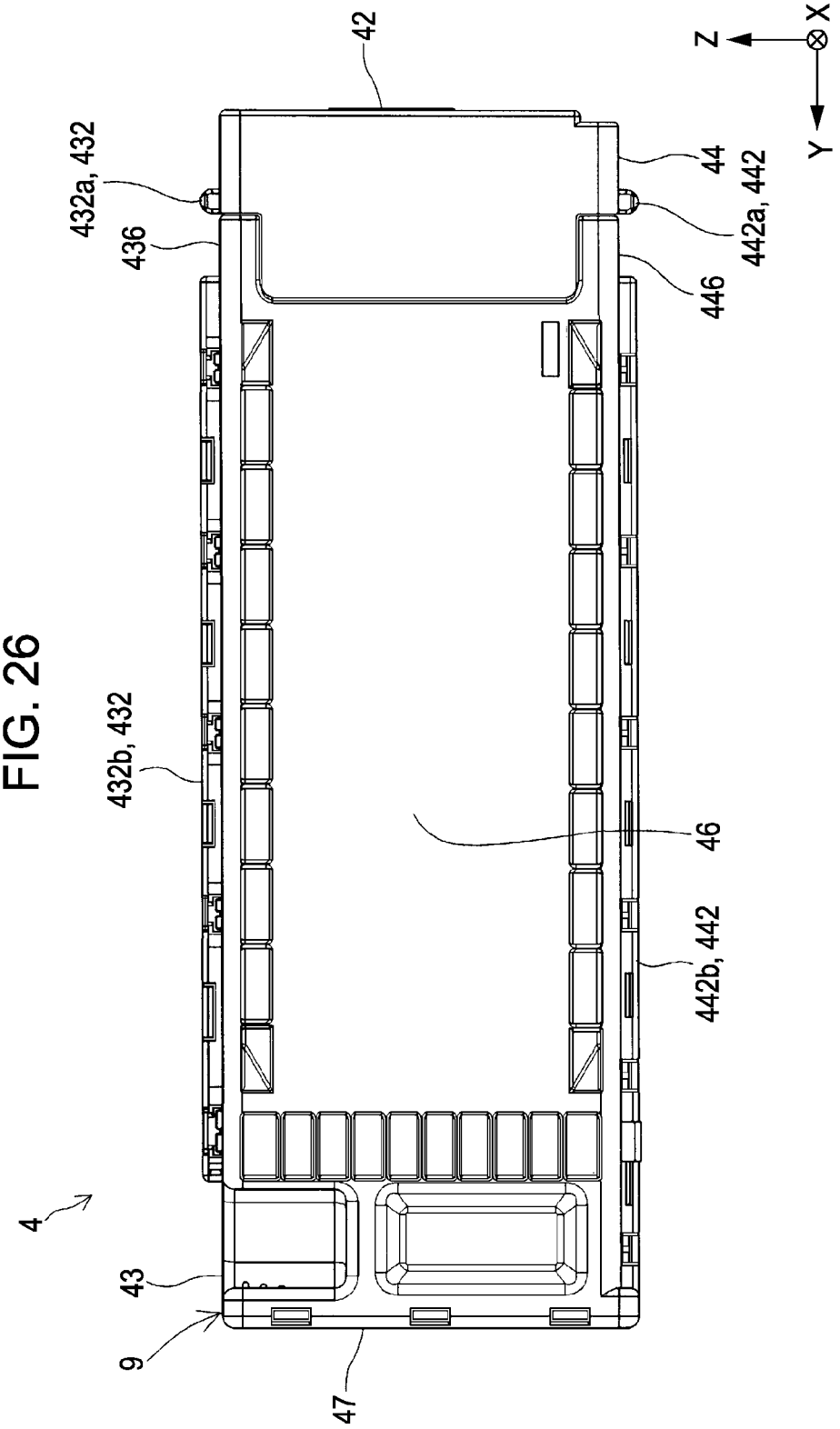
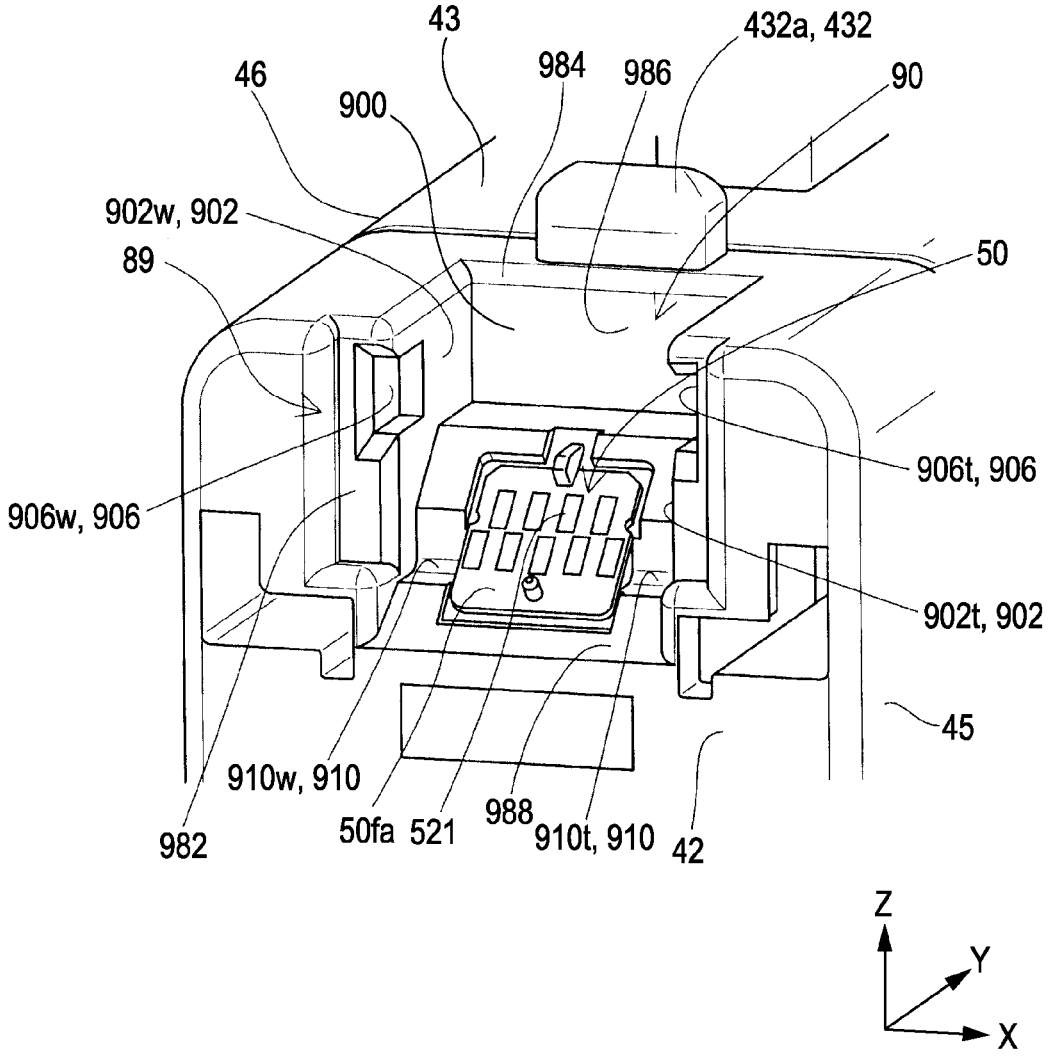


FIG. 27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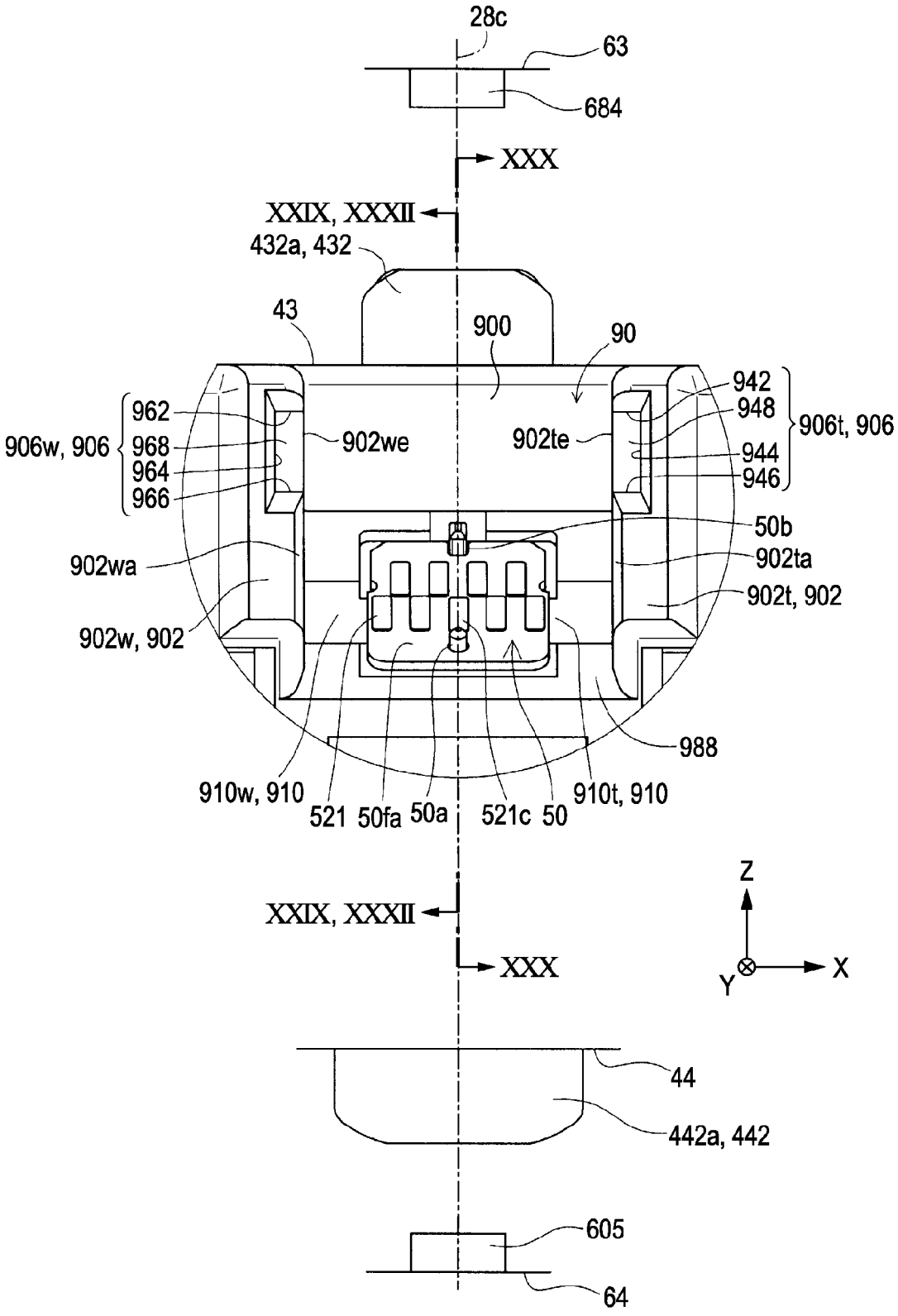
982
50fa
521
988
910t, 910
42
Z
Y
X

FIG. 28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902w, 902
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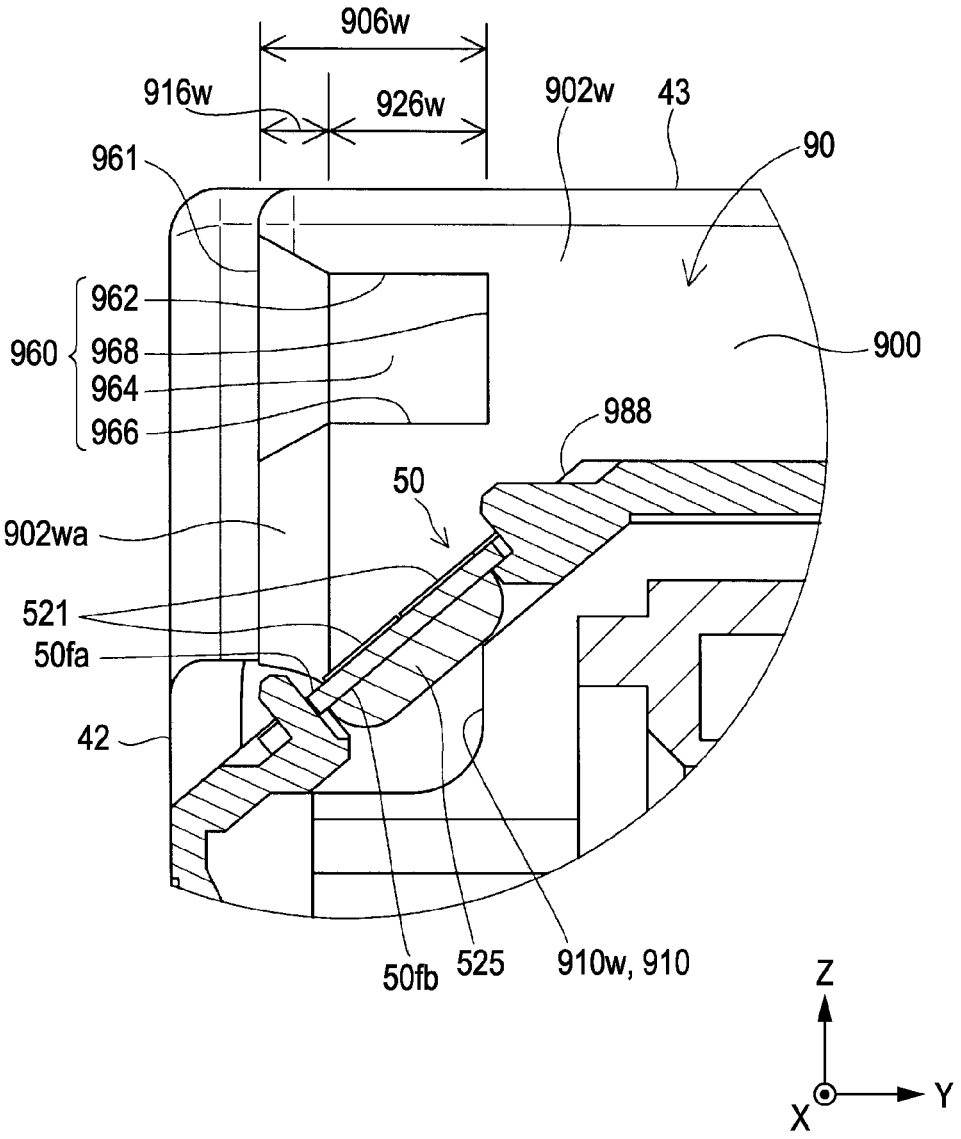
FIG. 29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964
966
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988
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50fa
42
50fb
525
910w, 910
Z
X
Y

FIG. 30

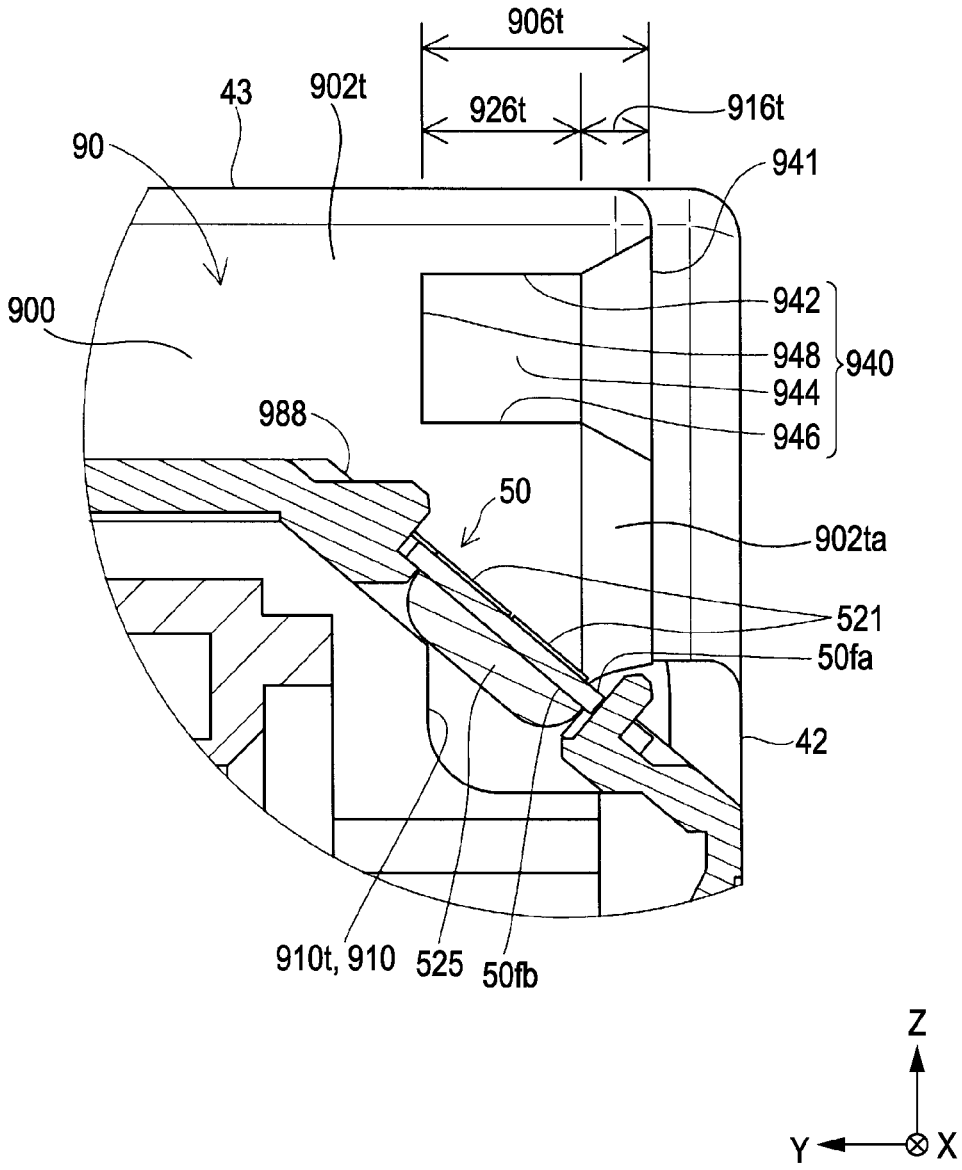

906t
926t
916t
43
902t
90
941
900
942
948
944
946
940
988
50
902ta
521
50fa
42
910t, 910
525
50fb
Z
Y
X

FIG. 31

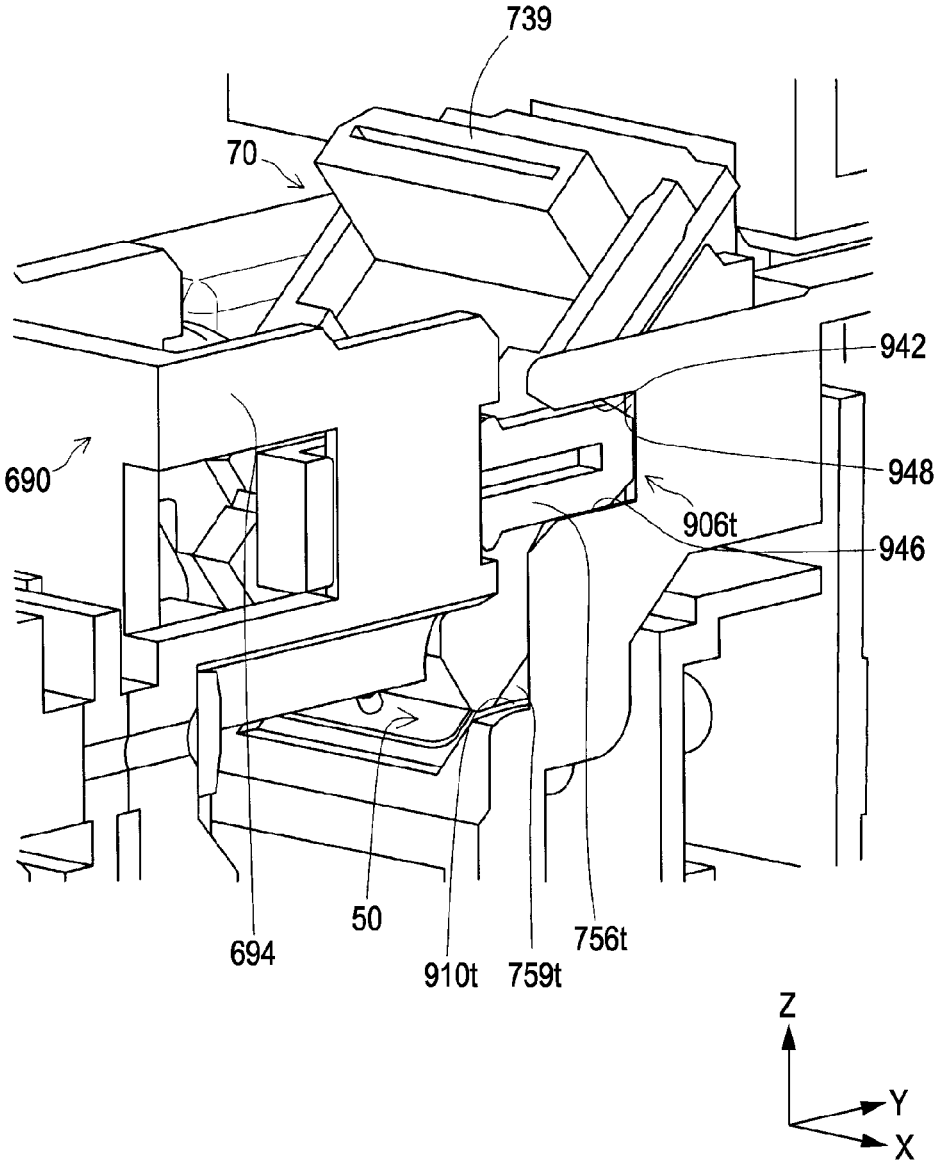


FIG. 32

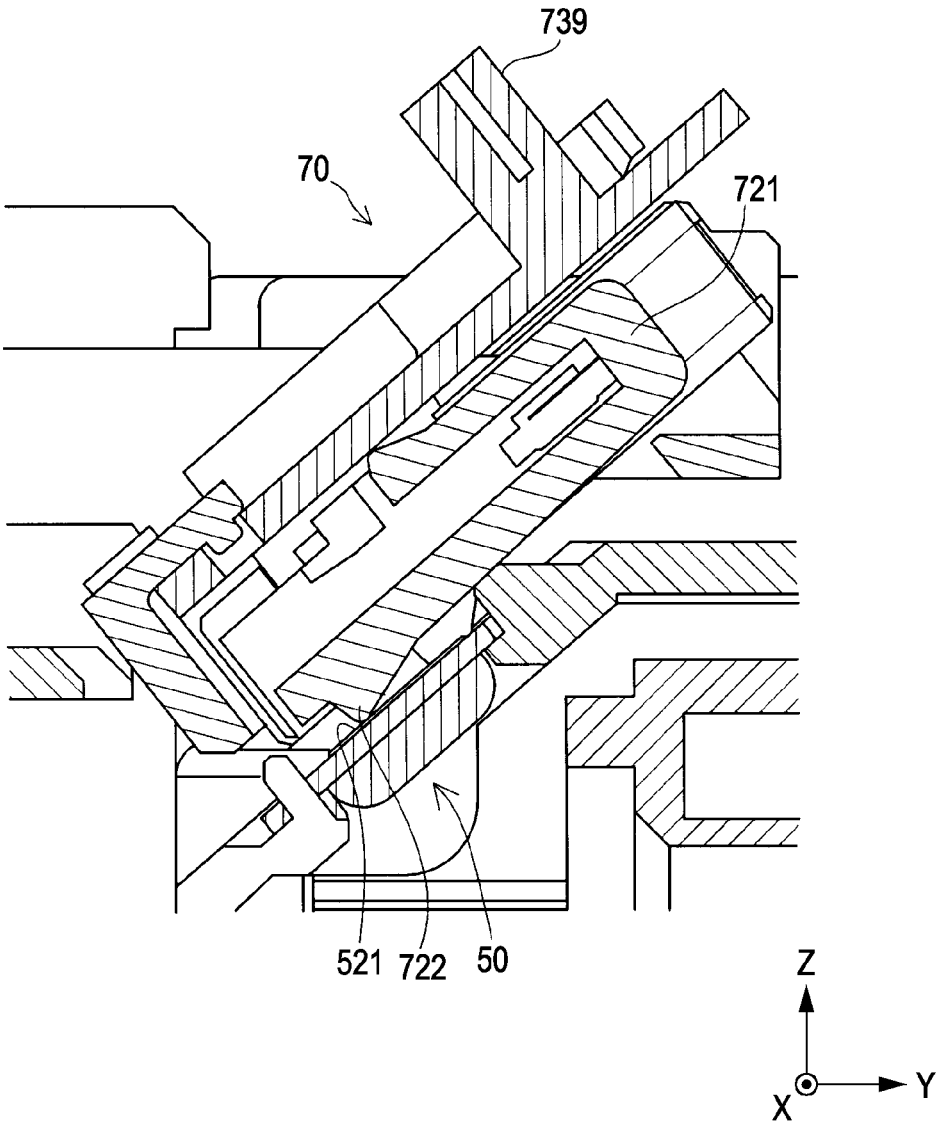


FIG. 33

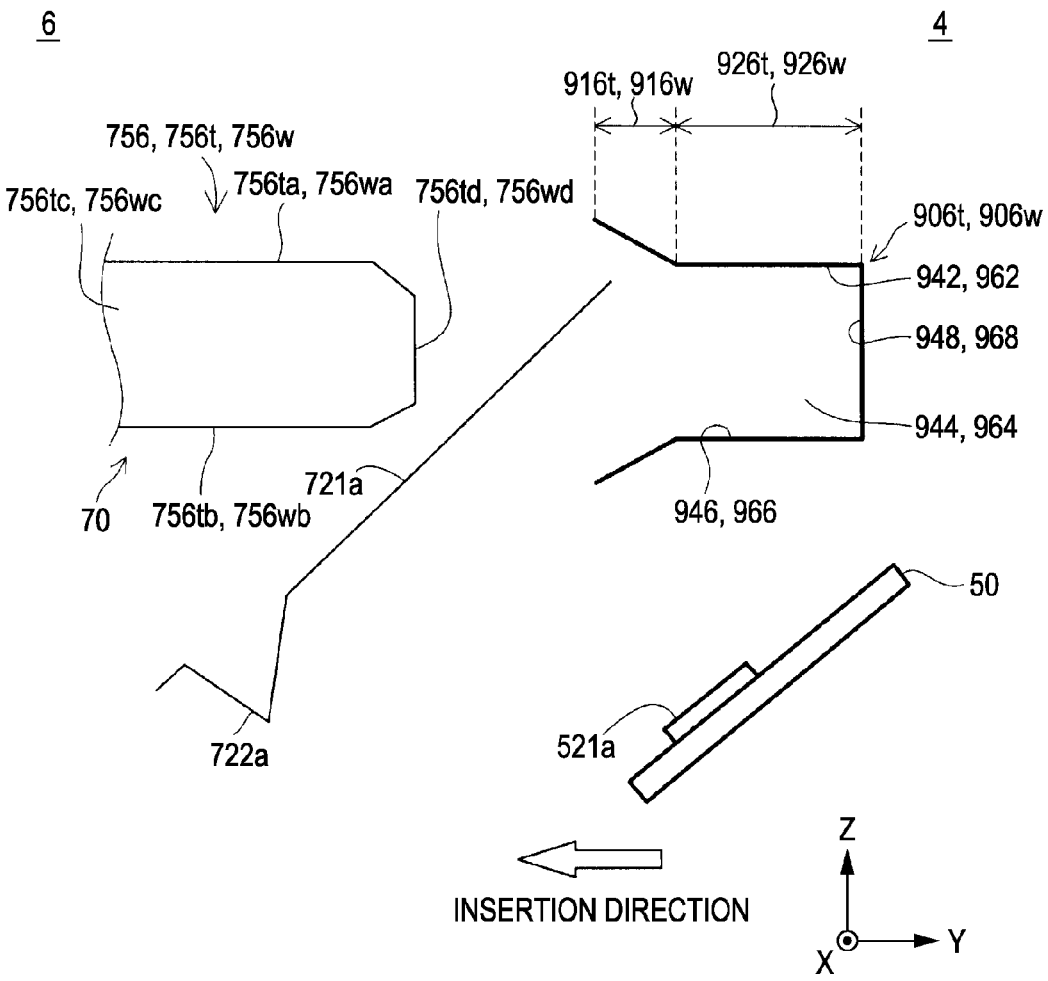

6
4
916t, 916w
926t, 926w
756, 756t, 756w
756ta, 756wa
756tc, 756wc
756td, 756wd
906t, 906w
942, 962
948, 968
944, 964
946, 966
721a
70
756tb, 756wb
722a
50
521a
INSERTION DIRECTION
Z
Y
X

FIG. 34

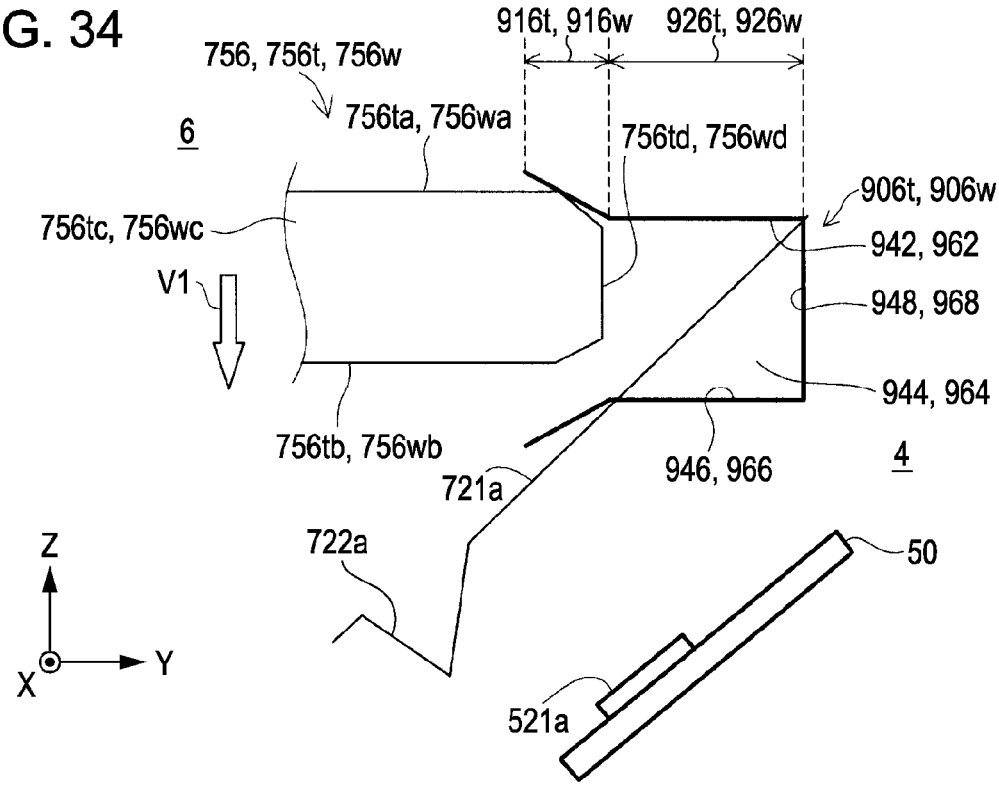

916t, 916w
926t, 926w
756, 756t, 756w
756ta, 756wa
6
756td, 756wd
906t, 906w
756tc, 756wc
942, 962
V1
948, 968
944, 964
756tb, 756wb
946, 966
4
721a
722a
50
Z
Y
X
521a

FIG. 35

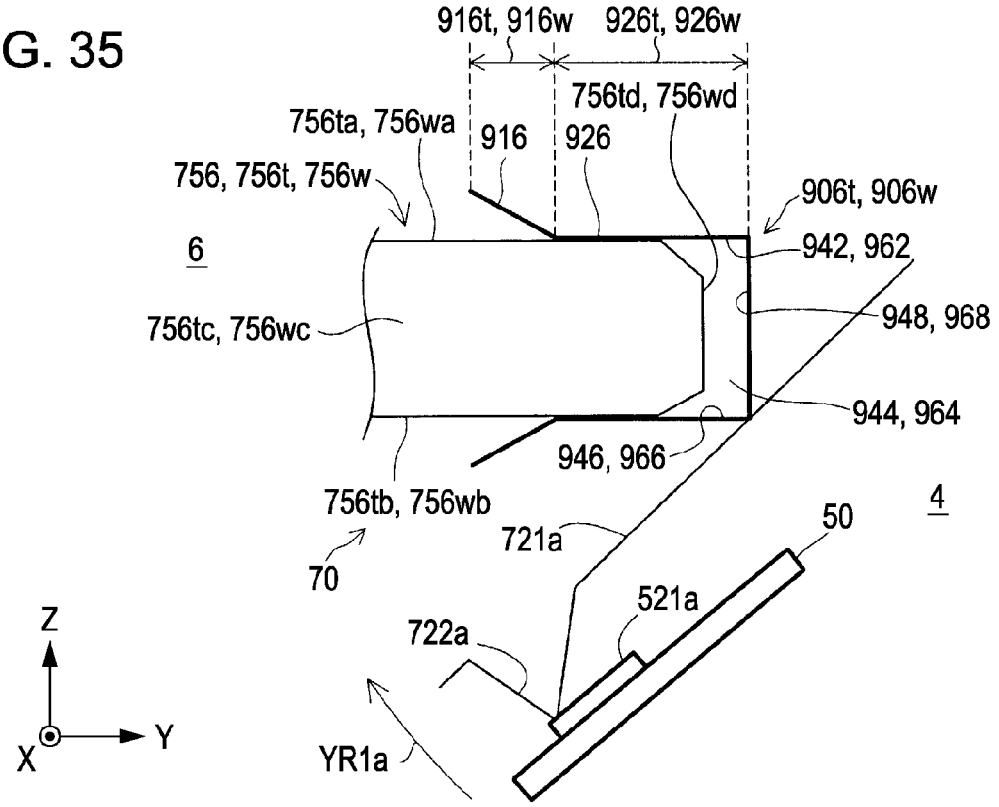

916t, 916w
926t, 926w
756td, 756wd
756ta, 756wa
916
926
756, 756t, 756w
906t, 906w
6
942, 962
756tc, 756wc
948, 968
944, 964
946, 966
756tb, 756wb
4
70
721a
50
521a
722a
Z
Y
X
YR1a

FIG. 36

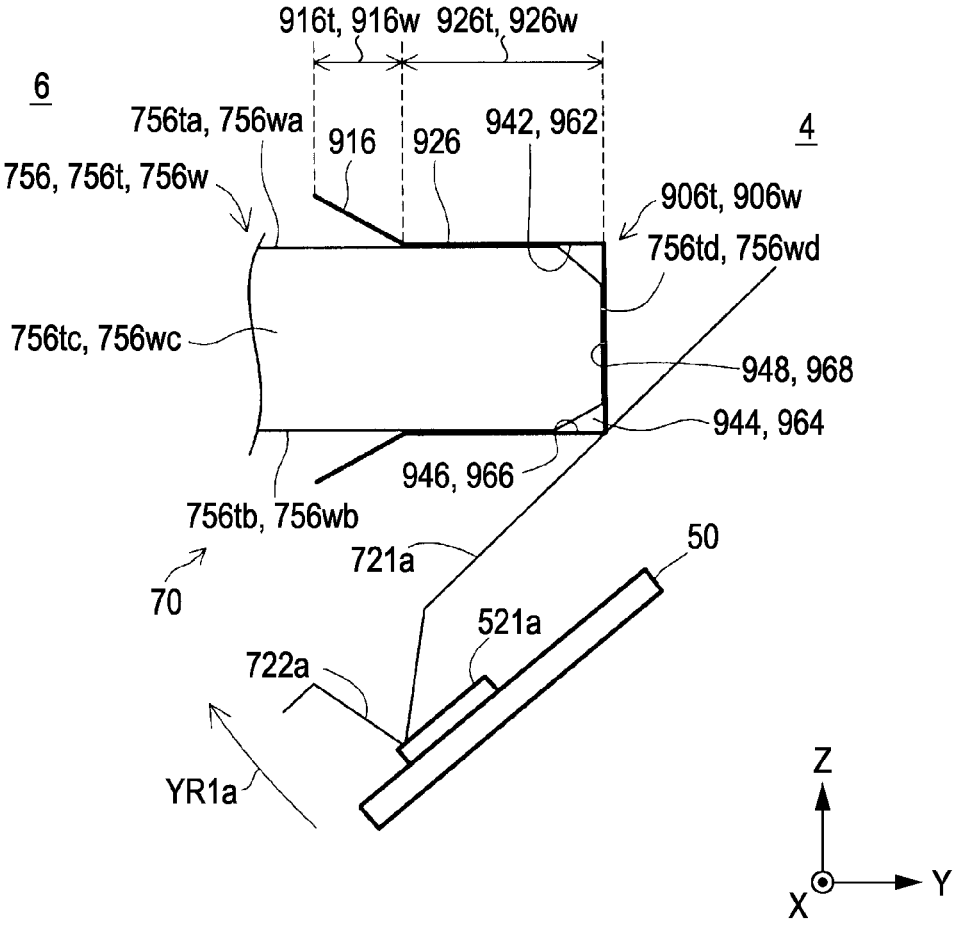

916t, 916w
926t, 926w
6
4
756ta, 756wa
916
926
942, 962
756, 756t, 756w
906t, 906w
756td, 756wd
756tc, 756wc
948, 968
944, 964
946, 966
756tb, 756wb
721a
50
70
521a
722a
YR1a
Z
Y
X

FIG. 37

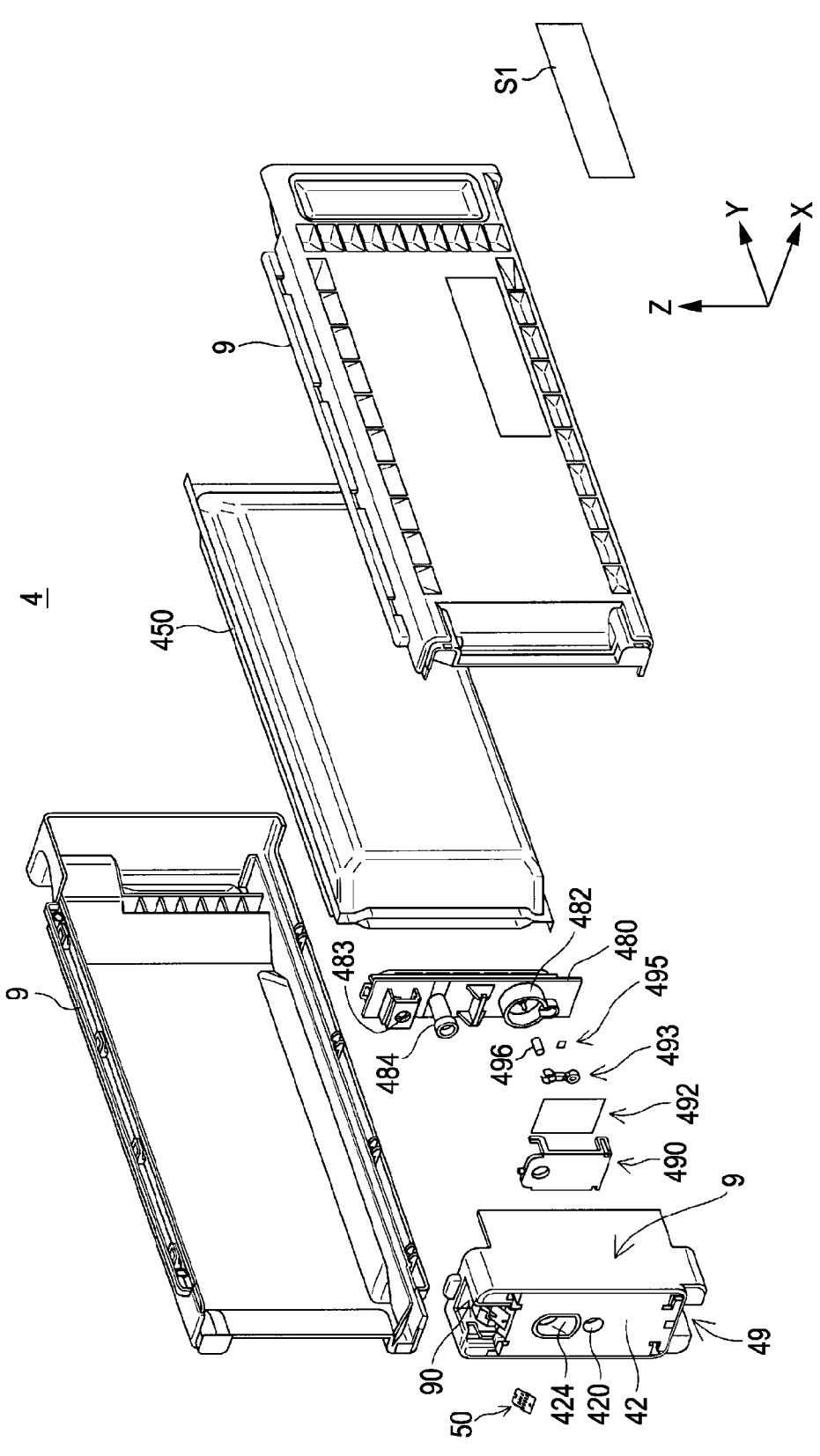

S1
Y
X
Z
9
4
450
9
482
480
483
495
484
496
493
492
490
9
49
90
424
420
42
50

FIG. 38A

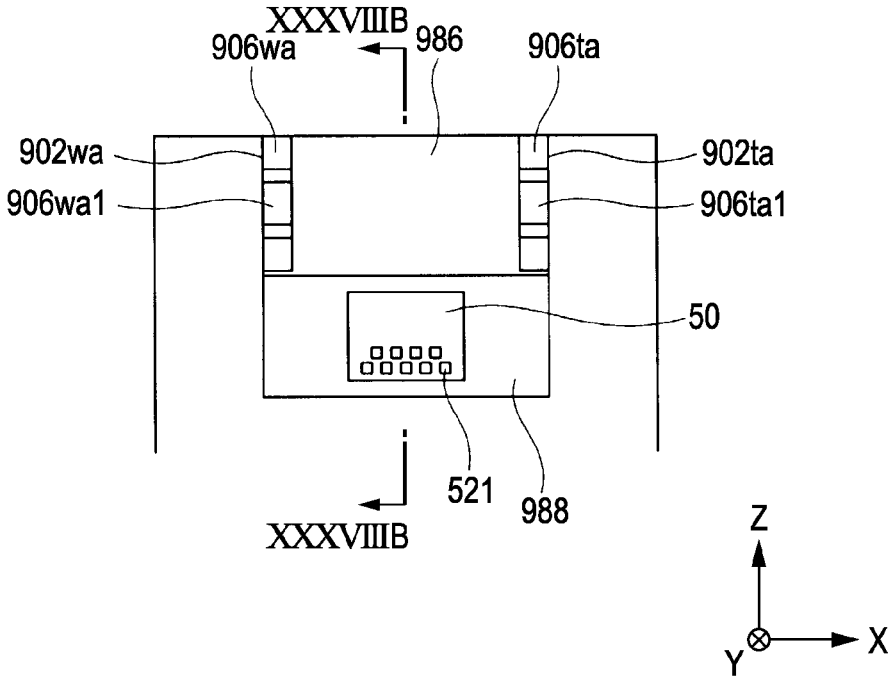


FIG. 38B

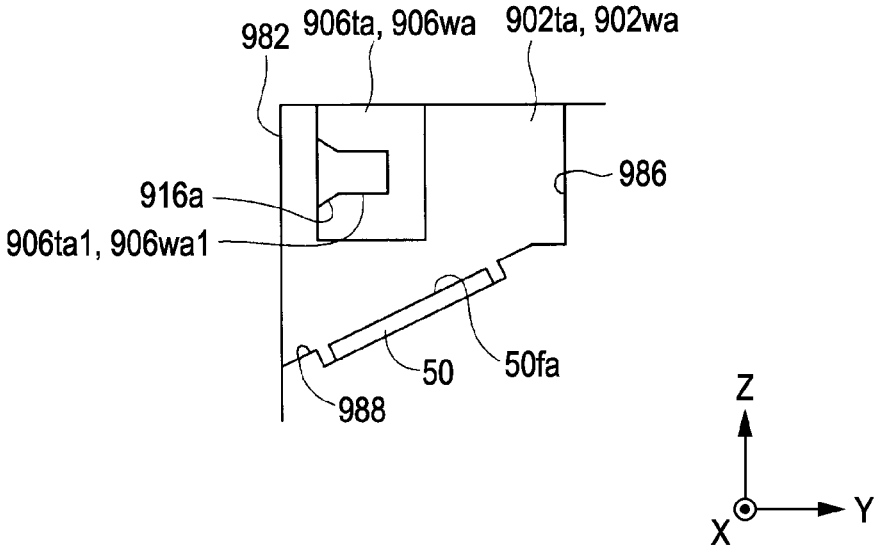


FIG. 39A

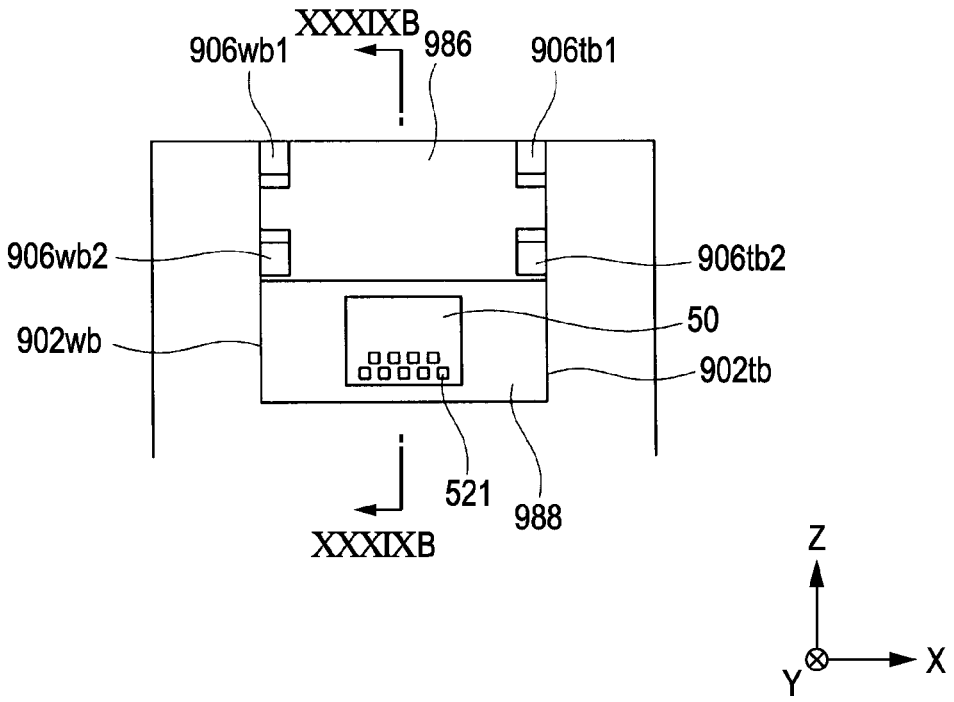


FIG. 39B

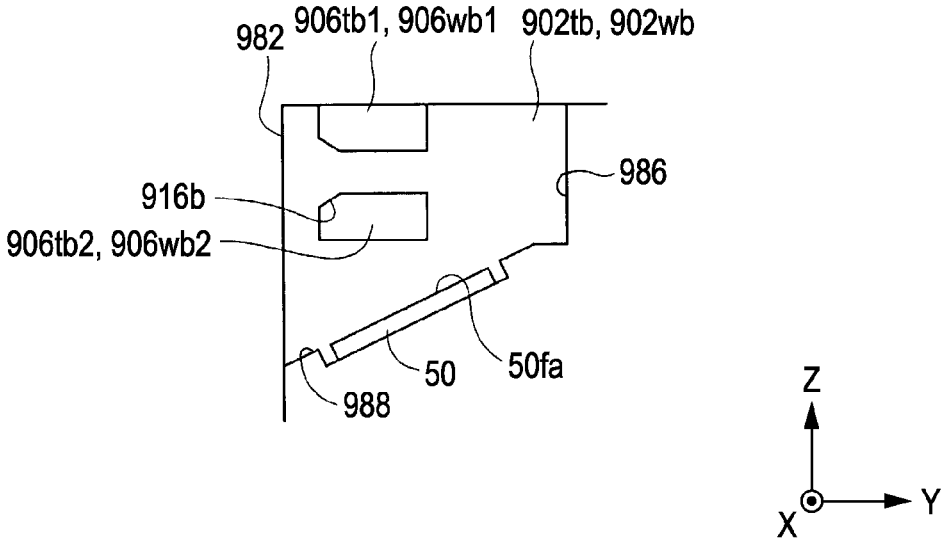


FIG. 40A

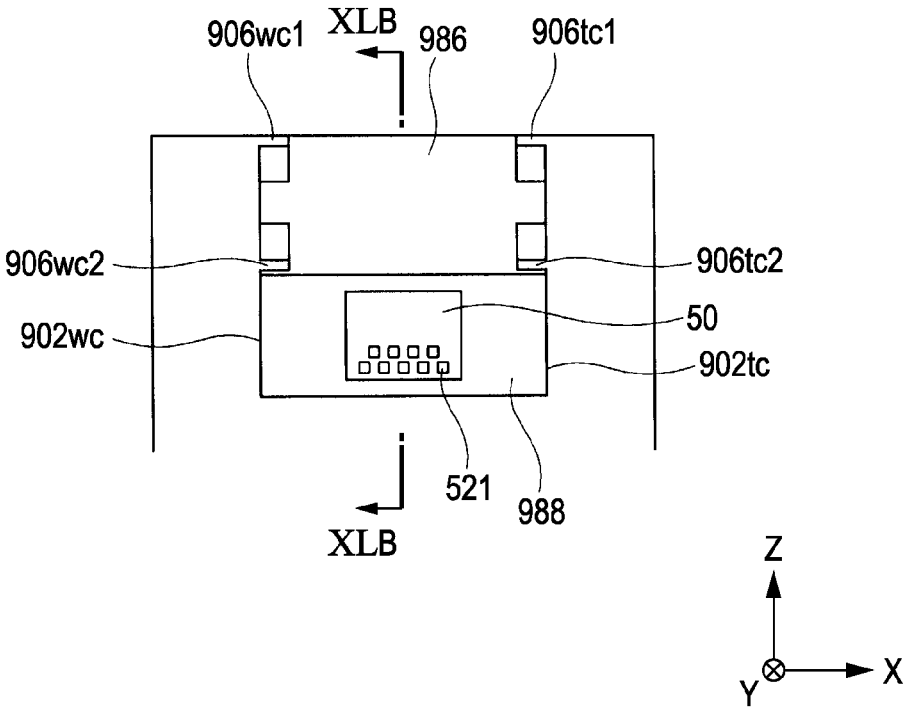


FIG. 40B

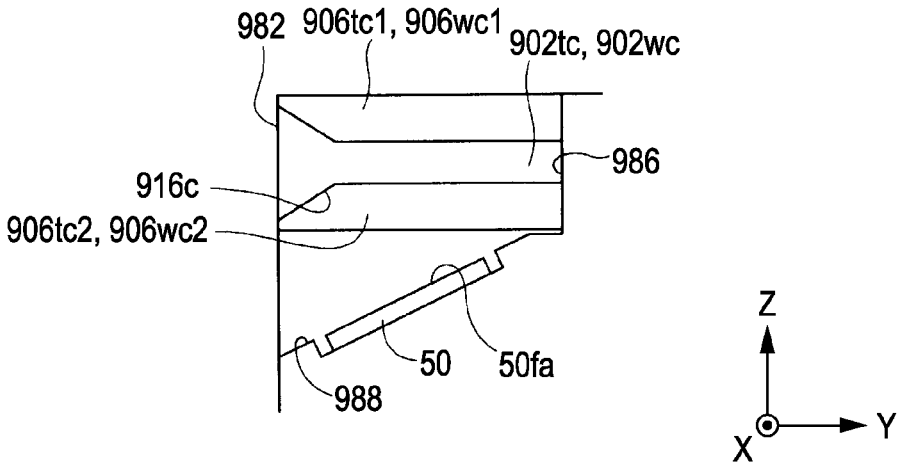


FIG. 41A

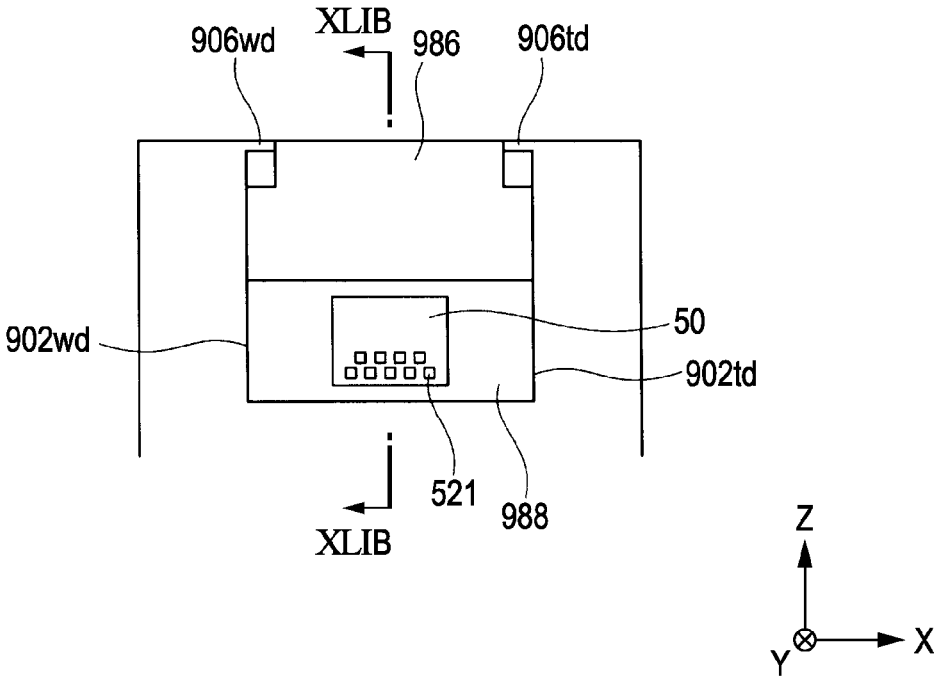


FIG. 41B

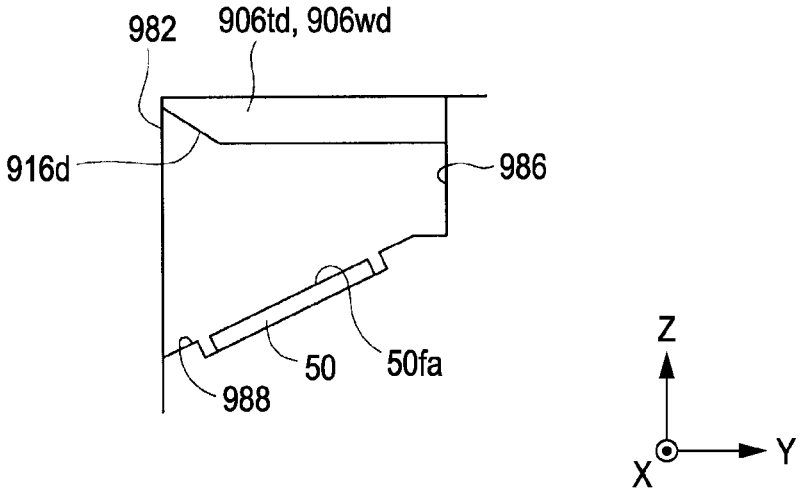


FIG. 42A

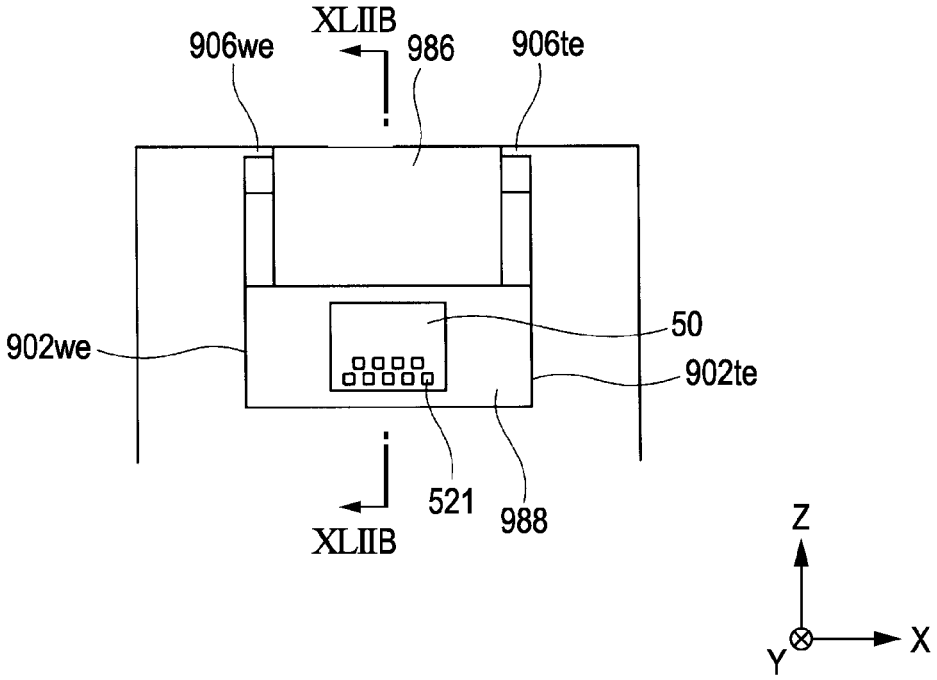


FIG. 42B

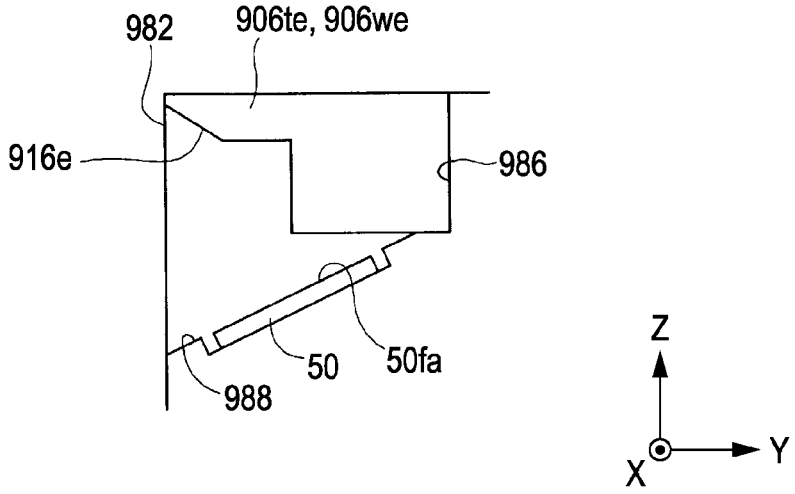


FIG. 43A

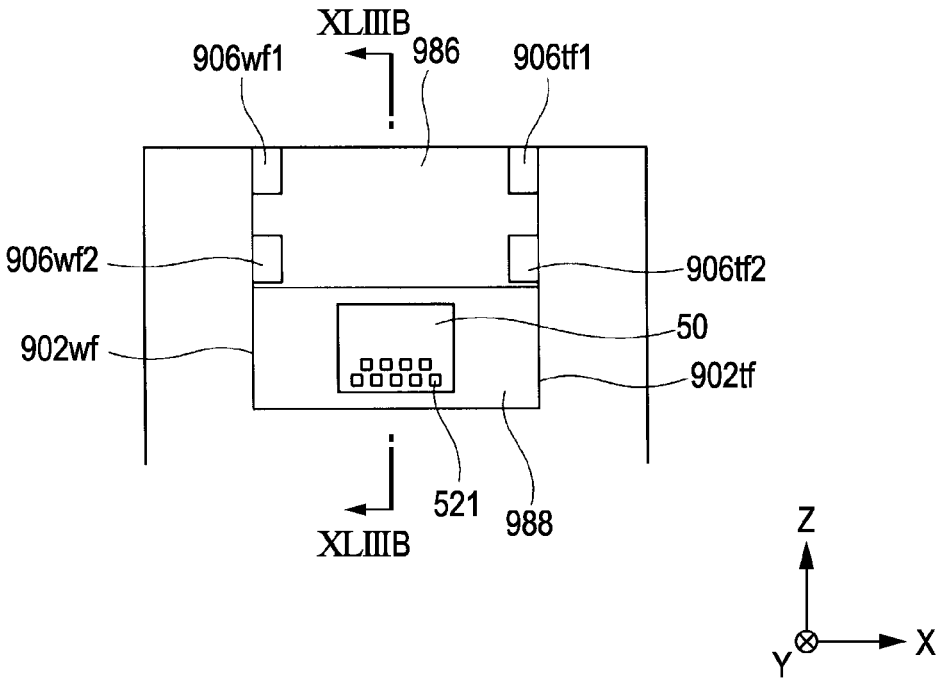


FIG. 43B

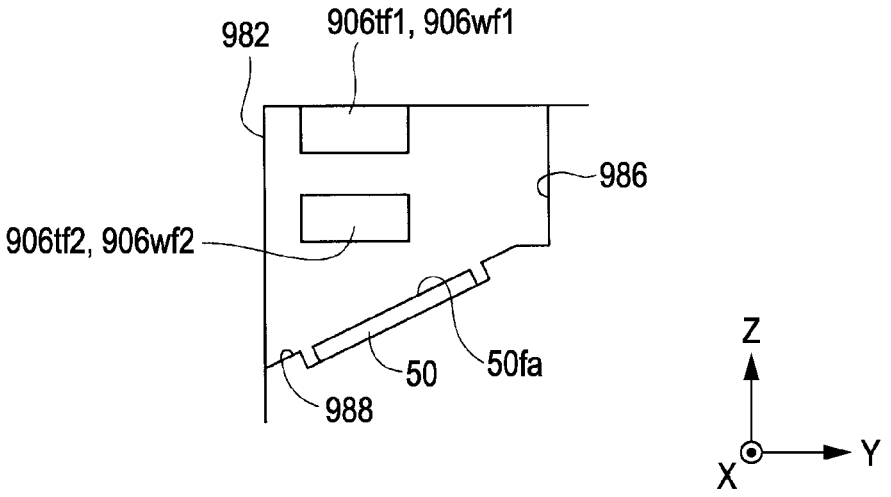


FIG. 44A

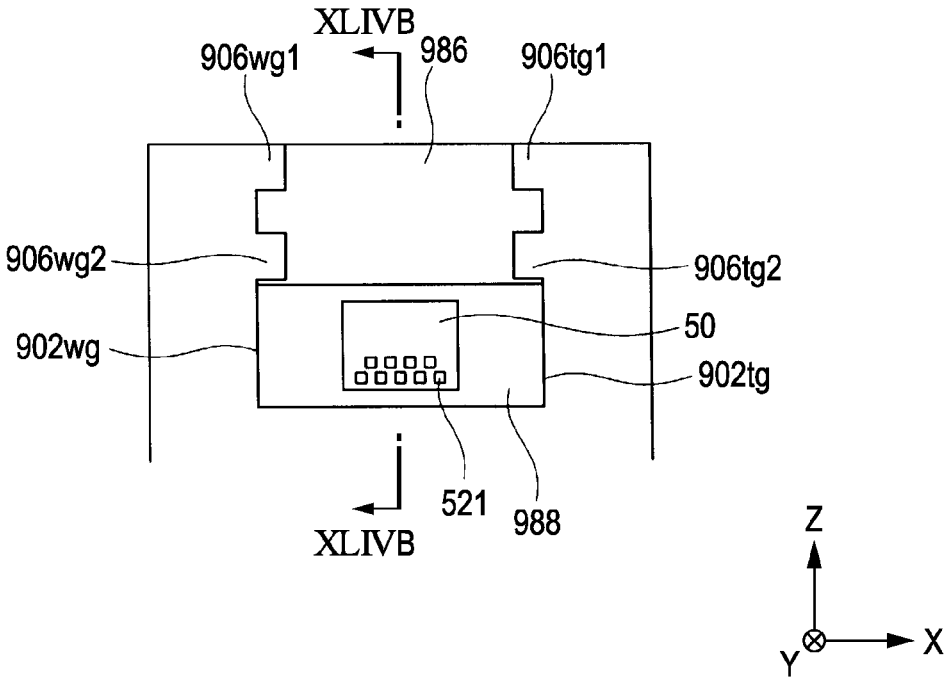


FIG. 44B

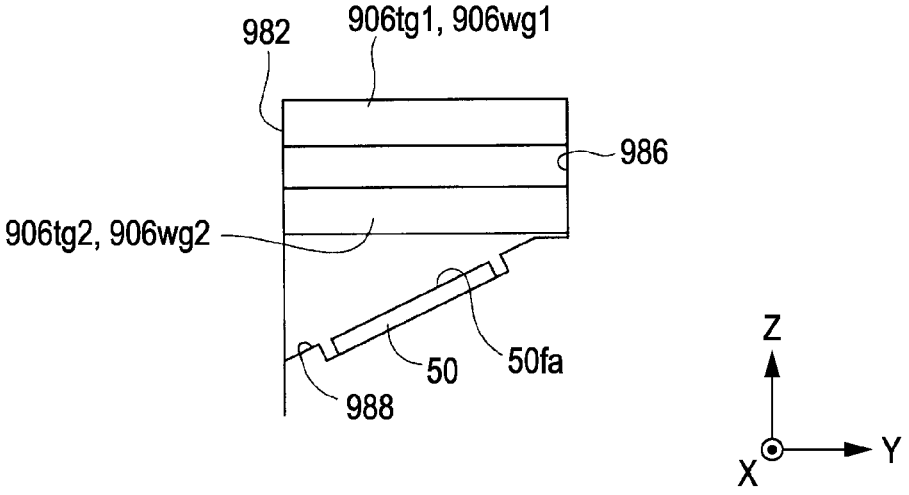


FIG. 45A

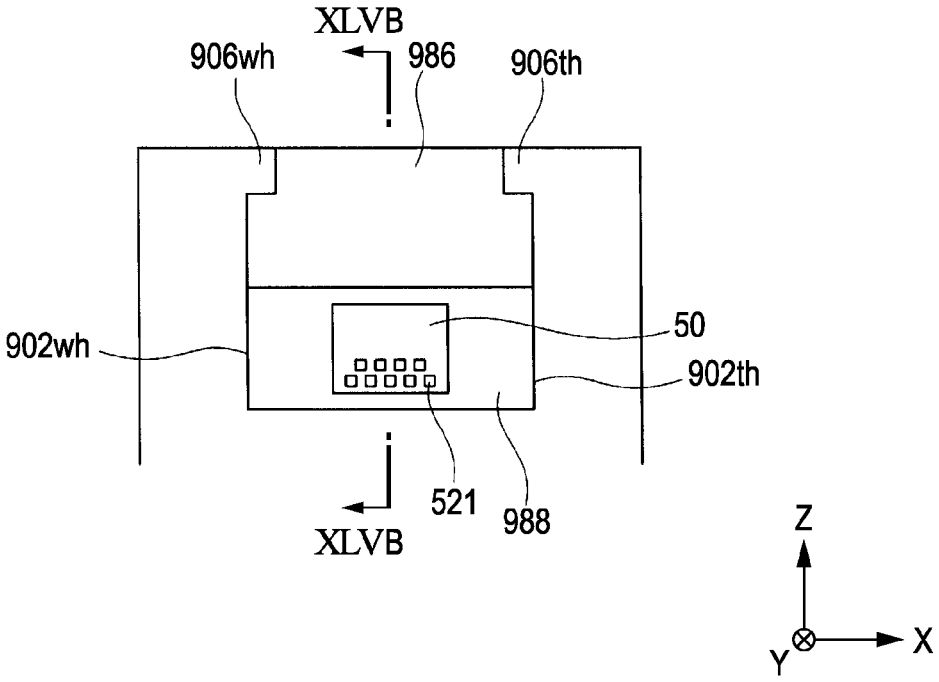


FIG. 45B

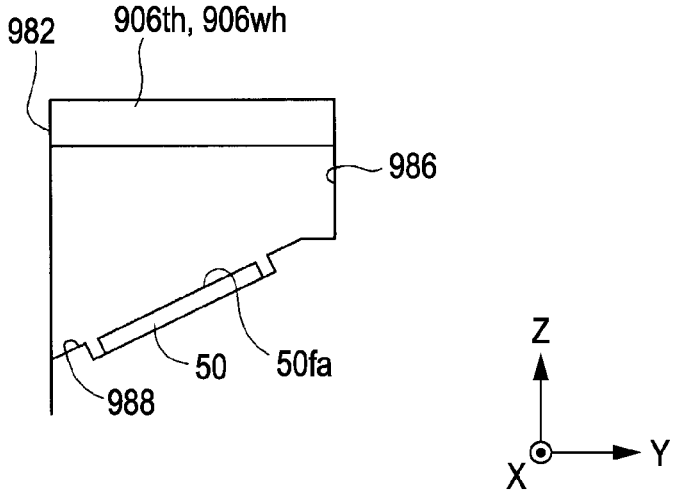


FIG. 46A

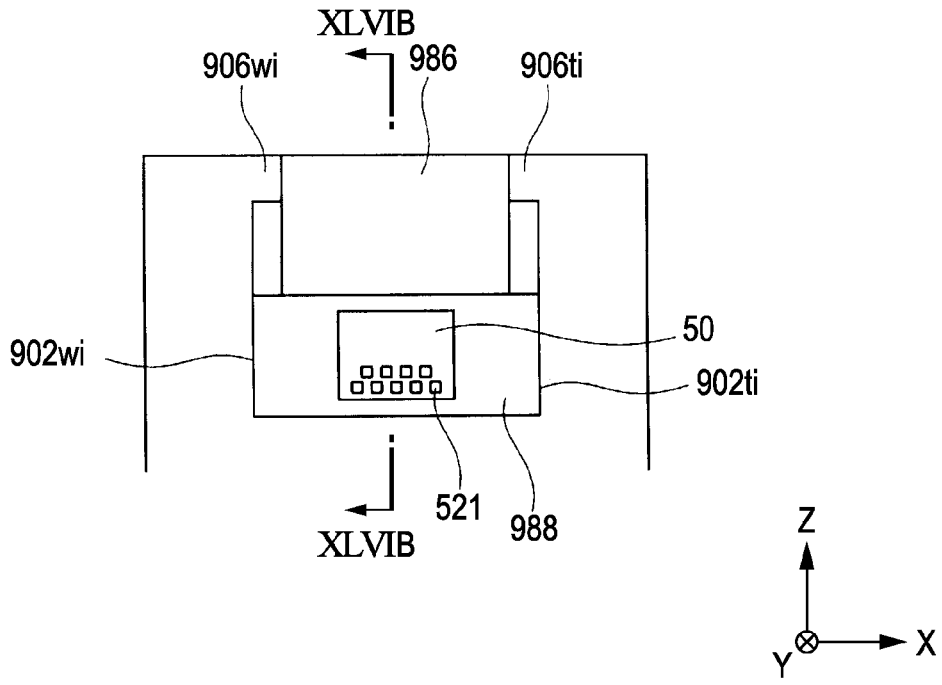
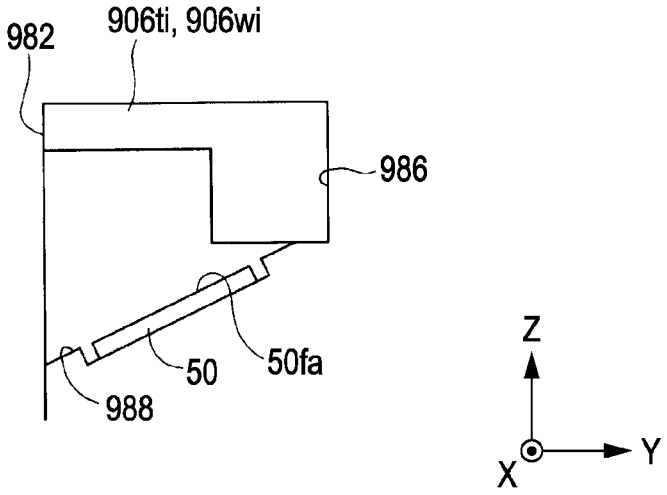


FIG. 46B



CARTRIDGE, PRINTING MATERIAL SUPPLY SYSTEM, AND PRINTING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a divisional application of U.S. patent application Ser. No. 13/738,347, filed on Jan. 10, 2013, which claims priority under 35 U.S.C. §119 to Japanese Application No. 2012-022819 filed on Feb. 6, 2012, No. 2012-005347 filed on Jan. 13, 2012, and No. 2012-013238 filed on Jan. 25, 2012 which are hereby incorporated by reference in its entirety.

BACKGROUND

1. Technical Field

The present invention relates to a cartridge which accommodates a printing material therein, a printing material supply system which includes a cartridge and a printing apparatus, and printing apparatus to which the cartridge is detachably mounted.

2. Related Art

A printer which is an example of a printing apparatus has a cartridge that accommodates ink therein and is detachably mounted thereto, and performs printing by supplying the ink from the cartridge to a printing head. Recently, a cartridge in which a circuit board that stores information regarding ink (for example, the color of ink) is mounted is used (for example, JP-A-2003-341100, JP-A-2007-230249, Specification of U.S. Pat. No. 6,203,147, JP-T-2002-505212, and JP-T-2002-513341). The circuit board mounted in the cartridge includes a storage device that stores the information regarding the ink and a terminal group (also referred to as a "cartridge side terminal group") for electrical connection to a printer. As the cartridge is mounted to a cartridge mounting unit of the printer, the cartridge side terminal group comes into contact with a terminal group (also referred to as an "apparatus side terminal group") provided in the cartridge mounting unit. Accordingly, each terminal of the cartridge side terminal group is electrically connected to the corresponding terminal of the apparatus side terminal group, such that signal reception and transmission between the printer and the cartridge is performed.

However, in the techniques of JP-A-2003-341100 and JP-A-2007-230249, due to manufacturing errors in the cartridge mounting unit or the cartridge, there is a possibility that the cartridge side terminal group and the apparatus side terminal group may not come into contact with each other so as to be electrically connected.

In the technique of Specification of U.S. Pat. No. 6,203,147, a connector provided with the apparatus side terminal group is movably provided in the cartridge mounting unit. Specifically, the connector is configured so as to be movable in a direction (the X axis direction and the Y axis direction in FIG. 7 of Specification of U.S. Pat. No. 6,203,147) orthogonal to an insertion direction (the Z axis direction in FIG. 7 of Specification of U.S. Pat. No. 6,203,147) of the cartridge. In addition, in the technique of Specification of U.S. Pat. No. 6,203,147, a recessed portion is provided in the front surface of the cartridge, and the cartridge side terminal group is arranged on the side surface in the recessed portion along the insertion direction. In this technique, since the connector is configured to be movable, the connector is moved according to the position of the cartridge when the cartridge is mounted to the cartridge mounting unit. Accordingly, there is an attempt to achieve proper connection between the cartridge side terminal group and the apparatus side terminal group.

In the technique described above, positioning in the X axis direction and the Y axis direction of the connector is performed by four side surfaces of the recessed portion in which the cartridge side terminal group is arranged. Therefore, errors in the shape of the recessed portion occur due to design errors in the cartridge, and thus there is a possibility that contact between the cartridge side terminal group and the apparatus side terminal group may not be properly achieved.

In addition, in the technique described above, there is a possibility that the apparatus side terminal group may rub against the side surface of the recessed portion or the cartridge side terminal group between when the cartridge is inserted into the cartridge mounting unit and when the cartridge is mounted to the cartridge mounting unit. There may be cases where the apparatus side terminal group rubs against the side surface of the recessed portion or the like, the constituent member of the cartridge is cut, and shavings are generated. In addition, there may be cases where dust is pulled therein due to static electricity generated by rubbing of the apparatus side terminal group against the side surface of the recessed portion or the like. When shavings, dust, and the like are present at the periphery of the apparatus side terminal group and the cartridge side terminal group, there may be cases where contact between the apparatus side terminal group and the cartridge side terminal group is not properly achieved.

In addition, in the techniques of JP-T-2002-505212 and JP-T-2002-513341, the connector is configured to be movable in the X axis direction which is a direction perpendicular to the insertion direction of the cartridge. In addition, in the techniques of JP-T-2002-505212 and JP-T-2002-513341, the recessed portion is provided in the front surface of the cartridge, and the cartridge side terminal group is provided on the bottom surface that is perpendicular to the insertion direction of the recessed portion. In the techniques of JP-T-2002-505212 and JP-T-2002-513341, as a guiding member provided in the recessed portion is inserted into a guiding slot of the cartridge mounting unit, positioning of the cartridge side terminal group and the apparatus side terminal group is performed.

In the techniques described above, the cartridge side terminal group is provided on the bottom surface of the recessed portion which is recessed in the reverse direction to the insertion direction and has a relationship of opposing the apparatus side terminal group in the insertion direction. Therefore, when the cartridge is attached to and detached from the cartridge mounting unit, the possibility of the apparatus side terminal group rubbing against the cartridge may be reduced. However, the cartridge side terminal group and the apparatus side terminal group come into point contact with each other between when the cartridge is inserted into the cartridge mounting unit and is connected thereto. Therefore, there is a possibility that contact between the cartridge side terminal group and the apparatus side terminal group may not be achieved due to a slight manufacturing error in the cartridge mounting unit or the cartridge.

The problems as described above are significant particularly in a large printer which performs printing on a large-sized sheet (for example, A2 to A0 sizes) because the size of the cartridge is increased.

The problems as mentioned above are problems that are not limited to the cartridge and the printer having the

cartridge that is detachable, but are common to a printing apparatus that supplies (ejects) different types of printing materials (for example, toner) from ink and a cartridge that is detachably mounted to the printing apparatus.

SUMMARY

An advantage of some aspects of the invention is that it provides a technique of properly achieving contact between a cartridge side terminal group and an apparatus side terminal group.

The invention can be realized in the following forms or application examples.

Application Example 1

According to Application Example 1, there is provided a cartridge detachably mounted to a printing apparatus which includes, assuming that three orthogonal spatial axes respectively are an X axis, a Y axis, and a Z axis, directions along the X axis, the Y axis, and the Z axis respectively are an X axis direction, a Y axis direction, and a Z axis direction, positive directions along the X axis, the Y axis, and the Z axis respectively are a +X axis direction, a +Y axis direction, and a +Z axis direction, and negative directions along the X axis, the Y axis, and the Z axis respectively are a −X axis direction, a −Y axis direction, and a −Z axis direction, a cartridge mounting unit into which the cartridge is inserted in the −Y axis direction toward an apparatus side front wall portion on a −Y axis direction side from an insertion hole on a +Y axis direction side, a printing material supply tube provided in the apparatus side front wall portion, and an apparatus side terminal unit which is provided closer to +Z axis direction side than the printing material supply tube of the apparatus side front wall portion, the apparatus side terminal unit having an apparatus side terminal group provided with a contact point on a surface tilted in a direction including a +Y axis direction component and a −Z axis direction component and first and second positioning portions respectively provided on a +X axis direction side and a −X axis direction side of the surface and being mounted in a state of being movable in the X axis direction and the Z axis direction with respect to the apparatus side front wall portion, the cartridge including: assuming that the X axis, the Y axis, and the Z axis for the cartridge in a mounted state in which the cartridge is mounted to the cartridge mounting unit respectively are an X axis, a Y axis, and a Z axis of the cartridge, two surfaces which oppose each other in the Y axis direction, the two surfaces including a rear surface positioned on the +Y axis direction side and an approximately rectangular front surface that is positioned on the −Y axis direction side and has a dimension in the Z axis direction greater than a dimension in the X axis direction; two surfaces which intersect the front surface and the rear surface and oppose each other in the Z axis direction, the two surfaces including a first side surface positioned on the +Z axis direction side and a second side surface positioned on a −Z axis direction side; two surfaces which intersect the front surface, the rear surface, the first side surface, and the second side surface and oppose each other in the X axis direction, the two surfaces including a third side surface positioned on the +X axis direction side and a fourth side surface positioned on the −X axis direction side; a supply tube insertion hole which is provided in the front surface and into which the printing material supply tube is inserted; and a concave portion which is provided in a corner portion at which the front surface and the first side surface intersect each other and into which the apparatus side terminal unit is inserted in the mounted state, wherein the concave portion includes an opening which is an entrance when the apparatus side terminal unit is inserted into the concave portion, and a first side wall, a second side wall, and a bottom wall that constitute at least a part of an inner wall of the concave portion, the first side wall and the second side wall oppose each other in the X axis direction, and the first side wall is positioned on the +X axis direction side and the second side wall is positioned on the −X axis direction side, the bottom wall is tilted in a direction including a −Y axis direction component and a +Z axis direction component and has a tilted surface provided with a cartridge side terminal group that comes into contact with the apparatus side terminal group in the mounted state, the first side wall is provided with a first restriction portion which restricts movements in the +Z axis direction and the +X axis direction of the apparatus side terminal unit by coming into contact with the first positioning portion in the +Z axis direction and the +X axis direction in the mounted state, and the second side wall is provided with a second restriction portion which restricts movements in the +Z axis direction and the −X axis direction of the apparatus side terminal unit by coming into contact with the second positioning portion in the +Z axis direction and the −X axis direction in the mounted state.

In the printing apparatus to which the cartridge according to Application Example 1 is mounted, the apparatus side terminal unit is movable in the X axis direction and the Z axis direction, and the cartridge according to Application Example 1 has the concave portion into which the apparatus side terminal unit is inserted. Accordingly, even in a case where the cartridge mounting unit or the cartridge has a manufacturing error, the apparatus side terminal unit is guided into the concave portion of the cartridge while absorbing the error as the apparatus side front wall portion is moved when the cartridge is mounted to the cartridge mounting unit. In addition, finally, the positioning of the apparatus side terminal group and the apparatus side terminal group is performed by the first and second restriction portions provided in the concave portion. That is, during the completion of the mounting and in the mounted state, the first and second restriction portions provided in the concave portion of the cartridge restrict the movements in the +Z axis direction and the ±X axis direction of the first and second positioning portions of the apparatus side terminal unit, thereby positioning the apparatus side terminal group and the cartridge side terminal group. Therefore, contact between the apparatus side terminal group and the cartridge side terminal group may be properly achieved.

In addition, in the printing apparatus to which the cartridge according to Application Example 1 is mounted, the apparatus side terminal group is provided on the surface tilted in the direction including the +Y axis direction component and the −Z axis direction component, and in the cartridge according to Application Example 1, the cartridge side terminal group is provided on the tilted surface tilted in the direction including the −Y axis direction component and the +Z axis direction component. That is, both the apparatus side terminal group and the cartridge side terminal group are provided on the surfaces tilted in the −Y axis direction which is the insertion direction of all the cartridges. When the cartridge is inserted into the cartridge mounting unit, the cartridge proceeds in the −Y axis direction. Here, the cartridge side terminal group also proceeds in the −Y axis direction and slowly approaches the apparatus side terminal group. However, the two do not come into contact with each other immediately before completing the mounting. In the

final stage of the mounting, after the apparatus side terminal unit is inserted into the concave portion of the cartridge, the apparatus side terminal group and the cartridge side terminal group slightly rub against each other immediately before completing the mounting. In addition, during the completion of the mounting and in the mounted state, the first and second restriction portions provided in the concave portion of the cartridge restrict the movements in the +Z axis direction and the ±X axis directions of the first and second positioning portions of the apparatus side terminal unit, thereby positioning the apparatus side terminal group and the cartridge side terminal group. As such, while the apparatus side terminal group and the cartridge side terminal group rarely rub against each other during the mounting of the cartridge, the apparatus side terminal group and the cartridge side terminal group rub slightly against each other immediately before completing the mounting of the cartridge, thereby reducing the possibility of shavings being generated as the apparatus side terminal group rubs against the cartridge during the mounting of the cartridge. In addition, even in a case where dust is present in the vicinity of the apparatus side terminal group and is interposed between the apparatus side terminal group and the cartridge side terminal group, the apparatus side terminal group comes into contact while linearly rubbing on the surface of the cartridge side terminal group and thus an effect of discharging the dust from the contact portion (a wiping effect) is exhibited, thereby reducing the possibility of dust being interposed between the apparatus side terminal group and the cartridge side terminal group.

Application Example 2

According to Application Example 1, each of the first restriction portion and the second restriction portion may include a +Z axis direction side contact surface which comes into contact with a +Z axis direction end portion of the corresponding positioning portion from the first and second positioning portions and a −Z axis direction side contact surface which comes into contact with a −Z axis direction end portion of the corresponding positioning portion from the first and second positioning portions.

In the cartridge according to Application Example 2, in the mounted state, the first restriction portion has the +Z axis direction side contact surface which comes into contact with the +Z axis direction end portion of the first positioning portion and the −Z axis direction side contact surface which comes into contact with the −Z axis direction end portion thereof, and the second restriction portion has the +Z axis direction side contact surface which comes into contact with the +Z axis direction end portion of the second positioning portion and the −Z axis direction side contact surface which comes into contact with the −Z axis direction end portion thereof. That is, the first and second restriction portions restrict the movements in the ±Z direction of the first and second positioning portions. Accordingly, the positioning of the apparatus side terminal group with respect to the cartridge side terminal group may be performed with good accuracy. Therefore, contact between the apparatus side terminal group and the cartridge side terminal group may be more properly achieved. Moreover, since the apparatus side terminal unit is able to be held on both sides in the +Z axis direction and the −Z axis direction, even when vibration or impacts from the outside are exerted during the use of the printing apparatus, a deviation of the contact position between the apparatus side terminal group and the cartridge side terminal group due to the vibration and impacts may be suppressed.

Application Example 3

In the cartridge according to Application Example 2, each of the first restriction portion and the second restriction portion may include an entrance part which extends toward the +Y axis direction side from the opening provided at an end surface on the −Y axis direction side and of which a dimension in the Z axis direction is monotonically decreased in the +Y axis direction, and a contact part which extends from an end portion in the +Y axis direction of the entrance part in the +Y axis direction, has a constant dimension in the Z axis direction, and comes into contact with the corresponding positioning portion from the first and second positioning portions in the mounted state.

In the cartridge according to Application Example 3, since the entrance part of which the dimension in the Z axis direction is monotonically decreased in the +Y axis direction from the −Y axis direction is included, even in a case where the cartridge or the cartridge mounting unit has a manufacturing error in the Z axis direction, the positioning portion of the apparatus side terminal unit which is movable in the Z axis direction may be easily guided to the restriction portion provided in the concave portion of the cartridge. In addition, since the contact part which has a constant dimension in the Z axis direction is included, the positioning of the apparatus side terminal group with respect to the cartridge side terminal group may be performed with good accuracy by causing the positioning portion of the apparatus side terminal unit to advance to the contact part after being guided to the entrance part.

Application Example 4

In the cartridge according to any one of Application Examples 1 to 3, each of the first and second restriction portions may include a +Y axis direction side contact surface that comes into contact with a +Y axis direction side end portion of the corresponding positioning portion from the first and second positioning portions in the mounted state.

In the cartridge according to Application Example 4, the first and second restriction portions respectively restrict the positions of the +Y axis direction side end portions of the first and second positioning portions. Accordingly, the apparatus side terminal unit may be prevented from strongly impacting the bottom wall in the cartridge concave portion by proceeding to far in the +Y axis direction when the cartridge is inserted into the cartridge mounting unit. Accordingly, the apparatus side terminal unit may be prevented from being broken.

Application Example 5

In the cartridge according to any one of Application Examples 1 to 4, a pair of bottom wall side concave portions may be formed in the bottom wall between the tilted surface and the first side wall and between the tilted surface and the second side wall.

In the cartridge according to Application Example 5, approximately triangular surfaces are exposed on the +X axis direction side and the −X axis direction side of the cartridge side terminal group. Accordingly, in a case where the cartridge side terminal group is provided on a circuit board, it is possible to easily perform mounting or removal

of the circuit board. In addition, when a pair of protrusions that protrude in the direction including the +Y axis direction component and the −Z axis direction component with respect to the surface are provided on the +X axis direction side and the −X axis direction side of the apparatus side terminal group so as to be received by the bottom wall side concave portions, in addition to the positioning of or suppressing of a positional deviation between the cartridge side terminal group and the apparatus side terminal group by the restriction portion and the positioning portion, it is possible to position the two or suppress a positional deviation therebetween even at the positions close to the cartridge side terminal group and the apparatus side terminal group. Therefore, contact between the apparatus side terminal group and the cartridge side terminal group may be more properly achieved.

Application Example 6

In the cartridge according to any one of Application Examples 1 to 5, a rod insertion hole which is provided at an intermediate position in the Z axis direction of the front surface between the first side surface and the second side surface and into which a rod provided in the apparatus side front wall portion is inserted may further be included, and the supply tube insertion hole may be provided between the rod insertion hole and the concave portion.

In the cartridge according to Application Example 6, as the rod is inserted into the rod insertion hole, positioning of the entirety of the cartridge with respect to the cartridge mounting unit is performed, and thus a positional deviation from the correct mounting position is suppressed. Therefore, a positional deviation in the vicinity of the rod insertion hole may be properly suppressed. However, the cartridge side terminal group provided in the corner portion of the front surface and the rod insertion hole are at positions separated from each other, and thus there may be cases where it is difficult to suppress a positional deviation of such a member that is at a position separated from the rod insertion hole. In particular, the large-capacity type cartridge used in the printing apparatus for large-sized printing has a large size, and the cartridge side terminal group and the rod insertion hole are at positions somewhat separated from each other. However, as described above, by employing the configurations of the apparatus side terminal unit that is movable in the X axis direction and the Z axis direction and the concave portion into which the apparatus side terminal unit is inserted, positioning of the cartridge side terminal group and the apparatus side terminal group may be performed with good accuracy. That is, even with the large-capacity type cartridge having a large size, it is possible to position the apparatus side terminal group and the cartridge side terminal group with good accuracy while performing the positioning of the entirety of the cartridge with good accuracy and absorbing a manufacturing error in the cartridge.

In addition, according to this application example, the supply tube insertion hole into which the printing material supply tube is inserted is provided between the rod insertion hole and the concave portion. That is, the printing material supply tube is provided at a position close to the rod. In addition, the supply tube insertion hole is provided at a position close to the rod insertion hole. Therefore, a positional deviation between the printing material supply tube and the supply tube insertion hole may be properly suppressed.

Application Example 7

In the cartridge according to any one of Application Examples 1 to 6, the first restriction portion may be a groove recessed in the +X axis direction from the first side wall, and the second restriction portion may be a groove recessed in the −X axis direction from the second side wall.

In the cartridge according to Application Example 7, since the grooves are respectively formed in the first and second side walls, the first and second restriction portions for restricting the movements of the first and second positioning portions may be easily formed.

Application Example 8

In the cartridge according to any one of Application Examples 1 to 6, the first restriction portion may be configured as a convex portion that protrudes in the −X axis direction from the first side wall, and the second restriction portion may be configured as a convex portion that protrudes in the +X axis direction from the second side wall.

In the cartridge according to Application Example 8, since the convex portions that protrude in the X axis direction are respectively provided to the first side wall and the second side wall, the first positioning portion and the second positioning portion may be easily formed.

Application Example 9

According to Application Example 9, there is provided a printing material supply system including: a printing apparatus; and the cartridge according to any one of Application Examples 1 to 8, wherein the printing apparatus includes, assuming that three orthogonal spatial axes respectively are an X axis, a Y axis, and a Z axis, directions along the X axis, the Y axis, and the Z axis respectively are an X axis direction, a Y axis direction, and a Z axis direction, positive directions along the X axis, the Y axis, and the Z axis respectively are a +X axis direction, a +Y axis direction, and a +Z axis direction, and negative directions along the X axis, the Y axis, and the Z axis respectively are a −X axis direction, a −Y axis direction, and a −Z axis direction, a cartridge mounting unit into which the cartridge is inserted in the −Y axis direction toward an apparatus side front wall portion on a −Y axis direction side from an insertion hole on a +Y axis direction side, a printing material supply tube provided in the apparatus side front wall portion, and an apparatus side terminal unit which is provided closer to a +Z axis direction side than the printing material supply tube of the apparatus side front wall portion, and the apparatus side terminal unit has an apparatus side terminal group provided with a contact point on a surface tilted in a direction including a +Y axis direction component and a −Z axis direction component and first and second positioning portions respectively provided on a +X axis direction side and a −X axis direction side of the surface, and is mounted in a state of being movable in the X axis direction and the Z axis direction with respect to the apparatus side front wall portion.

In the printing material supply system according to Application Example 9, a holder provided with the apparatus side terminal group is configured to be movable in the X axis direction and the Z axis direction. Accordingly, even in the case where the cartridge mounting unit or the cartridge has a manufacturing error, the apparatus side terminal group provided in the holder is moved to the position that comes into contact with the cartridge side terminal group when the cartridge is mounted to the cartridge mounting unit. In addition, finally, the positioning of the apparatus side terminal group and the cartridge side terminal group is performed by the first and second restriction portions provided

in the concave portion of the cartridge. That is, during the completion of the mounting and in the mounted state, the movements in the +Z axis direction and the ±X axis direction of the first and second positioning portions of the apparatus side terminal unit are restricted by the first and second restriction portions provided in the concave portion of the cartridge, thereby positioning the apparatus side terminal group and the cartridge side terminal group. Therefore, contact between the apparatus side terminal group and the cartridge side terminal group may be properly achieved. In addition, by employing the cartridge according to any one of Application Examples 1 to 8, the same effects as those described in Application Examples 1 to 8 are exhibited.

Application Example 10

According to Application Example 10, there is provided a printing apparatus to which a cartridge having a cartridge side terminal group is detachably mounted, including: assuming that three orthogonal spatial axes respectively are an X axis, a Y axis, and a Z axis, directions along the X axis, the Y axis, and the Z axis respectively are an X axis direction, a Y axis direction, and a Z axis direction, positive directions along the X axis, the Y axis, and the Z axis respectively are a +X axis direction, a +Y axis direction, and a +Z axis direction, and negative directions along the X axis, the Y axis, and the Z axis respectively are a −X axis direction, a −Y axis direction, and a −Z axis direction, a cartridge mounting unit into which the cartridge is inserted in the −Y axis direction toward an apparatus side front wall portion on a −Y axis direction side from an insertion hole on a +Y axis direction side; a printing material supply tube provided in the apparatus side front wall portion; and an apparatus side terminal unit which is provided closer to a +Z axis direction side than the printing material supply tube of the apparatus side front wall portion, wherein the apparatus side terminal unit has an apparatus side terminal group provided with a contact point on a surface tilted in a direction including a +Y axis direction component and a −Z axis direction component and first and second positioning portions respectively provided on a +X axis direction side and a −X axis direction side of the surface, and is mounted in a state of being movable in the X axis direction and the Z axis direction with respect to the apparatus side front wall portion.

In the printing apparatus according to Application Example 10, the apparatus side terminal unit having the apparatus side terminal group is movable in the X axis direction and the Z axis direction. Accordingly, even in the case where the cartridge mounting unit or the cartridge has a manufacturing error, the apparatus side terminal group is moved to the position that comes into contact with the cartridge side terminal group when the cartridge is mounted to the cartridge mounting unit. Therefore, contact between the apparatus side terminal group and the cartridge side terminal group may be properly achieved.

Application Example 11

In the printing apparatus according to Application Example 10, the cartridge mounting unit may include two wall portions that intersect the apparatus side front wall portion and oppose each other in the Z axis direction, the two wall portions including a first apparatus side side wall portion disposed on the +Z axis direction side and a second apparatus side side wall portion disposed on a −Z axis direction side, a rod having a center axis parallel to the Y axis direction may be provided at an intermediate position in the apparatus side front wall portion between the first apparatus side side wall portion and the second apparatus side side wall portion, and the printing material supply tube may be provided between the rod and the apparatus side terminal unit.

In the printing apparatus according to Application Example 11, the entirety of the cartridge with respect to the cartridge mounting unit is positioned by the rod, and thus a positional deviation from the correct mounting position may be suppressed. In addition, the printing material supply tube is provided between the rod and the apparatus side terminal unit. That is, the printing material supply tube is provided at a position relatively close to the rod. Therefore, a positional deviation between the printing material supply tube and the supply tube insertion hole of the cartridge into which the printing material supply tube is inserted may be properly suppressed. As such, although the positional deviation in the vicinity of the rod is able to be properly suppressed, the apparatus side terminal group and the rod are at positions separated from each other, and there may be cases where it is difficult to suppress the positional deviation. In particular, the printer for large-sized printing has a large size, and the apparatus side terminal unit and the rod are at positions somewhat separated from each other. However, as such, by employing the apparatus side terminal unit that is movable in the X axis direction and the Z axis direction, the apparatus side terminal group is moved to the position that comes into contact with the cartridge side terminal group when the cartridge is mounted to the cartridge mounting unit. Therefore, positioning of the cartridge side terminal group and the apparatus side terminal group may be performed with good accuracy.

In addition, the invention is able to be realized as various forms, and be realized as a printing apparatus, a method of manufacturing a printing apparatus, a method of manufacturing a cartridge, and the like besides the configurations of the above-described cartridge and the printing material supply system.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

FIG. **1** is a perspective view illustrating the configuration of a printing material supply system.

FIG. **2** is an external perspective view illustrating a mounted cartridge mounting unit.

FIG. **3** is a cross-sectional view taken along the line III-III of FIG. **2**.

FIG. **4** is an enlarged diagram of a circulation part on a cartridge mounting unit side.

FIG. **5** is a first external perspective view of the cartridge mounting unit.

FIG. **6** is a second external perspective view of the cartridge mounting unit.

FIG. **7** is a third external perspective view of the cartridge mounting unit.

FIG. **8** is a fourth external perspective view of the cartridge mounting unit.

FIG. **9** is a fifth external perspective view of the cartridge mounting unit.

FIG. **10** is a first external perspective view of an apparatus side front wall portion and the peripheral members thereof.

FIG. **11** is a second external perspective view of the apparatus side front wall portion and the peripheral members thereof.

FIG. **12** is an exploded perspective view of the apparatus side front wall portion and the peripheral members thereof.

FIG. **13** is a cross-sectional view taken along the line XIII-XIII of FIG. **10**.

FIG. **14** is a first exploded perspective view of an apparatus side terminal unit.

FIG. **15** is a second exploded perspective view of the apparatus side terminal unit.

FIG. **16** is a first external perspective view of the apparatus side terminal unit.

FIG. **17** is a second external perspective view of the apparatus side terminal unit.

FIG. **18** is a cross-sectional view taken along the line XVIII-XVIII of FIG. **17**.

FIG. **19** is a first external perspective view of a cartridge.

FIG. **20** is a second external perspective view of the cartridge.

FIG. **21** is a front view of the cartridge.

FIG. **22** is a rear view of the cartridge.

FIG. **23** is a top view of the cartridge.

FIG. **24** is a bottom view of the cartridge.

FIG. **25** is a first side view of the cartridge.

FIG. **26** is a second side view of the cartridge.

FIG. **27** is an external perspective view of the vicinity of a concave portion.

FIG. **28** is a front view of the vicinity of the concave portion.

FIG. **29** is a cross-sectional view taken along the line XXIX-XXIX of FIG. **28**.

FIG. **30** is a cross-sectional view taken along the line XXX-XXX of FIG. **28**.

FIG. **31** is a diagram for explaining a state of the connection between the apparatus side terminal unit and a circuit board.

FIG. **32** is a cross-sectional view taken along the line XXXII-XXXII in the mounted state.

FIG. **33** is a first diagram illustrating an embodiment of the contact.

FIG. **34** is a second diagram illustrating the embodiment of the contact.

FIG. **35** is a third diagram illustrating the embodiment of the contact.

FIG. **36** is a fourth diagram illustrating the embodiment of the contact.

FIG. **37** is an exploded perspective view of the cartridge.

FIG. **38**A is a front view of a first modified embodiment.

FIG. **38**B is a cross-sectional view taken along the line XXXVIIIB-XXXVIIIB of FIG. **38**A.

FIG. **39**A is a front view of a second modified embodiment.

FIG. **39**B is a cross-sectional view taken along the line XXXIXB-XXXIXB of FIG. **39**A.

FIG. **40**A is a front view of a third modified embodiment.

FIG. **40**B is a cross-sectional view taken along the line XXXXB-XXXXB of FIG. **40**A.

FIG. **41**A is a front view of a fourth modified embodiment.

FIG. **41**B is a cross-sectional view taken along the line XXXXIB-XXXXIB of FIG. **41**A.

FIG. **42**A is a front view of a fifth modified embodiment.

FIG. **42**B is a cross-sectional view taken along the line XXXXIIB-XXXXIIB of FIG. **42**A.

FIG. **43**A is a front view of a sixth modified embodiment.

FIG. **43**B is a cross-sectional view taken along the line XXXXIIIB-XXXXIIIB of FIG. **43**A.

FIG. **44**A is a front view of a seventh modified embodiment.

FIG. **44**B is a cross-sectional view taken along the line XXXXIVB-XXXXIVB of FIG. **44**A.

FIG. **45**A is a front view of an eighth modified embodiment.

FIG. **45**B is a cross-sectional view taken along the line XXXXVB-XXXXVB of FIG. **45**A.

FIG. **46**A is a front view of a ninth modified embodiment.

FIG. **46**B is a cross-sectional view taken along the line XXXXVIB-XXXXVIB of FIG. **46**A.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

Next, embodiments of the invention will be described in the following order:

A. First Example
B. Second Example
C. Modified Example

A. First Example

A-1. Entire Configuration of Printing Material Supply System

FIG. **1** is a perspective view illustrating the configuration of a printing material supply system **1**. In FIG. **1**, the X, Y, and Z axes which are three orthogonal spatial axes are drawn. The directions in which the arrows of the X axis, the Y axis, and the Z axis are directed respectively represent positive directions along the X axis, the Y axis, and the Z axis. The positive directions along the X axis, the Y axis, and the Z axis are respectively denoted by a +X axis direction, a +Y axis direction, and a +Z axis direction. The directions reverse to the directions in which the arrows of the X axis, the Y axis, and the Z axis are directed respectively represent negative directions along the X axis, the Y axis, and the Z axis. The negative directions along the X axis, the Y axis, and the Z axis are respectively denoted by a −X axis direction, a −Y axis direction, and a −Z axis direction. Directions along the X axis, the Y axis, and the Z axis regardless of whether being positive or negative are respectively called an X axis direction, a Y axis direction, and a Z axis direction. This applies the same to the figures and description described later. The directions of the X, Y, and Z axes drawn in the other figures correspond to those of the X, Y, and Z axes of FIG. **1**. The printing material supply system **1** includes a printer **10** as a printing apparatus and a cartridge **4**.

The printer **10** of this embodiment is an ink jet printer that discharges ink from a head **22**. The printer **10** is a large printer that performs printing on a large-sized sheet (A2 to A0 and the like) such as a poster. The printer **10** includes a cartridge mounting unit **6**, a control unit **31**, a carriage **20**, the head **22**, and a driving mechanism **30**. In addition, the printer **10** includes an operation button **15** for a user to operate the operations of the printer **10**.

In the cartridge mounting unit **6**, each of a plurality of cartridges **4** is detachably mounted. In this example, four types of single cartridges **4** respectively corresponding to four colors (black, yellow, magenta, and cyan) of ink, that is, a total of four cartridges **4** are mounted to the cartridge mounting unit **6**. In the printer **10** of this example, an exchange cover **13** is provided as the front surface (the

surface on the +Y axis direction side). The +Z axis direction side of the exchange cover **13** is tilted forward (the +Y axis direction side), the opening of the cartridge mounting unit **6** appears, and thus attaching and detaching of the cartridge **4** becomes possible. When the cartridge **4** is mounted to the cartridge mounting unit **6**, the ink is able to be supplied to the head **22** provided in the carriage **20** via a tube **24**. In this example, the ink in the cartridge **4** is suctioned by a pumping mechanism (not shown) of the printer **10**, thereby supplying the ink to the head **22**. In addition, the tube **24** is provided for each of the types of the ink. In addition, a state in which the cartridge **4** is mounted to the cartridge mounting unit **6** is also called a "mounted state".

In the head **22**, a nozzle is provided for each of the types of the ink. The head **22** prints data such as text and images by ejecting the ink toward a printing sheet **2** from ejection nozzles. In addition, a form in which the cartridge **4** is mounted to the cartridge mounting unit **6** and detailed configurations of the cartridge **4** and the cartridge mounting unit **6** will be described later. In addition, in this example, the printer **10** is a printer called a so-called "off-carriage type" in which the cartridge mounting unit **6** is not linked to the movement of the carriage **20**. The invention may also be applied to a printer called a so-called "on-carriage type" in which the cartridge mounting unit **6** is provided in the carriage **20** and the cartridge mounting unit **6** is moved along with the carriage **20**.

The control unit **31** performs control of each unit of the printer **10** and signal reception and transmission with the cartridge **4**. The carriage **20** moves the head **22** relative to the printing sheet **2**.

The driving mechanism **30** reciprocates the carriage **20** on the basis of a control signal from the control unit **31**. The driving mechanism **30** includes a timing belt **32** and a driving motor **34**. By transmitting the power of the driving motor **34** to the carriage **20** via the timing belt **32**, the carriage **20** is reciprocated in a main scanning direction (the X axis direction). In addition, the printer **10** includes a transport mechanism for moving the printing sheet **2** in a sub-scanning direction (the +Y axis direction). When printing is performed, the printing sheet **2** is moved in the sub-scanning direction by the transport mechanism, and the printing sheet **2** is output onto the front surface cover **11** after completing the printing.

In addition, at a position outside a printing region in which the carriage **20** is moved in the main scanning direction, a region called a home position is provided. At the home position, a maintenance mechanism that performs maintenance for enabling normal printing is mounted. The maintenance mechanism is constituted by a cap member **8** which is pressed against a surface (nozzle surface) where the nozzles are formed on the bottom surface side (a side toward the printing sheet **2**) of the head **22** and forms a closed space to surround the ejection nozzles, an elevating mechanism (not shown) that elevates the cap member **8** so as to be pressed against the nozzle surface of the head **22**, a suction pump (not shown) that introduces a negative pressure to the closed space formed by the cap member **8** pressed against the nozzle surface of the head **22**, and the like.

In this example, in a use state of the printing material supply system **1** (the printer **10** and the cartridge **4**), the axis along the sub-scanning direction in which the printing sheet **2** is transported is referred to as the Y axis, the axis along the direction of gravity (upward and rearward direction) is referred to as the Z axis, and the axis along the movement direction (left and right direction) of the carriage **20** is referred to as the X direction. Here, the "use state of the printing material supply system **1**" is referred to as a state in which the printing material supply system **1** is installed on a horizontal surface. In addition, in this example, the sub-scanning direction (forward direction) is referred to as the +Y axis direction, the reverse direction thereto (rearward direction) is referred to as the −Y axis direction, a direction (upward direction) directed upward from below in the direction of gravity is referred to as the +Z axis direction, and the reverse direction thereto (downward direction) is referred to as the −Z axis direction. In addition, when the printing material supply system **1** is viewed from the forward side (the +Y axis direction side), a direction directed to the left from the right is referred to as the +X axis direction, and the reverse direction thereto is referred to as the −X axis direction. In addition, in this example, the insertion direction in which the cartridge **4** is mounted to the cartridge mounting unit **6** is also referred to as the −Y axis direction, and the direction in which the cartridge **4** is detached from the cartridge mounting unit **6** is also referred to as the +Y axis direction. Therefore, in the cartridge mounting unit **6**, the −Y axis direction side is also called an inner side, and the +Y axis direction side is also called a forward side. In addition, in this example, the arrangement direction of the plurality of cartridges **4** is also referred to as the X axis direction.

FIG. **2** is an external perspective view illustrating the cartridge mounting unit **6** in the mounted state. In FIG. **2**, a form in which the four cartridges **4** are mounted to the respective slots of the cartridge mounting unit **6** is illustrated. Levers **672** are pushed down to the three slots excluding one slot in the −X axis direction side from the four slots. As such, since the levers **672** are pushed down after the cartridges **4** are mounted to the cartridge mounting unit **6**, the movement of the cartridge **4** is restricted, and thus the cartridge **4** is prevented from coming away from the cartridge mounting unit **6**. When the cartridge **4** is detached from the cartridge mounting unit **6**, the lever **672** is pushed up to release the restriction, and the cartridge **4** is detached. The lever **672** is provided to be movable in the Z axis direction in a wall portion **67** in which an insertion hole **69** through which the cartridge **4** passes when being attached and detached is formed. The ink of the mounted cartridge **4** is circulated to the tube **24** as the pumping mechanism **7** is driven. In addition, the detailed configuration of the cartridge mounting unit **6** will be described later.

FIG. **3** is a cross-sectional view taken along the line III-III of FIG. **2**. FIG. **3** illustrates a part of the cartridge mounting unit **6** and the cartridge **4**. When the cartridge **4** is mounted to the cartridge mounting unit **6**, the ink from a printing material accommodation portion **450** of the cartridge **4** is circulated to the tube **24** as indicated by the arrow by driving of the pumping mechanism **7**.

FIG. **4** is an enlarged diagram of a part on the −Y axis direction side in FIG. **3**. In the mounted state, each constituent member of the cartridge **4** and the cartridge mounting unit **6** is arranged as follows.

That is, a printing material supply tube **642** of the cartridge mounting unit **6** is inserted into and connected to a printing material lead-out tube **484** of the cartridge **4**. The printing material lead-out tube **484** circulates the ink of the printing material accommodation portion **450** to the outside (the printing material supply tube **642**). The printing material supply tube **642** circulates the ink discharged from the printing material lead-out tube **484** so as to be sent toward the head. In addition, in the mounted state, a rod **662** of the cartridge mounting unit **6** abuts onto a lever member **490** of the cartridge **4**. The rod **662** and the lever member **490** are used to detect a state in which the ink of the printing material

accommodation portion **450** is exhausted (also called an "ink end state") by the printer **10** side. Specifically, the ink end state is detected by detecting the displacement of the rod **662** using a sensor **138**. Here, the ink end state is referred to as a state in which the ink inside the cartridge **4** is depleted or a state in which little ink is left.

In addition, each terminal of a cartridge side terminal group (not shown) provided on the surface of a circuit board **50** of the cartridge **4** comes into contact with the corresponding terminal of an apparatus side terminal group **721** of the cartridge mounting unit **6**. The apparatus side terminal group **721** is electrically connected to a connector **739**, and wires (not shown) connected to the connector **739** are electrically connected to the control unit **31** of the printer **10**. Accordingly, a storage device of the circuit board **50** and the control unit **31** are electrically connected to each other, and thus signal reception and transmission between the control unit **31** and the circuit board **50** becomes possible. Here, the apparatus side terminal group **721** and the connector **739** are constituent members of an apparatus side terminal unit **70**. In addition, the detailed configuration of the apparatus side terminal unit **70** will be described later.

A-2. Detailed Configuration of Cartridge Mounting Unit

The detailed configuration of the cartridge mounting unit **6** will be described using FIGS. **5** to **9**. FIG. **5** is a first external perspective view of the cartridge mounting unit **6**. FIG. **6** is a second external perspective view of the cartridge mounting unit **6**. FIG. **7** is a third external perspective view of the cartridge mounting unit **6**. FIG. **8** is a fourth external perspective view of the cartridge mounting unit **6**. FIG. **9** is a fifth external perspective view of the cartridge mounting unit **6**. In addition, in FIGS. **5** and **8**, the tube **24** mounted to the cartridge mounting unit **6** is illustrated. In addition, in FIGS. **6**, **7**, and **9**, illustration of partial configurations is omitted so that the internal configuration of cartridge mounting unit **6** is visible. In addition, the cartridge mounting unit **6** of this example has the four cartridges **4** that are independently attachable and detachable and is configured so that the number of cartridges **4** attached and detached is increased depending on the specification of the printer **10**. That is, as illustrated in FIG. **6**, on the farthest +X axis direction side, reserve mounting spaces or members are provided so that the increased number of cartridges **4** are able to be mounted thereto.

As illustrated in FIG. **5**, in the cartridge mounting unit **6**, a cartridge accommodation chamber **61** that accommodates the cartridges **4** is formed by six wall portions mentioned below. The cartridge accommodation chamber **61** has an approximate rectangular parallelepiped shape. The shape of the cartridge accommodation chamber **61** corresponds to the external shape of the cartridges **4**. In addition, in the cartridge accommodation chamber **61**, each part that accommodates one of the four cartridges **4** is called a slot.

The cartridge mounting unit **6** includes an apparatus side front wall portion **62**, a first apparatus side side wall portion **63**, and a second apparatus side side wall portion **64**. In addition, the cartridge mounting unit **6** includes a third apparatus side side wall portion **65**, a fourth apparatus side side wall portion **66**, and an opening wall portion **67**. The cartridge accommodation chamber **61** is partitioned and formed by the six wall portions **62**, **63**, **64**, **65**, **66**, and **67**. Each of the external shapes of the six wall portions **62**, **63**, **64**, **65**, **66**, and **67** is an approximately rectangular shape.

As illustrated in FIGS. **5** and **6**, the apparatus side front wall portion **62** is positioned on the −Y axis direction side with respect to the cartridge accommodation chamber **61**. The apparatus side front wall portion **62** is a vertical wall portion in the use state of the printer **10**.

As illustrated in FIG. **6**, in the apparatus side front wall portion **62**, the apparatus side terminal unit **70**, a printing material supply mechanism **640**, and the rod **662** are provided. Specifically, in the order directed from the +Z axis direction to the −Z axis direction, the apparatus side terminal unit **70**, the printing material supply mechanism **640**, and the rod **662** are arranged. The apparatus side terminal unit **70** and the printing material supply mechanism **640** are provided in the surface on the +Y axis direction side (the side where the cartridge accommodation chamber **61** is positioned) of the apparatus side front wall portion **62**. In addition, the rod **662** is provided to penetrate through the apparatus side front wall portion **62** in the Y axis direction. On the −Y axis direction side (on the opposite side to the cartridge accommodation chamber **61**) of the apparatus side front wall portion **62**, the pumping mechanism **7** is provided.

The printing material supply mechanism **640** includes the printing material supply tube **642** described above and is used to circulate the ink in the cartridge **4** toward the printer **10**. The apparatus side terminal unit **70** includes the above-described apparatus side terminal group **721** (FIG. **7**) and the connector **739** (FIG. **6**) and is used to electrically connect the cartridge **4** and the printer **10** to each other. As illustrated in FIG. **6**, the apparatus side terminal unit **70** is provided closer to the first apparatus side side wall portion **63** side (the +Z axis direction side) than the printing material supply tube **642**. The rod **662** is used to detect the ink end state of the cartridge **4** by the printer **10** side. That is, the rod **662** constitutes a part of a detecting mechanism of the printer **10** described later. In addition, the rod **662** also functions as a positioning member for suppressing a positional deviation from the correct mounting position when the cartridge **4** is mounted to the cartridge mounting unit **6**. In addition, the detailed configuration of each of the apparatus side terminal unit **70**, the printing material supply mechanism **640**, and the rod **662** will be described later.

As illustrated in FIG. **5**, the first apparatus side side wall portion **63** is positioned on the +Z axis direction side with respect to the cartridge accommodation chamber **61**. The first apparatus side side wall portion **63** is provided in a direction intersecting the apparatus side front wall portion **62**. In this example, the first apparatus side side wall portion **63** is provided in a direction orthogonal to the apparatus side front wall portion **62**. The first apparatus side side wall portion **63** is a horizontal wall portion in the use state of the printer **10**. The first apparatus side side wall portion **63** constitutes the upper surface of the cartridge mounting unit **6**. In addition, in this specification, "intersect" means any state of (i) a state where two elements intersect each other and actually intersect, (ii) a state where one element intersects the other element when extending, and (iii) a state where mutual elements intersect each other in a case where each of the mutual elements extends.

As illustrated in FIG. **7**, the first apparatus side side wall portion **63** has first rails **682** for guiding the cartridges **4** to the mounting positions. The first rails **682** are provided to correspond to at least the number of cartridges **4** mounted. In this example, four corresponding to the number of cartridges **4** actually mounted and one reserve, that is, a total of five first rails **682** are provided. The first rails **682** are grooves which extend in the Y axis direction and into which parts of the cartridges **4** are inserted. In addition, an end

portion on the −Y axis direction side of the first rail **682** is provided with a leaf spring **684** as a locking member. In the mounted state, as the leaf spring **684** locks the cartridge **4**, the cartridge **4** is prevented from coming away from the cartridge mounting unit **6**.

As illustrated in FIGS. **5**, **6**, and **9**, the second apparatus side side wall portion **64** is positioned on the −Z axis direction side with respect to the cartridge accommodation chamber **61**. The second apparatus side side wall portion **64** opposes the first apparatus side side wall portion **63** with the cartridge accommodation chamber **61** interposed therebetween. The second apparatus side side wall portion **64** is provided in a direction intersecting the apparatus side front wall portion **62**. In this example, the second apparatus side side wall portion **64** is orthogonal to the apparatus side front wall portion **62**. The second apparatus side side wall portion **64** is a horizontal wall portion in the use state of the printer **10**. The second apparatus side side wall portion **64** constitutes the bottom surface of the cartridge mounting unit **6**.

As illustrated in FIG. **6**, the second apparatus side side wall portion **64** has second rails **602** for guiding the cartridges **4** to the mounting positions. The second rails **602** are provided to correspond to at least the number of cartridges **4** mounted. In this example, five second rails **602** are provided like the first rails **682**. The second rails **602** are grooves which extend in the Y axis direction and into which parts of the cartridges **4** are inserted. In addition, an end portion on the −Y axis direction side of the second rail **602** is provided with a leaf spring **604** as a locking member. In the mounted state, as the leaf spring **604** locks the cartridge **4**, the cartridge **4** is prevented from coming away from the cartridge mounting unit **6**. The first rail **682** and the second rail **602** having the same cartridge **4** mounted therebetween are provided at positions facing each other with the cartridge accommodation chamber **61** interposed therebetween.

The dimensions in the X axis direction of the first rail **682** and the second rail **602** are different from each other. Specifically, the dimension in the X axis direction of the first rail **682** is smaller than that of the second rail **602**. Accordingly, in a case where the cartridge **4** is to be inserted into the cartridge mounting unit **6** while the dimension in the Z axis direction is reversed by mistake, a configuration in which the cartridge **4** is not able to be inserted between the first and second rails **682** and **602** is achieved. Accordingly, the possibility of the cartridge **4** being inserted into the cartridge mounting unit **6** in a wrong state in which the direction in the Z axis direction is reversed may be reduced.

In addition, as illustrated in FIG. **6**, in the second apparatus side side wall portion **64**, at positions close to the apparatus side front wall portion **62**, apparatus side identification members **610** are provided. The apparatus side identification members **610** are provided to correspond to the number of cartridges **4** mounted. In this example, four apparatus side identification members **610** are provided. The apparatus side identification members **610** are used to identify whether or not the correct type (in this example, ink color) of cartridge **4** is mounted in each slot of the cartridge accommodation chamber **61**. The apparatus side identification members **610** form different shapes depending on the colors of ink in the mounted cartridges **4**. Specifically, each of the apparatus side identification members **610** is formed by one or more ribs, and a pattern determined by the number of ribs and the positions thereof varies depending on the type of the cartridge **4**. In the cartridge **4**, an identification member (also referred to as a "cartridge side identification member") formed by ribs is provided. The identification members of the cartridges **4** form different shapes depending on the colors of the ink accommodated. In addition, in a case where the correct type of cartridge **4** is inserted into the slot, the apparatus side identification member **610** and the cartridge side identification member are fitted to each other. On the other hand, in a case where a wrong type of cartridge **4** is inserted into the slot, the apparatus side identification member **610** and the cartridge side identification member are not able to be fitted to each other. Accordingly, the possibility of a wrong type of cartridge **4** being mounted into each of the slots of the cartridge mounting unit **6** may be reduced.

In addition, as illustrated in FIG. **6**, in the second apparatus side side wall portion **64**, at positions close to the apparatus side front wall portion **62**, restriction members **612** are provided. The restriction members **612** are provided to correspond to the number of cartridges **4** mounted. In this example, although five restriction members **612** are provided, the number that is actually used is four. The restriction member **612** abuts onto the cartridge **4** when the cartridge **4** is inserted into the cartridge accommodation chamber **61** of the cartridge mounting unit **6** toward the apparatus side front wall portion **62** on the −Y axis direction side from the insertion hole **69** (FIG. **5**) on the +Y axis side and reaches the correct mounting position. Accordingly, the possibility of the cartridge **4** being further pushed from the correct mounting position may be reduced.

As illustrated in FIG. **5**, the opening wall portion **67** is positioned on the +Y axis direction side with respect to the cartridge accommodation chamber **61**. The opening wall portion **67** has the insertion hole **69** for passing the cartridge **4** therethrough during attaching and detaching of the cartridge **4**. The opening wall portion **67** opposes the apparatus side front wall portion **62** with the cartridge accommodation chamber **61** interposed therebetween. The opening wall portion **67** is provided in the direction intersecting the first apparatus side side wall portion **63** and the second apparatus side side wall portion **64**. In this example, the opening wall portion **67** is orthogonal to the first apparatus side side wall portion **63** and the second apparatus side side wall portion **64**. The opening wall portion **67** is a vertical wall portion in the use state of the printer **10**.

The opening wall portion **67** is provided with the levers **672** that are movable in the Z axis direction. The lever **672** is moved in the −Z axis direction after the cartridge **4** is mounted to the cartridge mounting unit **6**. Accordingly, the lever **672** is caught on the cartridge **4** and prevents the cartridge **4** from being detached by mistake. The state in which the lever **672** is caught on the cartridge **4** is a state shown by the three levers **672** corresponding to the three cartridges **4** positioned on the +X axis direction of FIG. **2**.

As illustrated in FIGS. **5** and **8**, the third apparatus side side wall portion **65** is positioned on the +X axis direction side with respect to the cartridge accommodation chamber **61**. The third apparatus side side wall portion **65** is provided in a direction intersecting the apparatus side front wall portion **62**, the first apparatus side side wall portion **63**, the second apparatus side side wall portion **64**, and the opening wall portion **67**. In this example, the third apparatus side side wall portion **65** is orthogonal to the apparatus side front wall portion **62**, the first apparatus side side wall portion **63**, the second apparatus side side wall portion **64**, and the opening wall portion **67**. The third apparatus side side wall portion **65** is a vertical wall portion in the use state of the printer **10**. The third apparatus side side wall portion **65** constitutes the side surface of the cartridge mounting unit **6**.

As illustrated in FIG. **5**, the fourth apparatus side side wall portion **66** is positioned on the −X axis direction side with respect to the cartridge accommodation chamber **61**. The

fourth apparatus side side wall portion **66** opposes the third apparatus side side wall portion **65** with the cartridge accommodation chamber **61** interposed therebetween. The fourth apparatus side side wall portion **66** is provided in a direction intersecting the apparatus side front wall portion **62**, the first apparatus side side wall portion **63**, the second apparatus side side wall portion **64**, and the opening wall portion **67**. In this example, the fourth apparatus side side wall portion **66** is orthogonal to the apparatus side front wall portion **62**, the first apparatus side side wall portion **63**, the second apparatus side side wall portion **64**, and the opening wall portion **67**. The fourth apparatus side side wall portion **66** is a vertical wall portion in the use state of the printer **10**. The fourth apparatus side side wall portion **66** constitutes the side surface of the cartridge mounting unit **6**.

From the arrangement of the wall portions **62**, **63**, **64**, **65**, **66**, and **67**, the following relationship may be defined. The direction in which the apparatus side front wall portion **62** and the opening wall portion **67** or the insertion hole **69** oppose each other is the Y axis direction. The direction directed from the opening wall portion **67** or the insertion hole **69** to the apparatus side front wall portion **62**, that is, the direction in which the cartridge **4** is inserted (mounted) into the cartridge mounting unit **6** is the −Y axis direction, and the reverse direction, that is, the direction in which the cartridge **4** is pulled out of (detached from) the cartridge mounting unit **6** is the +Y axis direction. The direction in which the first apparatus side side wall portion **63** and the second apparatus side side wall portion **64** oppose each other is the Z axis direction. The direction directed from the first apparatus side side wall portion **63** to the second apparatus side side wall portion **64** is the −Z axis direction, and the reverse direction is the +Z axis direction. The direction in which the third apparatus side side wall portion **65** and the fourth apparatus side side wall portion **66** oppose each other is the X axis direction. The direction directed from the third apparatus side side wall portion **65** to the fourth apparatus side side wall portion **66** is the −X axis direction, and the reverse direction is the +X axis direction.

A-3. Detailed Configuration of Each Constituent Member of Cartridge Mounting Unit

Next, the detailed configurations of the members **70**, **640**, and **662** provided in the apparatus side front wall portion **62** will be described using FIGS. **10** to **13**. FIG. **10** is a first external perspective view of the apparatus side front wall portion **62** and the peripheral members thereof. FIG. **11** is a second external perspective view of the apparatus side front wall portion **62** and the peripheral members thereof. FIG. **12** is an exploded perspective view of the apparatus side front wall portion **62** and the peripheral members thereof. FIG. **13** is a cross-sectional view taken along the line XIII-XIII of FIG. **10**.

As illustrated in FIGS. **10** and **11**, for each of the slots of the cartridge mounting unit **6**, the apparatus side terminal unit **70**, the printing material supply mechanism **640**, and the rod **662** are provided in the apparatus side front wall portion **62** in this order from the +Z axis direction in the −Z axis direction. As illustrated in FIG. **12**, the apparatus side front wall portion **62** includes a first front wall portion **690** and a second front wall portion **692**. The first front wall portion **690** is mounted to the second front wall portion **692** by bolts BT.

A-3-1. Detailed Configuration of Printing Material Supply Mechanism **640**

As illustrated in FIG. **12**, the printing material supply mechanism **640** includes a cover member **650**, the printing material supply tube **642**, a seal member **646**, and a mounting member **649**.

The printing material supply tube **642** is connected to a circulation tube **659** provided in the second front wall portion **692**. Specifically, the printing material supply tube **642** is inserted into the cylindrical mounting member **649** and is connected to the circulation tube **659** inserted in the mounting member **649** in the same manner. The circulation tube **659** communicates with the tube **24**.

As illustrated in FIG. **13**, the printing material supply tube **642** has a supply passage **647** having a circular passage cross-section therein. The +Y axis direction side of the circumference of the printing material supply tube **642** is provided with a communication hole **648** that causes the outside and the supply passage **647** to communicate with each other. The ink of the cartridge **4** circulates through the communication hole **648**, the supply passage **647**, and the internal passage of the circulation tube **659** and flows to the tube **24**.

The seal member **646** is disposed between the outer periphery of the circulation tube **659** and the inner periphery of the printing material supply tube **642**. The seal member **646** is an elastic member (for example, rubber) and prevents the ink from leaking out. In addition, in this example, the mounting member **649** is a part of the first front wall portion **690**.

The printing material supply tube **642** has a center axis C. As illustrated in FIGS. **12** and **13**, the printing material supply tube **642** has a base end portion **644** fixed to the apparatus side front wall portion **62** and a tip end portion **643** connected to the cartridge **4**. Here, the axis parallel to the center axis C is the Y axis. In addition, regarding the direction along the Y axis (Y axis direction), the direction directed from the base end portion **644** to the tip end portion **643** is the +Y axis direction, and the reverse direction to the +Y axis direction is the −Y axis direction.

As illustrated in FIG. **12**, the cover member **650** is a member for reducing the possibility of the ink scattering out of the printing material supply tube **642** (specifically, the communication hole **648**) during attaching and detaching of the cartridge **4**. The cover member **650** includes an impelling member **652**, an abutting member **658**, a scattering prevention portion **653**, and a communication portion **655**. The abutting member **658** has an approximately circular external form. The abutting member **658** abuts onto the cartridge **4**. The abutting member **658** is configured to be movable in the Y axis direction. The center of the abutting member **658** is provided with a through-hole **656** through which the printing material supply tube **642** is inserted. The scattering prevention portion **653** receives, in a case where ink leaks from the printing material supply tube **642**, the leaking ink. Accordingly, the possibility of the ink scattering at the periphery of the printing material supply tube **642** may be reduced. The scattering prevention portion **653** has a concave shape. The impelling member **652** is a coil spring. One end of the impelling member **652** abuts onto the abutting member **658**, and the other end thereof abuts onto the first front wall portion **690**. In the mounted state, the impelling member **652** impels the abutting member **658** to be pressed against the cartridge **4**. When the cartridge **4** is mounted to the cartridge mounting unit **6**, as the cartridge **4** causes the abutting member **658** to advance in the −Y axis direction, the scattering prevention portion **653** also moves in the −Y axis

direction. The scattering prevention portion **653** is disposed on the −Z axis direction side of (immediately below) the printing material supply tube **642** regardless of the displacement between a state before the cartridge **4** is mounted and the mounted state. Specifically, the scattering prevention portion **653** is disposed on the −Z axis direction side of (immediately below) the communication hole **648** of the abutting member **658** regardless of the displacement between the state before the cartridge **4** is mounted and the mounted state. The ink received by the scattering prevention portion **653** circulates inside the communication portion **655** and reaches an absorbing material (not shown) provided in the cartridge mounting unit **6**.

A-3-2. Detailed Configuration of Rod **662**

As illustrated in FIGS. **12** and **13**, the rod **662** includes a center axis Cb parallel to the Y axis direction. The outer periphery of the rod **662** is provided with an impelling member **665** and a rod cover **670**. The rod cover **670** is cylindrical, and the rod **662** and the impelling member **665** are inserted therein. The rod cover **670** is a part of the first front wall portion **690**. The rod **662** is configured to be movable in the Y axis direction. The rod **662** includes one end portion **663** positioned on the +Y axis direction side and the other end portion **664** positioned on the −Y axis direction side. As illustrated in FIGS. **10** and **11**, the one end portion **663** protrudes from the rod cover **670** toward the +Y axis direction side. In the mounted state, the one end portion **663** abuts onto the lever member **490** (FIG. **4**) of the cartridge **4**. The other end portion **664** is positioned closer to the −Y axis direction side than the apparatus side front wall portion **62**. The other end portion **664** has a light-shielding portion **666**. In addition, a sensor **138** is provided closer to the −Y axis direction side than the apparatus side front wall portion **62**, and by detecting the displacement of the light-shielding portion **666** using the sensor **138**, the ink end state is detected by the control unit **31** of the printer **10**. The impelling member **665** is a coil spring. The impelling member **665** impels the rod **662** against the +Y axis direction side. In addition, a method of detecting the ink end using the rod **662** will be described later.

The rod **662** is positioned an intermediate position between the first apparatus side side wall portion **63** and the second apparatus side side wall portion **64** in the apparatus side front wall portion **62**. Specifically, in the Z axis direction, the rod **662** is provided at an intermediate position of a line segment that connects the inner surface of the first apparatus side side wall portion **63** and the second apparatus side side wall portion **64**. That is, as illustrated in FIG. **13**, the center axis Cb of the rod **662** is disposed at the intermediate position in the Z axis direction between the first apparatus side side wall portion **63** and the second apparatus side side wall portion **64**. Here, the "intermediate position" may not necessarily be completely intermediate and may not be disposed to be inclined toward any one of the first and second apparatus side side wall portions **63** and **64**. For example, the "intermediate position" includes a position in a range of 10% from the center position of the distance between the inner wall surfaces in the Z axis direction of the first apparatus side side wall portion **63** and the second apparatus side side wall portion **64**.

A-3-3. Detailed Configuration of Apparatus Side Terminal Unit **70**

As illustrated in FIGS. **10** and **11**, the apparatus side terminal unit **70** is provided in a terminal mounting portion **694**. Specifically, as illustrated in FIG. **12**, the apparatus side terminal unit **70** is mounted to the terminal mounting portion **694** as a pair of terminal side fitting portions **762** are fitted in the terminal mounting portion **694**. In addition, the apparatus side terminal unit **70** is mounted in a state of being movable in the X axis direction and the Z axis direction with respect to the apparatus side front wall portion **62** (specifically, the terminal mounting portion **694**). Specifically, the apparatus side terminal unit **70** is mounted to be slightly movable in the X axis direction and the Z axis direction with respect to the apparatus side front wall portion **62**.

Moreover, the apparatus side terminal unit **70** will be described using FIGS. **14** to **18**. FIG. **14** is a first exploded perspective view of the apparatus side terminal unit **70**. FIG. **15** is a second exploded perspective view of the apparatus side terminal unit **70**. FIG. **16** is a first external perspective view of the apparatus side terminal unit **70**. FIG. **17** is a second external perspective view of the apparatus side terminal unit **70**. FIG. **18** is a cross-sectional view taken along the line XVIII-XVIII of FIG. **17**. In addition, in FIG. **18**, a part of the first front wall portion **690** is illustrated by solid lines and a positioning portion **756** is illustrated by a dotted line for ease of understanding.

As illustrated in FIGS. **14** and **15**, the apparatus side terminal unit **70** includes the apparatus side terminal group **721**, a terminal block **724**, and a holder **750**. In addition, the apparatus side terminal unit **70** includes a connector substrate **730**. The connector substrate **730** includes a terminal group **732** (FIG. **15**) provided on the surface and the connector **739** provided on the rear surface. The terminal group **732** is constituted by a plurality of (in this example, nine) terminals and is electrically connected to the connector **739**.

The apparatus side terminal group **721** includes a plurality of (in this example, nine) terminals. Each of the terminals of the apparatus side terminal group **721** is configured so as to be elastically deformable. Each of the terminals of the apparatus side terminal group **721** is configured of a U-shaped leaf spring. One of the tip ends of each of the terminals is exposed from a surface **724***fa* of the terminal block **724**. The tip end portion exposed from the surface **724***fa* of the terminal block **724** becomes a terminal contact point **722** that comes into contact with a corresponding cartridge side terminal of the circuit board **50** of the cartridge **4** in the mounted state. That is, the terminal contact point **722** is provided on the surface **724***fa* of the terminal block **724**. The other of the tip ends of each of the terminals is exposed from a rear surface **724***fb* of the terminal block **724**. The tip end portion exposed from the rear surface **724***fb* of the terminal block **724** becomes a terminal contact point **723** that comes into contact with a corresponding terminal of the terminal group **732**. That is, the terminal contact point **723** is provided on the rear surface **724***fb* of the terminal block **724**.

The terminal block **724** holds the apparatus side terminal group **721**. In addition, the terminal block **724** holds the apparatus side terminal group **721** so that the one tip end portion that constitutes the terminal contact point **722** is exposed from the surface **724***fa* thereof. In addition, the terminal block **724** holds the apparatus side terminal group **721** so that the other tip end portion that constitutes the terminal contact point **723** is exposed from the rear surface **724***fb* thereof. In addition, as illustrated in FIG. **18**, the terminal block **724** holds the apparatus side terminal group **721** so that each of the terminals of the apparatus side terminal group **721** moves about an axis **721***r* parallel to the X axis direction through elastic deformation. In other words, the terminal block **724** holds the apparatus side terminal group **721** so that the terminal contact point **722** moves as

each of the terminals of the apparatus side terminal group **721** elastically deforms along a predetermined plane.

As illustrated in FIGS. **14** to **18**, the holder **750** holds the terminal block **724** and the connector substrate **730**. Specifically, the holder **750** has an accommodation space **751**, and the terminal block **724** and the connector substrate **730** are accommodated in the accommodation space **751** so as to be held by the holder **750**. In addition, as illustrated in FIG. **18**, the holder **750** holds the terminal block **724** in a state (called a "first state") where the surface **724***fa* of the terminal block **724** is in a direction parallel to the X axis while being tilted in a direction including a +Y axis direction component and a −Z axis direction component. In other words, the holder **750** holds the terminal block **724** so that the surface **724***fa* of the terminal block **724** is tilted with respect to the Y axis and the Z axis. As the terminal block **724** is held by the holder **750** in this state, the contact point **722** of the apparatus side terminal group **721** is provided on the surface **724***fa* tilted in the direction including the +Y axis direction component and the −Z axis direction component. In addition, the holder **750** holds the terminal block **724** in a state (called a "second state") where the axis **721***r* is positioned closer to the +Y axis direction side and the +Z axis direction side than the terminal contact point **722**. As the holder **750** holds the terminal block **724** while satisfying the first state and the second state, the terminal contact point **722** is in a state of being elastically deformable in the direction of an arrow YR**1** as illustrated in FIG. **18**. From a different viewpoint, the elastic deformation of the apparatus side terminal group **721** will be described below. The holder **750** holds the terminal block **724** in a state where a predetermined plane on which each of the terminals of the apparatus side terminal group **721** elastically deforms is a plane (also called a "YZ plane") parallel to the Y axis and the Z axis. As the holder **750** holds the terminal block **724** as such, each of the contact points **722** is in a state of being movable on the YZ plane.

As illustrated in FIGS. **14** and **15**, the holder **750** has a pair of wall portions **752** positioned on both sides in the X axis direction of the accommodation space **751** and a pair of the positioning portions **756** provided in the wall portions **752**. Here, one of the pair of wall portions **752** positioned on the +X axis direction side with respect to the accommodation space **751** is also called a first wall portion **752***t*, and the other thereof positioned on the −X axis direction side is also called a second wall portion **752***w*. In addition, one of the pair of positioning portions **756** provided in the first wall portion **752***t* is also called a first positioning portion **756***t*, and the other thereof provided in the second wall portion **752***w* is also called a second positioning portion **756***w*. In addition, in a case of using the first wall portion **752***t* and the second wall portion **752***w* without distinguishment therebetween, the wall portion **752** is used for the description. In addition, in a case of using the first positioning portion **756***t* and the second positioning portion **756***w* without distinguishment therebetween, the positioning portion **756** is used for the description.

The first wall portion **752***t* and the second wall portion **752***w* are walls that partition and form the accommodation space **751**. The first positioning portion **756***t* and the second positioning portion **756***w* are respectively positioned on the +X axis direction side and the −X axis direction side of the surface **724***fa* of the terminal block **724**. The first and second positioning portions **756***t* and **756***w* guide the cartridge **4** and the apparatus side terminal unit **70** to the contact position where the terminals of the apparatus side terminal group **721** respectively come into contact with the corresponding terminals of the cartridge side terminal group when the cartridge **4** is mounted to the cartridge mounting unit **6**. Specifically, the first positioning portion **756***t* and the second positioning portion **756***w* are configured to start being inserted into grooves formed in the cartridge **4** before contact between the apparatus side terminal group **721** and the cartridge side terminal group is started when the cartridge **4** is mounted to the cartridge mounting unit **6**. Accordingly, the cartridge **4** and the apparatus side terminal unit **70** may be moved to the contact position with good accuracy. The first positioning portion **756***t* extends along the Y axis direction (the insertion direction of the cartridge **4**). In addition, the first positioning portion **756***t* protrudes from the first wall portion **752***t* in the +X axis direction. The second positioning portion **756***w* extends along the Y axis direction (the insertion direction of the cartridge **4**). In addition, the second positioning portion **756***w* protrudes from the second wall portion **752***w* in the −X axis direction. In this example, in order to realize the first configuration, as illustrated in FIG. **18**, the positioning portion **756** is provided so that an end portion **757** on the +Y axis direction side of the positioning portion **756** is positioned closer to the +Y axis direction side than the closer contact point **722**. In addition, the end portion **757** has a tapered shape in which the dimension in the Z axis direction increases in the −Y axis direction from the +Y axis direction. Accordingly, the positioning portion **756** may be easily inserted into a restriction portion of the cartridge **4** described later. Each of the positioning portions **756***t* and **756***w* has four contact surfaces that come into contact with the groove formed in the cartridge **4** in the mounted state in which the cartridge **4** is mounted to the cartridge mounting unit **6**. In FIGS. **16** and **17**, from the four contact surfaces, the contact surfaces **756***wa*, **756***wb*, **756***wc*, and **756***wd* of the positioning portion **756***w* and only the contact surfaces **756***tb* and **756***td* of the positioning portion **756***t* are illustrated. From the four contact surfaces, of the two surfaces that oppose each other in the Z axis direction, the surface positioned on the +Z axis direction side is called an A surface **756***ta* (FIGS. **33** to **36**) and **756***wa*, and the surface positioned on the −Z axis direction side is called a B surface **756***tb* and **756***wb*. In addition, the surface intersecting the X axis direction is called a C surface **756***tc* (FIGS. **33** to **36**) and **756***wc*. In addition, the front end surface in the +Y axis direction is called a D surface **756***td* and **756***wd*.

As illustrated in FIG. **16**, the holder **750** has a pair of protrusions **759** that protrude in a direction in which the terminal contact points **722** of the apparatus side terminal group **721** are exposed (the direction including the +Y axis direction component and the −Z axis direction component) from the pair of wall portions **752**. From the protrusions **759**, one provided in the first wall portion **752***t* is called a first protrusion **759***t*, and the other provided in the second wall portion **752***w* is called a second protrusion **759***w*. The first protrusion **759***t* is provided to protrude in a direction that includes a +Y axis direction component and a −Z axis direction component with respect to the surface **724***fa* of the terminal block **724** from the +X axis direction side of the apparatus side terminal group **721**. The second protrusion **759***w* is provided to protrude in the direction that includes the +Y axis direction component and the −Z axis direction component with respect to the surface **724***fa* of the terminal block **724** from the −X axis direction side of the apparatus side terminal group **721**. The first protrusion **759***t* and the second protrusion **759***w* are received by a part (a bottom wall side concave portion **910** described later, see FIG. **27**) of the cartridge **4** in the mounted state. In addition, in a case of

using the first protrusion **759***t* and the second protrusion **759***w* without distinguishment therebetween, the protrusion **759** is used.

As illustrated in FIGS. **10** to **12**, the holder **750** is mounted to the apparatus side front wall portion **62** in the state of holding the terminal block **724**. Specifically, the holder **750** is mounted to the terminal mounting portion **694** of the first front wall portion **690**. The terminal mounting portion **694** has a pair of support walls **696** that oppose each other in the X axis direction and a pair of fitting holes **698** provided in the walls. On the other hand, the apparatus side terminal unit **70** is provided with the pair of terminal side fitting portions **762** that oppose each other in the X axis direction. As the terminal side fitting portions **762** are fitted into the pair of fitting holes **698** of the holder **750**, the apparatus side terminal unit **70** is mounted to the apparatus side front wall portion **62**. Here, clearances in the X axis direction are provided between the pair of terminal side fitting portions **762** and the pair of support walls **696**. Therefore, the apparatus side terminal unit **70** is in a state of being slightly movable in the X axis direction with respect to the apparatus side front wall portion **62**. In addition, clearances in the Y axis direction are provided between the pair of terminal side fitting portions **762** and the pair of fitting holes **698**. Therefore, the apparatus side terminal unit **70** is in a state of being slightly movable in the Z axis direction with respect to the apparatus side front wall portion **62**.

In addition, the pair of support walls **696** of the terminal mounting portion **694** are respectively provided with a pair of engagement portions **696***a* and **696***b* that oppose each other in the Y axis direction. In addition, the pair of terminal side fitting portions **762** of the holder **750** are respectively provided with a pair of engagement portions **762***a* and **762***b* that oppose each other in the Y axis direction. When the terminal side fitting portions **762** are fitted into the pair of fitting holes **698** of the terminal mounting portion **649**, the engagement portion **696***a* and the engagement portion **762***a* are engaged with each other in the −Y axis direction, and the engagement portion **696***b* and the engagement portion **762***b* are engaged with each other in the +Y axis direction. A clearance is rarely present between the engagement portion **696***a* and the engagement portion **762***a*. In addition, substantially no clearance is present even between the engagement portion **696***b* and the engagement portion **762***b*. Therefore, the apparatus side terminal unit **70** is not able to substantially move in the Y axis direction with respect to the apparatus side front wall portion **62**.

A-4. External Configuration of Cartridge **4**

Next, the schematic configuration of the cartridge **4** will be described using FIGS. **19** to **26**. In addition, the X, Y, and Z axes indicated in the figures illustrating the cartridge **4** correspond to the X, Y, and Z axes for the cartridge **4** in the mounted state. FIG. **19** is a first external perspective view of the cartridge **4**. FIG. **20** is a second external perspective view of the cartridge **4**. FIG. **21** is a front view of the cartridge **4**. FIG. **22** is a rear view of the cartridge **4**. FIG. **23** is a top view of the cartridge **4**. FIG. **24** is a bottom view of the cartridge **4**. FIG. **25** is a first side view of the cartridge **4**. FIG. **26** is a second side view of the cartridge **4**.

As illustrated in FIGS. **19** and **20**, the external shape of the cartridge **4** is an approximate rectangular parallelepiped shape. In this example, the cartridge **4** has dimensions that are reduced in the order of the Y axis direction, the Z axis direction, and the X axis direction. The cartridge **4** includes a case **9** that accommodates ink therein. The case **9** is a housing formed by molding a synthetic resin. The cartridge **4** includes a front surface **42**, a rear surface **47**, a first side surface **43**, a second side surface **44**, a third side surface **45**, and a fourth side surface **46**. In addition, the first side surface **43** is also called an upper surface **43**, the second side surface **44** is also called a bottom surface **44**, the third side surface **45** is also called a right side surface **45**, and the fourth side surface **46** is also called a left side surface **46**. The front surface **42** and the rear surface **47** oppose each other in the Y axis direction, and the front surface **42** is positioned on the −Y axis direction and the rear surface **47** is positioned on the +Y axis direction. The first side surface **43** and the second side surface **44** intersect the front surface **42** and the rear surface **47** and oppose each other in the Z axis direction. The first side surface **43** is positioned on the +Z axis direction side and the second side surface **44** is positioned on the −Z axis direction. The third side surface **45** and the fourth side surface **46** intersect the front surface **42**, the rear surface **47**, the first side surface **43**, and the second side surface **44** and oppose each other in the X axis direction. The third side surface **45** is positioned on the +X axis direction side and the fourth side surface **46** is positioned on the −X axis direction side.

The shape of the front surface **42** is an approximate rectangle in which the dimension in the Z axis direction is greater than the dimension in the X axis direction. The front surface **42** faces the apparatus side front wall portion **62** (FIG. **6**) in the mounted state. The front surface **42** is provided with a rod insertion hole **420** and a supply tube insertion hole **424**. The rod insertion hole **420** is provided at an intermediate position between the first side surface **43** and the second side surface **44** in the front surface **42**. In other words, in the Z axis direction, the rod insertion hole **420** is provided at the intermediate position that connects the first side surface **43** and the second side surface **44**. That is, a center axis Ce of the rod insertion hole **420** is disposed at the intermediate position in the Z axis direction between the first side surface **43** and the second side surface **44**. Here, the "intermediate position" may not necessarily be completely intermediate and may not be disposed to be inclined toward any one of the first and second side surfaces **43** and **44**. For example, the "intermediate position" includes a position in a range of 10% from the center position of the distance between the first side surface **43** and the second side surface **44** in the Z axis direction.

In the mounted state, the printing material supply tube **642** (FIG. **12**) is inserted into the supply tube insertion hole **424**. In addition, in the supply tube insertion hole **424**, the printing material lead-out tube **484** (FIG. **4**) for circulating the ink in the cartridge **4** to the outside is disposed. As the printing material supply tube **642** is connected to the printing material lead-out tube **484**, the ink in the cartridge **4** is able to be circulated to the printing material supply tube **642**.

In the mounted state, the rod **662** (FIG. **12**) of which a part of the outer periphery is covered with the rod cover **670** is inserted into the rod insertion hole **420**. As the rod **662** is inserted into the rod insertion hole **420**, positioning of the entirety of the cartridge **4** with respect to the cartridge mounting unit **6** is performed, and thus a position from the correct mounting position is suppressed. In addition, in the mounted state, the rod **662** abuts onto the lever member **490** (FIG. **4**).

As illustrated in FIGS. **19**, **23**, **25**, and **26**, the first side surface **43** has a first convex portion **432**. The first convex portion **432** protrudes toward the +Z axis direction side from the first side surface **43**. The first convex portion **432** extends along the Y axis direction. Specifically, as illustrated in

FIGS. **25** and **26**, the first convex portion **432** extends from a position close to the front surface **42** to a position close to the rear surface **47** in the first side surface **43**. More specifically, the first convex portion **432** is divided into a first part **432***a* on the −Y axis direction side and a second part **432***b* on the +Y axis direction side, and a first locking portion **436** having a concave shape is formed therebetween. As illustrated in FIGS. **24** to **26**, the second side surface **44** has a second convex portion **442**. The second convex portion **442** protrudes toward the −Z axis direction side from the second side surface **44**. The second convex portion **442** extends along the Y axis direction. Specifically, as illustrated in FIGS. **25** and **26**, the second convex portion **442** extends from a position close to the front surface **42** to a position close to the rear surface **47** in the second side surface **44**. More specifically, the second convex portion **442** is divided into a first part **442***a* on the −Y axis direction side and a second part **442***b* on the +Y axis direction side, and a second locking portion **446** having a concave shape is formed therebetween. When the cartridge **4** is mounted to the cartridge mounting unit **6**, the first convex portion **432** is inserted into the first rail **682** (FIG. **7**) and the second convex portion **442** is inserted into the second rail **602** (FIG. **6**). Accordingly, the cartridge **4** may be caused to smoothly advance in the corresponding slot of the cartridge mounting unit **6**.

As illustrated in FIG. **21**, a dimension (width) Xa in the X axis direction of the first convex portion **432** and a dimension (width) Xb in the X axis direction of the second convex portion **442** are different from each other. In this example, a relationship of dimension Xa<dimension Xb is satisfied. In addition, the second convex portion **442** has a greater dimension in the X axis direction than the first rail **682** (FIG. **7**), and thus the second convex portion **442** is not able to be inserted into the first rail **682**. Accordingly, the possibility of the cartridge **4** being mounted to the cartridge mounting unit **6** in a state where the directions of the first side surface **43** and the second side surface **44** are reversed may be reduced. In addition, in the mounted state, the leaf spring **684** (FIG. **7**) is inserted into the first locking portion **436**, and the leaf spring **604** (FIG. **6**) is inserted into the second locking portion **446**. Accordingly, the cartridge **4** is prevented from carelessly deviating from the cartridge mounting unit **6**.

As illustrated in FIG. **19**, a label S**1** is adhered to the third side surface **45**. In the label S**1**, information (notice in use and the like) regarding handling of the cartridge **4** is described.

As illustrated in FIG. **21**, in a corner portion **88** at which the front surface **42** and the second side surface **44** intersect each other, a concave portion **49** and a pair of restriction surfaces **421** are provided. In the concave portion **49**, a cartridge side identification member **491** is provided. The cartridge side identification member **491** is formed by one or more ribs and forms a different shape depending on the color of ink accommodated. In addition, the cartridge side identification member **491** is fitted to the apparatus side identification member **610** (FIG. **6**) by being mounted to the right slot of the cartridge mounting unit **6**. The pair of restriction surfaces **421** are disposed on both sides in the X axis direction of the concave portion **49**. The pair of restriction surfaces **421** abut onto the restriction members **612** (FIG. **6**) when the cartridge **4** reaches the correct mounting position.

As illustrated in FIGS. **19** and **21**, the cartridge **4** further includes a concave portion **90** provided in a corner portion **89** at which the front surface **42** and the first side surface **43** intersect each other. In other words, the concave portion **90** is provided over the front surface **42** and the first side surface **43**. In the concave portion **90**, the circuit board **50** is disposed. A cartridge side terminal group **521** is formed on a surface **50***fa* (FIG. **21**) of the circuit board **50**. The cartridge side terminal group **521** includes a plurality of (in this example, nine) terminals. In the mounted state, each of the terminals of the cartridge side terminal group **521** is electrically connected to the corresponding terminal of the apparatus side terminal group **721** (FIG. **15**).

Moreover, the detailed configuration of the concave portion **90** will be described using FIGS. **27** to **32**. FIG. **27** is an external perspective view of the vicinity of the concave portion **90**. FIG. **28** is a front view of the vicinity of the concave portion **90**. FIG. **29** is a cross-sectional view taken along the line XXIX-XXIX of FIG. **28**. FIG. **30** is a cross-sectional view taken along the line XXX-XXX of FIG. **28**. FIG. **31** is a diagram for explaining a state of the connection between the apparatus side terminal unit **70** and the circuit board **50**. FIG. **32** is a cross-sectional view taken along the line XXXII-XXXII in the mounted state.

As illustrated in FIG. **27**, the concave portion **90** has an opening **982** provided along a surface orthogonal to the Y axis and an opening **984** provided along a surface orthogonal to the Z axis. In addition, the inner walls of the concave portion **90** are mainly constituted by a pair of side walls **902** (**902***t* and **902***w*), a bottom wall **988**, and a rear wall **986**. A terminal accommodation chamber **900** into which the apparatus side terminal unit **70** is inserted is partitioned and formed inside the concave portion **90** by the inner walls **902**, **986**, and **988**. The concave portion **90** is an approximate hexahedron constituted by the opening **982**, the opening **984**, the pair of side walls **902***t* and **902***w*, the bottom wall **988**, and the rear wall **986** as main surfaces. The opening **982** and the rear wall **986** oppose each other in the Y axis direction, and the opening **982** is positioned in the −Y axis direction and the rear wall **986** is positioned in the +Y axis direction. In addition, the pair of side walls **902***t* and **902***w* oppose each other in the X axis direction, and the first side wall **902***t* is positioned on the +X axis direction side and the second side wall **902***w* is positioned on the −X axis direction side. The opening **984** and the bottom wall **988** oppose each other in a nonparallel state in the Z axis direction, and the opening **984** is positioned on the +Z axis direction side and the bottom wall **988** is positioned on the −Z axis direction side. The opening **982** is an entrance when the apparatus side terminal unit **70** is inserted into the concave portion **90** in the case where the cartridge **4** is mounted to the cartridge mounting unit **6**. The bottom wall **988** intersects the first side wall **902***t* and the second side wall **902***w*. The bottom wall **988** intersects the opening **982** at a side on the −Z direction side. In addition, the bottom wall **988** extends in the +Y axis direction while being tilted in the +Z direction from the position of the side on the −Z direction side of the opening **982**, and intersects the rear wall **986**. The rear wall **986** intersects the bottom wall **988**, the first side wall **902***t*, and the second side wall **902***w*. The opening **984** intersects the rear wall **986**, the first side wall **902***t*, the second side wall **902***w*, and the opening **982**. In addition, in a case of using the first side wall **902***t* and the second side wall **902***w* without distinguishment therebetween, the side wall **902** is used.

The circuit board **50** is mounted in the bottom wall **988**. Specifically, as illustrated in FIG. **29**, the surface **50***fa* of the circuit board **50** is disposed to be tilted in a direction including a −Y axis direction component and a +Z axis direction component. That is, the surface **50***fa* of the circuit board **50** is tilted with respect to the Y axis and the Z axis.

Here, the surface **50***fa* corresponds to the "tilted surface" described in Summary. As described above, the surface **50***fa* includes the cartridge side terminal group **521**. That is, the cartridge side terminal group **521** is provided on the surface tilted with respect to the −Y axis direction which is the insertion direction of the cartridge **4** into the cartridge mounting unit **6**. In addition, a rear surface **50***fb* of the circuit board **50** includes a storage device **525**. The storage device **525** stores information (for example, ink colors, date of manufacture, and the like) regarding the cartridge **4**. The cartridge side terminal group **521** and the storage device **525** are electrically connected to each other.

As illustrated in FIGS. **27** to **30**, the pair of side walls **902***t* and **902***w* that oppose each other in the X axis direction of the concave portion **90** are respectively provided with a pair of grooves **906***t* and **906***w*. The grooves **906***t* and **906***w* are provided to face each other in the X axis direction. In addition, as illustrated in FIG. **28**, the grooves **906***t* and **906***w* are provided to be symmetrical with respect to a YZ plane **28***c*. The YZ plane **28***c* is a surface that constitutes the center of the dimension (width) in the X axis direction of the cartridge. Elements that constitute each of the circuit board **50** and the concave portion **90** arranged in the concave portion **90** are provided to be symmetrical with respect to the YZ plane **28***c*. That is, the YZ plane **28***c* passes through the center of the dimension (width) in the X axis direction of the cartridge side terminal group **521**. In addition, in the cartridge side terminal group **521**, a terminal **521***c* provided at the center in the width direction of the cartridge side terminal group **521** intersects the YZ plane **28***c*. In addition, the YZ plane **28***c* passes through the center of the dimension (width) in the X axis direction of the circuit board **50**. In addition, the YZ plane **28***c* passes through the mounting portions **50***a* and **50***b* provided on the bottom wall **988** in order to mount the circuit board **50** to the bottom wall **988**. In addition, the YZ plane **28***c* passes through the terminal **521***c* provided at the center portion in the X axis direction in the cartridge side terminal group **521**. The terminal **521***c* is a terminal that comes into contact with a terminal **721***c* (see FIG. **16**) provided at the center portion in the X axis direction in the apparatus side terminal group **721**. In addition, the grooves **906***t* and **906***w* of the concave portion **90** and the pair of side walls **902***t* and **902***w* are provided to be symmetrical with respect to the YZ plane **28***c*. Moreover, the YZ plane **28***c* passes through the centers of the dimensions (widths) in the X axis direction of the first convex portion **432** (**432***a* and **432***b*) and the second convex portion **442** (**442***a* and **442***b*, see FIGS. **21** and **25**) described previously. In addition, although not illustrated in FIG. **28**, the YZ plane **28***c* passes through the centers of the dimensions (widths) in the X axis direction of the first locking portion **436** (FIG. **25**) provided in the first side surface **43** and the second locking portion **446** (FIG. **25**) provided in the second side surface **44**. In addition, the leaf springs **684** and **604** (FIGS. **6** and **7**) that lock the first locking portion **436** and the second locking portion **446** intersect the YZ plane **28***c*.

As illustrated in FIGS. **27** and **30**, the first side wall **902***t* is provided with the first groove **906***t* as a first restriction portion. The first groove **906***t* is formed in a shape in which a part of the first side wall **902***t* is dug in the +X axis direction. That is, the first groove **906***t* is recessed in the +X axis direction from the first side wall **902***t*. The first groove **906***t* extends along the Y axis direction. Specifically, the first groove **906***t* extends along the +Y axis direction from a position of the opening **982** toward the rear wall **986**. The first positioning portion **756***t* (FIG. **16**) is inserted into the first groove **906***t* in the mounted state. The end surface on the −Y axis direction side and the surface on the −X axis direction side of the first groove **906***t* are open. As illustrated in FIGS. **27** and **29**, the second side wall **902***w* is provided with the second groove **906***w* as a second restriction portion. The second groove **906***w* is formed in a shape in which a part of the second side wall **902***w* is dug in the −X axis direction. That is, the second groove **906***w* is recessed in the −X axis direction from the second side wall **902***w*. The second groove **906***w* extends along the Y axis direction. Specifically, the second groove **906***w* extends along the +Y axis direction from a position of the opening **982** toward the rear wall **906** side. The end surface on the −Y axis direction side and the surface on the +X axis direction side of the second groove **906***w* are open.

As illustrated in FIGS. **29** and **30**, the grooves **906***t* and **906***w* respectively have openings **941** and **961** at the end surfaces on the −Y axis direction side. The grooves **906***t* and **906***w* include entrance parts **916***t* and **916***w* that extend toward the +Y axis direction side from the openings **941** and **961** and contact parts **926***t* and **926***w* that extend toward the +Y axis direction side from the end portions in the +Y axis direction of the entrance parts **916***t* and **916***w*. The openings **941** and **961** of the end surfaces on the −Y axis direction side respectively are entrances into which the positioning portions **756***t* and **756***w* are inserted when the cartridge **4** is mounted to the cartridge mounting unit **6**. Since the openings **941** and **961** are formed closer to the −Y axis direction side than the cartridge side terminal group **521**, before starting contact between the apparatus side terminal group **721** and the cartridge side terminal group **521**, the insertion of the positioning portions **756***t* and **756***w* into the grooves **906***t* and **906***w* is started.

The entrance parts **916***t* and **916***w* are parts in the grooves **906***t* and **906***w* into which the positioning portions **756***t* and **756***w* are initially inserted. As illustrated in FIGS. **28** to **30**, the dimensions in the Z axis direction of the entrance parts **916***t* and **916***w* are monotonically decreased in the +Y axis direction. In addition, as illustrated in FIG. **28**, the dimensions in the X axis direction of the entrance parts **916***t* and **916***w* are decreased in the +Y axis direction from the −Y axis direction. That is, the entrance parts **916***t* and **916***w* are provided to be tapered by being gradually decreased in the dimensions in the Z axis direction and the X axis direction. Furthermore, in other words, the entrance parts **916***t* and **916***w* have tapered shapes in which the areas of the openings **941** and **961** are greatest.

In addition, as illustrated in FIGS. **28** to **30**, entrance parts **902***wa* and **902***ta* of the side walls **902***w* and **902***t* of the concave portion **90** have tapered shapes to correspond to the entrance parts **916***t* and **916***w*. That is, the distance (the interval in the X axis direction) between the side walls **902***w* and **902***t* at the parts of the entrance parts **902***wa* and **902***ta* are decreased in the +Y axis direction from the −Y axis direction.

The contact parts **926***t* and **926***w* respectively come into contact with the positioning portions **756***t* and **756***w* in the mounted state. As illustrated in FIGS. **29** and **30**, the contact parts **926***t* and **926***w* respectively have contact surfaces **940** and **960** that come into contact with the positioning portions **756***t* and **756***w* in the mounted state. As illustrated in FIG. **30**, the contact surface **940** that comes into contact with the first positioning portion **756***t*, that is, the contact surface **940** of the groove **906***t* has four surfaces **942**, **946**, **948**, and **944**. Similarly, as illustrated in FIG. **29**, the contact surface **960** that comes into contact with the second positioning portion **756***w*, that is, the contact surface **960** of the groove **906***w*

also has four surfaces **962**, **966**, **968**, and **964**. The four contact surfaces are respectively called an A surface **942** and **962**, a B surface **946** and **966**, a C surface **944** and **964**, and a D surface **948** and **968**.

As illustrated in FIG. **30**, the A surface **942** and the B surface **946** of the groove **906***t* oppose each other in the Z axis direction, and the A surface **942** is positioned on the +Z axis direction side and the B surface **946** is positioned on the −Z axis direction side. The D surface **948** of the groove **906***t* opposes the opening **941** in the Y axis direction, and the opening **941** is positioned on the −Y axis direction side and the D surface **948** is positioned on the +Y axis direction side. In addition, the D surface **948** intersects the A surface **942** and the B surface **946**. As illustrated in FIG. **28**, the C surface **944** of the groove **906***t* opposes an extension surface **902***te* of the first side wall **902***t* and is positioned on the +X axis direction side with respect to the extension surface **902***te* of the first side wall **902***t*. In addition, the C surface **944** intersects the A surface **942**, the B surface **946**, and the D surface **948**. The A surface **942** of the groove **906***t* comes into contact with the end portion on the +Z axis direction side of the first positioning portion **756***t* (FIG. **16**). The B surface **946** comes into contact with the end portion on the −Z axis direction side of the first positioning portion **756***t*. The first D surface **948** comes into contact with the end portion on the +Y axis direction side of the first positioning portion **756***t*. The first C surface **944** comes into contact with the end portion on the +X axis direction side of the first positioning portion **756***t*.

As illustrated in FIG. **29**, the A surface **962** and the B surface **966** of the groove **906***w* oppose each other in the Z axis direction, and the A surface **962** is positioned on the +Z axis direction side and the B surface **966** is positioned on the −Z axis direction side. The D surface **968** of the groove **906***w* opposes the opening **961** in the Y axis direction, and the opening **961** is positioned on the −Y axis direction side and the D surface **968** is positioned on the +Y axis direction side. In addition, the D surface **968** intersects the A surface **962** and the B surface **966**. As illustrated in FIG. **28**, the C surface **964** of the groove **906***w* opposes an extension surface **902***we* of the second side wall **902***w* and is positioned on the −X axis direction side with respect to the extension surface **902***te* of the second side wall **902***w*. In addition, the C surface **964** intersects the A surface **962**, the B surface **966**, and the D surface **968**. The A surface **962** of the groove **906***w* comes into contact with the end portion on the +Z axis direction side of the second positioning portion **756***w* (FIG. **16**). The B surface **966** comes into contact with the end portion on the −Z axis direction side of the second positioning portion **756***w*. The D surface **968** comes into contact with the end portion on the +Y axis direction side of the second positioning portion **756***w*. The C surface **964** comes into contact with the end portion on the −X axis direction side of the second positioning portion **756***w*.

Here, in a case of using the first groove **906***t* and the second groove **906***w* without distinguishment therebetween, they are simply called the "groove **906**". In addition, in a case of using the first contact part **926***t* and the second contact part **926***w* without distinguishment therebetween, they are simply called the "contact part **926**". In addition, in a case of using the first entrance part **916***t* and the second entrance part **916***w* without distinguishment therebetween, they are simply called the "entrance part **916**".

As illustrated in FIG. **27**, in the bottom wall **988**, a pair of bottom wall side concave portions **910***t* and **910***w* are respectively formed between the tilted surface **50***fa* and the first side wall **902***t* and between the tilted surface **50***fa* and the second side wall **902***w*. As illustrated in FIG. **31**, the pair of bottom wall side concave portions **910***t* and **910***w* are configured to respectively receive the pair of protrusions **759***t* and **759***w* (FIG. **16**) of the apparatus side terminal unit **70** in the mounted state. In addition, the pair of bottom wall side concave portions **910***t* and **910***w* are collectively called a first bottom wall side concave portion **910**.

A-5. Embodiment of Contact Between Cartridge Side Terminal Group **521** and Apparatus Side Terminal Group **721**

Next, an embodiment of contact between the cartridge side terminal group **521** and the apparatus side terminal group **721** when the cartridge **4** is mounted to the cartridge mounting unit **6** will be described using FIGS. **33** to **36**. FIG. **33** is a first diagram illustrating the embodiment of the contact. FIG. **34** is a second diagram illustrating the embodiment of the contact. FIG. **35** is a third diagram illustrating the embodiment of the contact. FIG. **36** is a fourth diagram illustrating the embodiment of the contact. A form of the cartridge **4** during mounting is illustrated in time series in the order of figures from FIGS. **33** to **36**. In addition, FIGS. **33** to **36** are illustrated focusing on a single cartridge side terminal **521***a* of the cartridge side terminal group **521** and a single apparatus side terminal **721***a* of the apparatus side terminal group **721**. In addition, the other terminals have the same mounting form. Since the shapes of the first and second positioning portions **756***t* and **756***w* are the same and the first and second grooves **906***t* and **906***w* are the same, for ease of understanding, reference numerals **756***t* and **756***w* are described together and reference numerals **906***t* and **906***w* are described together in FIGS. **33** to **36**.

As illustrated in FIG. **33**, when the cartridge **4** (FIG. **19**) is mounted to the cartridge mounting unit **6** (FIG. **5**), the cartridge **4** is caused to advance into the slot of the cartridge mounting unit **6** in the −Y axis direction. Here, as illustrated in FIG. **34**, before the cartridge side terminal **521***a* comes into contact with the terminal contact point **722***a* of the apparatus side terminal **721***a*, the insertion of the positioning portion **756** into the groove **906** is started. Here, even in a case where the cartridge mounting unit **6** has a slight manufacturing error, the apparatus side terminal unit **70** is guided into the concave portion **90** of the cartridge **4** while absorbing the error by moving in the X axis direction and the Z axis direction. As the cartridge **4** is caused to advance in the −Y axis direction while the positioning portion **756** comes into contact with the surface of the entrance part **916** of the groove **906**, the apparatus side terminal unit **70** is guided to the position at which the cartridge side terminal **521***a* and the apparatus side terminal **721***a* come into contact with each other. In FIG. **34**, a form in which the apparatus side terminal unit **70** is guided into the concave portion **90** (FIG. **27**) while moving slightly in a direction (−Z axis direction) indicated by the arrow V**1** is illustrated.

As illustrated in FIG. **35**, the cartridge **4** is caused to further advance in the −Y axis direction, and when the positioning portions **756***t* and **756***w* are inserted into the contact parts **926***t* and **926***w* of the groove **906**, the C surfaces **756***tc* and **756***wc* of the positioning portions **756***t* and **756***w* respectively come into contact with the C surfaces **944** and **964** of the grooves **906***t* and **906***w* and thus the movement in the X axis direction of the apparatus side terminal unit **70** (FIG. **10**) is restricted. In addition, here, the A surfaces **756***ta* and **756***wa* of the positioning portions **756***t* and **756***w* respectively come into contact with the A surfaces **942** and **962** of the grooves **906***t* and **906***w*, and the B

surfaces **756***tb* and **756***wb* respectively come into contact with the B surfaces **946** and **966**, thereby restricting the movement in the Z axis direction of the apparatus side terminal unit **70**. Accordingly, the positions in the X axis direction and the Z axis direction of the cartridge side terminal **521***a* and the terminal contact point **722***a* are determined. In addition, after the insertion of the positioning portion **756** into the contact part **926** is started, immediately before completing the full insertion, the terminal contact point **722***a* initially comes into contact with the cartridge side terminal **521***a*. At this time point, it is possible to cause the cartridge **4** to advance while the tip end surfaces **756***td* and **756***wd* of the positioning portions **756***t* and **756***w* do not come into contact with the D surfaces **948** and **968** of the grooves **906***t* and **906***w*. When the cartridge **4** is caused to further advance in the −Y axis direction from the state illustrated in FIG. **35**, the apparatus side terminal **721***a* elastically deforms, and the contact point **722***a* of the apparatus side terminal **721***a* moves in the direction of the arrow YR1*a* while coming into contact with the cartridge side terminal **521***a*. Here, the apparatus side terminal group and the cartridge side terminal group slightly rub against each other. In addition, finally, as illustrated in FIG. **36**, the tip end surfaces **756***td* and **756***tw* of the positioning portions **756***t* and **756***w* come into contact with the D surfaces **948** and **968** of the grooves **906***t* and **906***w* and thus the positions in the Y axis direction between the cartridge side terminal **521***a* and the terminal contact point **722***a* are determined. In this state, the mounting of the cartridge **4** to the cartridge mounting unit **6** is completed. In addition, during the completion of the mounting and in the mounted state, as in the final stage of the mounting illustrated in FIG. **36**, the A surfaces **756***ta* and **756***wa* of the positioning portions **756***t* and **756***w* come into contact with the A surfaces **942** and **944** of the grooves **906***t* and **906***w* in the +Z axis direction. In addition, the B surfaces **756***tb* and **756***wb* come into contact with the B surfaces **946** and **966** of the grooves **906***t* and **906***w* in the −Z axis direction. In addition, the C surface **756***tc* of the first positioning portion comes into contact with the C surface **944** of the first groove **906***t* in the +X axis direction, and the C surface **756***wc* of the second positioning portion comes into contact with the C surface **964** of the second groove **906***w* in the −X axis direction. Therefore, the movements in the Z axis direction and the X axis direction of the positioning portions **756***t* and **756***w* are restricted by the grooves **906***t* and **906***w*. Accordingly, at the position where contact between the apparatus side terminal **721***a* and the cartridge side terminal **521***a* is properly achieved, both **721***a* and **521***a* may be held.

A-6. Other Configurations of Cartridge **4**

FIG. **37** is an exploded perspective view of the cartridge **4**. As illustrated in FIG. **37**, the case **9** accommodates the printing material accommodation portion **450** and the cartridge side passage member **480**. The printing material accommodation portion **450** accommodates ink therein. In addition, the printing material accommodation portion **450** is a bag body having flexibility. In this example, the printing material accommodation portion **450** is formed of an aluminum-laminated multilayer film in which an aluminum layer is laminated and formed on a resin film layer. The cartridge side passage member **480** forms a passage (also called a "printing material lead-out passage") that causes the printing material accommodation portion **450** to communicate with the outside. That is, the one end portion of the cartridge side passage member **480** is connected to the printing material accommodation portion **450**, and the printing material lead-out tube **484** provided in the other end portion thereof is connected to the printing material supply tube **642** (FIG. **4**). A detection chamber **482** is proved part way through the printing material lead-out passage. In the detection chamber **482**, a coil spring **496** as an impelling member, a check valve **495**, and a pressure-receiving plate **493** are accommodated. In addition, an opening which is in one side surface of the detection chamber **482** is covered with a film **492** having flexibility. The pressure-receiving plate **493** is disposed between the coil spring **496** and the film **492**. The coil spring **496** impels the pressure-receiving plate **493** so as to increase the volume of the detection chamber **482**. The case **9** further accommodates a lever member **490**. The lever member **490** comes into contact with the film **492** from the outside of the detection chamber **482**. The volume of the detection chamber **482** changes according to a change in the internal pressure. The lever member **490** is displaced by the change in the volume of the detection chamber **482**. As described above, the rod **662** (FIG. **4**) abuts onto the lever member **490**. In a case where the inside of the printing material accommodation portion **450** is suctioned by the pumping mechanism **7** in a state where ink is accommodated in the printing material accommodation portion **450**, the ink is also supplied into the detection chamber **482** along with the suctioning. Accordingly, the pressure in the detection chamber **482** is maintained at a predetermined pressure. Here, since the volume of the detection chamber **482** is maintained to be large, the rod **662** (FIG. **4**) is in a state of being pressured in the −Y axis direction by the lever member **490** against the impelling force applied by the impelling member **665** (FIG. **4**). On the other hand, in a case where the inside of the printing material accommodation portion **450** is suctioned by the pumping mechanism **7** in a state where the ink of the printing material accommodation portion **450** is exhausted, the inside of the detection chamber **482** has a negative pressure. Through the inside of the detection chamber **482** having a negative pressure, the volume of the inside of the detection chamber **482** is reduced more than when at a predetermined pressure, and thus the lever member **490** is displaced. Accordingly, the rod **662** (FIG. **4**) is displaced in the +Y axis direction by the impelling force exerted by the impelling member **665** (FIG. **4**). As the displacement of the rod **662** (FIG. **4**) accompanied by the displacement of the lever member **490** is detected by the sensor **138** (FIG. **4**), the ink end state may be detected by the control unit **31**. In addition, the detection chamber **482**, the coil spring **496**, the pressure-receiving plate **493**, the film **492**, and the lever member **490** constitute a detection mechanism used for detecting the ink end state on the printer **10** side. In addition, the cartridge side passage member **480** further has an injection passage **483** for injecting the ink into the printing material accommodation portion **450** from the outside. After the ink is injected into the printing material accommodation portion **450**, the injection passage **483** is blocked.

A-7. Effects

First, as described with reference to FIGS. **10** to **12**, in this example, the apparatus side terminal unit **70** is movable in the X axis direction and the Z axis direction. In addition, as illustrated in FIGS. **27** to **30**, the cartridge **4** has the concave portion **90** into which the apparatus side terminal unit **70** is inserted. Accordingly, even in the case where the cartridge mounting unit **6** or the cartridge **4** has a manufacturing error, the apparatus side terminal unit **70** is guided into the concave

portion **90** of the cartridge **4** while absorbing the error by moving when the cartridge **4** is mounted to the cartridge mounting unit **6** (FIG. **34**). In addition, finally, the positioning of the apparatus side terminal group **721** and the cartridge side terminal group **521** is performed by the first and second restriction portions **906***t* and **906***w* provided in the concave portion **90**. That is, during the completion of the mounting and in the mounted state, the first and second restriction portions **906***t* and **906***w* provided in the concave portion **90** of the cartridge **4** restrict the movements in the Z axis direction and the X axis direction of the first and second positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70**, thereby positioning the apparatus side terminal group **721** and the cartridge side terminal group **521**. Therefore, contact between the apparatus side terminal group **721** and the cartridge side terminal group **521** may be properly achieved.

In addition, in the example, as illustrated in FIG. **13**, the rod **662** having the center axis Cb parallel to the Y axis direction is provided at the intermediate position between the first apparatus side side wall portion **63** and the second apparatus side side wall portion **64** in the apparatus side front wall portion **62**. In addition, as illustrated in FIG. **21**, the rod insertion hole **420** into which the rod **662** is inserted is provided at the intermediate position in the Z axis direction between the first and second side surfaces **43** and **44** in the front surface **42** of the cartridge **4**. In this embodiment, as the rod **662** is inserted into the rod insertion hole **420**, positioning of the entirety of the cartridge **4** with respect to the cartridge mounting unit **6** is performed, and thus a positional deviation from the correct mounting position is suppressed. Therefore, a positional deviation in the vicinity of the rod insertion hole **420** may be properly suppressed. However, the cartridge side terminal group **521** (FIG. **21**) provided in the corner portion **89** of the front surface **42** and the rod insertion hole **420** are at positions separated from each other, and thus there may be cases where it is difficult to suppress a positional deviation of such a member that is at a position separated from the rod insertion hole **420**. In particular, since the cartridge **4** of this example is the large-capacity type cartridge **4** used in the printer **10** for large-sized printing, the size thereof is large, and the cartridge side terminal group **521** and the rod insertion hole **420** are at the positions somewhat separated from each other. However, as described above, by employing the configurations of the apparatus side terminal unit **70** that is movable in the X axis direction and the Z axis direction and the concave portion **90** into which the apparatus side terminal unit **70** is inserted, positioning of the cartridge side terminal group **521** and the apparatus side terminal group **721** may be performed with good accuracy. That is, according to this example, even with the large capacity type cartridge **4** having a large size, it is possible to position the apparatus side terminal group **721** and the cartridge side terminal group **521** while performing the positioning of the entirety of the cartridge **4** and absorbing a manufacturing error in the cartridge **4**.

In addition, in this embodiment, the printing material supply tube **642** is provided between the rod **662** and the apparatus side terminal unit **70** (FIG. **13**). In addition, the supply tube insertion hole **424** into which the printing material supply tube **642** is inserted is provided between the rod insertion hole **420** and the concave portion **90** (FIG. **21**). That is, the printing material supply tube **642** is provided at a position close to the rod **662**. In addition, the supply tube insertion hole **424** is provided at a position close to the rod insertion hole **420**. Therefore, a positional deviation between the printing material supply tube **642** and the supply tube insertion hole **424** may be properly suppressed.

In addition, as illustrated in FIG. **18**, the apparatus side terminal group **721** is provided on the surface **724***fa* tilted in a direction including the +Y axis direction component and the −Z axis direction component. In addition, as illustrated in FIG. **29**, the cartridge side terminal group **521** is provided on the tilted surface **50***fa* tilted in the direction including the −Y axis direction component and the +Z axis direction component. That is, both the apparatus side terminal group **721** and the cartridge side terminal group **521** are provided on the surfaces tilted with the same tilt in the −Y axis direction which is the insertion direction of the cartridge **4** into the cartridge mounting unit **6**. As previously described with reference to FIGS. **33** to **36**, when the cartridge **4** is inserted into the cartridge mounting unit **6**, the cartridge **4** proceeds in the −Y axis direction. Here, the cartridge side terminal group **521** also proceeds in the −Y axis direction and slowly approaches the apparatus side terminal group **721**. However, the two do not come into contact with each other immediately before completing the mounting. In the final stage of the mounting, after the apparatus side terminal unit **70** is inserted into the concave portion **90** of the cartridge **4**, the apparatus side terminal group **721** and the cartridge side terminal group **521** slightly rub against each other immediately before completing the mounting (FIGS. **35** and **36**). In addition, during the completion of the mounting and in the mounted state, the first and second restriction portions **906***t* and **906***w* provided in the concave portion **90** of the cartridge **4** restrict the movements in the Z axis direction and the X axis direction of the first and second positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70**, thereby positioning the apparatus side terminal group **721** and the cartridge side terminal group **521**. As such, while the apparatus side terminal group **721** and the cartridge side terminal group **521** rarely rub against each other during the mounting of the cartridge **4**, the apparatus side terminal group **721** and the cartridge side terminal group **521** rub slightly against each other immediately before completing the mounting of the cartridge **4**, thereby reducing the possibility of shavings being generated as the apparatus side terminal group **721** rubs against the case **9** and the like of the cartridge **4** during the mounting of the cartridge **4**. In addition, even in a case where dust is present in the vicinity of the apparatus side terminal group **721** and is interposed between the apparatus side terminal group **721** and the cartridge side terminal group **521**, the apparatus side terminal group **721** comes into contact while linearly rubbing on the surface of the cartridge side terminal group **521** and thus an effect of discharging the dust from the contact portion (a wiping effect) is exhibited, thereby reducing the possibility of dust being interposed between the apparatus side terminal group **721** and the cartridge side terminal group **521**.

In addition, according to the above-described example, as illustrated in FIGS. **16**, **17**, and **36**, the end portions on the +Z axis direction side of the first and second positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70** are provided with the A surfaces **756***ta* and **756***wa*, and the end portions on the −Z axis direction side thereof are provided with the B surfaces **756***tb* and **756***wa*. In addition, as illustrated in FIGS. **28** to **30** and **36**, the grooves **906***t* and **906***w* as the first and second restriction portions provided in the concave portion **90** are respectively provided with the A surfaces **942** and **962** and the B surfaces **946** and **966**. As illustrated in FIG. **36**, the A surfaces **942** and **962** of the grooves **906***t* and **906***w* come into contact with the A

surfaces **756***ta* and **756***wa* provided at the end portions on the +Z axis direction side of the first and second positioning portions **756***t* and **756***w* in the mounted state. The B surfaces **946** and **966** of the grooves **906***t* and **906***w* come into contact with the B surfaces **756***tb* and **756***wb* provided at the end portions on the −Z axis direction side of the first and second positioning portions **756***t* and **756***w* in the mounted state. That is, the first and second restriction portions **906***t* and **906***w* restrict the movements in the ±Z direction of the first and second positioning portions **756***t* and **756***w*. Accordingly, positioning in the Z axis direction of the cartridge side terminal group **521** with respect to the apparatus side terminal group **721** may be performed with good accuracy. Therefore, contact between the apparatus side terminal group **721** and the cartridge side terminal group **521** may be more properly achieved. Moreover, since the apparatus side terminal unit **70** is able to be held on both sides in the +Z axis direction and the −Z axis direction, even when vibration or impacts from the outside are exerted during the use of the printer **10**, a deviation of the contact position between the apparatus side terminal group **721** and the cartridge side terminal group **521** due to the vibration and impacts may be suppressed.

Moreover, according to the above-described example, as illustrated in FIGS. **16**, **17**, **27**, and **28**, the movement in the +X axis direction of the first positioning portion **756***t* is restricted by the contact with the first groove **906***t* as the first restriction portion, and the movement in the −X axis direction of the second positioning portion **756***w* is restricted by the contact with the second groove **906***w* as the second restriction portion. That is, the movements in the ±X axis direction of the apparatus side terminal unit **70** are restricted by the first groove **906***t* and the second groove **906***w*. Accordingly, positioning in the X axis direction of the cartridge side terminal group **521** with respect to the apparatus side terminal group **721** may be performed with good accuracy. Therefore, contact between the apparatus side terminal group **721** and the cartridge side terminal group **521** may be more properly achieved. Moreover, since the apparatus side terminal unit **70** is able to be held on both sides in the +X axis direction and the −X axis direction, even when vibration or impacts from the outside are exerted during the use of the printer **10**, a deviation of the contact position between the apparatus side terminal group **721** and the cartridge side terminal group **521** due to the vibration and impacts may be further suppressed.

Moreover, in the above-described example, as illustrated in FIGS. **28** to **30** and **36**, the grooves **906***t* and **906***w* as the first and second restriction portions respectively have the D surfaces **948** and **968** that come into contact with the D surfaces **756***td* and **756***wd* of the end portions on the +Y axis direction side of the first and second positioning portions. Accordingly, the apparatus side terminal unit **70** may be prevented from strongly impacting the bottom wall **988** in the cartridge concave portion **90** due to proceeding to far in the +Y axis direction when the cartridge **4** is inserted into the cartridge mounting unit **6**. Accordingly, the apparatus side terminal unit **70** may be prevented from being broken.

In addition, in the above-described example, as illustrated in FIGS. **27** to **30**, since the grooves **906***t* and **906***w* are respectively formed in the first and second side walls **902***t* and **902***w*, the first and second restriction portions for restricting the movements of the first and second positioning portions **756***t* and **756***w* may be easily formed. In addition, in this embodiment, as illustrated in FIGS. **27** to **30**, the constituent elements of the cartridge **4** attached and detached by the user are the grooves **906**, and as illustrated in FIGS. **15** and **17**, the constituent elements of the cartridge mounting unit **6** which is stationary are the protruding members **756**. Therefore, the possibility of the printer **10** or the cartridge **4** being damaged as the first and second restriction portions **906***t* and **906***w* of the cartridge **4** impact on the constituent members of the printer **10** during attaching and detaching may be reduced.

In addition, in the above-described embodiment, as illustrated in FIGS. **29**, **30**, and **33** to **36**, the first and second restriction portions **906***t* and **906***w* respectively include the entrance parts **916***t* and **916***w* which extend in the +Y axis direction from the openings **941** and **961** provided at the end surfaces on the −Y axis direction side and of which the dimensions in the Z axis direction are decreased in the +Y axis direction. That is, the entrance parts **916***t* and **916***w* are provided to be tapered by being gradually decreased in the dimensions in the Z axis direction. Accordingly, even in a case where the cartridge **4** or the cartridge mounting unit **6** has a manufacturing error in the Z axis direction, the restriction portion **906** provided in the concave portion **90** of the cartridge **4** easily guides the positioning portion **756** of the apparatus side terminal unit **70** that is movable in the Z axis direction (FIG. **34**). In addition, the first and second restriction portions **906***t* and **906***w* have the contact parts **926***t* and **926***w* that extend from the end portions in the +Y axis direction of the entrance parts **916***t* and **916***w*, have constant dimensions in the Z axis direction, and respectively come into contact with the first and second positioning portions **745***t* and **745***w* in the mounted state. Accordingly, as the positioning portions **745***t* and **745***w* of the apparatus side terminal unit **70** are guided to the entrance parts **916***t* and **916***w* and thereafter advance to the contact parts **926***t* and **926***w*, positioning of the apparatus side terminal group **721** with respect to the cartridge side terminal group **521** may be performed with good accuracy.

In addition, as illustrated in FIG. **28**, in the above-described example, the dimensions in the X axis direction of the entrance part **916** are decreased in the +Y axis direction from the −Y axis direction. Accordingly, even in the case where the cartridge **4** or the cartridge mounting unit **6** has a manufacturing error in the X axis direction, the restriction portion **906** may easily guide the positioning portion **756**. However, since the dimension (width) in the X axis direction of each of the slots of the cartridge **4** or the cartridge mounting unit **6** is significantly smaller than the dimension in the Z axis direction thereof, it is thought that the manufacturing error in the X axis direction is relatively smaller than the manufacturing error in the Z axis direction. Therefore, it is possible to sufficiently achieve an effect of facilitating the guiding of the positioning portions **756***t* and **756***w* only by providing the tapered portions in the Z axis direction of the entrance parts **916**, without providing the tapered portions in the X axis direction.

Moreover, as illustrated in FIGS. **28** to **30**, in this embodiment, the entrance parts **902***wa* and **902***ta* of the side walls **902***w* and **902***t* of the concave portion **90** also have the tapered shapes to correspond to the entrance parts **916***t* and **916***w*. That is, the distance (the interval in the X axis direction) between the side walls **902***w* and **902***t* at the parts of the entrance parts **902***wa* and **902***ta* is reduced in the +Y axis direction from the −Y axis direction. As such, by widening the openings that receive the apparatus side terminal unit **70** in the entrance parts **902***wa* and **902***ta* of the concave portion **90**, it is possible to easily guide the apparatus side terminal unit **70** to the concave portion **90** of the cartridge **4**.

In addition, as illustrated in FIG. **27**, in the above-described embodiment, at both side parts in the X axis direction of the surface **50***fa* in the bottom wall **988** of the concave portion **90**, that is, between the tilted surface **50***fa* provided with the cartridge side terminal group **521** and the first and second side walls **902***t* and **902***w* of the concave portion **90**, the pair of bottom wall side concave portions **910***t* and **910***w* into which parts of the holder are inserted are provided. Due to the pair of bottom wall side concave portions **910***t* and **910***w*, approximately triangular surfaces are exposed on the +X axis direction side and the −X axis direction side of the cartridge side terminal group **521**. Accordingly, in the case where the cartridge side terminal group **521** is provided on the circuit board **50**, it is possible to easily perform mounting or removal of the circuit board **50**. In addition, as illustrated in FIG. **16**, the pair of protrusions **759***t* and **759***w* are provided on the +X axis direction side and the −X axis direction side of the apparatus side terminal group **721** so as to protrude in the direction including the +Y axis direction component and the −Z axis direction component with respect to the surface **724***fa*. The bottom wall side concave portions **910***t* and **910***w* provided in the concave portion **90** are spaces that respectively receive the protrusions **759***t* and **759***w*. In addition, as the protrusions **759***t* and **759***w* are received by the bottom wall side concave portions **910***t* and **910***w*, in addition to positioning of or suppressing of a positional deviation between the cartridge side terminal group **521** and the apparatus side terminal group **721** by the restriction portion **906** and the positioning portion **756**, it is possible to position the two or suppress a positional deviation therebetween even at the positions close to the cartridge side terminal group **521** and the apparatus side terminal group **721**. Accordingly, contact between the apparatus side terminal group **721** and the cartridge side terminal group **521** may be more properly achieved.

In addition, in the above-described embodiment, as illustrated in FIG. **28**, elements that constitute each of the circuit board **50** and the concave portion **90** are provided to be symmetrical with respect to the YZ plane **28***c* that constitutes the center of the dimension in the X axis direction of the cartridge **4**. In addition, although not shown in FIG. **28**, the YZ plane **28***c* passes through the centers of the dimensions (widths) in the Z axis direction of the first locking portion **436** (FIG. **25**) provided in the first side surface **43** and the second locking portion **446** (FIG. **25**) provided in the second side surface **44**. In addition, the leaf springs **684** and **604** (FIGS. **6** and **7**) that lock the first locking portion **436** and the second locking portion **446** intersect the YZ plane **28***c*. Therefore, a force is exerted by the apparatus side terminal unit **70**, the leaf springs **604** and **684** (FIGS. **6** and **7**), and the like on the cartridge **4** with a good balance in the state where the cartridge **4** is mounted to the cartridge mounting unit **6**, and thus the cartridge **4** is not easily tilted. Even according to this, it is possible to more properly achieve contact between the apparatus side terminal group **721** and the cartridge side terminal group **521**.

In addition, in the above-described embodiment, the cartridge mounting unit **6** has the holder **750** that holds the terminal block **724** (FIGS. **14** to **16**). That is, in the above-described embodiment, the terminal block **724** is not directly mounted to the apparatus side front wall portion **62** but is mounted to the apparatus side front wall portion **62** via the holder **750**. Therefore, the terminal block **724** and the apparatus side terminal group **721** are components having excellent versatility. That is, there may be cases where the positioning portion **756** for positioning the apparatus side terminal group **721** and the cartridge side terminal group **521** varies depending on the specification of the cartridge **4** or the printer **10**. The positioning portion **756** that needs a design change is not provided in the terminal block **724** but is provided in the holder **750**, and thus the shapes of the terminal block **724** and the apparatus side terminal group **721** held in the terminal block **724** may be made constant. Accordingly, the terminal block **724** and the apparatus side terminal group **721** are components having excellent versatility.

B. Modified Embodiment of Restriction Portion

FIGS. **38**A to **46**B are schematic diagrams illustrating various modified embodiments of the restriction portion provided in the concave portion **90**. FIG. **38**A is a front view of a first modified embodiment. FIG. **38**B is a cross-sectional view taken along the line XXXVIIIB-XXXVIIIB of FIG. **38**A. FIG. **39**A is a front view of a second modified embodiment. FIG. **39**B is a cross-sectional view taken along the line XXXIXB-XXXIXB of FIG. **39**A. FIG. **40**A is a front view of a third modified embodiment, and FIG. **40**B is a cross-sectional view taken along the line XXXXB-XXXXB of FIG. **40**A. FIG. **41**A is a front view of a fourth modified embodiment. FIG. **41**B is a cross-sectional view taken along the line XXXXIB-XXXXIB of FIG. **41**A. FIG. **42**A is a front view of a fifth modified embodiment. FIG. **42**B is a cross-sectional view taken along the line XXXXIIB-XXXXIIB of FIG. **42**A. FIG. **43**A is a front view of a sixth modified embodiment. FIG. **43**B is a cross-sectional view taken along the line XXXXIIIB-XXXXIIIB. FIG. **44**A is a front view of a seventh modified embodiment. FIG. **44**B is a cross-sectional view taken along the line XXXXIVB-XXXXIVB of FIG. **44**A. FIG. **45**A is a front view of an eighth modified embodiment. FIG. **45**B is a cross-sectional view taken along the line XXXXVB-XXXXVB of FIG. **45**A. FIG. **46**A is a front view of a ninth modified embodiment. FIG. **46**B is a cross-sectional view taken along the line XXXXVIB-XXXXVIB of FIG. **46**A. In FIGS. **38**A to **46**B, the front views schematically illustrate the concave portion **90** and the vicinity thereof, and the cross-sectional views schematically illustrate the concave portion **90** and the vicinity thereof. Regarding all the modified embodiments of FIGS. **38**A to **46**B, the configurations other than the configuration of the restriction portion into which the positioning portion **756** of the holder **750** is inserted are the same as those of the first example. In addition, in FIGS. **38**A to **46**B, like elements in the same configurations as those of the first example are denoted by like reference numerals, and description thereof will be omitted. In addition, the configuration of the printer **10** is the same as the configuration of the first example. In addition, since the first and second restriction portions have the same shape, in the cross-sectional views in FIGS. **38**A to **46**B, for ease of understanding, the reference numerals illustrating the first restriction portion in addition to the reference numerals illustrating the second restriction portion are described together.

In all the modified embodiments of FIGS. **38**A to **46**B, convex portions that protrude in the −X axis direction from the first side wall of the concave portion **90** and convex portions that protrude in the +X axis direction from the second side wall are provided, and the first and second restriction portions are configured by the convex portions. The convex portions may be provided separately from the first and second side walls of the concave portion **90** and may also be provided integrally.

In the first modified embodiment illustrated in FIGS. **38**A and **38**B, grooves **906***ta***1** and **906***wa***1** having shapes similar to those of the first example are formed by convex portions **906***ta* and **906***wa* and side walls **902***ta* and **902***wa*, and the positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70** are inserted into the grooves **906***ta***1** and **906***wa***1**. Entrance parts **916***a* of the grooves **906***ta***1** and **906***wa***1** are provided with tapered shapes only in the Z axis direction. Restriction of the movements in the ±Z direction of the positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70** is performed by A surfaces (surfaces on the +Z axis direction side) and B surfaces (surfaces on the −X axis direction side) of the grooves **906***ta***1** and **906***wa***1**, and restriction of the movements in the +Y axis direction is performed by D surfaces (surfaces on the +Y axis direction side) of the grooves **906***ta***1** and **906***wa***1**. Restriction of the movements in the ±X axis direction is performed by C surfaces formed by the side walls **902***ta* and **902***wa*. That is, the C surfaces are formed by parts of the side walls **902***ta* and **902***wa*.

In the second modified embodiment illustrated in FIGS. **39**A and **39**B, a pair of convex portions **906***tb***1** and **906***tb***2** that protrude in the −X axis direction from a first side wall **902***tb* of the concave portion **90** and a pair of convex portions **906***wb***1** and **906***wb***2** that protrude in the +X axis direction from a second side wall **902***wb* are provided. The convex portions **906***tb***1**, **906***tb***2**, **906***wb***1**, and **906***wb***2** correspond to omission of the D surfaces (the surfaces on the +Y axis direction side) from the grooves **906***ta***1** and **906***wa***1** of the first modified embodiment illustrated in FIGS. **38**A and **38**B. Restriction of the movements in the +Z direction of the positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70** is performed by the convex portions **906***tb***1** and **906***wb***1**. Restriction of the movements in the −Z direction of the positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70** is performed by the convex portions **906***tb***2** and **906***wb***2**. Restriction of the movements in the ±X axis direction is performed by the side walls **902***tb* and **902***wb*.

In the third modified embodiment illustrated in FIGS. **40**A and **40**B, a pair of convex portions **906***tc***1** and **906***tc***2** that protrude in the −X axis direction from a first side wall **902***tc* of the concave portion **90** and a pair of convex portions **906***wc***1** and **906***wc***2** that protrude in the +X axis direction from a second side wall **902***wc* are provided. The third modified embodiment is different from the second modified embodiment illustrated in FIGS. **39**A and **39**B in that the opening ends in the −Y axis direction of the convex portions **906***tc***1**, **906***tc***2**, **906***wc***1**, and **906***wc***2** are provided at the position of the opening **982** of the concave portion **90** and the end portions in the +Y axis direction extend to the position of the rear wall **986** of the concave portion **90**, but other points are common to the second modified embodiment.

In the fourth modified embodiment illustrated in FIGS. **41**A and **41**B, a convex portion **906***td* that protrudes in the −X axis direction from a first side wall **902***td* of the concave portion **90** and a convex portion **906***wd* that protrudes in the +X axis direction from a second side wall **902***wd* are provided. In the fourth modified embodiment, the convex portions **906***tc***2** and **906***wc***2** that restrict the movements in the −Z axis direction of the positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70** are removed from the third modified embodiment illustrated in FIGS. **40**A and **40**B. It is possible to restrict the movements in the +Z direction of the positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70** by the convex portions **906***td* and **906***wd*. Since the movement in the −Z axis direction is restricted as the apparatus side terminal group **721** and the cartridge side terminal group **521** come into contact with each other, it is possible to omit the function of restricting the movement in the −Z axis direction. In addition, restriction in the ±X axis direction is performed by the side walls **902***td* and **902***wd*.

In the fifth modified embodiment illustrated in FIGS. **42**A and **42**B, a convex portion **906***te* that protrudes in the −X axis direction from a first side wall **902***te* of the concave portion **90** and a convex portion **906***we* that protrudes in the +X axis direction from a second side wall **902***we* are provided. In the fifth modified embodiment, D surfaces that restrict the movements in the +Y axis direction of the positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70** are added to the convex portions **906***td* and **906***wd* of the fourth modified embodiment illustrated in FIGS. **41**A and **41**B. Other points are common to the fourth modified embodiment.

In the sixth to ninth embodiments of FIGS. **43**A to **46**B, the entrance parts **916***b* to **916***e* formed in the tapered shapes are respectively omitted from the second to fifth modified embodiments illustrated in FIGS. **38**A to **42**B. Other points are common to the second to fifth modified embodiments.

The same effects as those of the first example may also be obtained by the modified embodiments as described above. However, it is natural that the effect of the restriction of the movements in the −Z direction is not obtained by the restriction portions of the fourth, fifth, eighth, and ninth modified embodiments in which the function of restricting the movements in the −Z axis direction of the positioning portions **756***t* and **756***w* of the apparatus side terminal unit **70** is not provided, and the effect of the restriction of the movements in the +Y direction is not obtained by the restriction portions of the second to fourth and sixth to eighth modified embodiments in which the function of restricting the movements in the +Y direction is not provided. In addition, according to the above-described modified examples, since the convex portions that protrude in the X axis direction are respectively provided to the first side wall and the second side wall, the first positioning portion and the second positioning portion may be easily formed.

C. Modified Example

While the single example of the invention has been described above, the invention is not limited to the example and may employ various configurations without departing from the spirit thereof. For example, the following modifications can be made.

C-1. First Modified Example

In the above-described example, the cartridges **4** and **4***a* have the printing material accommodation portion **450**. However, the case **9** may directly accommodate ink.

C-2. Second Modified Example

In the above-described example, the positioning portion **756** is provided in the holder **750**. However, the positioning portion **756** may be provided in the terminal block **724** by simplifying the configuration of the holder **750**. In addition, in the above-described example, the apparatus side terminal group **721** that elastically deforms is employed. However, the apparatus side terminal group **721** that does not elastically deform may be employed. Even though the apparatus

side terminal group **721** does not elastically deform, the apparatus side terminal group **721** moves slightly in the +Z axis direction after coming into contact with the cartridge side terminal group **521** when being inserted into the concave portion **90**, and thus there is a possibility of the above-mentioned wiping effect being obtained.

C-3. Third Modified Example

In addition, the cartridge may be configured by the following embodiment.

First Embodiment

A cartridge detachably mounted to a printing apparatus which includes a cartridge mounting unit for mounting a cartridge, an apparatus side terminal unit that has a surface tilted with respect to an insertion direction when the cartridge is mounted and an apparatus side terminal having a contact point exposed from the surface, is disposed inside the cartridge mounting unit, is the apparatus side being mounted to be movable in a direction orthogonal to the insertion direction with respect to the cartridge mounting unit, the cartridge including:

a case which has an approximately rectangular parallelepiped shape that accommodates a printing material therein and has a concave portion at a part where two surfaces from among a plurality of surfaces constituting the case intersect each other; and

a cartridge side terminal which comes into contact with the contact point of the apparatus side terminal in a mounted state in which the cartridge is mounted to the cartridge mounting unit and is provided on a tilted surface that is tilted with respect to the insertion direction from among surfaces that partition and form the concave portion,

wherein the concave portion is a restriction portion into which a part of the apparatus side terminal unit is inserted to restrict a movement of the apparatus side terminal unit, and into which the part of the apparatus side terminal unit is inserted before starting a contact between the cartridge side terminal and the apparatus side terminal.

Even in the cartridge of the first embodiment, the same effect as that of Application Example 1 is exhibited.

In addition, the first embodiment may employ the configurations described in any one of Application Examples 1 to 8. For example, as in Application Example 2, the restriction portion (first and second restriction portions) may include contact surfaces with which parts (first and second positioning portions) of the apparatus side terminal unit come into contact, and the contact surfaces may include a +Z axis direction side contact surface that comes into contact with a +Z axis direction side end portion of the parts of the apparatus side terminal unit, and a −Z axis direction side contact surface that comes into contact with a −Z axis direction side end portion of the parts of the apparatus side terminal unit.

In addition, for example, as in Application Example 3, the restriction portion (first and second restriction portions) may include an entrance part and a contact part.

C-4. Fourth Modified Example

The invention is not limited to the ink jet printer and the ink cartridges thereof, and can also be applied to arbitrary printing apparatuses that eject liquids other than ink and cartridges thereof. For example, the invention is able to be applied to various printing apparatuses and cartridges thereof as follows:

(1) Image recording apparatuses such as fax devices

(2) Printing apparatuses that eject color materials to be used for manufacturing color filters for image display devices such as liquid crystal displays

(3) Printing apparatuses that eject electrode materials to be used for forming electrodes of organic EL (electroluminescence) displays, field emission displays (FED), and the like

(4) Printing apparatuses that eject liquid containing biological organic materials used for manufacturing biochips

(5) Specimen printing apparatuses as precision pipettes

(6) Printing apparatuses of lubricating oil

(7) Printing apparatuses of resin liquids

(8) Printing apparatuses that eject lubricating oil to precision machinery such as watches or cameras with pinpoint precision

(9) Printing apparatuses that eject transparent resin liquids such as ultraviolet curable resin liquids onto substrates to form micro-hemispherical lenses (optical lenses) or the like used for optical communication elements or the like

(10) Printing apparatuses that eject acidic or alkaline etchants for etching substrates or the like

(11) Printing apparatuses including liquid ejecting heads that discharge a minute amount of other arbitrary liquid droplets

In addition, the "liquid droplets" represent liquid states discharged from the printing apparatus, the liquid states including granular, tear-like, and thread-like shapes with trails. The "liquid" mentioned herein may be any material that can be ejected by the printing apparatus. For example, the "liquid" may be a material in a state where the material has a liquid phase, and liquid-state materials with high or low viscosities, sol, gel water, liquid-state materials such as inorganic solvents, organic solvents, solutions, liquid resin, and liquid metal (metallic melt), and the like belong to the "liquid". In addition to liquids as a state of a material, a material in which particles of functional materials made of solids such as pigments or metallic particles are dissolved, dispersed, or mixed with the solvent also belongs to the "liquid". As a representative example of the liquid, there is the ink described above in the embodiment or liquid crystals. Here, the ink may include various kinds of liquid-like compositions such as general water-based ink, oil-based ink, gel ink, and hot-melt ink.

What is claimed is:

1. A case mountable to a mounting unit of a printing apparatus, the mounting unit comprising a printing material supply tube, an apparatus side terminal, a rail extending in a mounting direction, which is the direction in which the case is mounted to the mounting unit, the rail arranged to guide the case in the mounting direction to a mounting position, and a locking member configured to lock the case in place at the mounting position,

the case comprising:

a case side terminal configured to come in contact with the apparatus side terminal in a mounted state in which the case is mounted to the printing apparatus; and

a convex portion extending in the mounting direction, the convex portion configured to have a first part and a second part which are to be inserted in the rail, wherein the locking member is inserted between the first part and the second part in the mounted state.

2. The case according to claim 1,
wherein there are a plurality of the apparatus side terminals,
in the mounted state, the case comprising:
a front surface provided with a supply tube insertion hole configured and adapted to receive insertion of the printing material supply tube;
a rear surface arranged to face opposite the front surface;
a first side surface arranged to form an upper surface;
a second side surface arranged to face opposite the upper surface;
a third side surface arranged to intersect with the front surface, the rear surface, the first side surface and the second side surface; and
a fourth side surface arranged to face opposite the third side surface, wherein
assuming that a Y axis direction is along a direction from the front surface toward the rear surface, a Z axis direction is along a direction from the second side surface toward the first side surface, and an X axis is along a direction from the fourth side surface toward the third side surface,
a center in the X axis direction of the convex portion is arranged to pass through a case side terminal that comes into contact with the apparatus side terminal provided in a central part in the X axis direction of the apparatus side terminals and pass through a YZ plane that is a plane parallel to the Y axis direction and the Z axis direction.

3. The case according to claim 2,
wherein a center in the X axis direction of a locking portion formed between the first part and the second part is arranged to pass through the YZ plane.

4. The case according to claim 2,
wherein the YZ plane is arranged to intersect with the locking member.

5. The case according to claim 2,
wherein the convex portion is formed on the first side surface and on the second side surface.

6. The case according to claim 2,
wherein a dimension in the X axis direction of a first convex portion that is the convex portion formed on the first side surface is different from a dimension in the X axis direction of a second convex portion that is the convex portion formed on the second side surface.

7. A cartridge mountable to a mounting unit of a printing apparatus, the mounting unit comprising a printing material supply tube, an apparatus side terminal, a rail arranged to guide the cartridge to a mounting position and a locking member configured to lock the cartridge at the mounting position,
in the mounted state, the cartridge comprising:
a front surface provided with a supply tube insertion hole configured and adapted to receive insertion of the printing material supply tube in a mounted state;
a rear surface arranged to face opposite the front surface;
a first side surface arranged to form an upper surface;
a second side surface arranged to face opposite the first side surface;
a third side surface arranged to intersect with the front surface, the rear surface, the first side surface and the second side surface;
a cartridge side terminal configured to come in contact with the apparatus side terminal in a mounted state that the cartridge is mounted to the printing apparatus; and
a convex portion that is configured to have a first part and a second part which are to be inserted in the rail, wherein
the locking member is inserted between the first part and the second part in the mounted state.

8. The cartridge according to claim 7,
wherein there are a plurality of the apparatus side terminals,
in the mounted state, the cartridge comprising:
a fourth side surface arranged to face opposite the third side surface, wherein
assuming that a Y axis direction is along a direction from the front surface toward the rear surface, a Z axis direction is along a direction from the second side surface toward the first side surface, and an X axis is along a direction from the fourth side surface toward the third side surface,
a center in the X axis direction of the convex portion is arranged to pass through a cartridge side terminal that comes into contact with the apparatus side terminal provided in a central part in the X axis direction of the apparatus side terminals and pass through a YZ plane that is a plane parallel to the Y axis direction and the Z axis direction.

9. The cartridge according to claim 8,
wherein a center in the X axis direction of a locking portion formed between the first part and the second part is arranged to pass through the YZ plane.

10. The cartridge according to claim 8,
wherein the YZ plane is arranged to intersect with the locking member.

11. The cartridge according to claim 8,
wherein the convex portion is formed on the first side surface and on the second side surface.

12. The cartridge according to claim 8,
wherein a dimension in the X axis direction of a first convex portion that is the convex portion formed on the first side surface is different from a dimension in the X axis direction of a second convex portion that is the convex portion formed on the second side surface.

13. The case according to claim 1, wherein,
the first part and the second part are located on a virtual plane extending along the mounting direction.

14. The case according to claim 1, wherein,
the case side terminal is located closer to a tip end side than to the convex portion.

15. The case according to claim 1, wherein,
in the mounting direction, the first part is located closer to a tip end side than to the second part; and
in the mounting direction, the first part is shorter than the second part.

16. The case according to claim one, wherein,
when the locking member is inserted between the first part and the second part, the case is locked in place by the locking member and thereby, movement of the case in a removal direction, opposite to the mounting direction, is restricted.

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