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54 **Inkjet printer.**

57 An inkjet printer comprises a printer unit (10) and a paper feed unit (50). Printer unit (10) is provided with the following: a carriage (12), an inkjet cartridge (11) mounted on the carriage and having an inkjet head (11a), that performs printing by ejecting ink towards a print medium; and a drive mechanisms (15, 16, 17, ...) for reciprocating carriage (12). The carriage and the drive mechanism are located either at the rear of or below inkjet head (11a). Paper feed unit (50) is provided with a mechanism for feeding the recording paper and is secured onto the recording head side of printer unit (10) on a detachable basis. The inkjet printer is capable of easily printing various print patterns on various recording materials, such a slip printing, in addition to normal printing which is performed by feeding a recording material that is relatively soft.

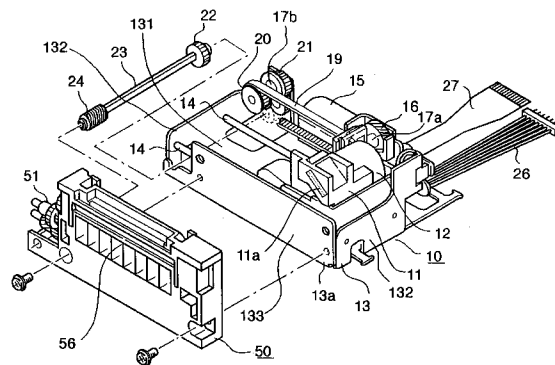


FIG. 1

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This invention relates to an inkjet printer and, more particularly, to an inkjet printer capable of slip printing.

"Slip printing" as the term is used here, refers to printing on relatively rigid print media like thick paper or cardboard, etc., that cannot be or should not be transported through a curved feed path. Thus, slip printing is contrasted by what will be called "normal printing" here, i.e. printing on flexible or pliant print media like ordinary paper.

US-A-4,920,258 discloses an inkjet printer suitable for normal printing only. The known inkjet printer comprises, mounted to a common frame, an inkjet unit, a carriage on which the inkjet unit is mounted, a carriage drive mechanism, and paper feed means including a platen disposed opposite the inkjet unit and feed rollers that transport recording sheets between the inkjet head and the platen through a bent feed path.

A printer dedicated to slip printing and not capable of normal printing is disclosed in JP-A-39270/1991.

A printer suitable for slip printing and normal printing is disclosed in US-A-4,375,923. This known printer has combined in one machine plural print stations of which one is designed for slip printing. Except for being an impact dot printer using an ink ribbon, this prior art has a very complex and bulky structure making it rather expensive.

Generally, slip printing can be performed by either of the thermal transfer method, the wire-dot method and the inkjet method. However, the inkjet method is best suited for slip printing for the following reasons:

(1) Both the thermal transfer method and the wire-dot method require an ink ribbon between the print head and the print medium, and the structure needed for mounting and transporting the ink ribbon increases the complexity of the printer. Further, the ink ribbon tends to stain the print medium unless special means are provided to avoid it. By contrast, in an inkjet printer the ink is stored in a cartridge, and this makes the structure simple. Although there is a risk of ink dripping that could result in staining the print medium, this problem can be easily prevented by keeping the ink in an ink bag in the cartridge at an appropriate negative pressure.

(2) As a general rule, the wire-dot method requires an accurate adjustment of the gap between the front end of the print head and the print medium. The size of this gap determines the impact force by which the wire-dots press the ink ribbon against the print medium. Because the print density largely depends on the impact force, the gap must be precisely adjusted. In the case of the thermal transfer method, because the ink in the ink ribbon that is

provided between the thermal head and the print medium is transferred, the resulting print density is influenced by the impact pressure applied to the ribbon. Thus, this method also requires an accurate maintenance of the gap, which imposes stringent requirements on the mechanism of operation and the precision of printer manufacture. For these reasons contact-based printing is not well-suited to slip printing the more so since a varying thickness of the print media may also influence the pressure. The non-contact printing method, i.e., the inkjet method, does not have the above disadvantages and thus appears to be best suited to slip printing.

It is, therefore, an object of the present invention to provide an inexpensive inkjet printer capable of performing high quality slip printing and normal printing.

This object is achieved with an inkjet printer as claimed in claim 1.

Preferred embodiments of the invention are subject-matter of the dependent claims.

According to the invention the printer comprises two separate units, a printer unit and a paper feed unit the latter being detachably mounted to a front end of the printer unit. The carriage and the drive mechanism for it are located either at the back of or below the inkjet head. Thus, when the paper feed unit is removed the nozzles of the inkjet head are immediately at or next to the front end of the printer unit. The paper feed unit is intended and designed for normal printing, i.e. to feed pliant print media to a position opposite the inkjet head. For slip printing the paper feed unit can be easily dismantled. When it is removed from the printer unit there are no obstacles to slip printing in front of the inkjet head. Therefore, this structure enables one printer to perform both, slip printing as well as normal printing.

In a preferred embodiment of the invention the frame of the printer unit has a front plate for mounting the paper feed unit. The nozzles of the inkjet head are kept in a plane parallel to the front plate, such that, when the paper feed unit is removed, the front side of the front plate provides a guide surface for rigid print media such as slip paper. Use of such guide surface for slip printing ensures the appropriate gap between the recording medium and the nozzles of the inkjet head. Since the gap size is not as critical as in thermal transfer printing or wire dot printing, accurate slip printing is made possible without requiring high-precision manufacturing of the printer.

The paper feed unit can be endowed with various functions according to the intended purpose. Different paper feed units can be provided so that the user can select the desired unit to suit a particular objective. A paper feed unit may have

plural paper feed mechanisms each providing a different unit amount of paper feed, i.e. a different line spacing. The line spacing can be predetermined, as an example, by setting deceleration ratios of gears employed to transmit the drive force to feed rollers. For example, when printing graphics, such as figures and graphs, or printing characters, such as enlarged characters that are larger than the height of a normal print line, space between lines would not be desirable. In such a case, the line spacing for graphic printing is set so that it is equal to the height of one print line of the inkjet head. On the other hand, when printing character strings, some spacing should be provided between two successive lines for readability. In this case, the unit amount of paper feed for character string printing is set to be larger than the height of one print line of the inkjet head.

As a general rule in inkjet printers, an increase in the viscosity of the ink in the inkjet head or the intrusion of air bubbles into its nozzles can impair the normal ink ejection. To recover from the error when this problem occurs, a preliminary ink eject operation, a so-called nozzle recovery, needs to be performed by ejecting ink droplets that are not used for recording purposes. In a preferred embodiment, the paper feed unit for the inkjet printer of the present invention is provided with an ink collecting recess that catches the ink droplets that are ejected from the inkjet head, and an ink absorption member that receives and absorbs the ink from the ink collecting recess. This facilitates the nozzle recovery of the inkjet head in the condition in which the paper feed unit is attached.

The invention will be described in detail below with reference to the drawings which illustrate preferred embodiments only and in which:

Fig. 1

is a partly exploded perspective view, seen from the front side, of an inkjet printer embodying the present invention,

Fig. 2

is a perspective view, seen from the rear side, of the inkjet printer,

Fig. 3

is a cross-sectional view of the inkjet printer,

Fig. 4

is a plan view of the inkjet printer,

Fig. 5

is a perspective view of the paper feed unit,

Fig. 6

are diagrams for explaining the mechanism for detecting the carriage home position,

Fig. 7(a) to (c)

are schematic diagrams for explaining how slip printing is performed using the inkjet printer of Figure 1,

Fig. 8

is a cross-sectional view similar to Fig. 3 showing another embodiment of the paper feed unit, Fig. 9

is a cross-sectional view similar to Fig. 3 showing still another embodiment of the paper feed unit, and

Fig. 10

shows the gear train used in the paper feed unit of Fig. 9.

The basic structure of a first embodiment of the invention will first be explained with reference to Figs. 1 to 6.

As shown in Fig. 1, the inkjet printer is composed of printer unit 10 and paper feed unit 50. Fig. 1 shows the paper feed unit 50 detached from the printer unit 10. Printer unit 10 comprises a frame 13. Frame 13 has a base plate 131, two side plates 132 and a front plate 133. The side plates 132 and the front plate 133 are bent at right angles from the base plate 131. Two guide rods 14 are mounted to the side plates 132 to extend in parallel to each other and to the front plate 133. A carriage 12 is slidably supported on the guide rods 14 for a reciprocating movement between the two side plates 132. An inkjet cartridge 11 is mounted on the carriage. The inkjet cartridge 11 includes an inkjet head 11a and an ink container (not shown). Nozzles of the inkjet head 11a, indicated by dots in Fig. 1, face the front side of the printer unit, i.e. towards front plate 133. Carriage 12 is coupled to a endless timing belt 19 stretched between a driving gear 18 and a driven gear 20 to extend in parallel to the guide rods 14. Timing belt 19 is arranged at the rear side of the carriage 12. Gear 18 is fixed to one end of a shaft 17a while gear 20 is fixed to one end of a shaft 17b. Shafts 17a and 17b are supported each at the other end by a respective flange portion 134, 135 of the frame. A drive motor 15 is disposed behind timing belt 19. A worm gear 15a (see Fig. 3) is fixed on the motor shaft. Worm gear 15a is engaged by a worm wheel 16 fixed to shaft 17a. Thus, drive of the motor 15 is transmitted via worm gear 15a, worm wheel 16, shaft 17a and gear 18 to the timing belt 19.

In the present embodiment drive motor 15 is a DC motor, whose shaft, when driven, always rotates in the same direction. Thus, the timing belt is also driven always in the same direction. In order to have the carriage reciprocating between the side plates 132 of the frame in response to such drive of the timing belt, a drive pin 30, shown in Fig. 3, is fixed to the timing belt 19 and alternately couples the carriage 12 with the upper and the lower run of timing belt 19. Since this is a well known mechanism a further detailed description will be omitted. Incidentally, cable 26 shown in the figures is for connecting the drive motor 15 and a sensor 31 explained later to a control circuit not shown. Like-

wise, cable 27 is for connecting the inkjet head 11a to the control circuit.

In this way, the drive power of drive motor 15 is used to reciprocate the carriage 12 and the inkjet cartridge along guide rods 14. The drive power of the motor is also used for driving a paper feed mechanism of the paper feed unit 50. This is achieved by means of a transmission shaft 23 best shown in Figs. 1 and 4. A gear 22 is fixed to one end of the transmission shaft 23 and a worm gear 24 to the other end. Transmission shaft 23 is supported in the frame 13 so that gear 22 is engaged with an intermediate gear 21 fixed to shaft 17b. In this way, transmission shaft 23 is driven in response to a movement of the timing belt 19.

Paper feed unit 50 is provided with a gear train 51. When the paper feed unit is mounted to the printer unit, the gear train 51 is engaged with worm gear 24. As shown in Fig. 3, paper feed unit 50 includes two feed rollers 52 and 53. Feed rollers 52, 53 are disposed in a feed path at an intermediate position between a paper inlet slit 56a and a paper outlet slit 56b and are arranged to be driven in mutually opposite directions by means of the gear train 51. With paper feed unit 50 mounted to the printer unit 10 printing is performed on print media fed by paper feed unit 50 through the feed path bent as shown in Fig. 3. With a serial printer like the present one, the print medium is fed by a distance corresponding to the line spacing each time one line has been printed and prior to the start of the next line. Since the worm gear is continuously rotated as the carriage is moved, the gear train 51 has to convert this continuous drive into an intermittent drive of the feed rollers 52, 53. In the present embodiment, printing is performed while the carriage is moved from a home position at one end of its range of movement to the other end. During this forward stroke of the carriage drive power is not transferred to the feed rollers. During the following backward stroke gear train 51 couples the drive rollers to the worm gear causing the print medium to be fed. Thus, gear train 51 functions as an intermittent or indexing drive mechanism.

According to the present invention paper feed unit 50 is mounted to the printer unit to be easily detachable. In this embodiment it is screwed onto front plate 133 of the frame 13. By configuring the printer unit 10 in the way described above, when the paper feed unit 50 is detached, the nozzles of inkjet head 11a are at the very front of the printer unit with nothing protruding forward beyond the plane of the nozzles (except for the front plate 133 in the embodiment). This enables rigid print media to be brought sufficiently near to the inkjet head 11a without necessity for bending. As will be explained in more detail later, in the preferred embodiment of the invention, front plate 133 is ar-

ranged in a manner so that its front side may be used as a guide surface 13a for such rigid print media like slip paper that cannot be fed through the curved feed path of paper feed unit 50.

In the present embodiment, as is best shown in Figs. 3 and 5, the lower part of the paper feed unit 50 is provided with an ink absorber 54 used to absorb ink which is ejected from the inkjet head for nozzle recovery. Ink absorber 54 is attached to paper feed unit 50 in a way that it can be easily replaced by removing paper feed unit 50 from printer unit 10. Figure 5 is a perspective view of paper feed unit 50. Ink absorber 54 has an L-shaped structure with ink-absorbing material 54a covered with an outer cover 55, made of resin, for example. Cover 55 is provided in order to prevent leakage of the stored waste-ink. At the upper end face of the vertical leg the ink-absorbing material is exposed. An ink collecting recess 50a is provided in the paper feed unit above the exposed end face. When ink recovery is to be performed the carriage is moved to a position at which the nozzles of the inkjet head are opposite the ink collecting recess 50a. Ink droplets ejected into the recess 50a will then be absorbed by the ink absorber, thus preventing any staining of the print medium. The coverage of ink absorber 54 with outer cover 55 prevents any staining of guide surface 13a. If guide surface 13a became stained, the print medium would also become stained during the slip printing to be described later.

Printer unit 10 is provided with a rotary encoder 25 that detects the rotation of motor 15. The encoder is fixed on the motor shaft in front of worm gear 15a as shown in Fig. 4. Encoder 25 is a cup-shaped member with a circumferential wall in which a plurality holes 25a are provided with regular intervals in the circumferential direction. This wall is received in the opening of a C-shaped sensor 31 of a so-called photo-interrupter type. As encoder 25 rotates, holes 25a allow the passage of the light emitted from one end of sensor 31 so that the other end of sensor 31 can pick up the light. In this way sensor 31 generates timing pulses and detects the rotation of motor 15. As will be appreciated by those of ordinary skill in the art, a signal representing the position of the carriage is derived from the timing pulses in the control circuit not shown.

Figure 6 depicts a mechanism for detecting the home position of carriage 12. A shield plate 33 is attached to carriage 12. When carriage 12 reaches the home position, shield plate 33 blocks the light path of sensor 31. Because the length of time during which the light path is blocked by shield plate 33 is greater than the length of time during which light is blocked between two successive holes 25a of rotary encoder 25, it is possible to

detect the home position by measuring the time during which no timing pulse is output by the sensor 31. In Fig. 6, (a) shows the carriage in a position just before reaching its home position, (b) shows the carriage in its home position with shield plate 33 intercepting the light, and (c) shows the carriage in a position when it has just left its home position.

Incidentally, while motor 15 has been described to be a DC motor in the above embodiment a step motor can be employed instead. In such case, where open loop control is possible, encoder 25 for detecting the rotation of the motor can be omitted.

In the inkjet printer composed as described above, control voltages for motor 15 and sensor 31 are supplied through cable 26. Likewise, control signals are supplied through cable 27 to inkjet head 11a. The rotational drive of motor 15 rotates timing belt 19 which in turn reciprocates carriage 12 as has been described. During the forward stroke of the carriage ink is ejected from inkjet head 11a according to the control signals and printing is performed. When printing of one line has been completed and the carriage is returned to its home position, the paper feed rollers 52 and 53 are driven to advance the print medium by one line. These operations are performed repeatedly for each line that is printed.

In the embodiment explained above, the drive mechanism for the carriage is provided behind inkjet head 11a. This enables the printer to perform slip printing by removing paper feed unit 50 from printer unit 10 as depicted in Figs.7(a) to (c). Removing paper feed unit 50 exposes the front surface of the front plate 133 of the frame 13. As has been mentioned before, the front surface serves as a guide surface 13a for slip paper or any other rigid recording media. As shown in the figure, guide surface 13a is positioned to ensure that there is an appropriate gap G between slip paper 60 and nozzles 61 of the inkjet head 11a. Incidentally, a card transport device similar to that depicted in Fig. 3b of EP-A-0 0609 845 may be used for slip printing with the printer unit 10 of the present invention to transport rigid print media such that it is guided by the guide surface 13a. However, as illustrated in Figs. 7(b) and (c), since the structure of the printer unit according to the present invention is particularly suitable for a small sized printer, its slip printing capability enables its use as a kind of a hand-held labelling machine. In this case the printer unit 10 with the paper feed unit removed, is held on a book (Fig. 7(c)) on a wall (Fig. 7(b) or wherever something is desired to be printed. Use of the printer unit in this way does not require any print media transport means. In Figs. 7 (b) and (c) the printer unit 10 has a casing 10a (shown in

section) attached to it. The casing allows easy handling and does, of course, not cover the front side of the printer unit.

Figure 8 is a diagram, similar to Fig. 3, depicting an inkjet printer according to a second embodiment of the present invention. In the second embodiment the printer unit 10 is the same as in the first embodiment while the paper feed unit 50' is different. More particularly, the paper feed unit of this second embodiment is designed for printing on slightly rigid paper e.g., postcards. Accordingly, as will be seen from a comparison between Figs. 3 and 8, the feed path in the paper feed unit of the second embodiment is only slightly curved. Inlet opening 62 for inserting the print medium is provided in the lower part of paper feed unit 50'. Feed rollers 52' and 53' are provided to feed the print medium in a roughly diagonal upward direction. Feed rollers 52'and 53' are driven by a gear train (not shown) quite similar to that of the first embodiment.

Figs. 9 and 10 illustrate a third embodiment of the invention. In the third embodiment the printer unit 10 is the same as in the first and second embodiments while the paper feed unit 50'' is different. The paper feed unit of the third embodiment is equipped with multiple paper feed mechanisms.

As shown in Fig. 9 which is a diagram similar to Figs. 3 and 8, paper feed unit 50'' has two separate paper inlets, i.e. first paper inlet 561 and second paper insertion inlet 562, and one common paper outlet 563. Print medium inserted from first paper inlet 561 is guided to first paper feed rollers 52a and 53a, and print medium inserted from second paper inlet 562 is guided to second paper feed rollers 52b and 53b. The amount of paper feed per line caused by feed rollers 52a, 53a is different from that caused by feed rollers 52b, 53b. For example, in one case the amount of paper feed is set to be suitable for graphic printing. This requires an amount of paper feed equal to the height of the print lines such that the bottom of one print line will be contiguous to the top of the next print line without intermediate space. In the other case, ordinary character printing is assumed, and the paper feed amount is set to equal the height of a print line plus the desired space between successive lines. Obviously, there are other ways in which the two types of paper feed can be used. Assuming for instance that the printer is only used for normal character printing, two different values of line spacing may be provided. Alternatively, if the printer is intended to be used for graphic printing only, paper feed by one pair of feed rollers may be set to a normal amount equal to the print line height, while that of the other pair of feed rollers may be set to half the normal amount for high-density printing in

order to permit overstriking. Thus, for different purposes the amount of paper feed per line can be assigned in several variations. By selecting the appropriate paper insertion inlet for a particular purpose, the user can obtain the desired print pattern. Further, although this embodiment is based on the assumption that two values of paper feed amount are required, three or more values can also be implemented as long as the corresponding number of required paper inlets and feed roller pairs can be accommodated in the paper feed unit.

Figure 10 shows a representative example of gear train 51 for the embodiment shown in Figure 9. The drive force transmitted to worm gear 24 through transmission shaft 23 is transmitted to gear 57a. A gear 57b is fixed to the same shaft as gear 57a and hence rotated together with gear 57a. Gear 57b is a partially toothed indexing gear. Depending on the angular position of gears 57a and 57b, a gear 58b is engaged with or disengaged from gear 57b, i.e. gear 58b is intermittently driven. Gear 58b in turn is engaged with gear 59b while gear 58a, which is coaxial with gear 58b and rotates with gear 58b, is engaged with gear 59a. Gear 59a is fixed to the shaft of the first feed roller 52a, and gear 59b is fixed to the shaft of the second feed roller 52b. Consequently, the drive source from worm gear 24 is transmitted to the two feed rollers 52a and 52b. However, because the drive force is transmitted through gears 58a and 58b that have different numbers of teeth, ultimately the transmission results in different paper feed amounts. The difference in paper feed amount can be set by changing the gear ratios of the intervening gears.

In the embodiments shown in Figures 3, 8, and 9, depending on the intended purpose, a roll paper holder for holding roll paper or a stacker for stacking cut sheets can be attached to the paper feed unit in order to enhance the printer's usefulness. Likewise, in the embodiment of Figure 7, a device that transports print medium 60 in the direction of lines can be attached in the lower part of printer unit 10.

Although the embodiments shown in Figures 1 and 8 contain a drive mechanism at the back of inkjet head 11a, the drive mechanism can also be provided below the head 11a in order to enable slip printing in the same manner as in the embodiments described above. Further, although the embodiments show the case where paper feed unit 50 is secured to printer unit 10 with screws, the present invention is by no means limited to this method of securing. Other means, such as permanent magnets, can be employed as long as the means allows easy detachment of the paper feed unit.

The embodiments described above use a motor 15 that rotates only in one direction and employ drive pin 3 to achieve a reciprocating movement of the carriage. In this case the drive input transmitted to the paper feed mechanism of the paper feed unit 50, 50' or 50'' is a rotational force in a fixed direction. Alternatively, it is possible to cause the carriage to move back and forth by using a motor that repeatedly rotates in opposite directions. In such a case, the drive input transmitted to the paper feed mechanism becomes a rotational force that repeatedly rotates in opposite directions in correspondence with the carriage's reciprocating motions. To feed paper in a fixed direction, paper feed rollers 52 and 53 must always rotate in one direction. Therefore, the paper feed mechanism in the paper feed unit must be provided with a conversion mechanism that transforms the rotational force that repeatedly rotates in opposite directions into a rotational force in one direction, either through the use of a one-way clutch or through the combination of several intermittent gears.

As described above, this invention places a carriage and a drive mechanism for a printer unit either at the rear or in the lower portion of the inkjet head and secures the paper feed unit to the printer unit on a detachable basis.

In this manner, the printer can perform slip printing when the paper feed unit is removed, as well as performing normal printing, thus increasing its range of application. Another advantage of the inkjet printer of the present invention is its facility for performing slip printing. Further, the provision of a print guide surface in the lower portion of the inkjet head enables the printer to hold the print medium securely for slip printing. This improves print quality and enables the printer to print on small papers.

The inkjet printer of the present invention can also offer a variety of paper feed units incorporating a wide range of functions. Thus, the present invention can provide an inkjet printer capable of easily printing various print patterns on a variety of recording materials through the replacement of paper feed units to suit a particular objective.

Claims

1. An inkjet printer comprising:
 - a printer unit (10) including
 - a frame (13),
 - a carriage (12) slidably supported on the frame (13),
 - an inkjet cartridge (11) mounted on the carriage and having an inkjet head (11a), and
 - a drive mechanism (15, 15a, 16-20) for reciprocating said carriage, said drive mechanism being located either at the back of or

- below the inkjet head (11a) such that the nozzles of the inkjet head are immediately at or next to a front end of the printer unit, and
a paper feed unit (50, 50', 50'') having a paper feed mechanism (51, 52, 53; 52', 53'; 52a, 52b, 53a, 53b) for feeding print media to be printed by said inkjet head (11a),
wherein said paper feed unit (50, 50', 50'') is detachably mounted to said front end of the printer unit (10)
2. The printer of claim 1 wherein a guide surface (13a) for rigid print media (60) is provided on the printer unit (10) said guide surface being exposed when the paper feed unit is detached and defining a plane extending in front of and spaced by a predetermined gap from the nozzles of the inkjet head (11a).
3. The printer of claim 2 wherein said guide surface (13a) is formed by the front side of a front plate (133) of said frame (13) said front plate also serving as a flange plate for mounting the paper feed unit (50, 50', 50'').
4. The printer of any one of the preceding claims, wherein the said paper feed unit (50, 50', 50'') includes
ink collecting means (50a) for receiving ink droplets ejected from the inkjet head (11a) for nozzle recovery, and
ink absorption means (54) disposed in communication with said ink collecting means.
5. The printer of claim 4, wherein said ink absorption means (54) comprises an absorption member (54a) covered with an outer layer (55) of a material impermeable for the ink.
6. The printer of claim 4 or 5, wherein said ink absorption means (54) is detachably mounted to said paper feed unit (50, 50', 50'').
7. The printer of any one of the preceding claims, further comprising means (22-24) for drivingly coupling said paper feed mechanism (51, 52, 53; 52', 53'; 52a, 52b, 53a, 53b) to said drive mechanism (15, 15a, 16-20).
8. The printer of claim 7, wherein the paper feed mechanism (51, 52, 53; 52', 53'; 52a, 52b, 53a, 53b) of said paper feed unit (50, 50', 50'') comprises an intermittent drive unit (51) for transporting the print medium by a predetermined amount every cycle of the reciprocating movement of the said carriage (12).
9. The printer of any one of the preceding claims, wherein said paper feed unit (50', 50'') comprises plural paper feed mechanisms (52a, 53a, 52b, 53b) each associated with a respective one of plural feed paths, each paper feed mechanism adapted to transport print media along the corresponding feed path by an amount per cycle of the reciprocating movement of the carriage different from that of the other paper feed mechanisms.
10. The printer of claim 9, wherein the paper feed amounts are predetermined as a combination of an amount of paper feed per line substantially equal to the height of a printing line as determined by said inkjet head (11a) and an amount of paper feed greater than the height of a printing line, respectively.

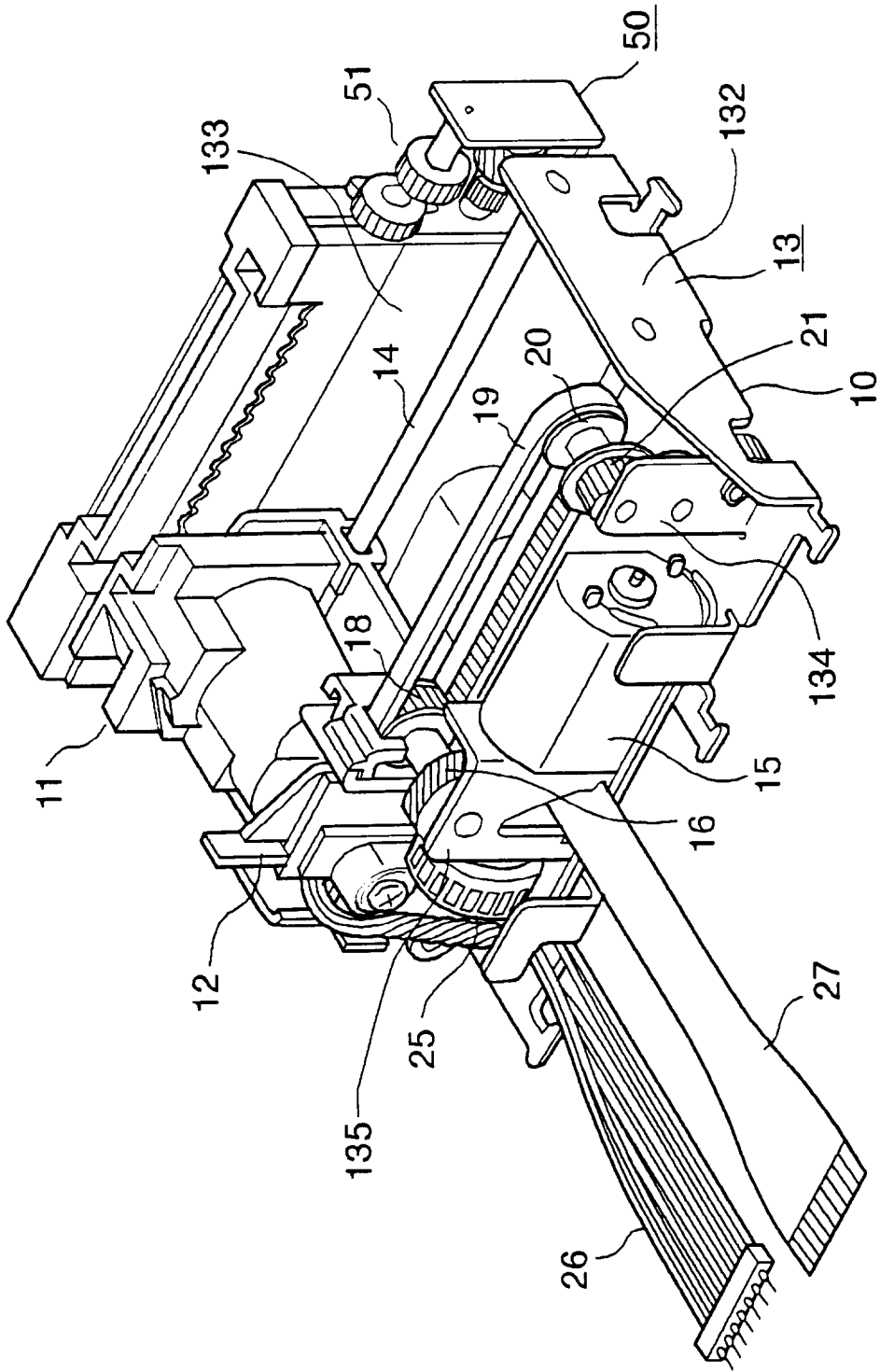


FIG. 2

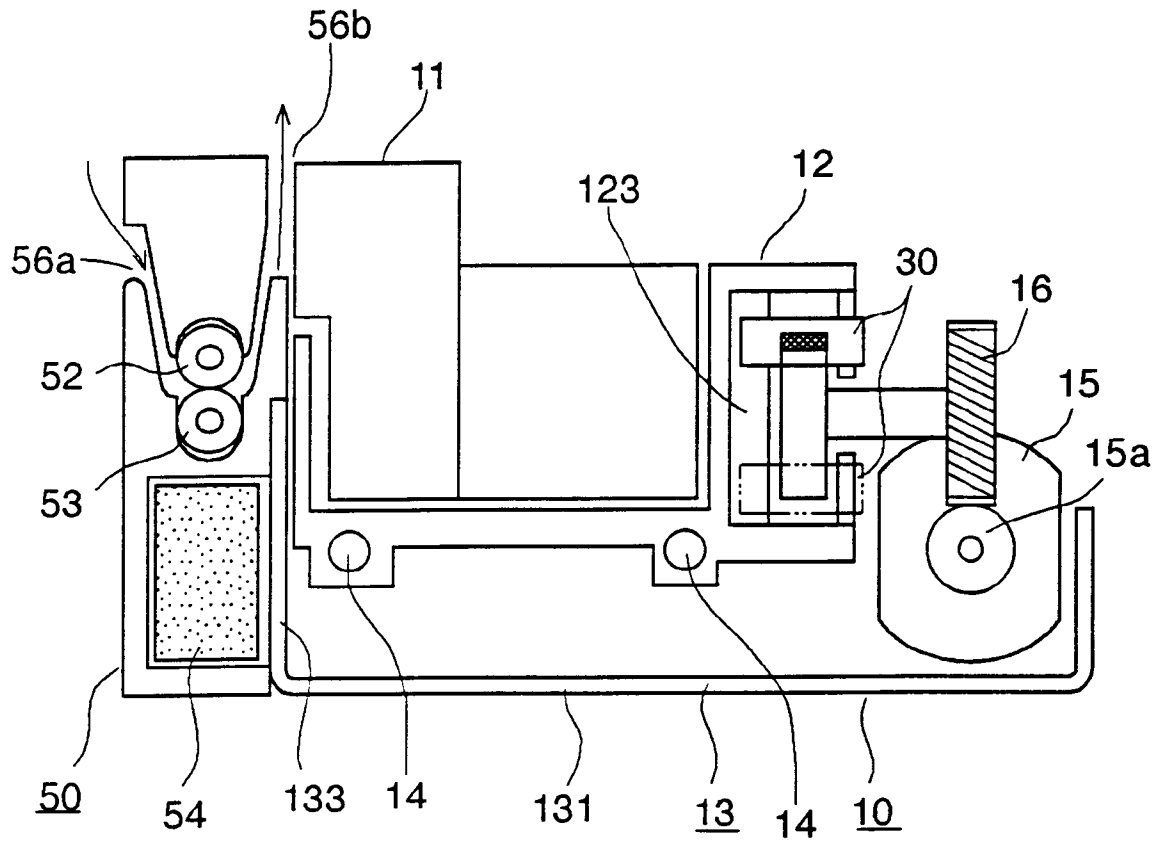


FIG. 3

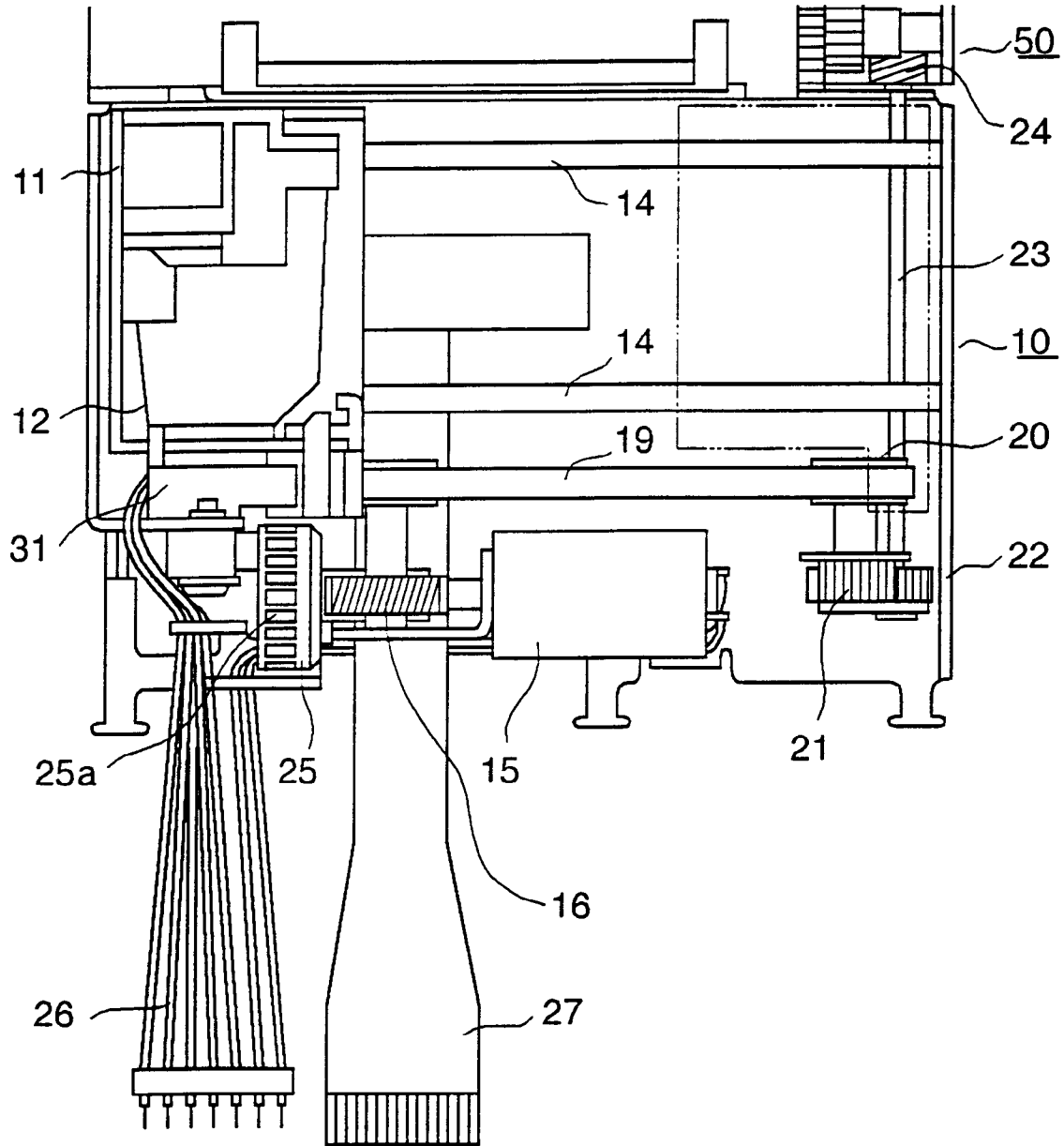


FIG. 4

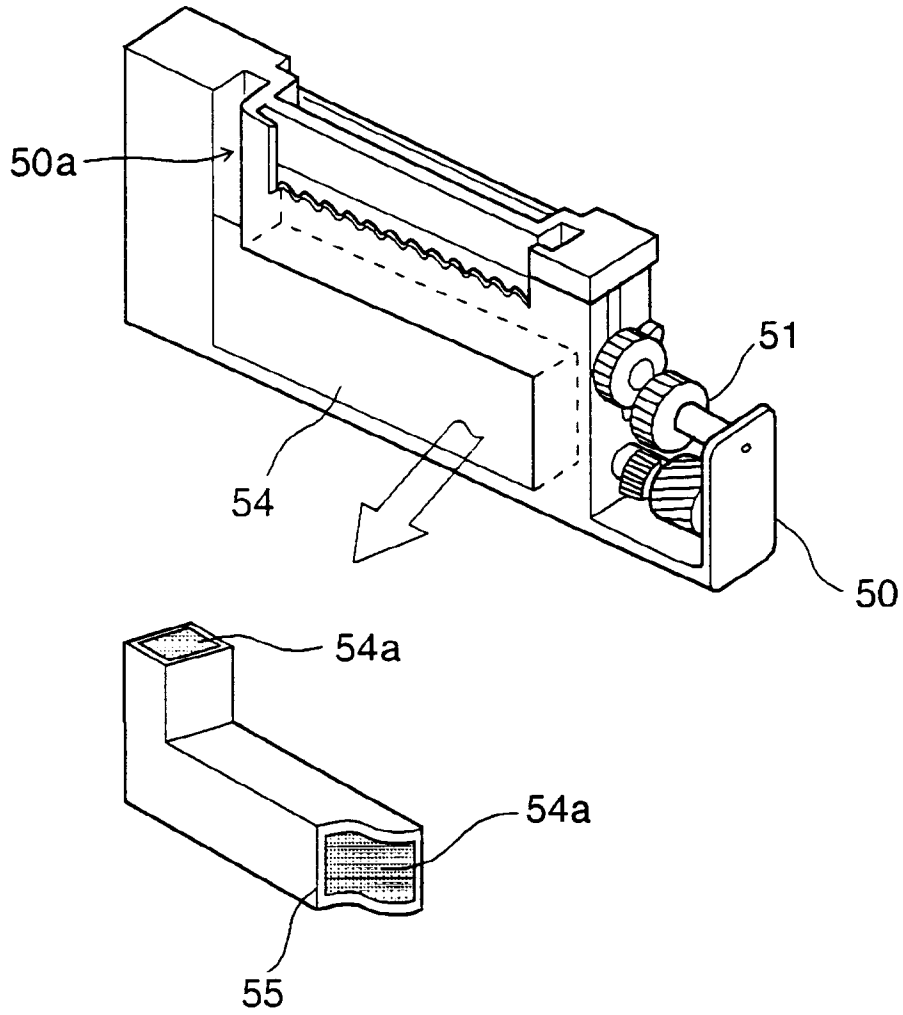


FIG. 5

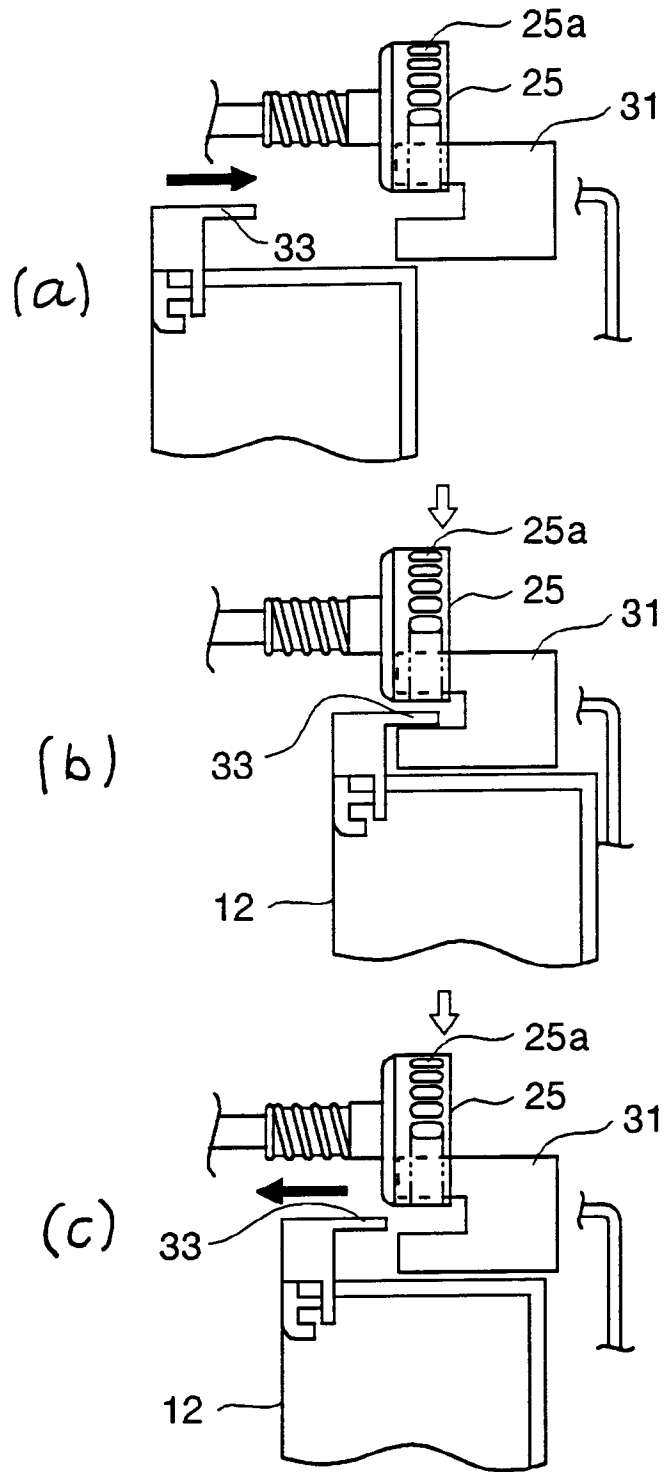


FIG. 6

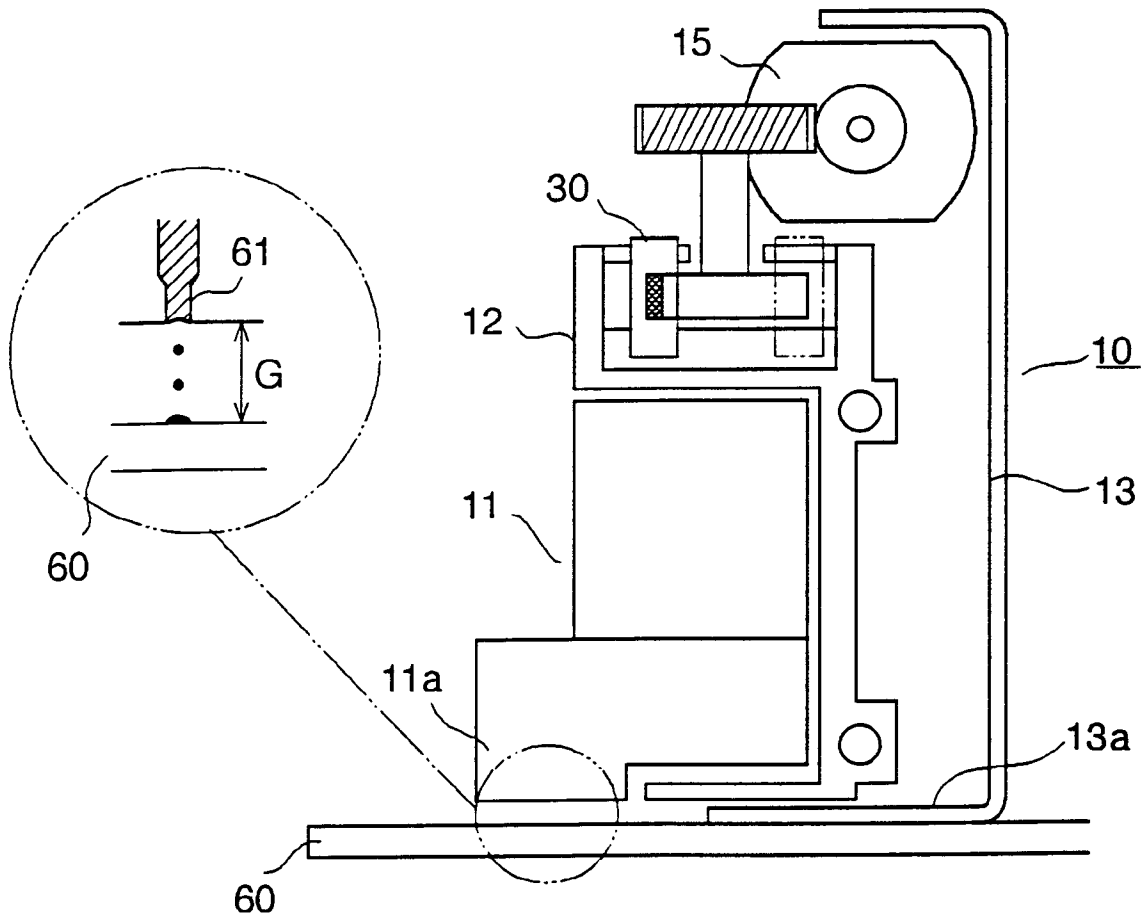


FIG. 7a

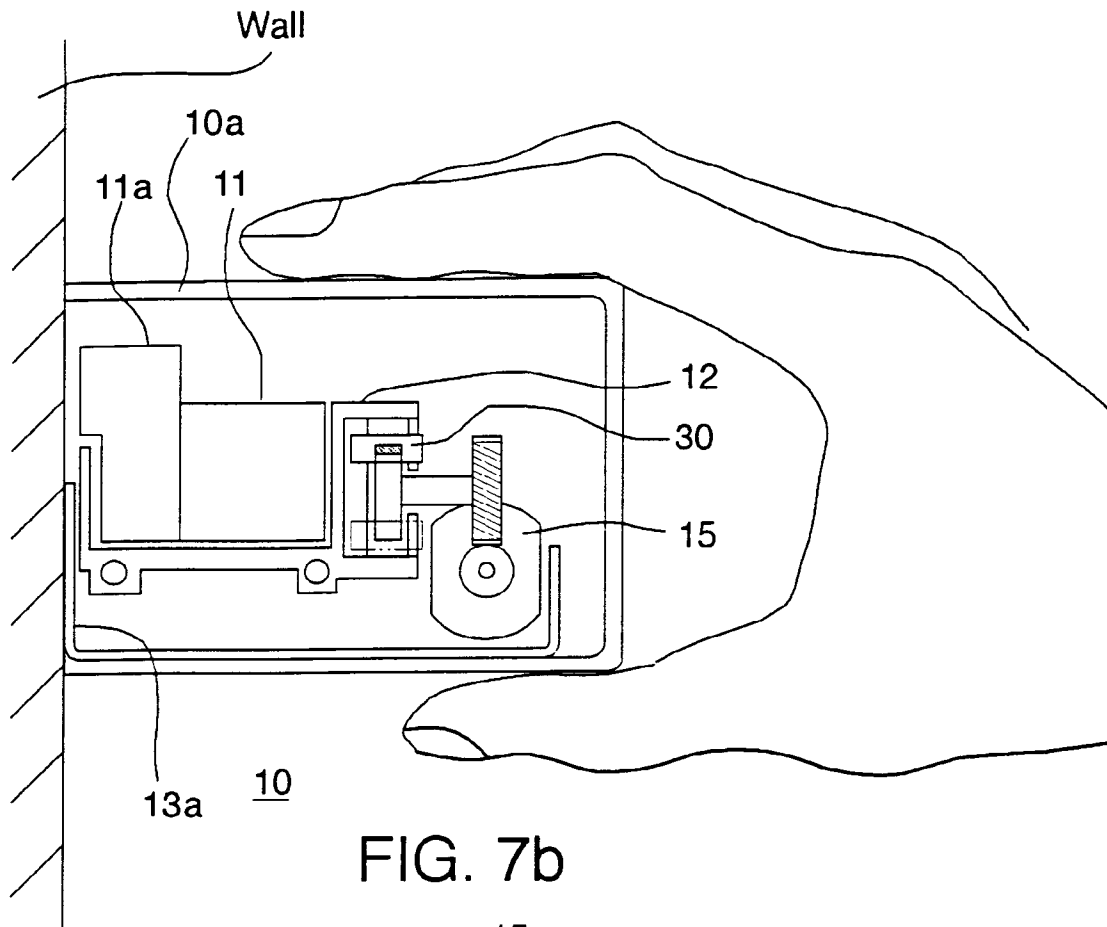


FIG. 7b

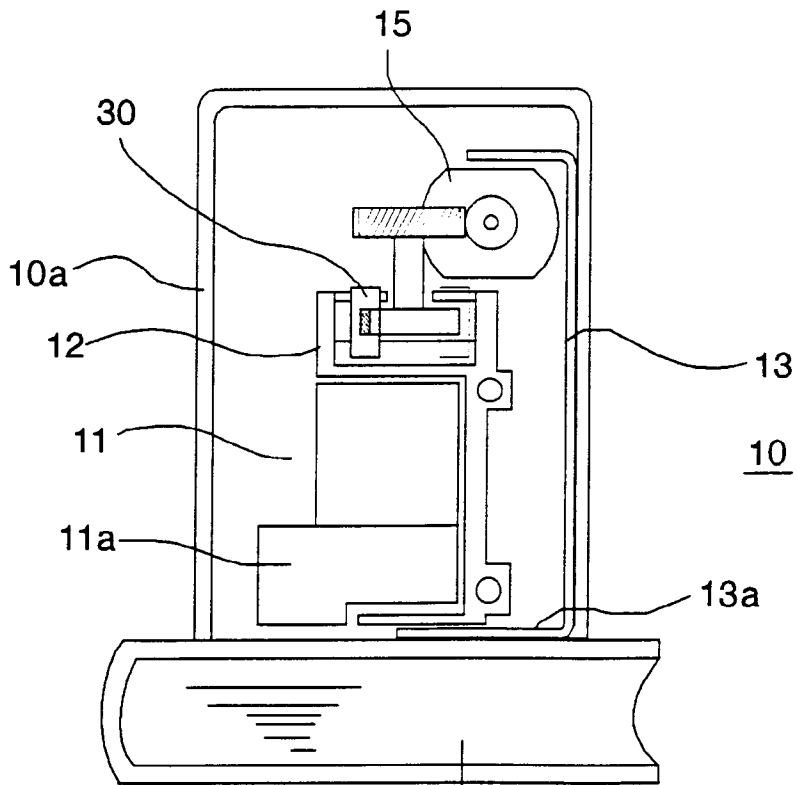


FIG. 7c

Book

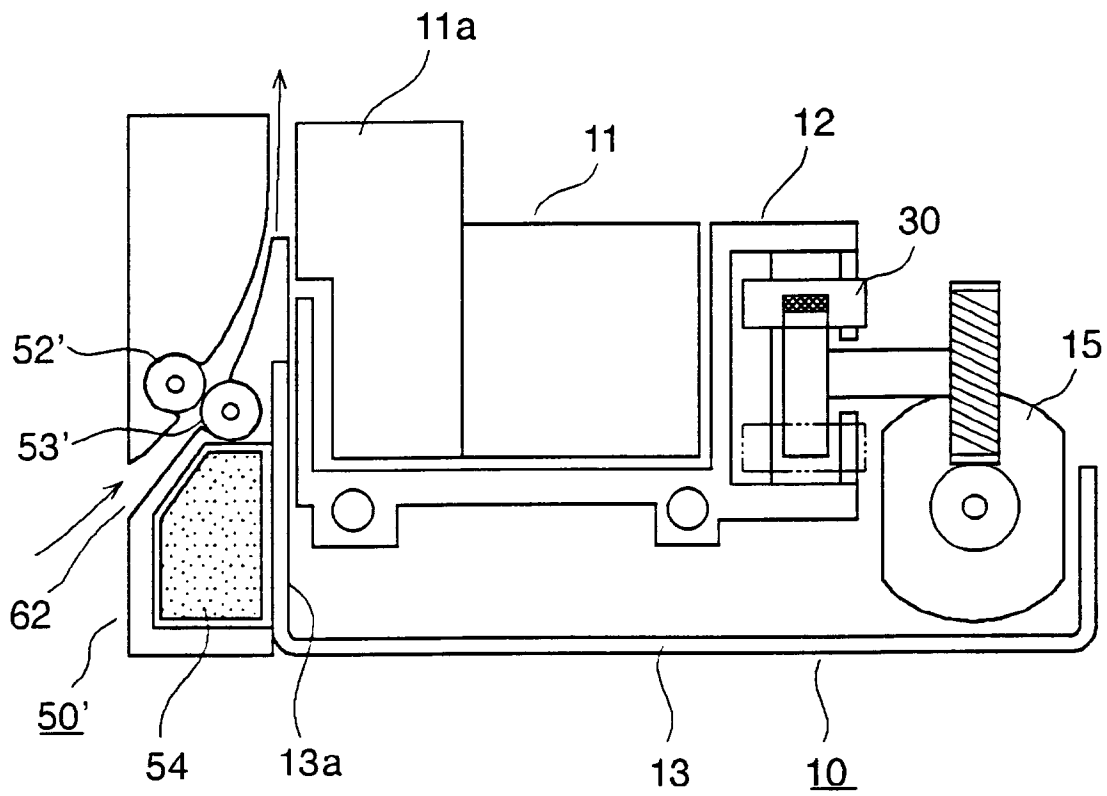


FIG. 8

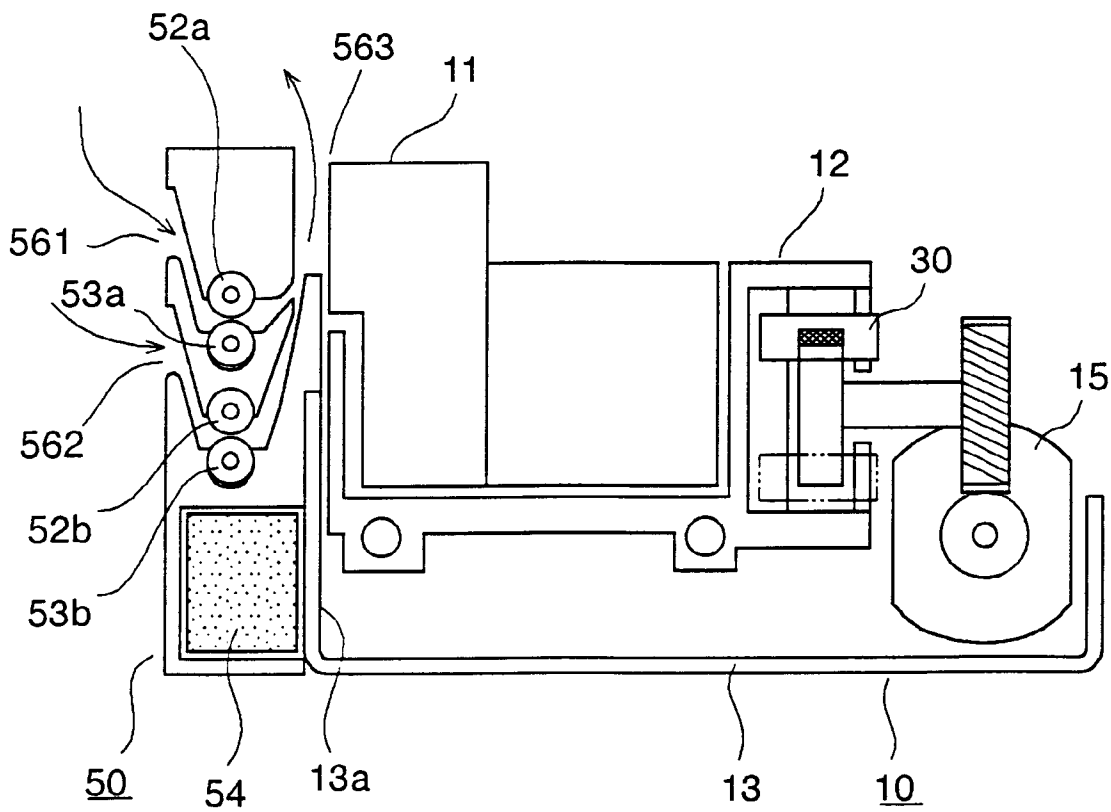


FIG. 9

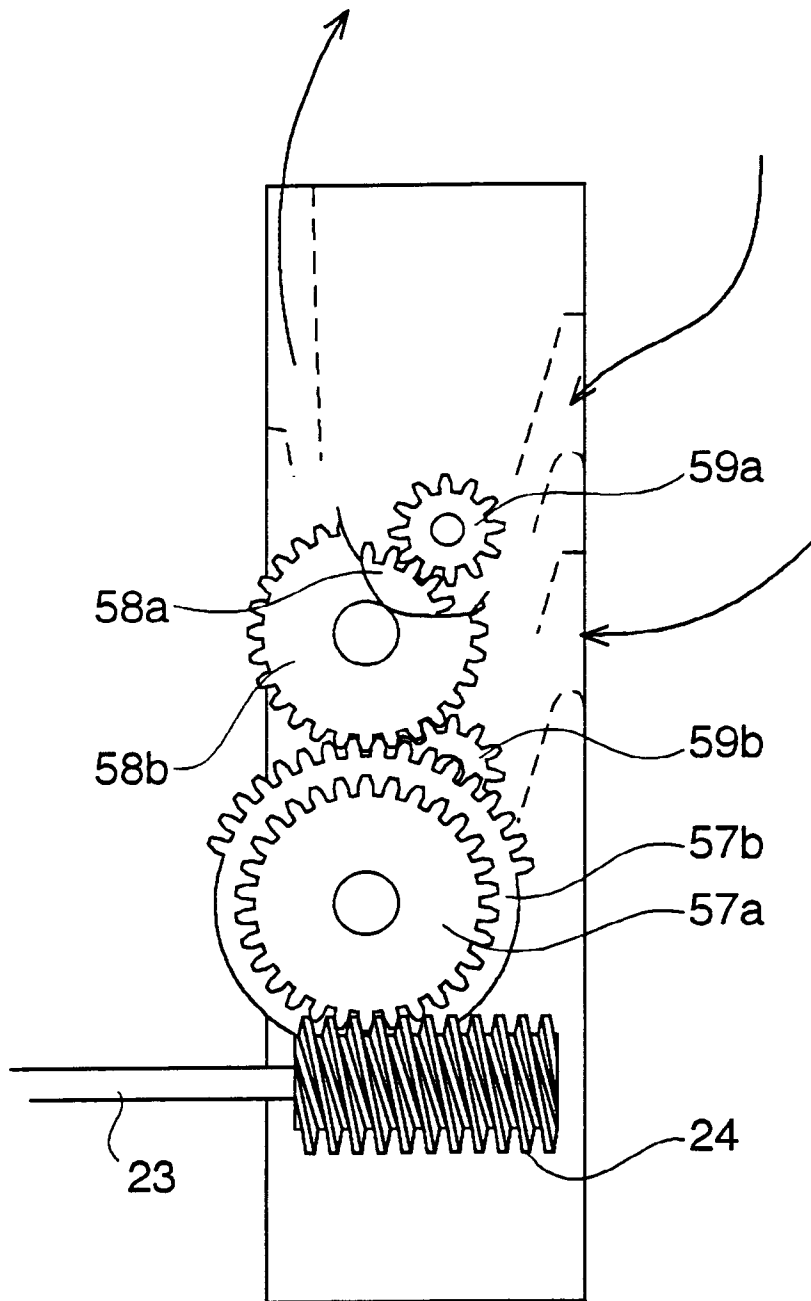


FIG. 10