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(54) **Ink jet apparatus and method for installing an ink jet head on an ink jet apparatus.**

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## Description

### BACKGROUND OF THE INVENTION

#### Field of the Invention

The present invention relates to an ink jet apparatus as disclosed in the preamble of Claim 1 and a method for installing an ink jet head on an ink jet apparatus as disclosed in the preamble of claim 2.

#### Description of the Related Art

In a liquid jet recording apparatus having an exchangeable liquid injecting/recording head, the recording head must be positioned precisely so as to allow the accuracy with which a recording liquid can be discharged at a required position on a recording material to be improved or so as to allow the recording head to be electrically connected to an apparatus body.

Conventional methods of, or devices for, positioning a recording head have been proposed in the specification of, for example, U.S. Patent No. 4,709,246.

From US-A-4,709,246 an ink jet recording apparatus according to the preamble of claim 1 is known, said apparatus comprising: a mounting portion (carriage nest) on which an ink jet cartridge is detachably mounted, said cartridge having a connector (connector pads 26) and a recording head portion for discharging ink to perform image recording (orifice plate 27), said mounting portion having a body connector (terminals 14 in the nest bottom) associated therewith for electrically connecting the connector of said cartridge to said apparatus; recording head positioning means (cantilever spring 39 and/or knife edge 37) for positioning the recording head portion of the cartridge on said mounting portion; and operation means (fastening means 40 comprising the features lever arm portions 41, hinge portions 42, camming portions 43 and seating portions 44) for displacing said cartridge and said body connector relative to each other in order to connect said body connector with said cartridge connector.

### SUMMARY OF THE INVENTION

In view of the aforementioned conventional techniques, an object of the present invention is to provide a simple and reliable structure for positioning a recording head relative to a carriage with a higher degree of accuracy and to provide a method for installing an ink jet head on an ink jet apparatus in a simple and reliable way.

The structure provided by the present invention is particularly suitable for use in a recording apparatus which employs a plurality of recording heads for recording images.

In other words, an object of the present invention is to provide a structure for positioning a plurality of recording heads relative to a carriage with a high degree of accuracy so as to allow an ink discharged from the plurality of recording heads to be attached to predetermined positions with a high degree of accuracy.

According to the present invention, this objects are solved by the features in the characterising portion of claim 1 or claim 2.

In the present invention, both electrical connection and disconnection and reliable positioning of the recording head and releasing of that positioning can be achieved by a single series of recording head mounting/removing operations.

Furthermore, in the present invention, each of the individual recording heads is fixed relative to the carriage using as a contacting surface (a reference surface for positioning) a surface of the recording head which is in the same plane as that on which a plurality of ink discharge openings are disposed linearly. In consequence, variations in the structures of the plurality of recording heads have less effect on the accuracy with which the discharge opening arrays of the recording heads are disposed relative to the carriage. Variations in the structures of the recording heads may be caused by variations in the thickness or of warpage of the supporting plates, the substrates, or the ceiling plates of the recording heads. As a result, the individual recording heads can be readily disposed on the carriage with a high degree of accuracy.

### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a schematic side view, partly in cross-section, of a liquid jet recording apparatus showing a first embodiment of the present invention;

Fig. 1B is a top view of the liquid jet recording apparatus of Fig. 1A;

Figs. 2A and 2B show a state where a recording head is removed from the recording apparatus of Figs. 1A and 1B;

Figs. 3A, 3B and 3C show the relation between an engagement hole and an engagement shaft in the recording apparatus of Figs. 1A and 1B;

Fig. 4 is a schematic side view of an example of a link mechanism of the recording apparatus of Figs. 1A and 1B;

Fig. 5 is a side view of an example of a connector portion;

Figs. 6 and 7 are side views of another example of an engagement hole - an engagement shaft structure;

Figs. 8 and 9 are perspective views of examples of an ink jet cartridge employed in the present invention;

Figs. 10A, 10B, 10C and 10D show a second embodiment of the liquid jet recording apparatus according to the present invention;

Fig. 11 is a perspective view of another example of the cartridge employed in the present invention;

Fig. 12A is a plan view, partly in cross-section, of an example of a full-color liquid jet recording apparatus to which the present invention is applied;

Fig. 12B is a schematic perspective view of the liquid jet recording apparatus of Fig. 12A;

Fig. 13 is a plan view, partly in cross-section, of another example of the vicinity of a pushing shaft (pushing pin);

Fig. 14 is a schematic view of an example of a liquid jet recording apparatus body to which the present invention is applied;

Fig. 15 is a schematic view of an example of the vicinity of a lever operation portion of the apparatus shown in Fig. 14;

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will now be described below with reference to the accompanying drawings.

[Embodiment 1]

In this embodiment, a connector on a body is made movable. During the insertion of the connector on the body into a connector on a recording head of a carriage, the connector on the body is fixed by a positioning means. After the insertion, fixing of the body connector is released, and the body connector is thereby made movable relative to the body so as to achieve highly accurate positioning of the recording head. Thus, in the present embodiment, both electrical connection and reliable positioning of the recording head can be achieved by a series of recording head mounting/removing operations. In this embodiment, the accuracy of recording head positioning is further improved by conducting positioning utilizing the pressure applied by a pressurizing member.

Referring first to Figs. 1A and 1B, a carriage 2 on which a cartridge C with a recording head 1 (the cartridge C will be described later) can be detachably mounted is placed on a scanning rail 11 in such a manner as to be slidable therealong. One end of the carriage 2 is supported by a sliding rail 12. The carriage 2 is movable along a recording medium 30 for scanning. As the carriage 2 is moved along the recording medium 30 for scanning, ink particles supplied from an ink tank 13 are discharged from a plurality of discharge openings 3 (having an electrothermal energy conversion member 3a for forming droplets of ink in accordance with an image to be recorded) of the recording head 1 in accordance with an image to be recorded so as to record on the recording medium 30 images such as characters or figures. The recording medium 30 is conveyed by rollers 15, 16, 17 and 18 in synchronism with the recording of images. During the recording, the recording medium 30 is maintained at a predetermined position relative to the recording head 1 by a guide 50. The ink jet cartridge C having the recording head 1 and the ink tank 13 can be mounted on the carriage 2, as will be described in detail later (see Figs. 8 and 9).

The cartridge C is mounted on the carriage 2 in the manner described below.

The recording head 1 of the cartridge C is arranged such that it is positioned with vertical contact surfaces 1a and 1b and a horizontal contact surface 1c thereof being in contact with and pressed against vertical contact surfaces 2a and 2b and a horizontal contact surface 2c of the carriage 2. More specifically, when the cartridge C is to be mounted on a mounting portion 2f of the carriage 2, the cartridge C is first located just above the mounting portion 2f, and then moved downward so as to insert the recording head 1 between a front end portion 2g and a rear end portion 2h of the mounting portion 2f, as shown in Fig. 2B. Thereafter, a lever 7, which will be described later, is operated and a connector holder 40 and a pressing pin 10 engaging with the connector holder 40 are thereby moved in the direction indicated by the arrow A (movement of the pressing pin 10, a connector 6 and the connector holder 40 in a direction indicated by the arrow A will be described in detail later) so as to press the cartridge C in a direction indicated by the arrow A. This allows the contact surfaces 1a and 1b of the recording head to come into contact with the contact surfaces 2a and 2b, thereby horizontally positioning the recording head 1 relative to the carriage 2. A surface 1d of the recording head 1 which engages with the pressing pin 10 is an inclined surface, and this generates a component of the pushing force which presses the horizontal contact surface 1c of the recording head 1 against the horizontal contact surface 2c of the carriage 2 and thereby positions the recording head 1 in a vertical direction. The pressing pin 10 slidably provided on the connector holder 40 is urged by a coil spring 10a. The recording head 1 is positioned in its crosswise direction in the manner described below.

Fig. 1B shows a state where the recording head 1 is positioned in a direction of scanning (in the crosswise direction of the cartridge C). As shown in Fig. 1B, the recording head 1 of the cartridge C has three protrusions 1ℓ and 1m (one of them being not shown) on its side edge, which make contact with contact surfaces 2ℓ and 2m of the carriage 2 when the recording head is positioned in the scanning direction. At that time, since the presence of the inclined surface 1d of the recording head 1 generates a component f2 of a pushing force f1 generated by the pressing pin 10 in a direction indicated by the arrow A in the crosswise direction of the recording head 1, in addition to the above-described component having a vertical direction, the protrusions 1ℓ and 1m are pressed against the contact surface 2ℓ and 2m of the carriage, by means of which the recording head 1 is positioned in its crosswise direction. More specifically, in this embodiment, as the cartridge C is pressed by the pressing pin 10, forward, crosswise and vertical components of the pressing force are generated.

The connector 6 is mounted on the connector holder 40 with a backlash (a play) therebetween by means of a tension spring 41 which urges the connector 6 in the direction indicated by the arrow B. Reference numerals 1e and 1f denote rough guides for guiding the recording head 1 when it is inserted into the carriage 2.

The cartridge C is removed from the carriage 2 in the following manner.

Fig. 2A shows a state where the recording head (cartridge C) is released from its positioned state, and Fig. 2B shows a state where the recording head (cartridge C) is being removed from the carriage 2.

When the cartridge C is to be removed from the carriage 2, the lever 7, which will be described later, is operated and the connector holder 40 is thereby moved in the rightward direction, as shown in Fig. 2A, so as to release the recording head 1 from its fixed state. When the connector holder 40 is moved in the rightward direction, the recording head 1 abuts against the rough guides 1e and 1f and is thereby restricted from moving further to the right. In consequence, the body connector 6 is separated from the head connector 5, and at the same time the pressing pin 10 is separated from the recording head 1 and thereby releases the recording head 1 from its positioned state (as shown in Fig. 2A). After the recording head 1 has been released from its positioned state, the connector 6 is weakly urged in the rightward direction (in the direction indicated by the arrow B) by the elastic force of the tension spring 41, and engagement shafts 6a, 6b and 6c of the body connector 6 are thereby fitted into engaging portions 40b, 40ℓa and 40ma of engagement hole 40a and two engagement holes (40ℓ and 40m) for positioning the connector 6.

Fig. 2B shows a state where the cartridge C is being removed (released) from the carriage 2.

After the separation of the head connector 5 from the body connector 6 and that of the pressing pin 10 from the recording head 1, the recording head can be raised in the direction indicated by the arrow a, as stated above.

Next, engagement and disengagement between the head connector 5 on the cartridge C and the body connector 6 will be described in detail.

Figs. 3A to 3C respectively show states where the engagement shaft is fitted into the engagement hole.

Turning to Fig. 3A, when the body connector 6 is to be inserted into the head connector 5, the lever 7, which will be described later, is operated in a state where the engagement shaft 6a integrally formed with the body connector 6 is fitted into the fitting portion 40b of the engagement hole in the connector holder 40 so as to move the body connector 6 and the connector holder 40 together. At that time, the head connector 5 is roughly positioned as a consequence of the insertion of the cartridge C into the mounting portion 2f of the carriage 2, and the body connector 6 is roughly positioned as a consequence of the fitting of the engagement shaft 6a into the fitting portion 40b. After the body connector 6 has been fitted into the head connector 5 with an inclined surface (not shown) of the body connector 6 acting as a guide surface, the connector holder 40 is moved rightwardly by a distance ℓ , as shown in Fig. 3B (this movement of the connector holder 40 is achieved by the pivot of the lever 7, as will be described later). Movement of the connector holder 40 by this distance ℓ allows the engagement shaft 6a to be separated from the fitting portion 40b. This results in releasing of the body connector 6 from its positioned state (it is to be noted that the body connector 6 is movable when it is in the state shown in Fig. 3A). The body connector 6 is engaged with the head connector 5 more firmly than it is urged by the tension spring 41, so it is released from the connector holder 40, i.e., the connector 6 is disengaged from the connector holder 40. At that time, since a large diameter portion 40c of the engagement hole 40a has a larger diameter than the engagement shaft 6a of the body connector 6, the engagement shaft 6a is loosely fitted into the large diameter portion 40c with a gap g therebetween. This means that, while the body connector 6 is in engagement with the head connector 5, the body connector 6 is disengaged from the connector holder 40. Therefore, the cartridge C (the recording head 1) is positioned relative to the car-

riage 2 only by the pressing force of the pressing pin 10, which ensures accurate positioning of the recording head 1 relative to the carriage 2.

Fig. 3C shows a fitting state of the engagement shaft 6a into the engagement hole 40a which is obtained when the cartridge C (the recording head 1) is removed (released). When the cartridge C is removed from the carriage 2, the lever 7, which is in its vertical position, is pivoted counterclockwise and is thereby positioned in its horizontal position so as to move the connector holder 40 rightwardly. Although the body connector 6 is engaged with the head connector 5 firmly, as the connector holder 40 moves rightwardly, a left edge L of the engagement hole 40a abuts against the engagement shaft 6a, and then pushes the engagement shaft 6a in the direction indicated by the arrow b (see Fig. 3C). As a result, the body connector 6 is disengaged (released) from the head connector 5. Concurrently with this, the pressing pin 10 moves together with the connector holder 40 and is separated from the recording head 1.

Thereafter, the cartridge C can be removed from the mounting portion 2f in the manner shown in Figs. 2A and 2B.

In the above description, only the relation between the engagement shaft 6a and the engagement hole 40a of the connector holder 40 has been explained. However, the same relation is established between the other engagement shafts 6b and 6c and the other corresponding two engagement holes.

Fig. 4 shows an example of a mechanism for moving the connector holder 40.

As shown in Fig. 4, a shaft 20 provided on the connector holder 40 is connected to a link 21. The shaft 20 is fitted into a slide hole 2a formed in the carriage 2 in such a manner as to be slidable therealong. A slide hole 21a formed in the link 21 receives a carriage shaft 9 in such a manner that the carriage shaft 9 can slide along the hole 21a. The lever 7 is rotatably engaged with the carriage shaft 9. A nib 21b of the link 21 is fitted into a cam hole 7a of the lever 7. In consequence, as the lever 7 is rotated, the link 21 is moved in the rightward and leftward directions. In Fig. 4, the position of the lever 7 shown by the solid line represents a recording-head-released state, and the lever position shown by the broken line represents a recording-head-locked state (positioned state). As the operator pivots the lever 7 from its recording-head-released state (shown by the solid line) to its recording-head-locked state (shown by the broken line), the connector holder 40 connected to the link 21 moves leftwardly first. After the body connector (not shown) has been inserted into the head connector (not shown), the link 21 moves back to the right by the distance $\ell$ while being guided along the cam hole 7a. The cam hole 7a is so designed that the rotation of the lever 7 stops after the link 21 has moved back by the distance $\ell$. Also, the cam hole 7a is so designed that the lever 7 is pushed by the reaction of the pushing force of the pressing pin 10 which presses the recording head 1, which is transmitted to the lever 7 through the link 21, and is thereby fixed at its stop position.

More specifically, by pivoting the lever 7 clockwise, connection of the body connector 6 to the head connector 5, release of the body connector 6 from its positioned state, and the positioning of the recording head 1 can be performed in series.

The body connector 6 can be removed from the head connector 5 by pivoting the lever 6 counterclockwise.

The above-described embodiment employs a pair of connectors consisting of the edge of a printed circuit board, and a card-edge connector. However, the present invention is not limited to this, and a pair of connectors such as those shown in Fig. 5 may also be employed. This example is a combination of male and female connectors consisting of a plurality of pins 23a and a plurality of recesses 22a which receive the pins 23a.

In this embodiment, only one recording head is mounted on and removed from the carriage. However, the present invention can also be applied to, for example, a full-color ink jet recording apparatus which employs a plurality of recording heads.

Figs. 6 and 7 show another example of a structure for mounting a cartridge on a carriage. In Figs. 6 and 7, arms 53 and 54 are rotatably supported on a connector holder 50 through arm shafts 51 and 52. The arm 53 is urged by a spring 55 clockwise, whereas the arm 54 is urged by a spring 56 counterclockwise. The body connector 6 is mounted on the connector holder 50 with a backlash (a play) therebetween. The body connector 6 is urged rightwardly by the tension spring 41.

When the recording head 1 is in its released state, the body connector 6 is weakly urged rightwardly by the tension spring 41. At that time, the engagement shaft 6a is in contact with contact portions 53a and 54a of the arms 53 and 54, by means of which the connector 6 is positioned.

Fig. 7 shows a state in which the connectors are connected with each other. When the body connector 6 is inserted into the head connector 5, the body connector 6 moves leftwardly together with the connector holder 50 in a state where the engagement shaft 6a of the body connector 6 is in contact with the contact portions 53a and 54a of the arms. After the body connector 6 has been engaged with the head connector 5, the arm 53 on the connector holder 50 abuts against a contact pin 46 provided on a carriage 45 and starts to rotate counterclockwise, whereas the arm 54 abuts

against a contact pin 47 and begins to rotate clockwise.

This results in release of the contact of the body connector 6 with the arms 53 and 54. At that time, since the body connector 6 is connected to the head connector 5 more firmly than it is urged by the tension spring 41, it is released from the connector holder 50. Furthermore, since an engagement hole 50a has a larger diameter than the engagement shaft 6a of the body connector 6, the engagement shaft 6a is loosely fitted into the engagement hole 50a with a gap g therebetween. This means that, while the body connector 6 is in engagement with the head connector 5, the body connector 6 is disengaged from the connector holder 50.

More specifically, by pivoting the lever (not shown) and thereby moving the connector holder 50 leftwardly, connection of the body connector 6 to the head connector 5, release of the body connector 6 from its positioned state and fixing of the recording head 1 can be performed in sequence.

In the above description, only the relation between the engagement hole 50a of the connector holder 50 and the engagement shaft 6a of the body connector 6 has been described. The same relation, however, holds between the other engagement shafts and the other engagement holes.

Next, the cartridge C will be described below in detail with reference to Fig. 8 which is a perspective view of the cartridge C employed in this embodiment.

As shown in Fig. 8, an upper portion of the cartridge C forms the ink tank 13, while a lower portion thereof constitutes the recording head 1. The recording head 1 has at its left edge the contact surfaces 1a and 1b and at its right edge the head connector 5. The cartridge C can be mounted on the carriage 2.

Fig. 9 is a perspective view of another example of the cartridge C.

As shown in Fig. 9, a tank portion 80 and a connector 85 are arranged side by side so as to reduce the height H of the cartridge C. Thus, the height H of the cartridge C mounted on the carriage can be maintained low.

Furthermore, since the thickness W of the cartridge is small, it is possible to reduce the size of the carriage 3, which accommodates a plurality of cartridges in an aligned state.

Connector covers 83 are formed integrally with the outer wall of the tank so as to prevent careless contact of the connector 85. A positioning portion 81 consists of contact surfaces 81a and 81b. Provision of contact surfaces (not shown) on the recording head 86 at positions separated from these positioning surfaces 81a and 81b through a sufficient distance ensures that the recording head is fixed firmly when an inclined portion 84 thereof is pressed by the pressing pin (not shown).

[Embodiment 2]

Next, a second embodiment of the present invention will be described below with reference to Figs. 10A to 10D.

In this embodiment, the pressing pin which acts as a pressurizing shaft has at its distal end a tapered or rounded portion which makes contact with the recording head. The recording head has an inclined surface which makes contact with the distal end of the pressuring shaft. The carriage has a contact surface which makes contact with the outer peripheral surface of the pressuring shaft and thereby receives components having a direction perpendicular to the pressurizing shaft. Pressure is applied to the recording head by the pressurizing shaft so as to position the recording head in the mounting portion of the carriage. In this way, when the cartridge is mounted on the mounting portion, a large amount of moment is prevented from being applied to the pressing pin. This allows the pressing pin to advance smoothly from the connector holder and ensures that the recording head is positioned accurately by the elastic force of the spring of the pressing pin.

In Figs. 10A to 10D, the same reference numerals are used to denote parts which are the same as those in the first embodiment, description thereof being omitted.

When the recording head 1 is mounted on the mounting portion 2f, it is positioned with its contact surfaces 1a, 1b and 1c in contact with and pressed against the contact surfaces 2a, 2b and 2c of the carriage 2. More specifically, a pressure f is applied to the recording head 1 by the pressing pin 10 engaging with the connector holder 40 which is a retaining member so as to bring the contact surfaces 1a and 1b of the recording head 1 into contact with the contact surfaces 2a and 2b of the carriage 2 and thereby position the recording head in a horizontal direction. Both the pressing pin 10 and the pressurized surface 1d of the recording head 1 are inclined. This generates a component f1 of the pressure f generated by the pressing pin 10, which brings the contact surface 1c of the recording head 1 into contact with the contact surface 2c of the carriage 2 and thereby positions the recording head 1 in a vertical direction. The pressing pin 10 is urged by a coil spring 10a.

Fig. 10B shows a state in which the recording head is positioned in a direction of scanning. As shown in Fig. 10B, the recording head 1 has three protrusions 1ℓ and 1m (one of them being not shown), which make contact with contact surfaces 2ℓ and 2m on the carriage 2 so as to position the

recording head in the direction of scanning. The presence of the inclined surface 1d of the recording head 1 generates a component f2 of the pressure f applied by the pressing pin 10, which presses the protrusions 1ℓ and 1m against the contact surfaces 2ℓ and 2m on the carriage 2 and thereby positions the recording head in the direction of scanning.

Thus, as the pressing pin 10 is moved in the direction indicated by the arrow A and the distal end 10b of the pressing pin 10 thereby abuts against the the inclined surface 1d of the recording head 1, generating the pushing force f, the components f1 and f2 of the pushing force f are generated by the presence of the inclined surface 1d, and the recording head 1 is pressed and positioned in both the vertical and horizontal directions. Furthermore, in the present embodiment, since the outer peripheral surface 10c of the pressing pin 10 is in contact with an inclined surface 2s of the carriage, reactions f1' and f2' of the components f1 and f2 are received by this inclined surface 2s, as shown in Fig. 10C. Moreover, an engagement slit 40s formed in the connector holder 40 into which the pressing pin 10 is inserted is elongated, and this elongated slit 40s and the inclined surface 2s form a right angle (90 degrees). In consequence, even if the pressing pin 10 is inserted between the inclined surface 1d of the recording head 1 and the inclined surface 2s of the carriage 2 in a slightly shifting state, neither the component f1 nor f2 is applied to the pin 10.

Thus, in the present invention, when the cartridge C is mounted on the mounting portion 2f, no moment is applied to the pressing pin 10 which is the pressurizing shaft, and this allows the pressing pin 10 to advance from the connector holder 40 smoothly and thereby ensures that the recording head 1 is positioned accurately by the elastic force of the spring 10a. As a result, only the pushing force f in an axial direction of the pressing pin 10 acts between the pressing pin 10 and the connector holder 40, thus eliminating scuffing of the pressing pin 10 and reducing the force required to move the connector holder 40.

Fig. 11 shows another example of the cartridge C.

In this example, the thickness W of the cartridge in the direction of scanning is small, and this allows a carriage which accommodates a plurality of cartridges in a aligned state to be made small.

The cartridge C has an ink tank portion 80 for containing ink. Connector covers 83 are formed integrally with the outer wall of the tank portion 80 so as to prevent careless contact of the connector 85. A positioning portion 81 consists of contact surfaces 81a and 81b. Provision of contact surfaces on the recording head 86 (having a plurality of nozzles whose discharge surfaces are directed downward) at positions which are separated from these contact surfaces 81a and 81b sufficiently allows the recording head to be fixed reliably when the inclined surface 84 is pressed by the pressing pin 10. A knob 82 is used when the cartridge C is mounted on and removed from the mounting portion. The knob 82 has an air vent 82a. A notch 83a and guides 83b are guides of the cartridge C which are used when the cartridge is mounted on the mounting portion.

Figs. 12A and 12B show an example of a full color ink jet recording apparatus which employs a plurality of recording head. It is assumed that the cartridge shown in Fig. 11 is employed in this recording apparatus. In Figs. 12A and 12B, the same reference numerals are used to denote parts which are the same as those of the preceding embodiment.

In this example, four cartridges C1, C2, C2 and C4 (containing ink of different colors, e.g., yellow, magenta, cyan and black) of the type shown in Fig. 11 are positioned on the carriage 2.

The connector holder 40 has four pressing pins 10, which are urged in the leftward direction as viewed in Figs. 12A and 12B by the corresponding springs 10a. The connector holder 40 engages with the links 21 through the shafts 20, and is movable in the rightward or leftward direction as the lever 7 engaged with the links 21 is rotated clockwise or counterclockwise. When the connector holder 40 is moved in the rightward direction, pressurization is removed and the cartridges become exchangeable. When the cartridges are mounted on the carriage, the connector holder 40 is moved in the leftward direction.

When the cartridges C are to be mounted on the mounting portions 2f, the recording heads 86 of the cartridges C are inserted into recesses 2f1 of the mounting portions 2f from above. At that time, rectangular portions 2h of the carriage 2 are fitted between the guides 83b of the cartridges C, by means of which the cartridges C are roughly positioned. Thereafter, the operation lever 7 is pivoted clockwise so as to advance the holder 40. As the holder 40 is moved forward, the guides 54 of the carriage 2 are inserted into the notches 83a of the cartridges C and the pins 10 are brought into engagement with the cartridges C, whereby the cartridges C are mounted on the mounting portions 2f. Springs 59 are provided on the carriage 2 for pressing the cartridges C mounted on the mounting portions 2f rearwardly and thereby positioning the cartridges with a high degree of accuracy. When the cartridges C have been mounted on the respective mounting portions 2f, the distal ends 10b of the pressing pins 10 are in contact with the contact surfaces 1d of the cartridges C (C1 to C4),

pressing the cartridges. Also, the outer peripheral surfaces 10c of the pins 10 are in contact with the contact surfaces 2S of the carriage 2 which separately receive thrusts in directions perpendicular to the pressing pin. In consequence, the retaining member 40 receives only reactions of the springs 10a, no thrusts being applied to the retaining member 40. This enables the lever 7 to be operated with a small amount of force when a plurality of cartridges are simultaneously removed from the mounting portions. Reference numerals 11a denote bearings, 51 a flexible cable, and 52 a toothed belt through which a driving force for moving back and forth the carriage 2 is transmitted to the carriage 2.

Fig. 13 shows another example of the pushing pin.

A pushing pin 150 of this example has a rounded distal end 150a, which makes contact with the inclined surface 2d of the recording head. Like the pushing pin shown in Fig. 10B, the pushing pin 150 having such a rounded distal end is capable of generating a pushing force f having a component f2 thereof in a direction perpendicular to the axial direction, which acts on the inclined surface 1d of the recording head, when the pushing pin 150 is pressed in its axial direction.

In this invention, the body connector may be connected to the cartridge connector by moving both connectors or either of them.

Fig. 14 schematically shows a recording apparatus, such as a printer, a copier, or a facsimile, in which the present invention is carried out.

A recording apparatus body 100 has an openable cover 101 at an operation side thereof. When the cover 101 is pivoted about a central shaft thereof and is thereby opened, the interior of the apparatus body becomes exposed. This opening of the cover 101 permits pivotal operation of the lever 7 and, hence, mounting and removal of bubble-jet type recording head cartridges A, B, C and D on and from the apparatus body. When the lever 7 is pivoted to a position shown by the solid line in Fig. 14, the cartridges shown in Fig. 11 can be mounted on the carriage. Positioning of the lever 7 at that position precludes closing of the cover 101, so that the device is protected from accidental closing. The cartridge C shown by the broken line in Fig. 14 represents that which is being mounted on the apparatus, and the solid line in Fig. 14 represents the cartridge after it has been located at a predetermined position in the apparatus body for recording. When the cartridge is at its predetermined position in the apparatus, the recording head protrudes downwardly between recording medium conveying rollers 16 and 18, and the discharge openings of the recording head face the guide surface of a platen 50. A reference numeral 102 denotes a flexible sheet of an electric wiring portion, and reference numerals 11 and 12 designate carriage guiding rails.

The connector holder 40 is shown as in a state where the cartridge has been inserted and then fixed relative to the carriage by the pivot of the lever to a position shown by the broken line. For details, see Figs. 10A, 10B, 10C, 10D, 11, 12A and 12B and the descriptions made with reference to these figures. Shafts 20 and 202 are provided on the two sides with respect to the direction in which the connector holder 40 is moved relative to the carriage. The shafts 20 and 202 are aligned at the same level. The shafts 20 and 202 are fitted into two slots elongated in a straight line with each other on the two side surfaces of the carriage in such a manner as to be slidable therealong. The shafts 20 and 202 located at the positions shown by the solid line correspond to the lever 7 shown by the solid line. The shafts 20 and 202 shown by the broken line correspond to the lever 7 shown by the broken line. The shafts 20 and 202 ensure more reliable parallel movement of the connector holder. In this embodiment, the shafts 20 and 202 are not provided on the connector body but are disposed above and in the vicinity of the recording head positioning pushing pin 10 so as to improve the accuracy with which the pushing pin is positioned. Alternatively, shafts similar to the shafts 20 and 202 may be provided on the connector body so as to ensure stable parallel movement of the connector body. In that case, it is preferable to arrange the body connector such that it becomes movable in the leftward and rightward directions by a distance equal to a gap after it has been connected to the cartridge connector. In this embodiment, the elongated slot for the shaft 202 may be formed such that the shaft 202 becomes movable in the rightward and leftward directions after the connection of the connectors so that the pushing pin 10 can be positioned only through the shaft 20.

Fig. 15 is a view similar to Fig. 12A, and shows the engagement of the lever 7 with the shaft 20. As has been described with reference to Fig. 12A, the link 21 connects the lever 7 with the shaft 20. The recording apparatus body of this embodiment is a copier, the configuration of which is described below in brief. Below an original pressing plate and an original glass table are disposed an optical reading means and a means for converting the information which is read by the optical reading means to produce an electrical signal. The obtained electrical signal is converted by the flexible sheet into a recording head driving signal, which is supplied to the recording head to form a full color ink image. A cassette 210 is inserted into the lower portion of the apparatus body from the side of a discharge tray 213. The recording medium is conveyed out of the cassette by a feeding roller 211 in

the direction opposite to that of the insertion of the cassette.

The present invention is not limited to the aforementioned embodiments and various changes may be possible without departing from the scope of the invention.

As will be understood from the foregoing description, in the first and second embodiments, the connector for electrically connecting the recording head with the apparatus body is in a positioned state while it is inserted into the recording head. The connector is released from its positioned state after the insertion. In consequence, the recording head can be exchanged by a simple operation, and accurate positioning of the recording head and the reliable electrical connection are enabled. More specifically, according to the first and second embodiments, both the electrical connection between the recording head and the carriage and positioning of the recording head can be achieved by one operation. While the body connector is being inserted into the head connector, the body connector is in a positioned state. After the insertion, the body connector is released from its positioned state. This allows the recording head to be positioned only by the pushing of the pressing member, thus eliminating involvement of the connector in the positioning of the recording head.

Thus, the recording head can be mounted on and removed from the apparatus body by a series of operations, improving the mounting and removal operation.

In the aforementioned structures, positioning of the cartridge (the recording head) relative to the carriage is performed utilizing part of the frame of the cartridge with the recording head.

## Claims

**1.** An ink jet apparatus, comprising:

a head mounting portion (2f) for mounting an ink jet head (1) theron;

an electrical connector (6) on a body side provided on a part of said head mounting portion (2f) and connected with an electrically connecting portion (5) on an ink jet head side; and

an operation member (7) for fixing said ink jet head (1) to said head mounting portion (2f) and performing the electrical connection;

**characterized in that**

said electrical connector (6) on the body side is supported by a supporting member (40); and that

said electrical connector (6) on the body side is released from the support by said supporting member (40) while the electrical connection between said electrical connector (6) on the body side and said electrically connecting portion (5) on the ink jet head side is maintained by the fact that the fixation of said ink jet head (1) to said head mounting portion (2f) as well as the electrical connection between said electrically connecting portion (5) on the ink jet head side and said electrical connector (6) on the body side are performed by the operation of said operation member (7).

**2.** A method for installing an ink jet head (1) on an ink jet apparatus comprising a head mounting portion (2f) for mounting said ink jet head (1) thereon, an electrical connector (6) on a body side provided on a part of said head mounting portion (2f) and connected with an electrically connecting portion (5) on an ink jet head side, and an operation member (7) for fixing said ink jet head (1) to said head mounting portion (2f) and performing the electrical connection;

**characterized in that**

the fixation by positioning of said ink jet head (1) to said head mounting portion (2f) as well as the electrical connection between said electrically connecting portion (5) on the ink jet head side and said electrical connector (6) on the body side are performed by the operation of said operation member (7), which leads a supporting member (40) for supporting said electrical connector (6) on the body side to release said electrical connector (6) on the body side while the electrical connection between said electrical connector (6) on the body side and said electrically connecting portion (5) on the ink jet head side is maintained.

**3.** An ink jet recording apparatus according to claim 1, wherein a force generated by said operation member (7) in one direction is utilized as a pushing force with which said electrical connector (6) is connected to said electrically connecting portion (5) and as said pushing force acting on said head mounting portion (2f).

**4.** An ink jet recording apparatus according to claim 1, wherein the pushing force generated by said operation member (7) for connecting said electrical connector (6) to said electrically connecting portion (5) is generated by the movement of said electrical connector (6) toward said electrically connecting portion (5).

**5.** An ink jet cartridge according to claim 1, wherein said ink jet head (1) has a thermoelectrical conversion body which generates thermal energy required for forming ink droplets.

## Patentansprüche

1. Tintenstrahldruckvorrichtung, mit

einem Kopfbefestigungsabschnitt (2f), um einen Tintenstrahldruckkopf (1) darauf zu befestigen,

einer elektrischen Anschlußeinrichtung (6) seitens des Grundkörpers, die an einem Teil des Kopfbefestigungsabschnitts (2f) geschaffen ist und mit einem elektrischen Anschlußabschnitt (5) seitens des Tintenstrahldruckkopfs verbunden wird, und

einem Betätigungselement (7) zum Fixieren des Tintenstrahldruckkopfs (1) an dem Kopfbefestigungsabschnitt (2f) und zum Realisieren der elektrischen Verbindung,

**dadurch gekennzeichnet, daß**

die elektrische Anschlußeinrichtung (6) seitens des Grundkörpers mittels eines Halteelements (40) gelagert ist, und daß

die elektrische Anschlußeinrichtung (6) seitens des Grundkörpers aus der Lagerung durch das Halteelement (40) gelöst ist, während die elektrische Verbindung zwischen der elektrischen Anschlußeinrichtung (6) seitens des Grundkörpers und dem elektrischen Anschlußabschnitt (5) seitens des Tintenstrahldruckkopfs aufgrund der Tatsache aufrechterhalten wird, daß die Fixierung des Tintenstrahldruckkopfs (1) an dem Kopfbefestigungsabschnitt (2f) sowie die elektrische Verbindung zwischen dem elektrischen Anschlußabschnitt (5) seitens des Tintenstrahldruckkopfs und der elektrischen Anschlußeinrichtung (6) seitens des Grundkörpers durch die Betätigung des Betätigungselements (7) realisiert werden.

2. Verfahren zum Einbau eines Tintenstrahldruckkopfs (1) in eine Tintenstrahldruckvorrichtung mit einem Kopfbefestigungsabschnitt (2f), um einen Tintenstrahldruckkopf (1) darauf zu befestigen, einer elektrischen Anschlußeinrichtung (6) seitens des Grundkörpers, die an einem Teil des Kopfbefestigungsabschnitts (2f) geschaffen ist und mit einem elektrischen Anschlußabschnitt (5) seitens des Tintenstrahldruckkopfs verbunden wird, und einem Betätigungselement (7) zum Fixieren des Tintenstrahldruckkopfs (1) an dem Kopfbefestigungsabschnitt (2f) und zum Realisieren der elektrischen Verbindung,

**dadurch gekennzeichnet, daß**

die Fixierung durch Positionieren des Tintenstrahldruckkopfs (1) an dem Kopfbefestigungsabschnitt (2f) sowie die elektrische Verbindung zwischen dem elektrischen Anschlußabschnitt (5) seitens des Tintenstrahldruckkopfs und der elektrischen Anschlußeinrichtung (6) seitens des Grundkörpers durch die Betätigung des Betätigungselements (7) realisiert werden, welches ein Halteelement (40) zum Halten der elektrischen Anschlußeinrichtung (6) seitens des Grundkörpers dazu bringt, die elektrische Anschlußeinrichtung (6) seitens des Grundkörpers zu lösen, während die elektrische Verbindung zwischen der elektrischen Anschlußeinrichtung (6) seitens des Grundkörpers und dem elektrischen Anschlußabschnitt (5) seitens des Tintenstrahldruckkopfs aufrechterhalten wird.

3. Tintenstrahlaufzeichnungsvorrichtung gemäß Anspruch 1, wobei eine durch das Betätigungselement (7) in einer Richtung erzeugte Kraft als eine Schubkraft, mittels welcher die elektrische Anschlußeinrichtung (6) mit dem elektrischen Anschlußabschnitt (5) verbunden wird, und als die auf den Kopfbefestigungsabschnitt (2f) wirkende Schubkraft verwendet wird.

4. Tintenstrahlaufzeichnungsvorrichtung gemäß Anspruch 1, wobei die durch das Betätigungselement (7) zum Verbinden der elektrischen Anschlußeinrichtung (6) mit dem elektrischen Anschlußabschnitt (5) erzeugte Schubkraft durch die Bewegung der elektrischen Anschlußeinrichtung (6) in Richtung auf den elektrisch Anschlußabschnitt (5) erzeugt wird.

5. Tintenstrahlkassette gemäß Anspruch 1, wobei der Tintenstrahldruckkopf (1) ein thermoelektrisches Umwandlungsteil hat, welches die zum Ausbilden von Tintentröpfchen erforderliche thermische Energie erzeugt.

## Revendications

1. Appareil à jet d'encre, comportant :

une partie (2f) de montage de tête sur laquelle une tête (1) à jet d'encre est destinée à être montée ;

un connecteur électrique (6) sur un côté de corps prévu sur une portion de ladite partie (2f) de montage de tête et connecté à une partie (5) de connexion électrique sur un côté de la tête à jet d'encre ; et

un élément (7) de manoeuvre pour fixer ladite tête (1) à jet d'encre à ladite partie (2f) de montage de tête et pour réaliser la connexion électrique ;

caractérisé en ce que :

ledit connecteur électrique (6) sur le côté de corps est supporté par un élément (40) de support ; et en ce que

ledit connecteur électrique (6) sur le côté

de corps est libéré du support par ledit élément (40) de support tandis que la connexion électrique entre ledit connecteur électrique (6) sur le côté de corps et ladite partie (5) de connexion électrique sur le côté de la tête à jet d'encre est maintenue par le fait que la fixation de ladite tête (1) à jet d'encre à ladite partie (2f) de montage de tête ainsi que la connexion électrique entre ladite partie (5) de connexion électrique sur le côté de la tête à jet d'encre et ledit connecteur électrique (6) sur le côté de corps sont réalisées par la manoeuvre dudit élément (7) de manoeuvre.

**2.** Procédé pour la mise en place d'une tête (1) à jet d'encre sur un appareil à jet d'encre comportant une partie (2f) de montage de tête sur laquelle ladite tête (1) à jet d'encre est destinée à être montée, un connecteur électrique (6) sur un côté de corps prévu sur une portion de ladite partie (2f) de montage de tête est connecté à une partie (5) de connexion électrique sur un côté de la tête à jet d'encre, et un élément (7) de manoeuvre pour fixer ladite tête (1) à jet d'encre à ladite partie (2f) de montage de tête et pour réaliser la connexion électrique ;

caractérisé en ce que :

la fixation par le positionnement de ladite tête (1) à jet d'encre sur ladite partie (2f) de montage de tête ainsi que la connexion électrique entre ladite partie (5) de connexion électrique sur le côté de la tête à jet d'encre et ledit connecteur électrique (6) sur le côté de corps sont réalisées par la manoeuvre dudit élément (7) de manoeuvre, ce qui amène un élément (40) de support, destiné à supporter ledit connecteur électrique (6) sur le côté du corps, à libérer ledit connecteur électrique (6) sur le côté du corps tandis que la connexion électrique entre ledit connecteur électrique (6) sur le côté du corps et ladite partie (5) de connexion électrique sur le côté de la tête à jet d'encre est maintenue.

**3.** Appareil d'enregistrement à jet d'encre selon la revendication 1, dans lequel une force générée par ledit élément (7) de manoeuvre dans un sens est utilisée en tant que force de poussée avec laquelle ledit connecteur électrique (6) est connecté à ladite partie (5) de connexion électrique et en tant que force de poussée agissant sur ladite partie (2f) de montage de tête.

**4.** Appareil d'enregistrement à jet d'encre selon la revendication 1, dans lequel la force de poussée générée par ledit élément (7) de manoeuvre pour connecter ledit connecteur électrique (6) à ladite partie (5) de connexion électrique est générée par le mouvement dudit connecteur électrique (6) vers ladite partie (5) de connexion électrique.

**5.** Cartouche à jet d'encre selon la revendication 1, dans laquelle ladite tête à jet d'encre comporte un corps de conversion thermoélectrique qui génère de l'énergie thermique nécessaire pour former des gouttelettes d'encre.

FIG. 1A

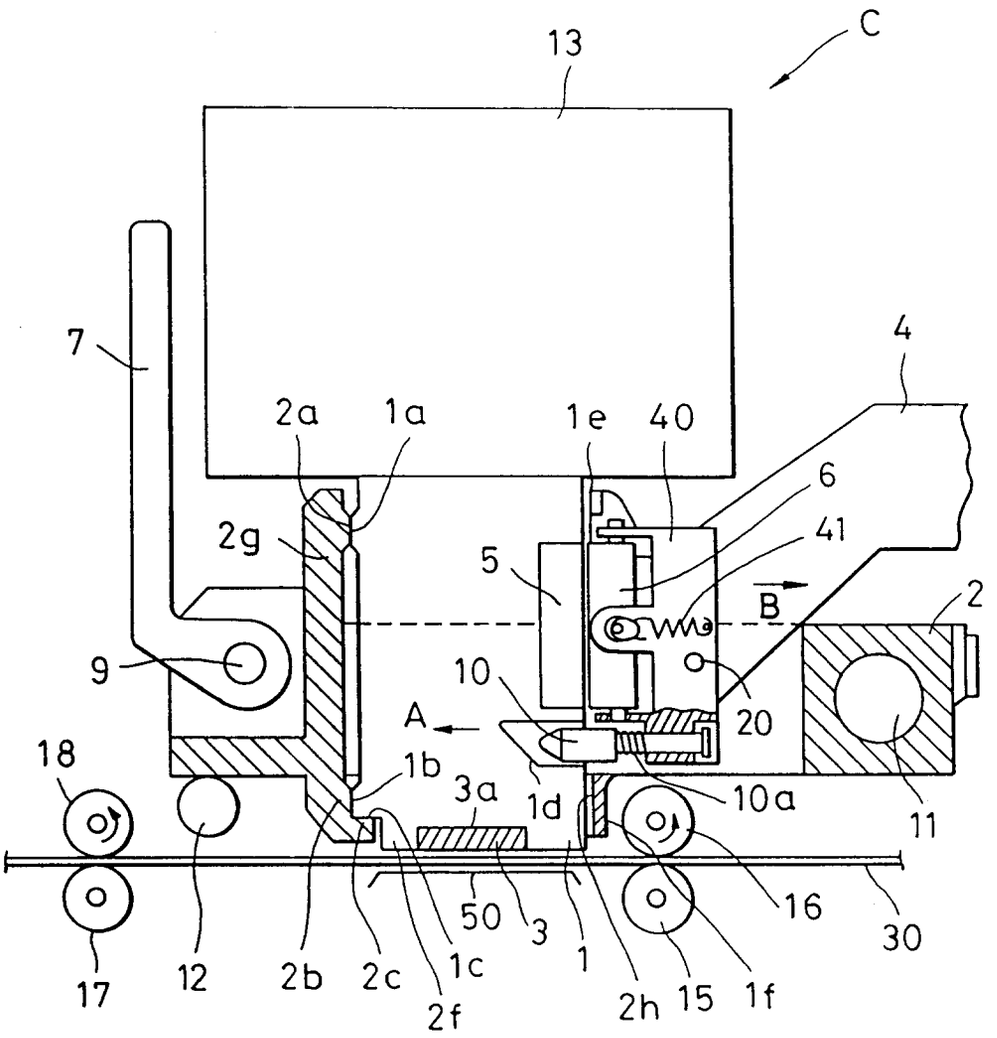

C
13
7
4
2a
1a
1e
40
6
41
2g
5
B
2
9
10
20
A
18
1b
3a
1d
10a
11
50
3
1
16
30
17
12
2b
2c
1c
2f
2h
15
1f

FIG. 1B

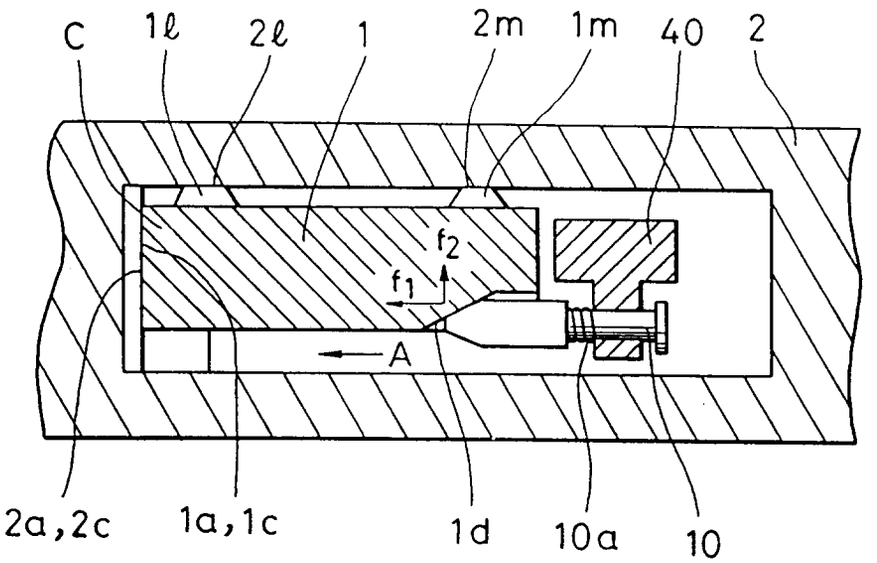


FIG. 2A

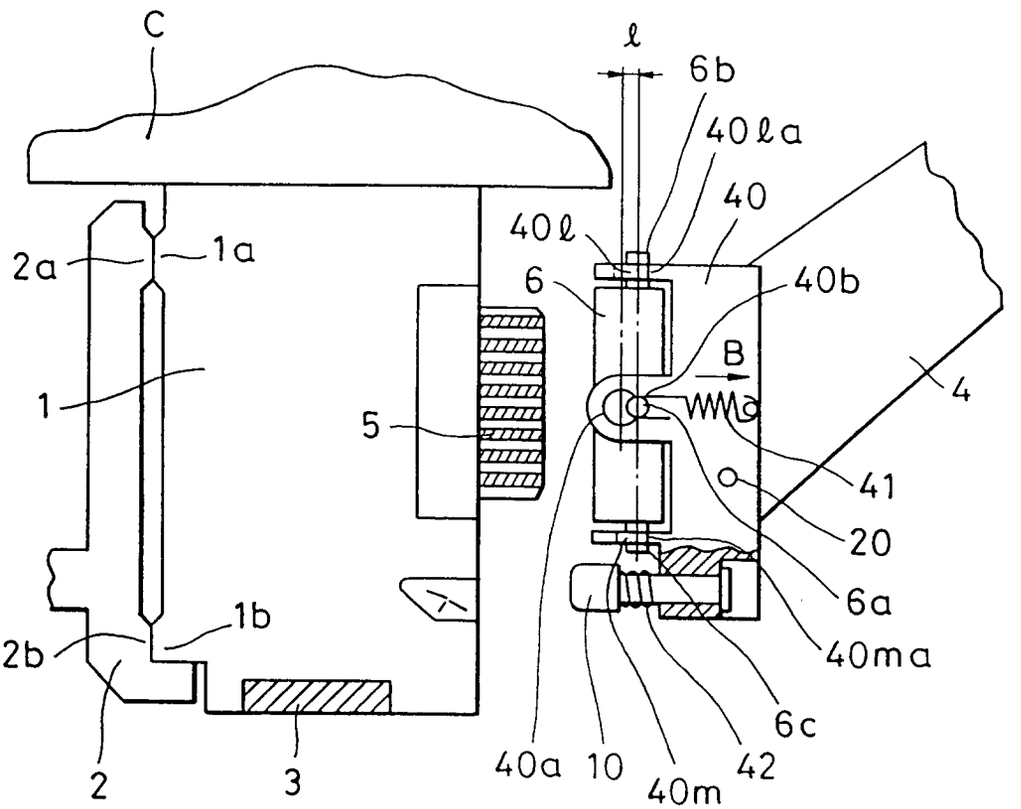

C
ℓ
6b
40ℓa
40
40ℓ
6
40b
B
4
2a
1a
1
5
41
20
6a
40ma
1b
2b
6c
40a
10
40m
42
2
3

FIG. 2B

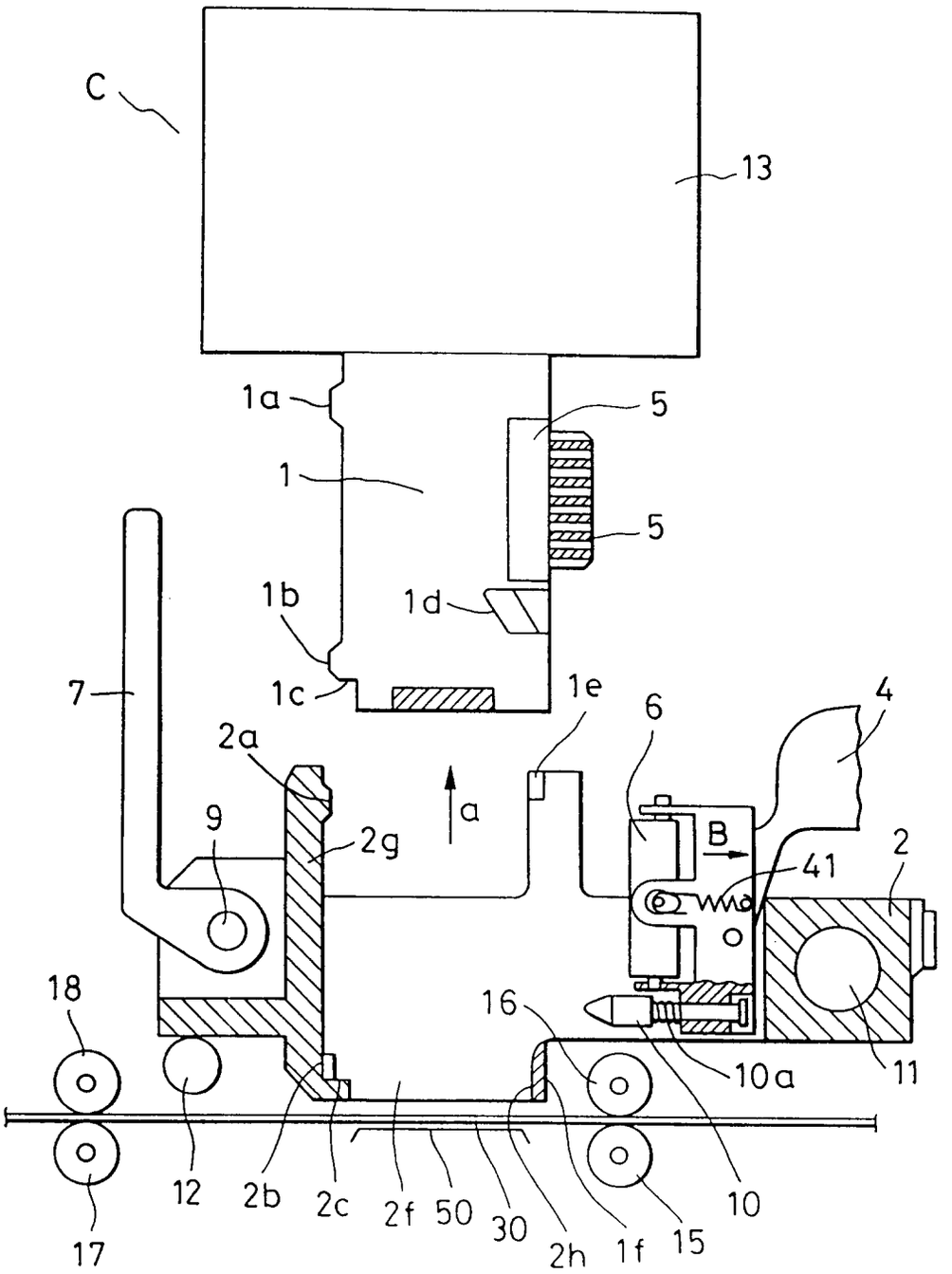

C
13
1a
5
1
5
1b
1d
7
1c
1e
6
4
2a
a
9
2g
B
41
2
18
16
10a
11
12
2b
2c
2f
50
30
2h
1f
15
10
17

FIG. 3A

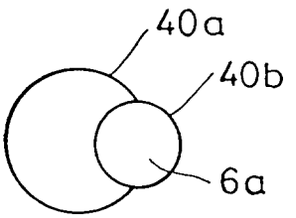



FIG. 3B

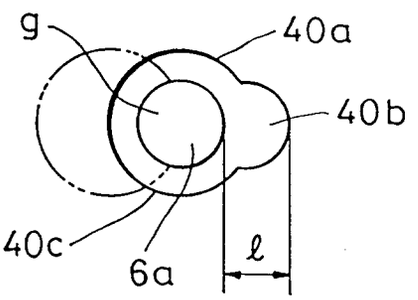



FIG. 3C

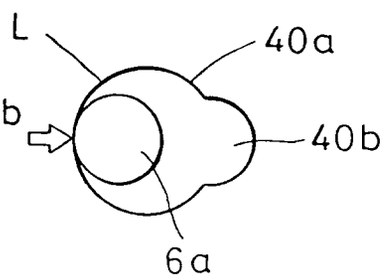


FIG. 4

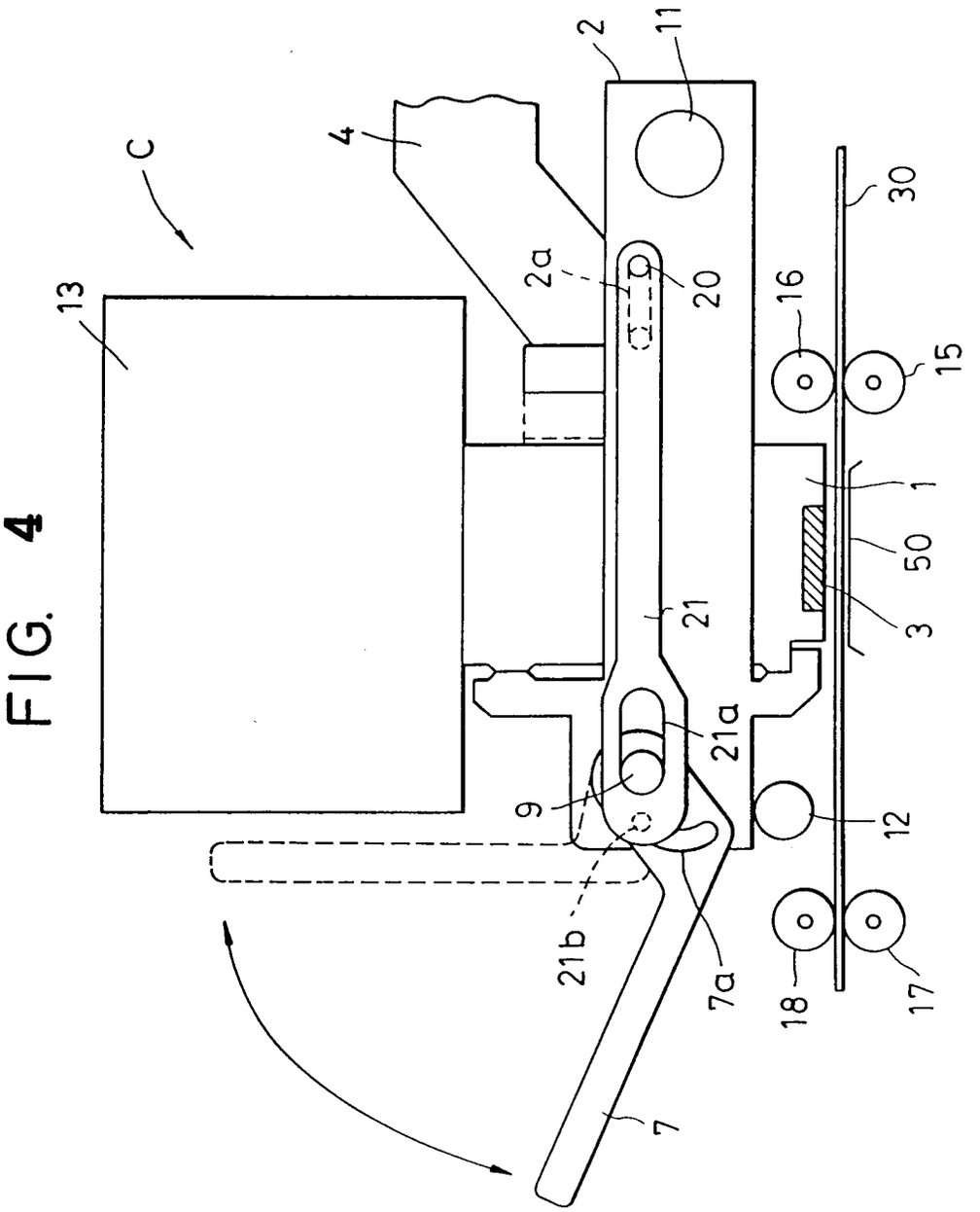


FIG. 5

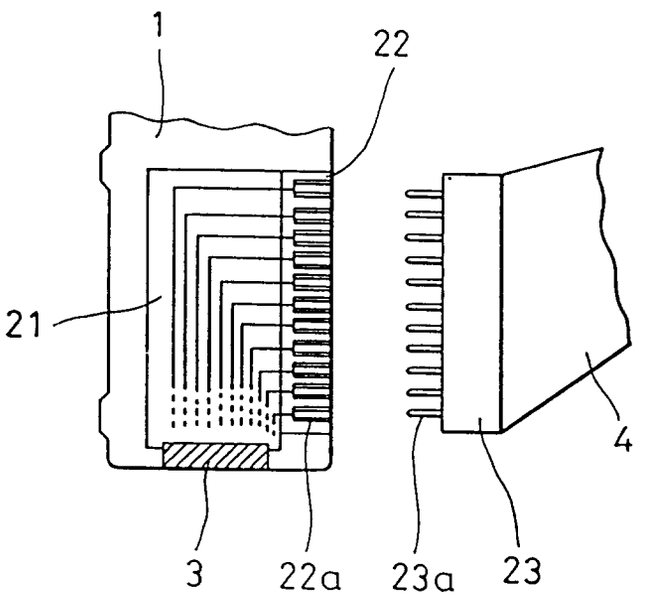


FIG. 6

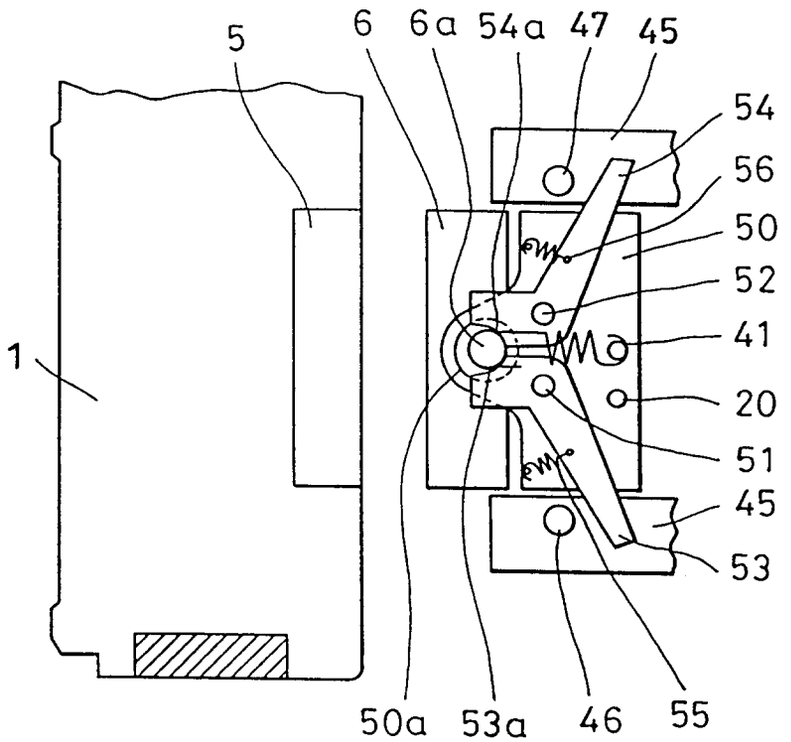


FIG. 7

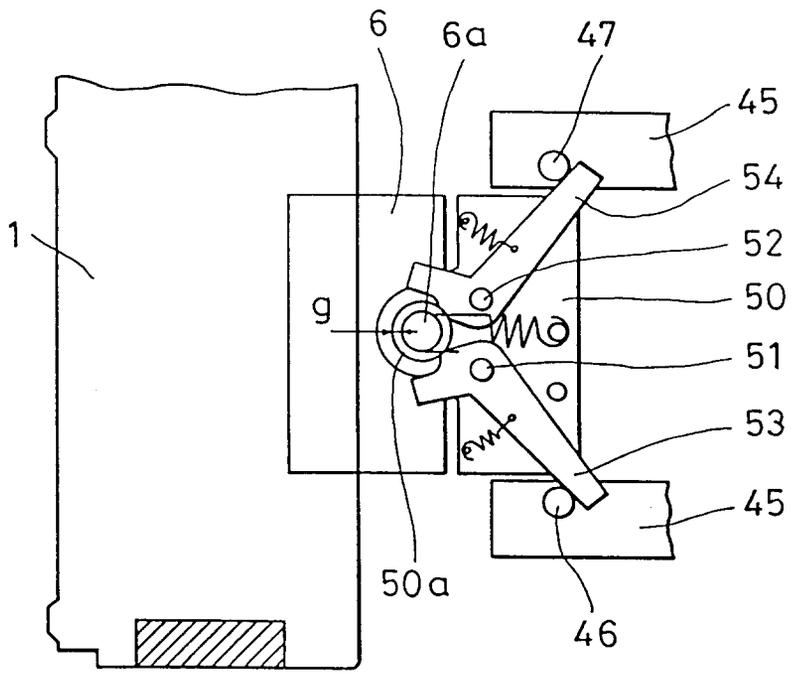


FIG. 8

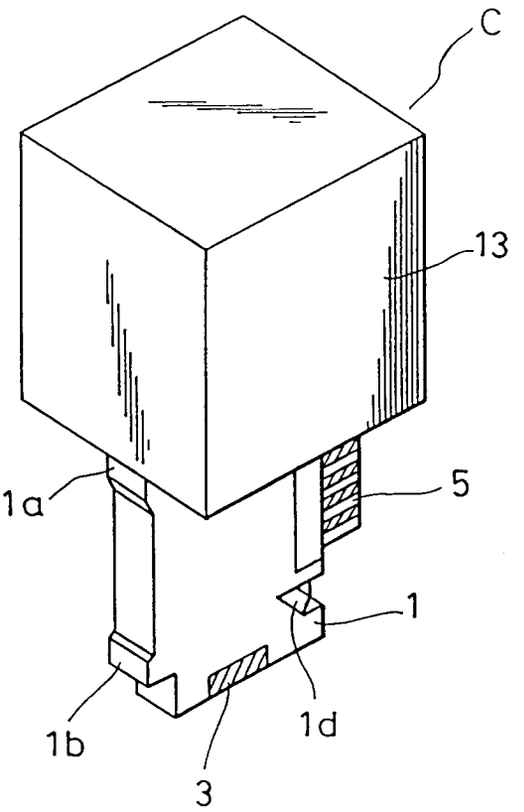


FIG. 9

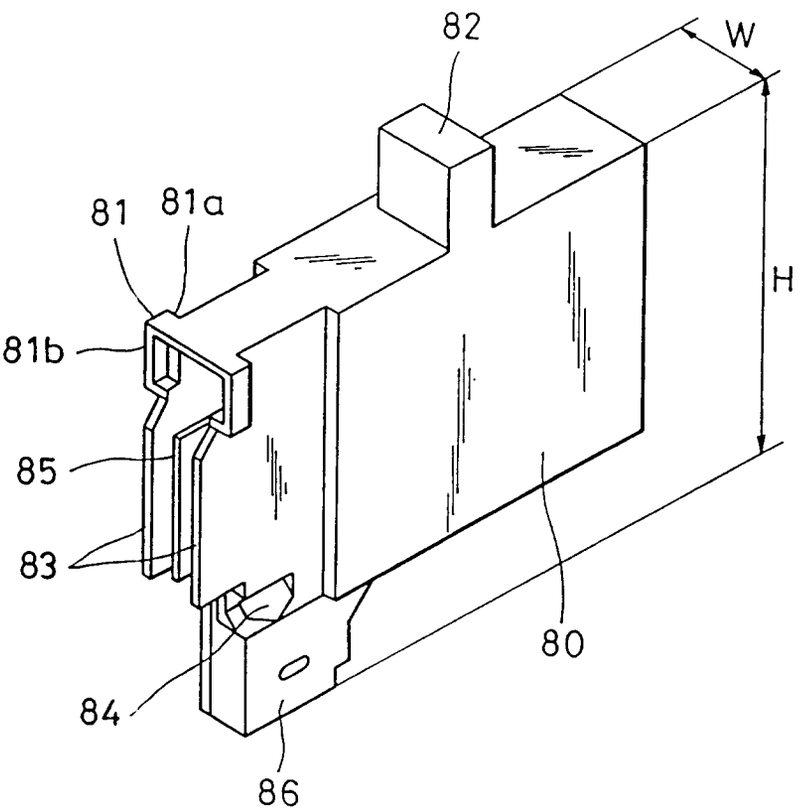


FIG. 10A

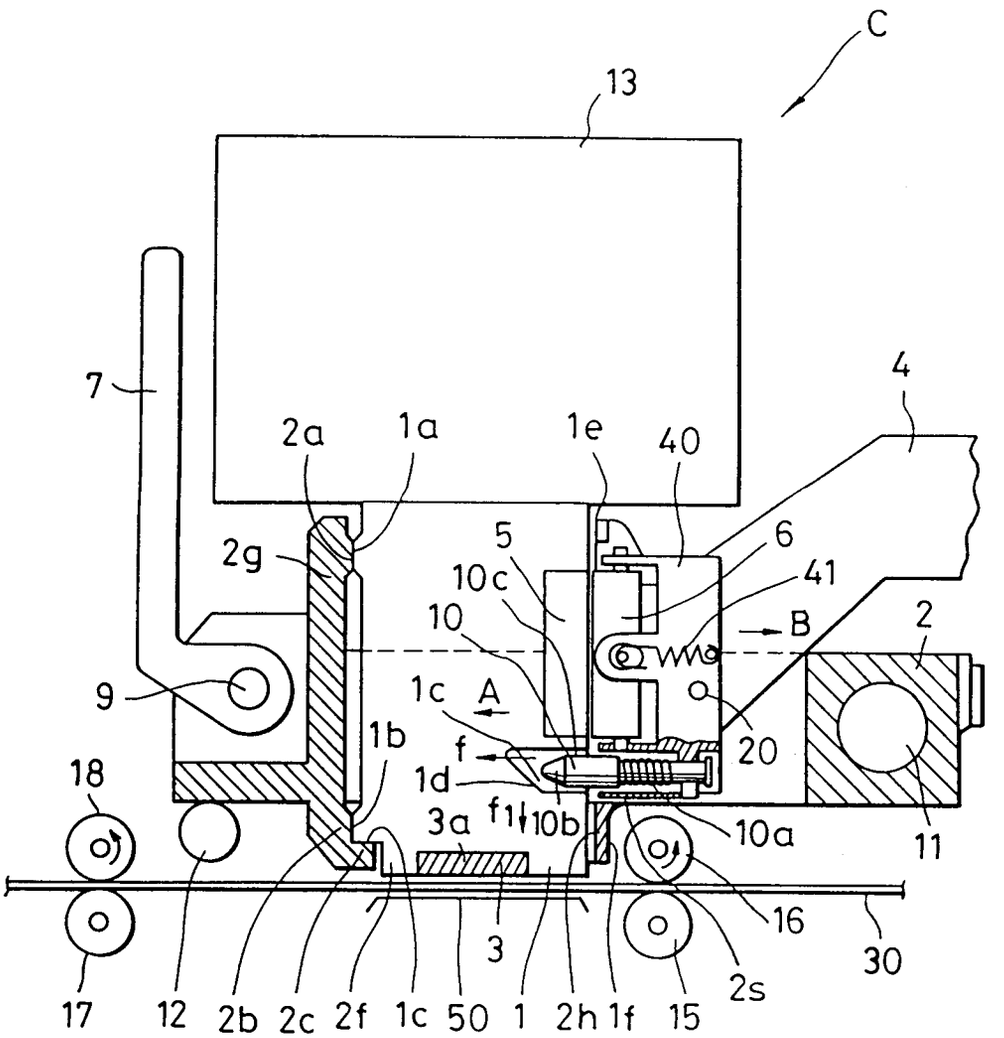

C
13
7
4
2a
1a
1e
40
2g
5
6
10c
41
10
B
2
9
1c
A
20
1b
f
18
1d
3a
f1
10b
10a
11
16
3
30
17
12
2b
2c
2f
1c
50
1
2h
1f
15
2s

FIG. **10B**

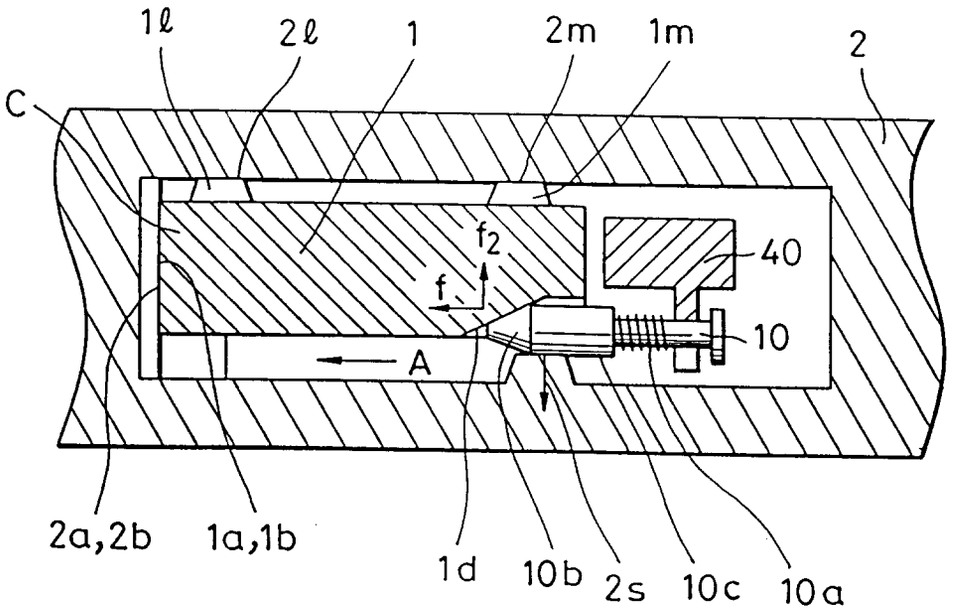


FIG. 10C

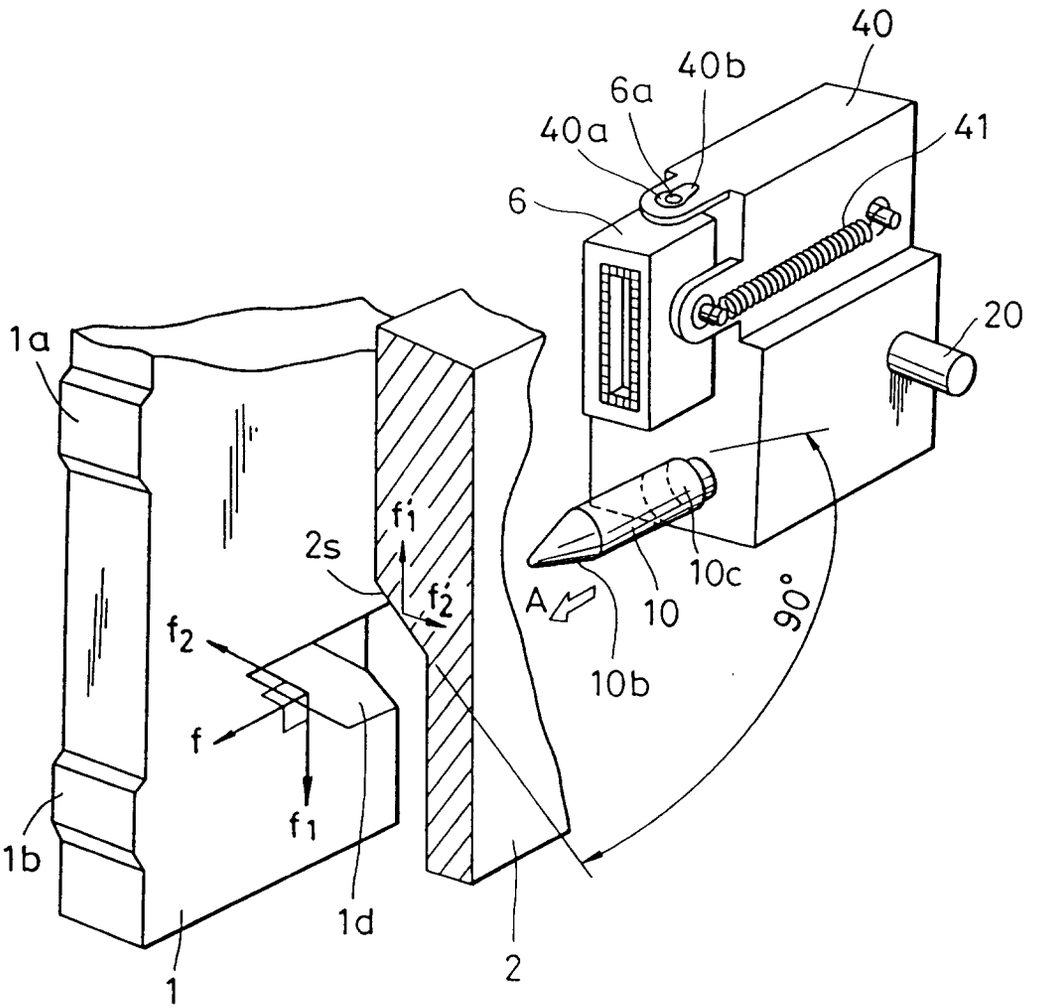


FIG. **10D**

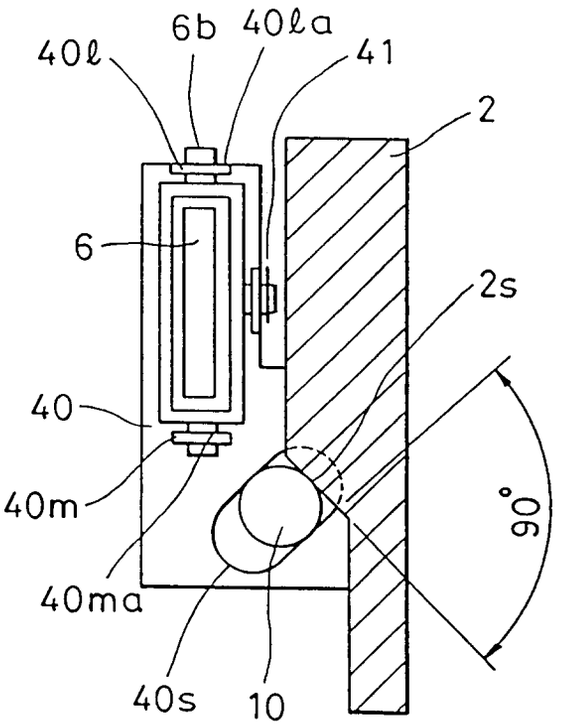


FIG. 11

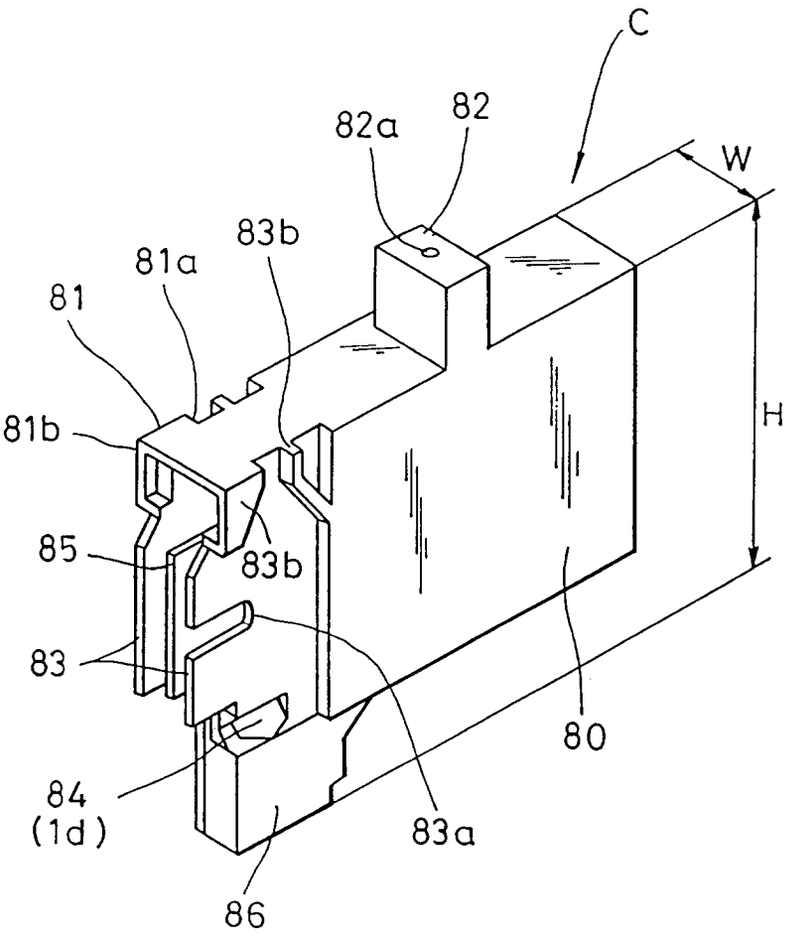


FIG. **12A**

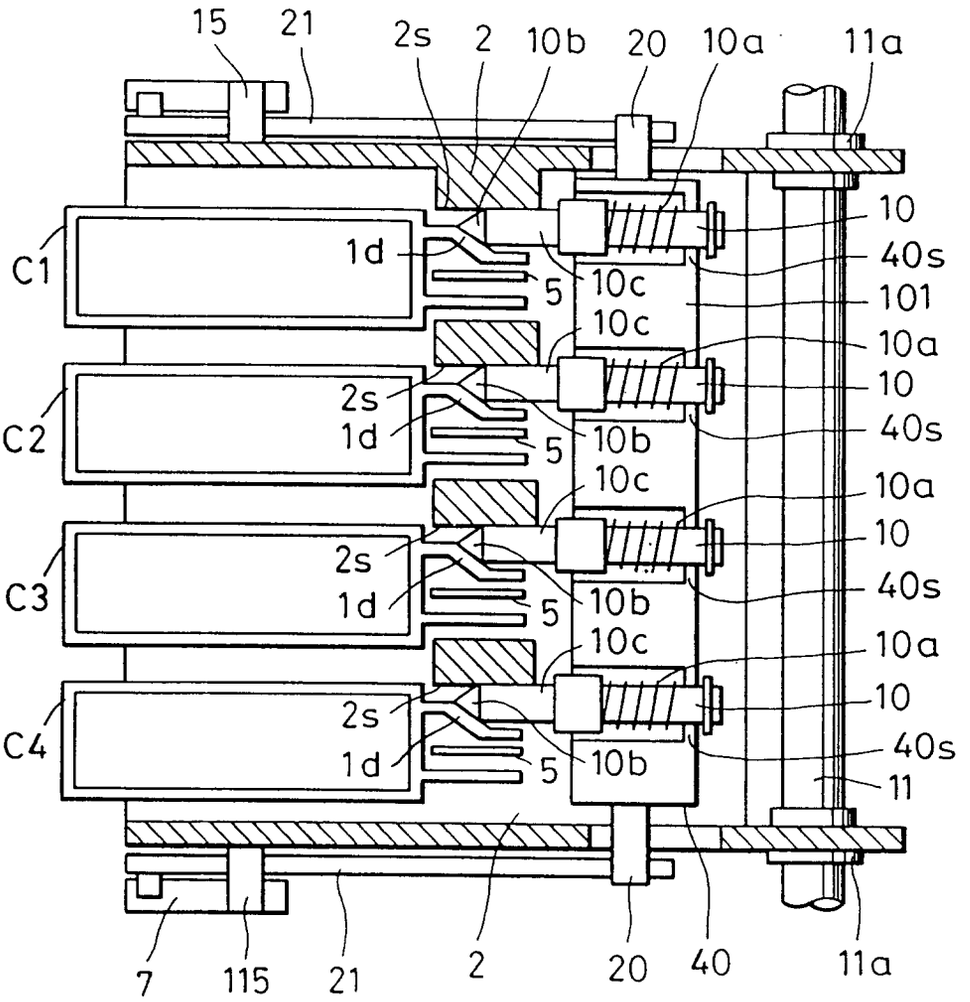

15
21
2s
2
10b
20
10a
11a
10
40s
101
10a
10
40s
10a
10
40s
10a
10
40s
11
C1
C2
C3
C4
1d
5
10c
10b
7
115
21
2
20
40
11a

FIG. 12B

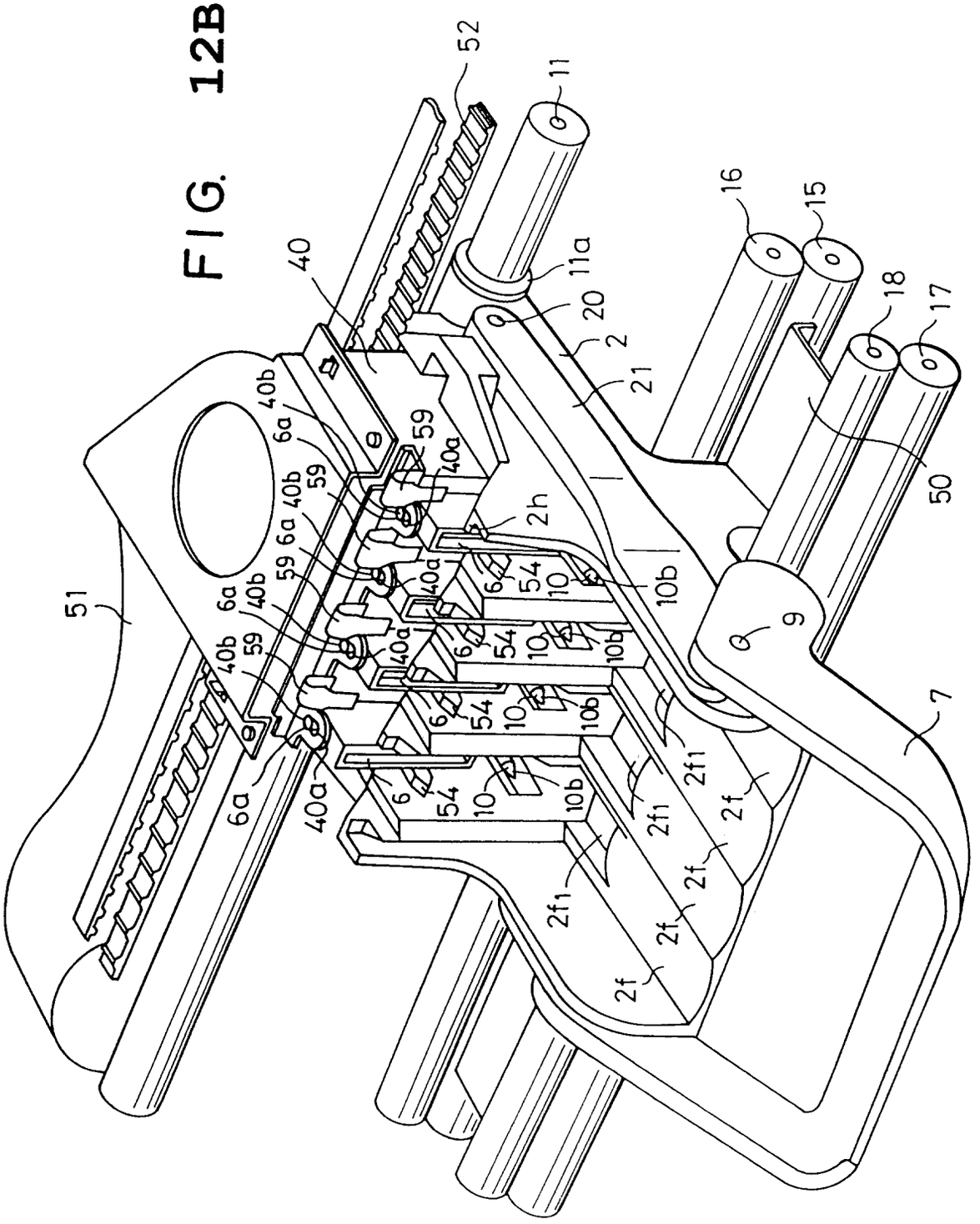
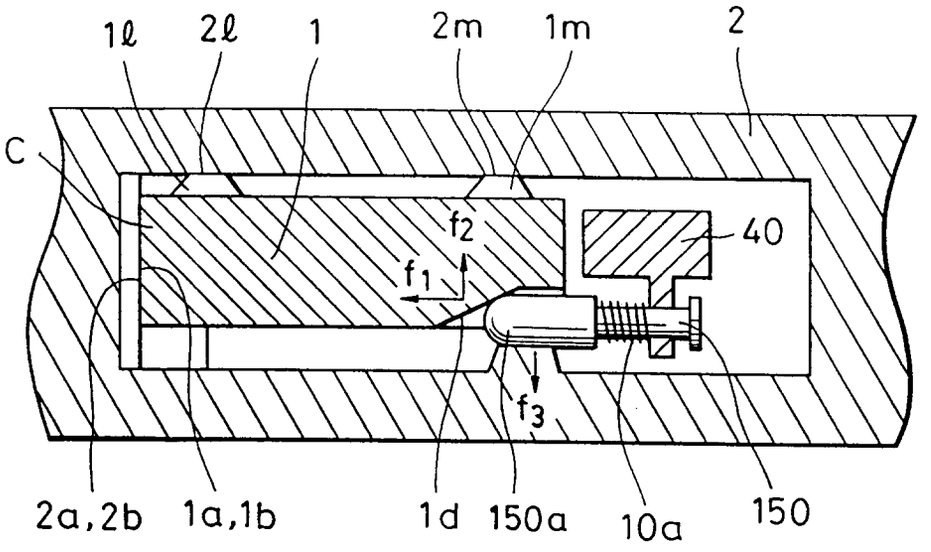

52
11
16
15
40
11a
18
17
20
2
21
40b
6a
59
40a
2h
50
51
54
10
10b
9
7
2f1
2f

FIG. 13



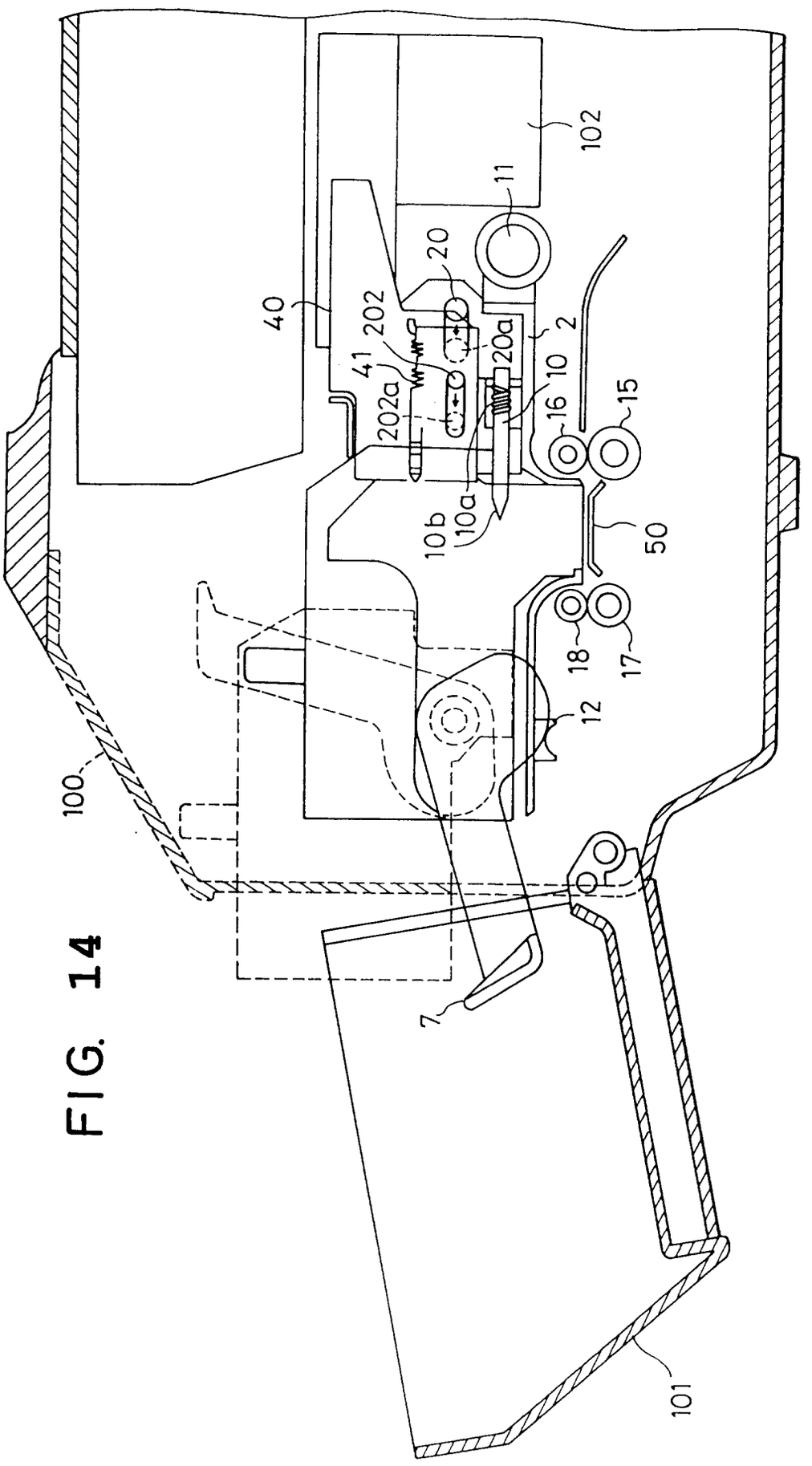



FIG. 14

FIG. 15