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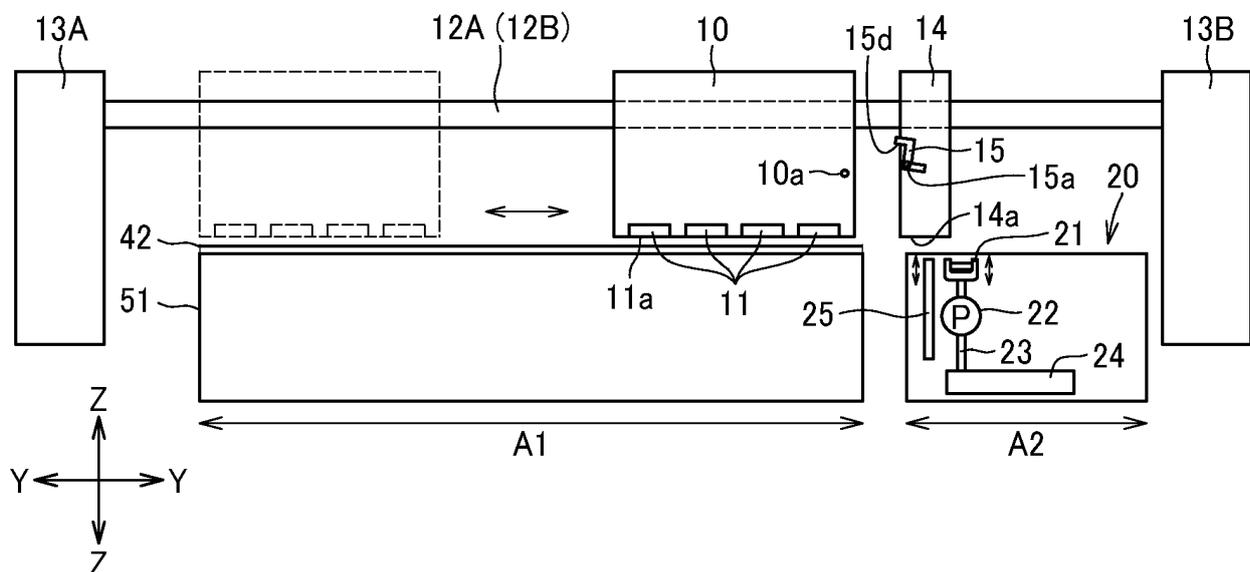
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(54) **LIQUID DISCHARGE APPARATUS**

(57) A liquid discharge apparatus (100) includes a liquid discharge head (11), a carriage (10), a cap (21), a cover (14), and a support (12A, 12B). The liquid discharge head (11) has a discharge face (11a) and discharges a liquid from the discharge face (11a) to perform a liquid discharge operation. The carriage (10) mounts the liquid discharge head (11) and is movable in main scanning directions. The cap (21) covers the discharge

face (11a) of the liquid discharge head (11). The cover (14) covers the cap (21). The cover (14) is decouplable from and couplable to the carriage (10), and movable in the main scanning directions. The support (12A, 12B) extends in the main scanning directions and supports the carriage (10) and the cover (14) movable in the main scanning directions.

**FIG. 2A**



**Description**

## BACKGROUND

## Technical Field

**[0001]** Embodiments of the present disclosure relate to a liquid discharge apparatus.

## Related Art

**[0002]** In the related art, a liquid discharge apparatus includes a cap that covers a discharge face of a liquid discharge head. The cap sucks liquid from nozzles of the liquid discharge head and keeps moisture in the nozzles at times other than a liquid discharge operation. However, depending on the type of liquid, the liquid may be fixed (adhered) and deposited in the cap due to properties such as high viscosity, low solubility, and fast drying.

**[0003]** In Japanese Unexamined Patent Application Publication No. 2002-316421, the liquid discharge apparatus includes a cover that covers and protects the cap during a printing operation. The cover is moved by a driving force of a motor for bringing the cap into contact with and separating the cap from the discharge face of the liquid discharge head. Thus, the cover reciprocally moves between a position for protecting the cap and a position retracted from the cap. The cover covers the cap when the cap does not cover the discharge face to prevent liquid from being fixed or deposited in the cap. In Japanese Unexamined Patent Application Publication No. 2002-316421, the liquid discharge apparatus includes a mechanism for transmitting the driving force of the motor for driving the cap to the cap, and thus the configuration of the apparatus may become complicated.

## SUMMARY

**[0004]** The present disclosure has an object to provide a liquid discharge apparatus in which a cover is movable between a position where the cover covers the cap and a position where the cover is retracted from the cap with a simple configuration.

**[0005]** Embodiments of the present disclosure describe an improved liquid discharge apparatus that includes a liquid discharge head, a carriage, a cap, a cover, and a support. The liquid discharge head has a discharge face and discharges a liquid from the discharge face to perform a liquid discharge operation. The carriage mounts the liquid discharge head and is movable in main scanning directions. The cap covers the discharge face of the liquid discharge head. The cover covers the cap. The cover is decouplable from and couplable to the carriage, and movable in the main scanning directions. The support extends in the main scanning directions and supports the carriage and the cover movable in the main scanning directions.

**[0006]** As a result, according to one aspect of the

present disclosure, the cover is movable between the position where the cover covers the cap and the position where the cover is retracted from the cap with a simple configuration.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

**[0007]** A more complete appreciation of the disclosure and many of the attendant advantages and features thereof can be readily obtained and understood from the following detailed description with reference to the accompanying drawings, wherein:

- FIG. 1 is a schematic view of a liquid discharge apparatus according to an embodiment of the present disclosure;
- FIGS. 2A and 2B are side views of a liquid discharge apparatus according to an embodiment of the present disclosure;
- FIGS. 3A and 3B are perspective views of a claw according to an embodiment of the present disclosure;
- FIG. 4 is a side view of the liquid discharge apparatus of FIGS. 2A and 2B, illustrating a series of operations of an auxiliary carriage in a maintenance mode;
- FIG. 5 is a side view of the liquid discharge apparatus of FIGS. 2A and 2B, illustrating the series of operations of the auxiliary carriage in the maintenance mode;
- FIG. 6 is a side view of the liquid discharge apparatus of FIGS. 2A and 2B, illustrating the series of operations of the auxiliary carriage in the maintenance mode;
- FIG. 7 is a side view of the liquid discharge apparatus of FIGS. 2A and 2B, illustrating the series of operations of the auxiliary carriage in the maintenance mode;
- FIG. 8 is a side view of the liquid discharge apparatus of FIGS. 2A and 2B, illustrating the series of operations of the auxiliary carriage in the maintenance mode;
- FIG. 9 is a side view of the liquid discharge apparatus of FIGS. 2A and 2B, illustrating the series of operations of the auxiliary carriage in the maintenance mode;
- FIG. 10 is a side view of the liquid discharge apparatus of FIGS. 2A and 2B, illustrating the series of operations of the auxiliary carriage in the maintenance mode;
- FIGS. 11A to 11C are diagrams of the claw of FIGS. 3A and 3B, which is rotated counterclockwise by a first pin;
- FIGS. 12A to 12D are diagrams of the claw of FIGS. 3A and 3B, which is rotated clockwise by a second pin; and
- FIG. 13 is a diagram of an auxiliary carriage for supplying a cleaning liquid, according to an embodi-

ment of the present disclosure.

**[0008]** The accompanying drawings are intended to depict embodiments of the present invention and should not be interpreted to limit the scope thereof. The accompanying drawings are not to be considered as drawn to scale unless explicitly noted. Also, identical or similar reference numerals designate identical or similar components throughout the several views.

#### DETAILED DESCRIPTION

**[0009]** In describing embodiments illustrated in the drawings, specific terminology is employed for the sake of clarity. However, the disclosure of this specification is not intended to be limited to the specific terminology so selected and it is to be understood that each specific element includes all technical equivalents that have a similar function, operate in a similar manner, and achieve a similar result.

**[0010]** Referring now to the drawings, embodiments of the present disclosure are described below. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

**[0011]** Embodiments of the present disclosure are described below with reference to the drawings. In the drawings, like reference signs denote like elements, and overlapping description may be simplified or omitted as appropriate.

**[0012]** FIG. 1 illustrates an overall configuration of an inkjet recording apparatus according to an embodiment of the present disclosure. In the following description, a serial type inkjet recording apparatus that discharges ink as a liquid will be described as an example of a liquid discharge apparatus according to an embodiment of the present disclosure. In FIG. 1, a direction X is a sub-scanning direction, and a direction Y is a main scanning direction. The directions X, Y, and Z are orthogonal to each other.

**[0013]** As illustrated in FIG. 1, an inkjet recording apparatus 100 includes a carriage 10 in the upper portion thereof. The carriage 10 includes liquid discharge heads 11 that discharge ink droplets of colors of yellow (Y), cyan (C), magenta (M), and black (K).

**[0014]** The carriage 10 includes a head tank 35 that supplies inks of the respective colors to the corresponding nozzle rows of the liquid discharge heads 11. The inks of the respective colors are supplied from ink cartridges of the respective colors to the head tank 35 via supply tubes of the respective colors.

**[0015]** A sheet feeding unit is disposed above a sheet stacking portion (pressure plate) 41 of a sheet feeding tray 2. The sheet feeding unit feeds a sheet 42 as a recording medium stacked on the sheet stacking portion 41 toward a sheet guide 45. The sheet feeding unit includes a sheet feeding roller (semicircular roller) 43 and a separation pad 44. The sheet feeding roller (semi-

circular roller) 43 separates and feeds sheets 42 one by one from the sheet stacking portion 41. The separation pad 44 faces the sheet feeding roller 43 and is made of a material having a large friction coefficient. The separation pad 44 is pressed against the sheet feeding roller 43.

**[0016]** The inkjet recording apparatus 100 includes the sheet guide 45, a counter roller 46, a conveyance guide 47, a pressing member 48, a conveyance belt 51, and a charging roller 56. The sheet guide 45 feeds the sheet 42 fed from the sheet feeding unit under the liquid discharge head 11. The conveyance belt 51 electrostatically attracts the fed sheet 42 and conveys the sheet 42 to a position facing the liquid discharge head 11. The conveyance belt 51 is an endless belt looped around a conveyance roller 52 and a tension roller 53. The charging roller 56 charges the surface of the conveyance belt 51. The charging roller 56 contacts a surface layer of the conveyance belt 51 and rotates along with the rotation of the conveyance roller 52. The conveyance roller 52 is rotationally driven by a sub-scanning motor via a timing belt, so that the conveyance belt 51 is rotated in a belt conveyance direction (the sub-scanning direction).

**[0017]** The inkjet recording apparatus 100 also includes a sheet ejection unit that ejects the sheet 42 on which an object has been recorded by the liquid discharge head 11. The sheet ejection unit includes a separation claw 61, sheet ejection rollers 62 and 63, and a sheet ejection tray 3. The separation claw 61 separates the sheet 42 from the conveyance belt 51. The sheet ejection tray 3 is disposed below the sheet ejection roller 62.

**[0018]** A duplex unit 71 is detachably attached to the rear portion of the inkjet recording apparatus 100. As the conveyance belt 51 rotates in the reverse direction to convey the sheet 42 backward, the duplex unit 71 takes in the sheet 42 conveyed backward. Then, the duplex unit 71 reverses the sheet 42 and feeds the sheet 42 again to the nip between the counter roller 46 and the conveyance belt 51. A manual sheet feeding tray 72 is disposed on the upper face of the duplex unit 71.

**[0019]** The liquid discharge head 11 is driven in response to an image signal while the carriage 10 moves to perform a printing operation. The liquid discharge head 11 discharges droplets of ink to record an object such as characters or an image corresponding to one line on the sheet 42 not in motion. After the sheet 42 is conveyed by a predetermined amount, the liquid discharge head 11 records the object corresponding to the next line. When the inkjet recording apparatus 100 receives a recording end signal or detects the arrival of the trailing end of the sheet 42 at the recording area, the printing operation is finished and the sheet 42 is ejected to the sheet ejection tray 3.

**[0020]** FIGS. 2A and 2B are side views of a part of the inkjet recording apparatus 100.

**[0021]** As illustrated in FIGS. 2A and 2B, guide rods 12A and 12B as a pair of supports are laterally stretched between left and right side plates 13A and 13B. The guide

rods 12A and 12B extend in the main scanning direction. The side plates 13A and 13B serve as a part of a housing of the inkjet recording apparatus 100. The support may be a guide rail.

**[0022]** The carriage 10 and an auxiliary carriage 14 serving as a cover are supported by the guide rods 12A and 12B. The carriage 10 is movable in the main scanning direction along the guide rods 12A and 12B by a main scanning drive motor. The auxiliary carriage 14 moves in the main scanning direction along the guide rods 12A and 12B when the carriage 10 pushes the auxiliary carriage 14 or the carriage 10 coupled to the auxiliary carriage 14 moves (details will be described later).

**[0023]** Each of the liquid discharge heads 11 mounted on the carriage 10 has a nozzle row in which multiple nozzles are arrayed in the sub-scanning direction. The liquid discharge head 11 has a discharge face 11a on which ends of the nozzles are arranged. Ink is discharged downward in FIG. 2A from the ends of the nozzles on the discharge face 11a.

**[0024]** A printing area A1 as a liquid discharge region and a maintenance area A2 are arranged in the main scanning direction. The liquid discharge head 11 discharges liquid to the sheet 42 conveyed in the printing area A1 to perform the printing operation on the sheet 42. The maintenance area A2 is disposed on one side of the printing area A1 in the main scanning direction.

**[0025]** The maintenance unit 20 and the auxiliary carriage 14 are disposed in the maintenance area A2. The maintenance unit 20 includes a cap 21, a suction pump 22, a waste liquid tube 23, a waste liquid tank 24, and a wiper 25 as a wiping member.

**[0026]** The cap 21 covers the discharge face 11a of each liquid discharge head 11 as illustrated in FIG. 2B to prevent evaporation of moisture in the ink in the liquid discharge head 11 during a non-liquid discharge operation such as a maintenance mode. The cap 21 is movable in the vertical direction in FIG. 2B to approach and separate from the discharge face 11a. The cap 21 is connected to the suction pump 22 via a flexible waste liquid tube 23. The waste liquid tube 23 is connected to the waste liquid tank 24 on the side opposite to the side connected to the cap 21. The suction pump 22 performs a suction operation with the discharge face 11a covered by the cap 21 to drain ink adhering to the discharge face 11a or the inside of the nozzles to the waste liquid tank 24. Thus, the cap 21 according to the present embodiment has functions to retain moisture inside the liquid discharge head 11 and suck the remaining ink. However, the cap 21 may have only a function to cover the discharge face 11a to retain moisture.

**[0027]** The wiper 25 wipes the discharge face 11a to remove, for example, ink adhering to the discharge face 11a. The wiper 25 is movable in the vertical direction in FIG. 2A.

**[0028]** The auxiliary carriage 14 has a cover face 14a. The cover face 14a according to the present embodiment

is flat. The cover face 14a contacts the side of the cap 21 that covers the discharge face 11a, to seal the cap 21. The cover face 14a is not limited to being flat as long as the cover face 14a can seal the cap 21, and other shapes such as a recessed shape can be appropriately adopted.

**[0029]** The auxiliary carriage 14 includes a claw 15 as an engagement part. As illustrated in FIGS. 3A and 3B, the claw 15 is rotatable about a support shaft 15a (i.e., an axis). The claw 15 includes a first projection 15b and a second projection 15c that project in the sub-scanning direction (from the surface of the paper on which FIGS. 2A and 2B are drawn toward the back). As illustrated in FIGS. 2A and 2B, one side 15d of the claw 15 is an engaging portion that engages with an engaged portion 10a of the carriage 10.

**[0030]** A description will be given below of a procedure in which the cover face 14a of the auxiliary carriage 14 is switched between a state of covering the cap 21 and a state of retracting the auxiliary carriage 14 from the cap 21 in the maintenance mode with reference to FIGS. 4 to 12D.

**[0031]** As illustrated in FIG. 4, the carriage 10 is positioned in the printing area A1 during the printing operation (liquid discharge operation). The cap 21 moves upward and contacts the cover face 14a of the auxiliary carriage 14 positioned above the cap 21. As a result, the cap 21 is sealed by the cover face 14a. Accordingly, the inside of the cap 21 can be prevented from being opened to the outside air, and thus can be prevented from drying. The cap 21 is positioned at the top of the movable range thereof.

**[0032]** When the printing operation is interrupted or finished and the maintenance operation is started, the cap 21 moves downward and retracts from the cover face 14a as illustrated in FIG. 5. Thus, the sealed state of the cap 21 is released.

**[0033]** Subsequently, as illustrated in FIG. 6, the carriage 10 moves from the printing area A1 to the maintenance area A2 and contacts the auxiliary carriage 14 at a contact position.

**[0034]** In this state, the auxiliary carriage 14 is not coupled to the carriage 10. From this state, when a driving force for moving the carriage 10 in the direction indicated by arrow B1 in FIG. 6 is applied to the carriage 10, the carriage 10 pushes the auxiliary carriage 14. Thus, the carriage 10 moves in the direction indicated by arrow B1 together with the auxiliary carriage 14. As a result, the auxiliary carriage 14 moves from the position facing the cap 21 (i.e., a cap position).

**[0035]** When the auxiliary carriage 14 moves in the direction indicated by arrow B1 in FIG. 6, the first projection 15b (see FIG. 3B) of the claw 15 contacts a first pin 101 (see FIGS. 11A to 11C) attached to, for example, the housing of the inkjet recording apparatus 100. As a result, from the state illustrated in FIG. 6 to the state illustrated in FIG. 7, the claw 15 rotates counterclockwise in FIG. 6, and the one side 15d of the claw 15 engages with the engaged portion 10a of the carriage 10 as illustrated in

FIG. 7. Specifically, as illustrated in FIG. 11A, when the claw 15 moves in the direction indicated by arrow B 1 along with the movement of the auxiliary carriage 14, the first projection 15b of the claw 15 contacts the first pin 101 as illustrated in FIG. 11B, and force is applied to the first projection 15b. As a result, the claw 15 rotates in the direction indicated by arrow B2 in FIG. 11B about the support shaft 15a, and the one side 15d of the claw 15 engages with the engaged portion 10a as illustrated in FIG. 11C (i.e., an engaged position). As a result, the auxiliary carriage 14 is coupled to the carriage 10 at a coupling position as illustrated in FIG. 7.

**[0036]** With the auxiliary carriage 14 coupled to the carriage 10, the carriage 10 changes the movement direction thereof and moves in the direction indicated by arrow B3 as illustrated in FIG. 8. The auxiliary carriage 14 moves in the direction indicated by arrow B3 following the carriage 10. At this time, if the wiper 25 is moved upward, the wiper 25 can wipe the cover face 14a of the auxiliary carriage 14. When the cover face 14a seals the cap 21, ink adhering to the cap 21 is adhered to the cover face 14a. The wiper 25 can wipe off the ink adhering to the cover face 14a. When the carriage 10 is positioned in the maintenance area A2, the cap 21 covers the discharge face 11a of each liquid discharge head 11 to perform the suction operation by the suction pump 22, or a wiping operation of the discharge face 11a of each liquid discharge head 11 is performed by the wiper 25 at a wiper position.

**[0037]** When the carriage 10 and the auxiliary carriage 14 further move in the direction indicated by arrow B3, the second projection 15c (see FIG. 3B) of the claw 15 contacts a second pin 102 (see FIGS. 12A to 12D) attached to, for example, the housing of the inkjet recording apparatus 100. As a result, from the state illustrated in FIG. 8 to the state illustrated in FIG. 9, the claw 15 rotates clockwise in FIG. 8, and the claw 15 disengages from the engaged portion 10a of the carriage 10 as illustrated in FIG. 9. Specifically, as illustrated in FIG. 12A, when the claw 15 moves in the direction indicated by arrow B3 along with the movement of the auxiliary carriage 14, the second projection 15c of the claw 15 contacts the second pin 102 as illustrated in FIG. 12B, and force is applied to the second projection 15c. As a result, the claw 15 rotates in the direction indicated by arrow B4 in FIG. 12C about the support shaft 15a as illustrated in FIG. 12C, and the claw 15 disengages from the engaged portion 10a as illustrated in FIG. 12D (i.e., a disengaged position). As a result, the auxiliary carriage 14 is decoupled from the carriage 10 as illustrated in FIG. 9.

**[0038]** From this state, as illustrated in FIG. 10, the carriage 10 moves in the direction indicated by arrow B1 and pushes the auxiliary carriage 14 to move the auxiliary carriage 14 to the position facing the cap 21 again. Subsequently, the carriage 10 moves to the left in FIG. 10, and only the carriage 10 moves to the printing area A1. The cap 21 is moved upward and is covered by the cover face 14a of the auxiliary carriage 14 to return to the

state illustrated in FIG. 4 again. Each component such as the carriage 10 is operated as described above in the maintenance mode.

**[0039]** As described above, in the present embodiment, the auxiliary carriage 14 having the cover face 14a can reciprocally move between the position where the cover face 14a covers the cap 21 and the position where the cover face 14a is retracted from above the cap 21 without a dedicated driving source. In the present embodiment, the auxiliary carriage 14 is supported by the guide rods 12A and 12B, and can be coupled to and decoupled from the carriage 10. Thus, as the carriage 10 pushes the auxiliary carriage 14, the auxiliary carriage 14 can move along the guide rods 12A and 12B in the direction indicated by arrow B1 in FIG. 5. The auxiliary carriage 14 can move in the direction indicated by arrow B3 in FIG. 8 following the carriage 10 to which the auxiliary carriage 14 is coupled. Accordingly, to cover the cap 21 by the cover face 14a of the auxiliary carriage 14, the auxiliary carriage 14 moves to the position facing the cap 21 (see FIG. 4). During the maintenance operation of each liquid discharge head 11 by the maintenance unit 20, the auxiliary carriage 14 moves to the position retracted from the cap 21 (see FIG. 7), and the cap 21 covers the discharge face 11a of the liquid discharge head 11.

**[0040]** As described above, the auxiliary carriage 14 can be moved without a dedicated driving source, and the structure of the liquid discharge apparatus can be simplified. The auxiliary carriage 14 coupled to the carriage 10 is movable to the left in FIG. 8. Accordingly, the auxiliary carriage 14 can be moved to the position facing the wiper 25, and the wiping operation of the cover face 14a of the auxiliary carriage 14 can be performed by the wiper 25. As described above, the auxiliary carriage 14 is not coupled to a dedicated drive mechanism and is supported by the guide rods 12A and 12B. Accordingly, the auxiliary carriage 14 can be easily attached and detached, and the structure of the liquid discharge apparatus can be simplified.

**[0041]** The auxiliary carriage 14 is decoupled from the carriage 10 at a decoupling position, i.e., at least at the position where the auxiliary carriage 14 faces the cap 21 (the position illustrated in FIG. 4) or at a position on the left from the cap 21 in FIG. 2A in the main scanning direction (i.e., between the cap position and the liquid discharge region). Accordingly, the auxiliary carriage 14 remains at the position where the auxiliary carriage 14 is decoupled from the carriage 10, or the auxiliary carriage 14 is pushed by the carriage 10 to the right in FIG. 2A in the main scanning direction after the decoupling to position the auxiliary carriage 14 at the position facing the cap 21 again as illustrated in FIG. 4. The auxiliary carriage 14 is coupled to the carriage 10 at any position where the carriage 10 is in contact with the auxiliary carriage 14 on the right from the decoupling position in FIG. 2A in the main scanning direction. Thus, the auxiliary carriage 14 can be coupled to the carriage 10 and moved together

with the carriage 10 within a desired range in the main scanning direction.

**[0042]** As illustrated in FIG. 13, the auxiliary carriage 14 may have a cleaning nozzle 16 as a cleaning liquid supplier. The cleaning nozzle 16 is connected to, for example, a cleaning liquid tank that stores a cleaning liquid. The auxiliary carriage 14 has an end of the cleaning nozzle 16 on the cover face 14a and supplies the cleaning liquid to the cap 21 from the cleaning nozzle 16. Thus, the cap 21 can be cleaned.

**[0043]** The above-described embodiments are illustrative and do not limit the present disclosure. Numerous additional modifications and variations are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims.

**[0044]** In the present disclosure, the liquid to be discharged is not limited to a particular liquid as long as the liquid has a viscosity or surface tension to be discharged from a head (liquid discharge head). However, preferably, the viscosity of the liquid is not greater than 30 millipascal-second (mPa·s) under ordinary temperature and ordinary pressure or by heating or cooling. Examples of the material to be discharged include a solution, a suspension, or an emulsion including, for example, a solvent, such as water or an organic solvent; a colorant, such as dye or pigment; a functional material, such as a polymerizable compound, a resin, or a surfactant; a biocompatible material, such as deoxyribonucleic acid (DNA), amino acid, protein, or calcium; and an edible material, such as a natural colorant. Such a solution, a suspension, or an emulsion can be used for, e.g., inkjet ink; surface treatment liquid; a liquid for forming an electronic element component, a light-emitting element component, or an electronic circuit resist pattern; or a material solution for three-dimensional fabrication.

**[0045]** The term "liquid" includes not only ink but also paint, a pretreatment liquid, a binder, and an overcoat liquid.

**[0046]** In the present disclosure, the term "liquid discharge apparatus" includes a carriage including a liquid discharge head and drives the liquid discharge head to discharge liquid. The term "liquid discharge apparatus" used herein includes, in addition to apparatuses to discharge liquid to a recording medium serving as a medium onto which liquid can adhere, apparatuses to discharge liquid into gas (air) or different liquid.

**[0047]** For example, the "liquid discharge apparatus" may further include devices relating to feeding, conveying, and ejecting of the medium onto which liquid can adhere and also include a pretreatment device and an aftertreatment device.

**[0048]** The "liquid discharge apparatus" may be, for example, an image forming apparatus to form an image on a sheet by discharging ink, or a three-dimensional fabrication apparatus to discharge fabrication liquid to a powder layer in which powder material is formed in layers to form a three-dimensional object.

**[0049]** The "liquid discharge apparatus" is not limited to

an apparatus that discharges liquid to visualize meaningful images such as letters or figures. For example, the liquid discharge apparatus may be an apparatus that forms patterns having no meaning or an apparatus that fabricates three-dimensional images.

**[0050]** The above-described term "medium onto which liquid can adhere" represents a medium on which liquid is at least temporarily adhered, a medium on which liquid is adhered and fixed, or a medium into which liquid adheres and permeates. Specific examples of the "medium onto which liquid can adhere" include, but are not limited to, a recording medium such as a paper sheet, recording paper, a recording sheet of paper, a film, or cloth, an electronic component such as an electronic substrate or a piezoelectric element, and a medium such as layered powder, an organ model, or a testing cell. The "medium onto which liquid can adhere" includes any medium to which liquid adheres, unless otherwise specified.

**[0051]** Examples of materials of the "medium onto which liquid can adhere" include any materials to which liquid can adhere even temporarily, such as paper, thread, fiber, fabric, leather, metal, plastic, glass, wood, and ceramic.

**[0052]** Examples of the liquid discharge apparatus further include: a treatment liquid applying apparatus that discharges a treatment liquid onto a sheet to apply the treatment liquid to the surface of the sheet, for reforming the surface of the sheet; and an injection granulation apparatus that injects a composition liquid, in which a raw material is dispersed in a solution, through a nozzle to granulate fine particle of the raw material.

**[0053]** The terms "image formation," "recording," "printing," "image printing," and "fabricating" used herein may be used synonymously with each other.

**[0054]** Aspects of the present disclosure are, for example, as follows.

#### Aspect 1

**[0055]** A liquid discharge apparatus includes a carriage including a liquid discharge head, a support extending in a main scanning direction and supporting the carriage movably in the main scanning direction, a cap to cover a discharge face of the liquid discharge head, and a cover to cover the cap. The cover is supported movably in the main scanning direction by the support. The cover can be coupled to and decoupled from the carriage.

**[0056]** In other words, a liquid discharge apparatus includes a liquid discharge head, a carriage, a cap, a cover, and a support. The liquid discharge head has a discharge face and discharges a liquid from the discharge face to perform a liquid discharge operation. The carriage mounts the liquid discharge head and is movable in main scanning directions. The cap covers the discharge face of the liquid discharge head. The cover covers the cap. The cover is decouplable from and couplable to the carriage, and movable in the main scanning directions. The support extends in the main scanning

directions and supports the carriage and the cover movable in the main scanning directions.

#### Aspect 2

**[0057]** In the liquid discharge apparatus according to Aspect 1, the cover covers the cap during a liquid discharge operation by the liquid discharge head.

**[0058]** In other words, the cover covers the cap in the liquid discharge operation.

#### Aspect 3

**[0059]** In the liquid discharge apparatus according to Aspect 1 or 2, the cover is moved to one side in the main scanning direction by being pushed by the carriage and moved to the other side in the main scanning direction by the carriage being moved to the other side in the main scanning direction with the cover coupled to the carriage.

**[0060]** In other words, the carriage moves in a first direction of the main scanning directions to push and move the cover in the first direction, and the carriage moves in a second direction opposite to the first direction to move the cover coupled to the carriage in the second direction.

#### Aspect 4

**[0061]** In the liquid discharge apparatus according to Aspect 3, a region in which the liquid discharge head discharges a liquid onto a recording medium is a liquid discharge region.

**[0062]** The cap is disposed outside the liquid discharge region. The cover is decoupled from the carriage at a position where the cover faces the cap or at a position closer to the liquid discharge region than the position.

**[0063]** In other words, the liquid discharge head discharges the liquid onto a medium in a liquid discharge region. The cap is at a cap position outside the liquid discharge region. The cover is decoupled from the carriage at a decoupling position between the cap position and the liquid discharge region. The cover faces the cap at the cap position.

#### Aspect 5

**[0064]** In the liquid discharge apparatus according to Aspect 4, the carriage moves from the liquid discharge region toward the cover, and the carriage and the cover are coupled to each other at a position on the one side in the main scanning direction from a position where the carriage contacts the cover and on the one side in the main scanning direction from a position where the cover is decoupled from the carriage.

**[0065]** In other words, the carriage moves from the liquid discharge region toward the cover in the first direction and contacts the cover at a contact position. The cover is coupled to the carriage at a coupling position

farther from the liquid discharge region than the contact position and the decoupling position in the first direction.

#### Aspect 6

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**[0066]** The liquid discharge apparatus according to any one of Aspects 1 to 5, further includes a wiper to wipe the discharge face. The cover moves to a position facing the wiper and is wiped by the wiper.

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**[0067]** In other words, the liquid discharge apparatus according to any one of Aspects 1 to 5, further includes a wiper to wipe the discharge face at a wiper position. The wiper wipes the cover moved to the wiper position.

15 Aspect 7

**[0068]** In the liquid discharge apparatus according to any one of Aspects 1 to 6, the cover includes an engagement part that is rotatable. The carriage has a portion to be engaged. An engaging portion of the engagement part engages with the portion to be engaged by rotation of the engagement part, and the cover is coupled to the carriage.

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**[0069]** In other words, the cover includes an engagement part having an engaging portion and an axis around which the engagement part is rotatable between an engaged position and a disengaged position. The carriage has an engaged portion engageable with the engagement part of the cover. The engaging portion of the cover rotated toward the engaged position engages with the engaged portion of the carriage to couple the cover to the carriage.

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#### Aspect 8

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**[0070]** The liquid discharge apparatus according to any one of Aspects 1 to 7, the cover includes a cleaning liquid supplier.

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**[0071]** In other words, the cover includes a cleaning liquid supplier to supply a cleaning liquid to the cap.

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### Claims

45 1. A liquid discharge apparatus (100) comprising:

a liquid discharge head (11) having a discharge face (11a) to discharge a liquid from the discharge face (11a) to perform a liquid discharge operation;

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a carriage (10) mounting the liquid discharge head (11), the carriage (10) movable in main scanning directions;

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a cap (21) to cover the discharge face (11a) of the liquid discharge head (11);

a cover (14) to cover the cap (21), the cover (14) decouplable from and couplable to the carriage (10), and movable in the main scanning direc-

- tions; and  
 a support (12A, 12B) extending in the main scanning directions and supporting the carriage (10) and the cover (14) movable in the main scanning directions.
2. The liquid discharge apparatus (100) according to claim 1,  
 wherein the cover (14) covers the cap (21) in the liquid discharge operation.
3. The liquid discharge apparatus (100) according to claim 1 or 2,  
 wherein the carriage (10) moves in a first direction of the main scanning directions to push and move the cover (14) in the first direction, and the carriage (10) moves in a second direction opposite to the first direction to move the cover (14) coupled to the carriage (10) in the second direction.
4. The liquid discharge apparatus (100) according to claim 3,  
 wherein the liquid discharge head (11) discharges the liquid onto a medium in a liquid discharge region,  
 the cap (21) is at a cap position outside the liquid discharge region, and  
 the cover (14) is decoupled from the carriage (10) at a decoupling position between the cap position and the liquid discharge region, and the cover (14) faces the cap (21) at the cap position.
5. The liquid discharge apparatus (100) according to claim 4,  
 wherein the carriage (10) moves from the liquid discharge region toward the cover (14) in the first direction and contacts the cover (14) at a contact position, and  
 the cover (14) is coupled to the carriage (10) at a coupling position farther from the liquid discharge region than the contact position and the decoupling position in the first direction.
6. The liquid discharge apparatus (100) according to any one of claims 1 to 5, further comprising a wiper (25) to wipe the discharge face (11a) at a wiper position,  
 the wiper (25) wiping the cover (14) moved to the wiper position.
7. The liquid discharge apparatus (100) according to any one of claims 1 to 6,  
 wherein the cover (14) includes an engagement part (15) having:  
 an engaging portion (15d); and  
 an axis around which the engagement part (15) is rotatable between an engaged position and a disengaged position,  
 the carriage (10) has an engaged portion (10a) engageable with the engagement part of the cover (14), and  
 the engaging portion (15d) of the cover (14) rotated toward the engaged position engages with the engaged portion (10a) of the carriage (10) to couple the cover (14) to the carriage (10).
8. The liquid discharge apparatus (100) according to any one of claims 1 to 7, wherein the cover (14) includes a cleaning liquid supplier (16) to supply a cleaning liquid to the cap (21).

FIG. 1

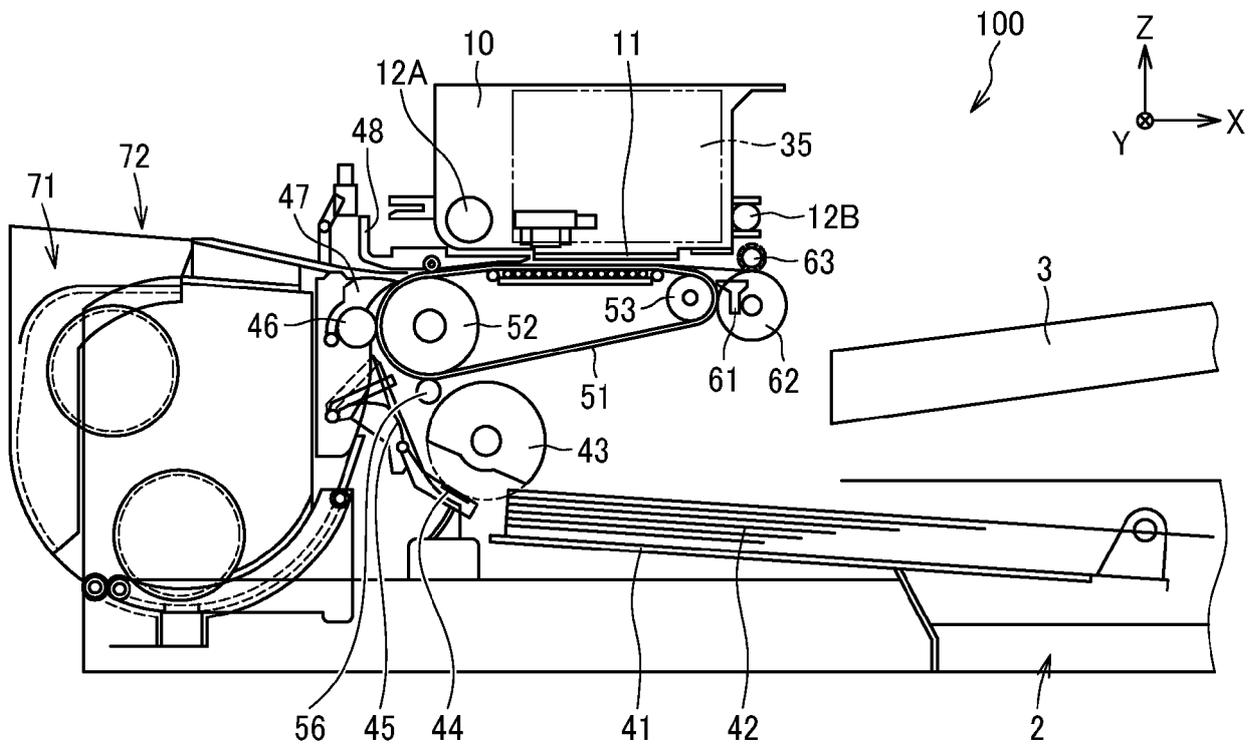


FIG. 2A

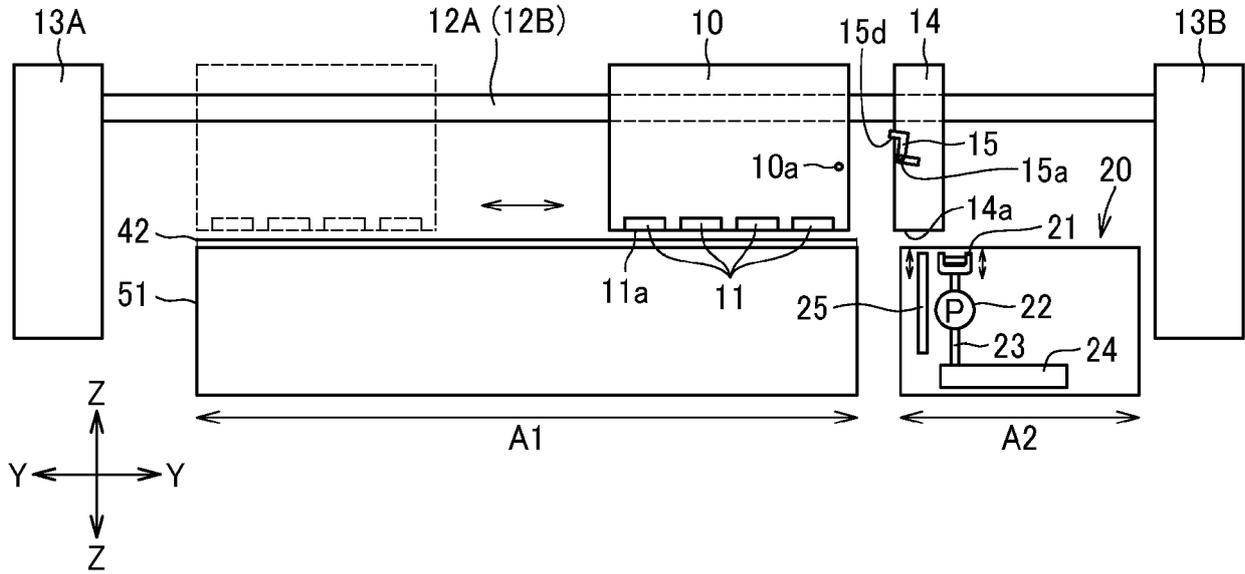


FIG. 2B

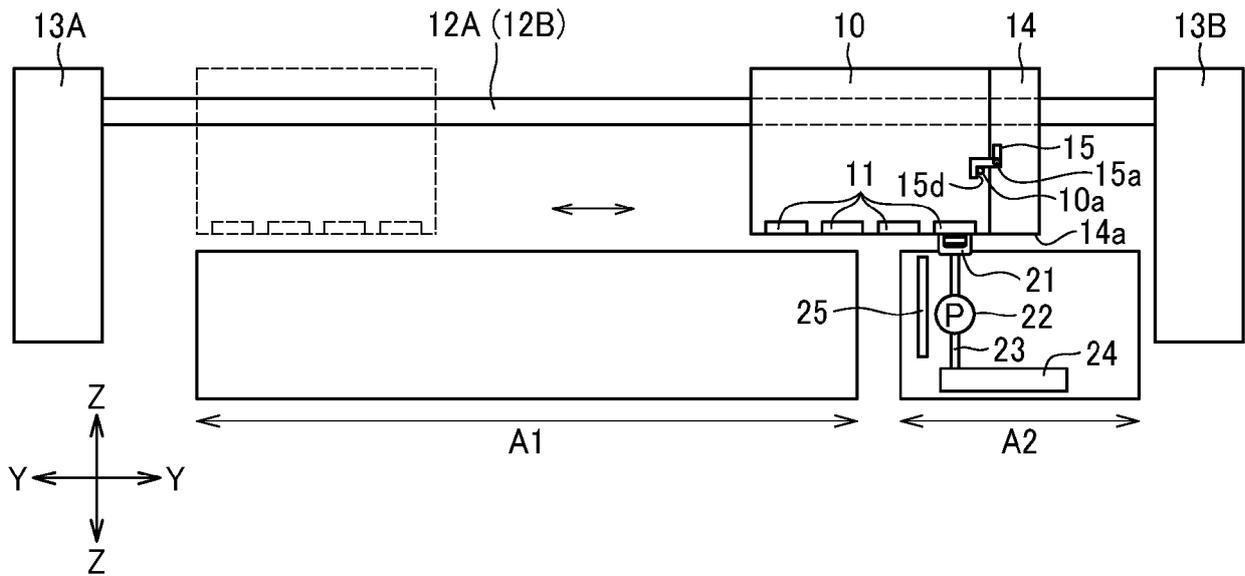


FIG. 3A

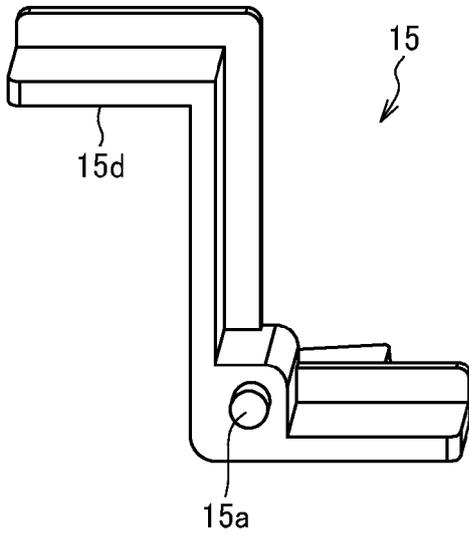


FIG. 3B

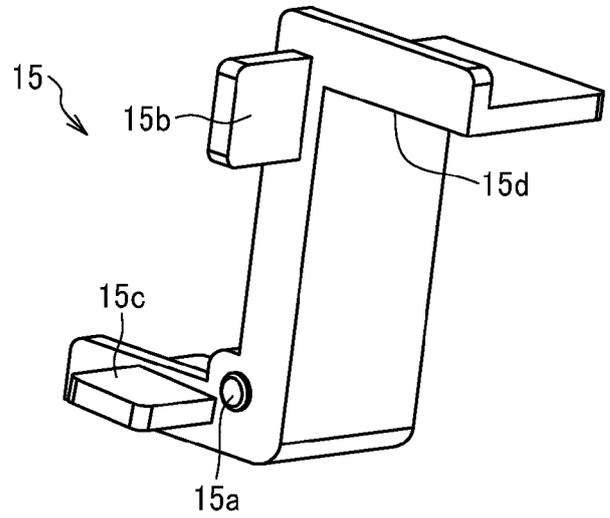


FIG. 4

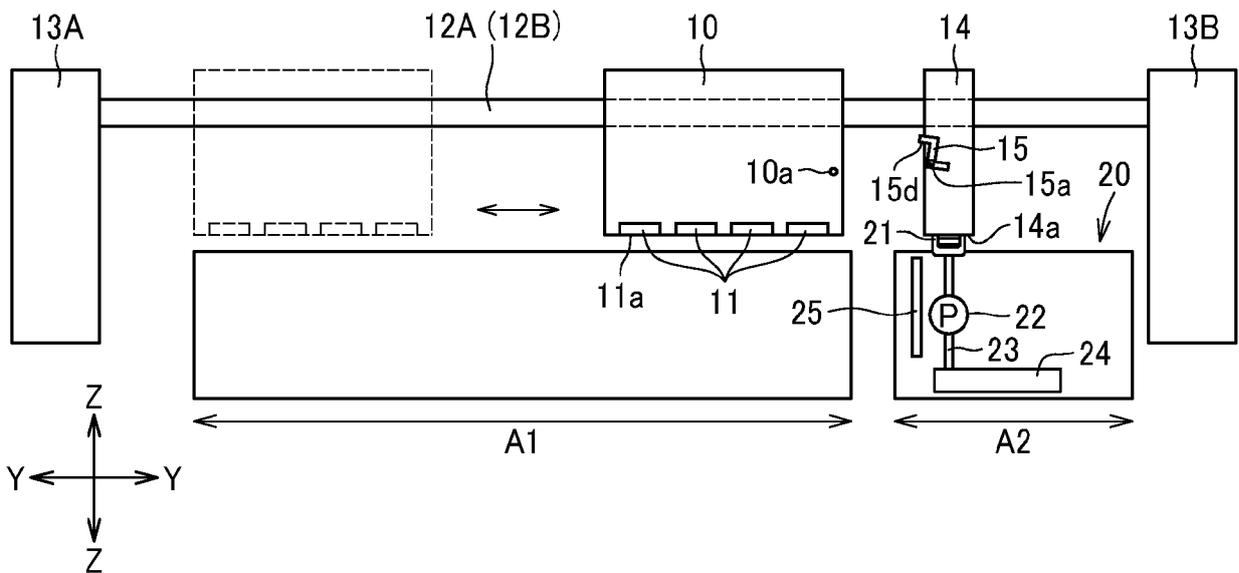


FIG. 5

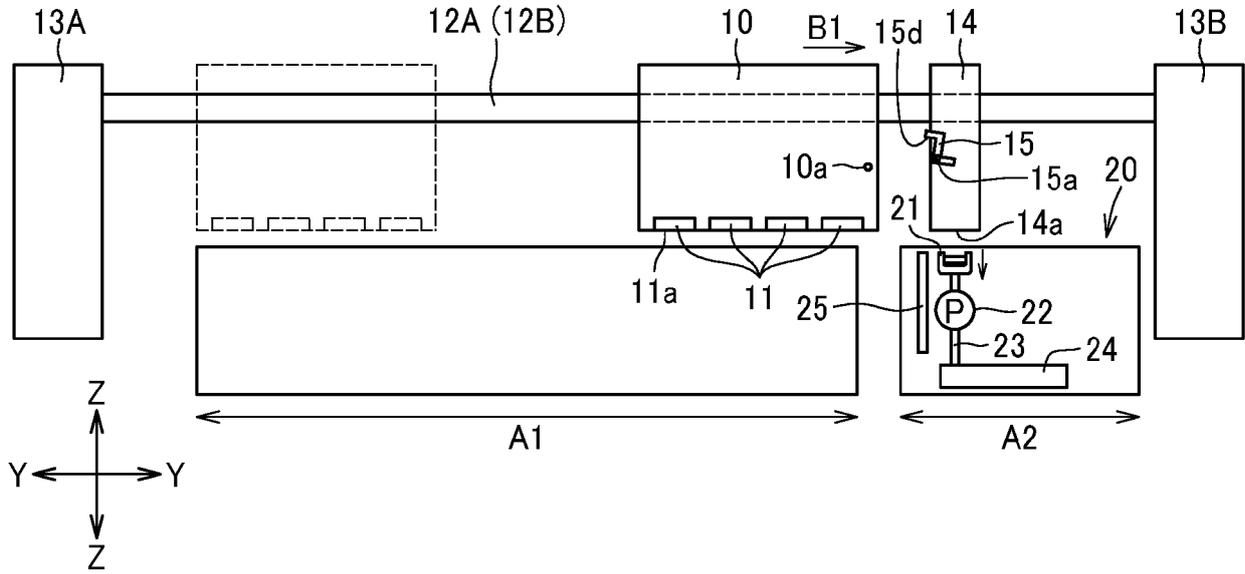


FIG. 6

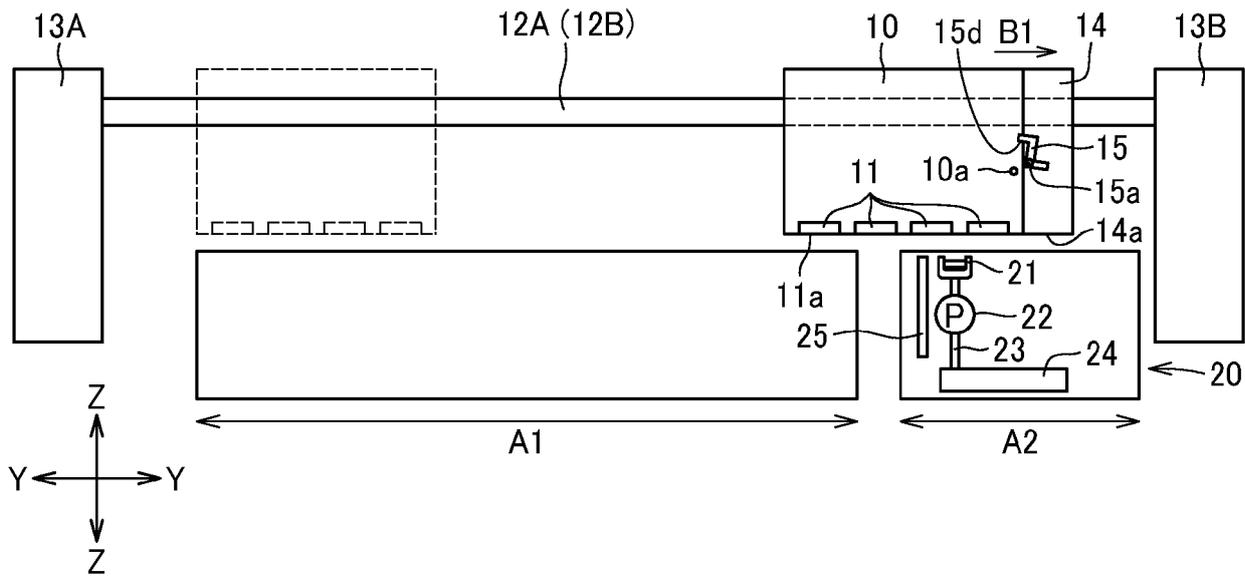


FIG. 7

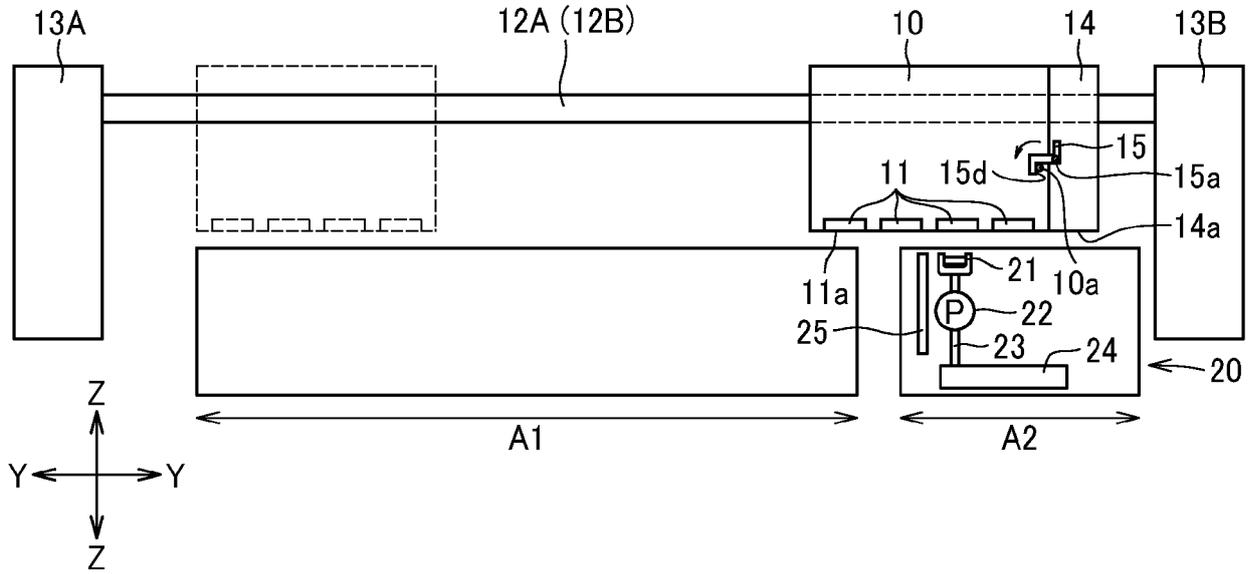


FIG. 8

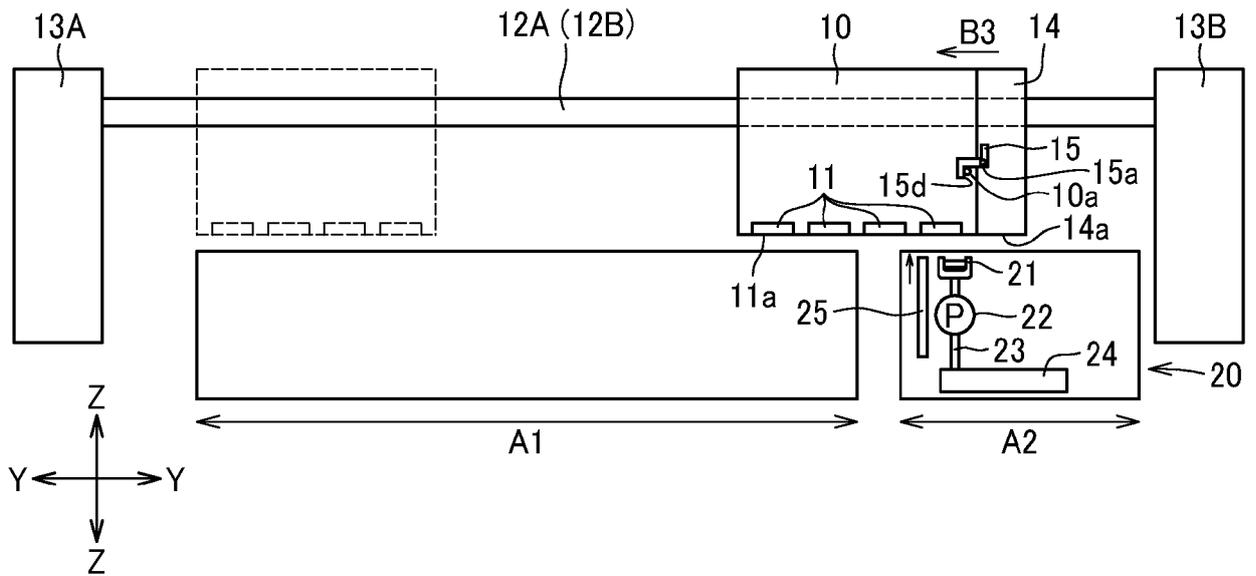


FIG. 9

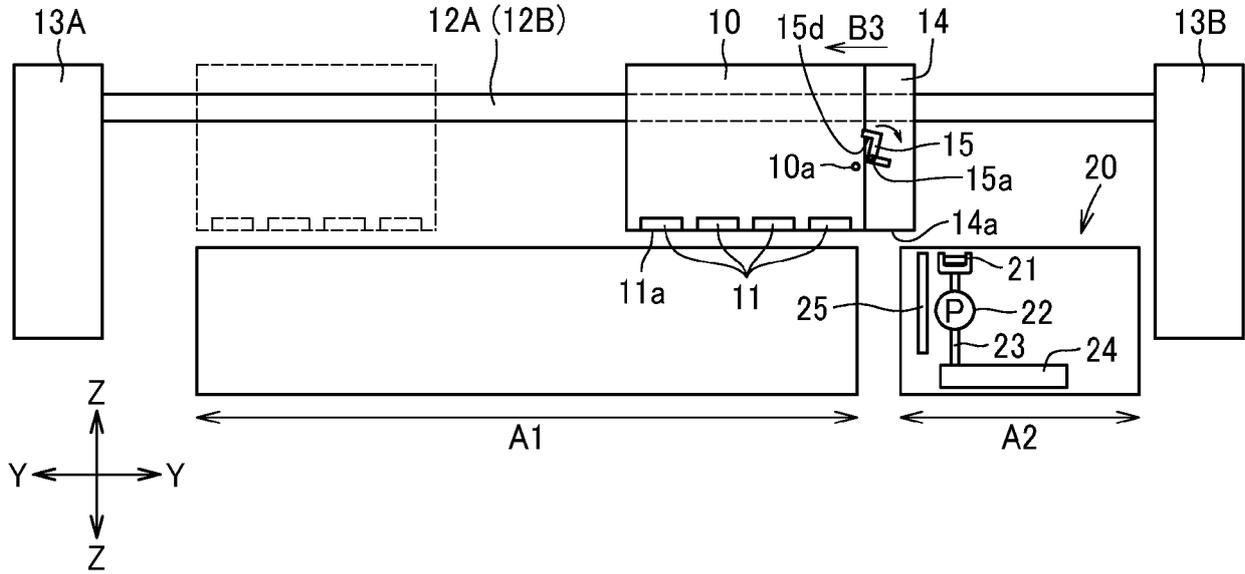


FIG. 10

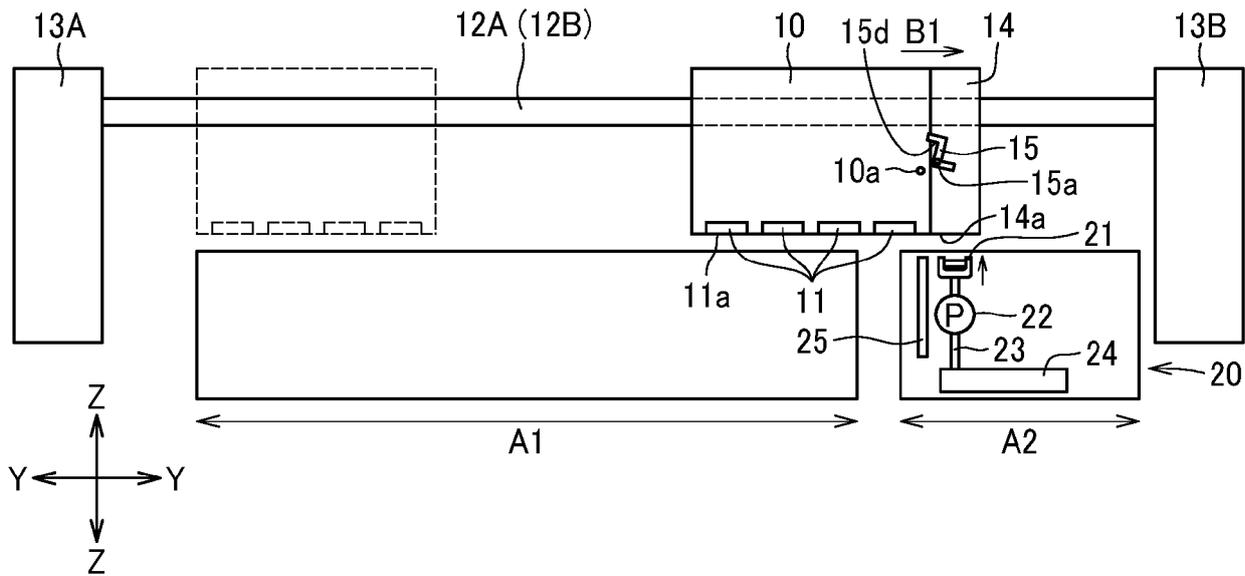


FIG. 11A

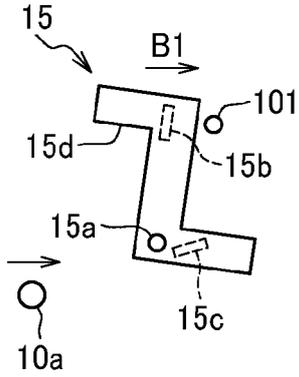


FIG. 11B

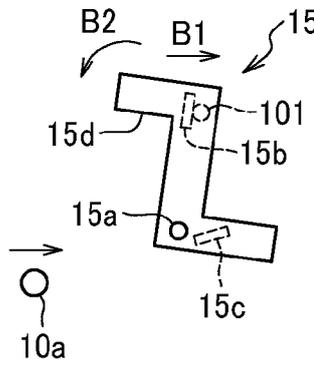


FIG. 11C

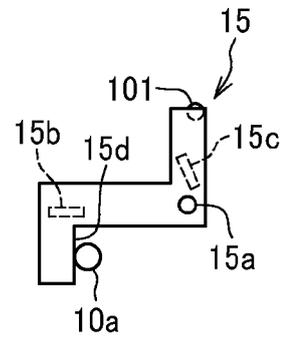


FIG. 12A

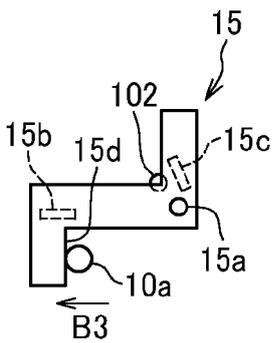


FIG. 12B

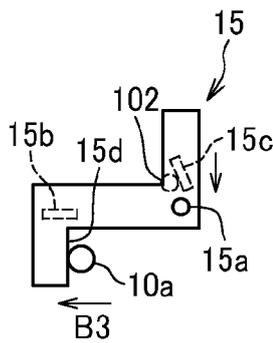


FIG. 12C

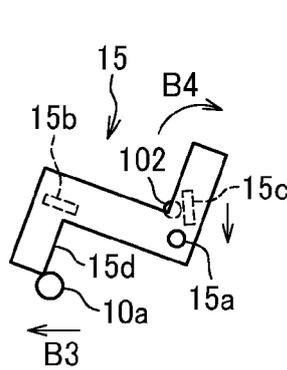


FIG. 12D

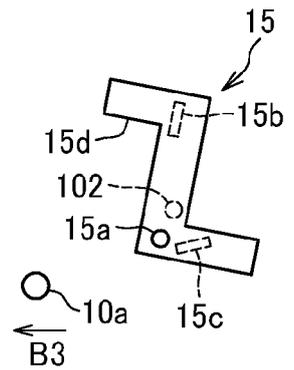
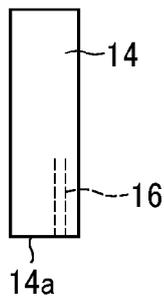


FIG. 13





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A	US 2013/265364 A1 (KAWAKAMI TAKAYUKI [JP] ET AL) 10 October 2013 (2013-10-10) * the whole document *	1-8	
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			B41J
The present search report has been drawn up for all claims			
Place of search <b>The Hague</b>		Date of completion of the search <b>2 December 2024</b>	Examiner <b>Dewaele, Karl</b>
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**REFERENCES CITED IN THE DESCRIPTION**

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