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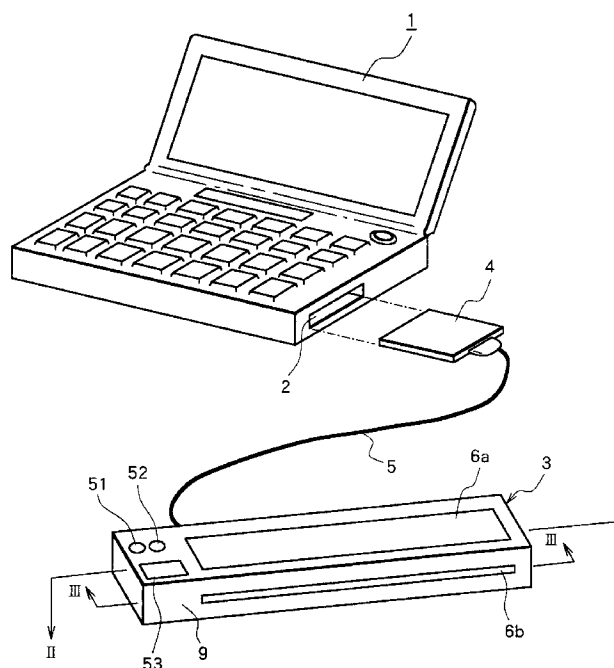
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(54) **Portable printer with interface for receiving supply of power from external source**

(57) A portable printer is provided with an interface for simultaneously supplying power and print information from an external computer. An interface card is connected to the portable printer by a cable. The interface card is configured in a shape that can be inserted into

a PCMCIA card slot of an external computer. The portable printer becomes electrically connected to the computer by inserting the interface card into the card slot. Then, supply of power and transmission of image information, such as print data, can be simultaneously performed from the computer to the portable printer.

FIG. 1



Description

The present invention relates to a portable printer.

As computers become increasingly smaller and more portable, there are more opportunities to carry a computer around and use it out of the office, for example on business trips. In association with this, a need has developed for printing out text or images prepared using the computer while away from the office.

Portable printers have been produced that are similar to stationary printers, but are smaller and lighter weight. Portable printers are configured to be driven by a power supply unit, such as a rechargeable primary or secondary cell, so that they can be used even where no AC power supply is available.

If a user were to rely only on the battery of a portable printer to drive the printer, the user would be unable to use the printer once the battery ran out. Because operation time of a battery-powered portable printer is limited by the battery in this way, the user must also carry along extra batteries or an AC adapter in addition to the portable printer. In other words, the user must carry the computer, an AC adapter for the computer, the portable printer, and also an AC adapter or extra batteries for the printer. This results in the problem of the portable printer being extremely troublesome to carry around.

It is an objective of the present invention to overcome the above-described problems.

In order to achieve the above-described objectives, a portable printer according to the present invention includes: an interface unit connectable to an external device to receive power and print information from the external device; a memory unit that stores the print information; a recording unit that forms images on a recording medium; and a control unit for controlling the recording unit to print an image according to the print information stored in the memory unit.

Thus, a printer may be provided including an interface for simultaneously supplying power and print information from an external computer.

With this configuration, the portable printer is driven by power supplied via the interface unit. Print information is also received via the same interface and is stored in the memory unit. The control unit controls the print unit to print on the print medium according to the print information stored in the memory unit, for example, by scanning across the surface of the print medium.

In this way, the portable printer is capable of simultaneously receiving power and print information from an external computer via a single interface unit. Accordingly, power for driving the portable printer can be supplied from the power source of the external computer. Therefore, there is no need for the user to provide a separate AC adapter for the portable printer.

According to another aspect of the present invention, the interface unit conforms to PCMCIA standards. Therefore, it can be easily electrically connected to an external computer. The interface unit could be any type

of interface capable of supplying power as well as print information. For example, the interface unit could be a Centronics interface, an USB interface, or an IEEE1394 interface.

According to another aspect of the present invention, a power storage unit is provided for supplying power to various components of the portable printer. Therefore, the portable printer can be operated even when it is disconnected from the external computer. Also, power supplied from the external computer via the interface unit is stored in the power storage unit so that power drawn from the power storage unit while the portable printer is disconnected from the portable computer can be replenished while the portable printer is connected to the portable computer.

According to another aspect of the present invention, the recording unit is an ink jet type recording unit that ejects ink to print. Therefore, printing is performed without the recording unit contacting the print medium so that good printing results can be obtained even when the print surface is not flat. Further, compared to a recording unit that requires, for example, a print ribbon, the configuration is simpler so that the overall device can be made smaller. Also, printed images are clearer.

According to another aspect of the present invention, a piezoelectric type ink jet head, which has low power consumption, is used as the recording unit. Therefore, the load on the power source of the computer can be kept low when printing using the portable printer.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the invention will become more apparent from reading the following description of the preferred embodiment taken in connection with the accompanying drawings in which:

Fig. 1 is a perspective view showing external configuration of a portable printer according to the present embodiment;

Fig. 2 is a cross-sectional view taken along line II-II of Fig. 1;

Fig. 3 is a cross-sectional view taken along line III-III of Fig. 1; and

Fig. 4 is a block diagram showing electrical configuration of the portable printer of the present embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A portable printer according to preferred embodiments of the present invention will be described while referring to the accompanying drawings wherein like parts and components are designated by the same reference numerals to avoid duplicating description.

Fig. 1 is a perspective view showing external con-

figuration of a portable printer 3 according to the present embodiment of the invention and a portable computer 1 connected to the portable printer 3. The portable computer 1 includes a card slot 2 conforming to PCMCIA standards. Although not shown in the drawings, the card slot 2 includes a power source pin and data transmission pins. The power source pin is for supplying power to, for example, the LSI provided in a LAN card or a modem card, and also to the portable printer 3 in a manner to be described below.

The portable printer 3 has a slender tubular casing 9. At an upper surface of the casing 9 is provided a power switch 51 for turning on and off a power source of the portable printer 3, an online switch 52, and a liquid crystal display (LCD) 53 for displaying various conditions of the printer. An opening portion 6a is formed in the upper surface of the casing 9. A sheet supply port 6b is formed in a side surface of the casing 9. Although not shown in the drawings, print sheets, which serve as a print medium, are supplied into the portable printer 3 through the sheet supply port 6b.

An interface card 4 is connected to the portable printer 3 via a cable 5. The interface card 4 is configured into a shape insertable into the card slot 2 and includes connector elements that connect to the power supply pin and to the data transmission pins of the card slot 2 when the interface card 4 is inserted into the card slot 2. With this configuration, the portable printer 3 becomes electrically connected to the portable computer 1 by insertion of the interface card 4 into the card slot 2 so that the interface card 4 can simultaneously perform both supply of power and transmission of image information, such as print data, between the portable computer 1 and the portable printer 3.

Figs. 2 and 3 show internal configuration of the portable printer 3 according to the embodiment. Fig. 2 is a top cross-sectional view and Fig. 3 is a side cross-sectional view of the portable printer.

The casing 9 houses a carriage 7, a carriage movement mechanism, a sheet transport mechanism. The carriage 7 is mounted in the opening portion 6a and an ink jet head 10 is mounted on the carriage 7. The sheet transport mechanism is for transporting print sheets from the sheet supply port 6b in a sheet transport direction. The carriage movement mechanism is for reciprocally moving the carriage 7 through a space 8 in a direction substantially perpendicular to the sheet transport direction in a range corresponding to the size of the print sheet.

It is desirable that the ink jet head 10 be formed from a piezoelectric type ink jet head because piezoelectric type ink jet heads have much lower power consumption than other types of print heads, such as thermal type print heads. For example, a thermal type print head requires about 60.00 mJ of power to print each character, but an ink jet type print head requires only 0.14 mJ of power to print each character.

Piezoelectric type ink jet heads have ink chambers

filled with ink. At least one piezoelectric element is provided in each ink chamber. Also, an aperture is formed in fluid connected with each ink chamber. With this configuration, application of an electric signal to the piezoelectric element will cause the piezoelectric element to deform so as to pressurize the ink filling the ink chamber. An ink droplet is ejected from the aperture as a result.

The carriage movement mechanism includes: a drive pulley 11 rotatably supported in the casing 9 at a right-hand side thereof as viewed in Figs. 2 and 3; a follower pulley 12 rotatably supported in the casing 9 at a left-hand side thereof as viewed in Figs. 2 and 3; a timing belt 13 spanning between the drive pulley 11 and the follower pulley 12 and fixedly attached to the carriage 7 by a securing portion of the carriage 7; a pulley gear 14 formed integrally with the drive pulley 11; a drive gear 15 meshingly engaged with the pulley gear 14; and a pulse motor 16 capable of driving the drive gear 15 in forward and reverse directions.

The transport mechanism is disposed in the casing 9 at the left-hand side thereof as viewed in Figs. 2 and 3. As shown in Fig. 2, the transport mechanism includes transport rollers 21, each disposed on a rotational shaft 21a. Although the transport mechanism includes two transport rollers 21 as shown in Fig. 2, to facilitate explanation, only one of the transport rollers 21 and related configuration thereof will be described below while referring to Fig. 3. The transport roller 21 is rotatably supported on the casing 9 by bearings 22, 22 and is for transporting the print sheet. Although the transport roller 21 is shifted to the left of the center position of the casing 9 as viewed in Fig. 3, it is positioned near the substantial center of print sheets to be transported.

The transport mechanism further includes: a gear 23 fixed on the rotational shaft 21a; a driving gear 26 connected with the gear 23 via an idle gear 24 so that rotation of the driving gear 26 rotates the gear 23; and a pulse motor 25 for driving rotation of the driving gear 26.

Supplementary rollers 28, 28 are disposed in confrontation with the transport roller 21 on a rotational shaft 29. The rotational shaft 21a is rotatably supported on a bearing member 35 at one end and on a connection member 31 at the other end. A coil spring 34 is disposed between the connection member 31 and the left side of the casing 9 so as to constantly urge the supplementary rollers 28, 28 into contact with the transport roller 21. With this configuration, the supplementary rollers 28, 28 support sheets in contact with the transport roller 21, thereby supplementing transport operations performed by the transport roller 21.

The transport mechanism configured in this manner transports print sheets supplied through the sheet supply port 6b in a direction perpendicular to the direction of reciprocal movement of the carriage 7. After printing has been performed by the ink jet head 10 mounted on the carriage 7, the transport mechanism discharges the print sheet from a sheet discharge port not shown in the

drawings.

Circuit boards 42 are disposed in parallel with each other between the pulse motor 16 and the transport mechanism. The circuit boards 42 include control circuitry for controlling the transport mechanism and the carriage movement mechanism in order to print images and the like. A rechargeable battery 20 is provided next to the circuit boards 42. A flexible cable 41 is provided to electrically connect the ink jet head 10 with the circuit boards 42.

Next, an explanation for electrical configuration of the portable printer 3 of the present embodiment will be provided while referring to Fig. 4. Fig. 4 is a block diagram showing the electrical configuration of the portable printer 3 according to the present embodiment.

As shown in Fig. 4, the portable printer 3 includes a variety of electrical components connected together, such as a CPU 60; a ROM 61 for storing a control program file for controlling the various electrical components of the portable printer 3; a RAM 62 for storing print data and the like; an LCD control portion 66 for controlling display of the LCD 53; a head drive portion 65 for controlling drive of the ink jet head 10; a motor controller portion 67 for controlling the pulse motors 16, 25; a power control portion 64 for performing a variety of actions such as monitoring residual amount of charge in the battery and controlling recharge of the rechargeable battery 20; and a PCMCIA interface control portion 63.

The PCMCIA interface control portion 63 is contained in the interface card 4. The PCMCIA interface control portion 63 serves to convert levels and timing of a variety of signals transmitted to and received from the portable computer 1 so that signal levels and timings match processes performed within the portable printer 3. The PCMCIA interface control portion 63 also serves to supply power from the portable computer 1 to the portable printer 3.

The CPU 60, the ROM 61, the RAM 62, the head drive portion 65, the LCD control portion 66, the motor controller portion 67, and the power control portion 64 are mounted on the circuit boards 42.

Next, operations of the portable printer 3 will be explained. The portable printer 3 is used with the interface card 4 inserted in the card slot 2 of the portable computer 1.

When the interface card 4 is inserted in the card slot 2, the portable computer 1 can supply power to the portable printer 3. When the power switch 51 is pressed while the portable computer 1 in this condition, the portable printer 3 will enter an operable condition. The power control portion 64 supplies power from the portable computer 1 to the circuit boards 42 and to various motors of the portable printer 3 and also, while monitoring the residual amount of charge in the rechargeable battery 20, recharges the rechargeable battery 20. It should be noted, when the interface card 4 is not inserted in the card slot 2, the power source control portion 64 supplies electrical energy from the battery 20 to the circuit boards

42 and to the motors.

When the user wishes to print out text and the like prepared using the portable computer 1, he or she indicates this desire to the portable computer 1, which accordingly outputs a print command to the portable printer 3 to execute printing operations. The portable computer 1 outputs print data, which is transmitted through the PCMCIA interface control portion 63 and stored in the RAM 62. The CPU 60 commands the motor controller portion 67 to drive the pulse motor 16 in its forward rotational direction to move the carriage 7. In synchronization with this, the CPU 60 drives the head drive portion 65 according to the print data stored in the RAM 62 so that the ink jet head 10 ejects ink to print. Printing continues until a single line of print has been completed.

When a single line of print has been printed, the pulse motor 16 is driven in its reverse rotational direction so that the carriage 7 is returned to its starting position. Then, the pulse motor 25 is driven so that the transport roller 21 is rotated by a predetermined amount sufficient to feed the print sheet by one line's worth of print. Then, the next line of print is printed. The desired text is printed out by repeating the above-described operations.

With a portable printer 3 configured as described above, the portable printer 3 can be brought into electrical connection with the portable computer 1 by inserting the interface card 4 into the card slot 2 of the computer 1. Because this enables the portable printer 3 to simultaneously receive print data and power from the computer 1, there is no need for the user to carry an AC adapter for the printer 3.

Because an ink jet head 10, particularly a piezoelectric type ink jet head, is used as the printing unit, power consumed by the portable printer 3 during printing is kept low so that the load on the power source of the computer is also kept low. This configuration helps prevent a system down condition from occurring in the computer 1.

Here, a system down condition of the computer 1 will be described. The computer 1 includes a battery, such as a small secondary cell or dry cell, which serves as a power source when the computer 1 is not supplied with power via an AC adapter. The battery of the computer 1 supplies power to the interface card 4 via a power source circuit, such as a DC/DC converter. The current that can be drawn from the battery is limited by the battery and the power source circuit. When the current drawn from the battery exceeds that allowed by the rating of the power source circuit, the voltage will drop.

Such a drop in voltage can cause a system down condition, wherein the drop in voltage causes the logic, such as the CPU, of the computer 1 to reset. In the worst situation, such a voltage drop can damage the elements of the power source circuit or damage peripheral equipment, such as a hard disk of the computer 1.

When the ink jet head 10 is formed from a piezoelectric type head, power consumed from the power source battery in the computer can be kept low. There-

fore, when the ink jet head 10 is formed from a piezoelectric type head, the portable printer 3 can be used to print many sheets of images without fear of overtaxing the supply source of the computer 1 and causing a computer down condition, even when the portable printer is used at a location where no AC power supply is available, such as in a car or outdoors.

While the invention has been described in detail with reference to specific embodiments thereof, it would be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention, the scope of which is defined by the attached claims.

For example, although the present embodiment describes the interface of the portable printer 3 as being a PCMCIA interface, any interface can be used that is capable of receiving power and print information from an external device. For example, a Centronics interface, an USB interface, or an IEEE1394 interface could be used as the interface of the present invention.

Further, although the embodiment describes a portable computer as an example of an external device for supplying power and print data when connected to the portable printer 3, any information processing device capable of outputting print data and supplying power could be used instead. For example, the external device can be a word processor or a personal digital assistant (PDA).

Claims

1. A portable printer for forming images on a recording medium, the portable printer comprising:

an interface unit connectable to an external device to receive power and print information from the external device;
a memory unit that stores the print information;
a recording unit that forms images on the recording medium; and
a control unit for controlling the recording unit to print an image according to the print information stored in the memory unit.

2. A printing system for forming images on a recording medium, the printing system comprising:

an external device including an interface slot with a connection element for supplying power and a connection element for supplying print information; and
a printer including:
an interface unit connectable to the interface slot and receiving power and print information therefrom;
a memory unit that stores the print information;
a recording unit that forms images on the re-

cording medium; and
a control unit for controlling the recording unit to print an image according to the print information stored in the memory unit.

3. A portable printer as claimed in claim 1 or a system as claimed in claim 2, wherein the interface unit complies with PCMCIA interface standards.

4. A portable printer or system as claimed in any preceding claim, further comprising a battery for supplying power to the recording unit, the memory unit, and the control unit when the interface unit is not connected to the external device, wherein power received by the interface unit from the external device is used to recharge the battery.

5. A portable printer or system as claimed in claim 4, further comprising a power source control portion controls recharge of the battery while monitoring residual amount of charge in the battery.

6. A portable printer or system as claimed in any preceding claim, wherein the recording unit includes an ink jet type print head that forms images by ejecting ink.

7. A portable printer or system as claimed in any preceding claim, wherein the recording unit includes an ink jet type print head formed with an ink chamber and an aperture in fluid connection with the ink chamber and having a piezoelectric element that, upon application of an electric signal, deforms to pressurize ink in the ink chamber so that ink is ejected from the aperture to form images.

8. A portable printer or system as claimed in claim 6 or 7, wherein the recording unit further includes:

a recording medium transport mechanism for transporting the recording medium in a transport direction; and
a head movement mechanism for reciprocally moving the ink jet type print head in a scanning direction substantially perpendicular to the transport direction in a range corresponding to size of the recording medium.

9. A portable printer or system as claimed in any preceding claim, wherein the interface unit is a USB interface.

10. A portable printer or system as claimed in any preceding claim, wherein the interface unit is an IEEE1394 interface.

11. A portable printer or system as claimed in any preceding claim, wherein the interface unit is a Centro-

nics interface.

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FIG. 1

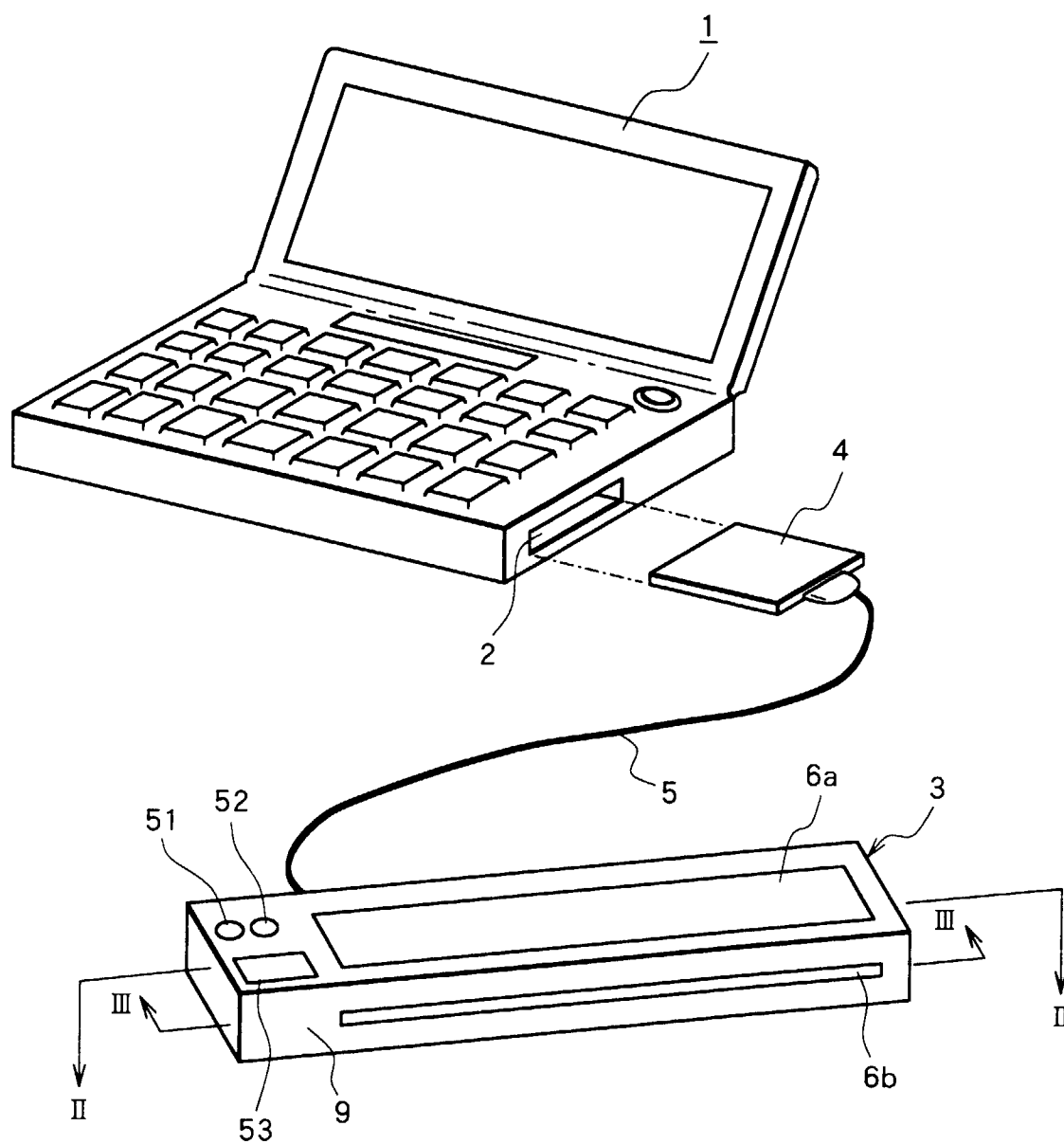


FIG. 2

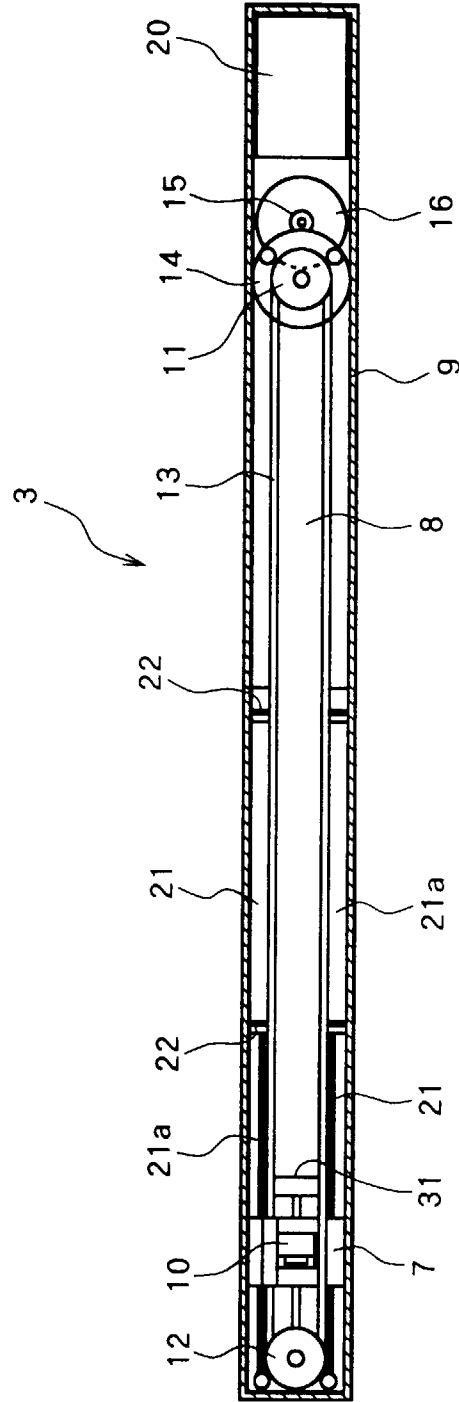


FIG. 3

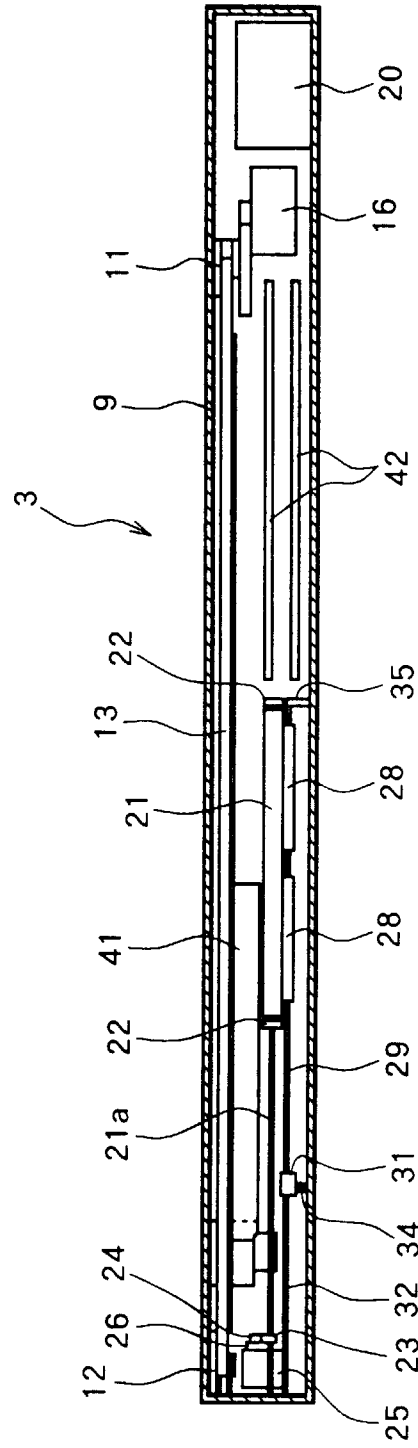


FIG. 4

