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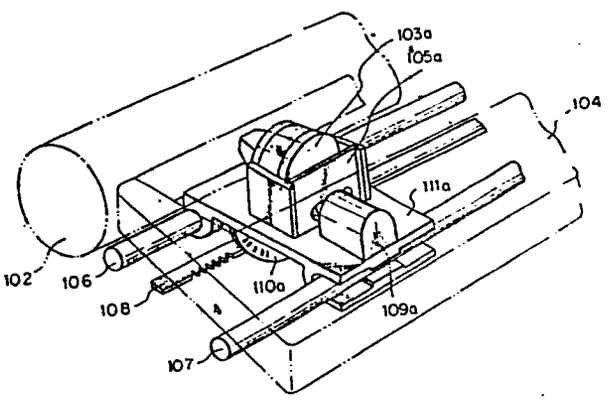
(54) Multihead serial printer.

(57) Print heads (103a, 103b) are mounted on carriages (111a, 111b) respectively, which are independently movable by respective motors (110a, 110b) for enabling the print heads (103a, 103b) to effect uniform printing. A shift mechanism (105a) is mounted on at least one of the carriages (111a) for moving the print head (103a) in a paper-feeding direction along the surface of a platen (1).

Fig. 7



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TITLE OF THE INVENTION

MULTIHEAD SERIAL PRINTER

BACKGROUND OF THE INVENTION

The present invention relates to a multihead serial printer having a plurality of print heads arranged along a horizontal or character-spacing direction.

One known multihead printer is disclosed in Japanese Laid-Open Patent Publication No. 58-163670. The disclosed printer has a plurality of print heads and is selectively operable between a high-speed printing mode and a high-density printing mode. There is another known printer having a print head and a pen head both mounted on a single carriage, the printer being switchable between a mode in which the printer operates as a printer and another mode in which the printer operates as a plotter.

With the conventional multihead printers, the plurality of print heads are driven by a single motor, and each print head has a fixed print area. In such a multihead printer, the printing speed is higher in proportion to the number of print heads used in the case where characters to be printed along one line are uniformly dispersed fully across the line.

In actual printing operation, however, characters are printed in various quantities and areas, and in many cases characters are printed in lefthand portions of lines only. Therefore, the prior multihead printers have suffered problems in that only certain print heads are subjected to

wear and a high temperature, and the print speed is not so high as compared with printers having a single print head.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a multihead serial printer which has print heads subjected to uniform loads in various printing modes, is capable of printing characters at a high speed with a relatively small number of print heads, produces reduced vibrations and noise, and is small in size, light in weight, and suitable for use as a terminal of office automation equipment.

Another object of the present invention is to provide a multihead serial printer which is relatively small in size with an increased number of carriages, has a reduced number of guide shafts, and is capable of printing at a low speed and a high density without requiring to control the amount of feed of paper.

Still another object of the present invention is to provide a multihead serial printer having carriages movable at a high speed with a small drive source, and an ordinary print head and a pen head selectively usable for high-speed printing and high-speed plotting modes.

In accordance with the present invention, there is provided a multihead serial printer including a plurality of print heads mounted respectively on carriages, and a plurality of motors for independently moving the carriages, respectively, for enabling the print heads to effect

printing operation uniformly. The carriages are independently movably supported on common guide shafts and movable in a horizontal or character-spacing direction by independent drive sources. At least one carriage has a shift mechanism for moving the print head along the surface of a platen in a paper-feeding direction. One of the print heads may comprise an ordinary print head and the other a pen head having a plurality of pens. The pen head has means for selectively pressing the pens and a vertical shift mechanism for moving the pens along the platen surface in the paper feeding direction (column direction).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a multihead serial printer according to a first embodiment of the present invention;

FIG. 2 is a block diagram of a control circuit for the multihead serial printer shown in FIG. 1;

FIG. 3 is a flowchart of operation of the control circuit of FIG. 2;

FIG. 4 is a diagram explanatory of an example of operation of print heads;

FIG. 5 is an enlarged exploded perspective view of a self-propelled carriage in the multihead serial printer of the present invention;

FIG. 6 is a perspective view of a multihead serial printer according to a second embodiment of the present invention;

FIG. 7 is a fragmentary perspective view of a mechanism for shifting a print head in a column direction and moving the same in a line direction;

FIG. 8 is a diagram showing shift positions for print heads;

FIG. 9 is a diagram illustrative of printing procedures for various print formats;

FIG. 10 is an exploded perspective view of a shift mechanism;

FIGS. 11 and 12 are side elevational views showing unshifted and shifted positions of the print head;

FIGS. 13 and 14 are side elevational and plan views of a carriage drive mechanism;

FIG. 15 is an exploded perspective view of the carriage drive mechanism;

FIG. 16 is a perspective view of a modification of the second embodiment of the present invention;

FIG. 17 is a diagram showing different print format examples;

FIG. 18 is a perspective view of a multihead serial printer according to a third embodiment of the present invention; and

FIG. 19 is an enlarged exploded perspective view of a vertical shift mechanism for a pen head in the multihead serial printer illustrated in FIG. 18.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention for attaining the above-

mentioned objects will now be described in detail with reference to embodiments illustrated in the accompanying drawings.

FIG. 1 shows in perspective a multihead serial printer according to a first embodiment of the present invention. A platen 1 is rotatably supported by and between a pair of side plates, with a sheet 2 of print paper set around the platen 1.

Self-propelled carriages 3a, 3b are movable independently along the platen 1 in a horizontal, or a character-spacing, or line direction. The carriages 3a, 3b are guided by a pair of guide shafts 4a, 4b. One of the carriages 3a supports thereon a wire dot-matrix print head 5a, an ink ribbon cassette or cartridge 6a, and a spacing motor (described later), and the other carriage 3b similarly supports thereon a wire dot-matrix print head 5b, an ink ribbon cassette or cartridge 6b, and a spacing motor.

The ink ribbon cassettes 6a, 6b are removably mounted on the carriages 3a, 3b, respectively, for replacement.

The spacing motors mounted respectively on the carriages 3a, 3b are independently drivable by a control circuit, described later on, for self-propelling the carriages 3a, 3b so that the print heads 5a, 5b will be positioned in print-start positions which allows the print heads to complete required printing in a shortest period of time. Thereafter, the carriages 3a, 3b are moved in the

character-spacing direction according to their respective operation sequences, while the print heads 5a, 5b are independently actuated to cause the print wires to press the sheet 2 against the platen 1 with the ink ribbons of the ink ribbon cassettes 6a, 6b being interposed therebetween, thus impressing dot-matrix characters on the sheet 2.

With the print heads 5a, 5b mounted respectively on the carriages 3a, 3b and the carriages 3a, 3b independently drivable by the motors, the print areas covered by the print heads 5a, 5b are rendered variable. Lefthand and righthand halves on lines can therefore uniformly be printed by the two print heads 5a, 5b, and a time interval required for printing one line can be shortened.

FIG. 2 illustrates in block a control circuit for controlling the multihead serial printer according to the first embodiment. The control circuit includes a main control unit 7 for controlling the printer as a whole, the main control unit 7 being primarily composed of a CPU, I/O ports, a timer, and memories.

The control circuit also includes a pair of subcontrol units 8a, 8b for controlling character-spacing operation of the carriages 3a, 3b and printing operation of the print heads 5a, 5b on the carriages 3a, 3b, a pair of head driver circuits 9a, 9b for driving the print heads 5a, 5b, respectively, a pair of motor driver circuits 10a, 10b for driving the spacing motors on the carriages 3a, 3b, and

a motor driver circuit 12 for driving a line feed motor 13. Designated as 11a, 11b are the spacing motors for moving the carriages 3a, 3b in the character-spacing direction.

The control circuit is generally indicated by 14. Printing commands and data are delivered over a signal line 15 from an external device of the multihead serial printer to the main control unit 7. The control circuit 14 also has signal lines 16a, 16b for delivering feedback signals from the spacing motors 11a, 11b to the subcontrol units 8a, 8b, respectively, and a signal line 17 for delivering a feedback signal from the line feed motor 13 to the main control unit 7.

FIG. 3 shows a flowchart of successive steps of operation of the control circuit 14. Operation of the multihead serial printer will be described with reference to FIGS. 2 and 3.

Print command reception:

The main control unit 7 of the multihead serial printer receives character data for one line from the external device over the signal line 15.

Delivery of print instructions:

The main control unit 7 divides the received one-line character data into two optimum print blocks to be printed respectively by the print heads 5a, 5b so that the time required for the printing operation will be as short as possible, and issues print instructions to the subcontrol units 8a, 8b for printing the print blocks.

Simultaneously, the main control unit 7 instructs the subcontrol units 8a, 8b with print-start positions and character-spacing directions for the print heads 5a, 5b so that the carriages 3a, 3b will not impinge against each other when the print heads 5a, 5b print the desired character blocks simultaneously.

Movement toward print-start position:

Based on the instructions from the main control unit 7, the subcontrol units 8a, 8b enable the spacing motors 11a, 11b to move the carriages 3a, 3b from their present positions so that the print heads 5a, 5b reach the instructed print-start positions.

More specifically, the subcontrol unit 8a is triggered by a trigger pulse (described later) to apply direction and drive signals to the motor driver circuit 10a, which energizes the spacing motor 11a to move the carriage 3a. Thereafter, the carriage 3a is repeatedly moved until the print head 5a reaches the print-start position.

Where the spacing motor 11a is a DC motor and closed-loop control is effected, a feedback signal delivered over the signal line 16a is used as a trigger pulse for the above repetitive carriage moving operation. Where the spacing motor 11a is to be controlled in an open loop, the trigger pulse for the repetitive carriage moving operation may be generated within the subcontrol unit 8a.

The print head 5b is likewise moved to the print-

start position by the subcontrol unit 8a, the motor driver circuit 10b, and the spacing motor 11b in the same manner as described above.

Printing operation:

After the print heads 5a, 5b have reached the print-start positions, a mode of printing operation is initiated.

In the printing operation, the subcontrol unit 8a moves the print head 5a in a character-spacing direction instructed by the main control unit 7. Therefore, the subcontrol unit 8a issues the same signal as used in moving the carriage 3a to the print-start position to the motor driver circuit 10a. At the same time, the subcontrol unit 8a enables the head driver circuit 9a to instruct the print head 5a to print a print pattern corresponding to a current position of the print head 5a in the print block instructed by the main control unit 7. The print head 5a now drives those print wires which correspond to the print pattern to effect printing in response to the instruction from the head driver circuit 5a.

The printing operation is repeated while moving the carriage 3a until all print patterns in the print block instructed by the main control unit 7 are printed.

When all print patterns have been printed, the subcontrol unit 8a issues a signal indicative of an end of the printing operation (hereinafter referred to as a "print end signal") to the main control unit 7, and the printing operation is now finished.

The printing operation has been described with respect to the subcontrol unit 8a and the carriage 3a controlled thereby. The same printing operation is also effected by the subcontrol unit 8b and the carriage 3b controlled thereby. The carriages 3a, 3b effect their printing operations simultaneously.

Line feed operation:

Upon completion of the printing operation, the print end signals issued from the subcontrol units 8a, 8b are applied to the main control unit 7, which now enters into a line feed operation.

For line feed, the main control unit 7 is triggered with a trigger pulse (described later) to apply direction and drive signals for the line feed motor 13 to the motor driver circuit 12. In response to the applied signals, the motor driver circuit 12 is energized to rotate the line feed motor 13 for feeding the sheet 2 shown in FIG. 1.

Thereafter, the above line feed operation is repeated until the sheet 2 is fed over a desired interval.

Where the line feed motor 13 is a DC motor and closed-loop control is effected, a feedback signal delivered over the signal line 17 is used as a trigger pulse for the above repetitive line feed operation. Where the line feed motor 13 is to be controlled in an open loop, the trigger pulse for the repetitive line feed operation may be generated within the main control unit 7.

The successive steps of operation from the print

command reception to the line feed operation are repeated by the control circuit 14 for successively operating the printer for printing.

An example of operation of the print heads 5a, 5b is illustrated in FIG. 4. In this example, the print data contain only 50 characters from the lefthand end in the maximum capacity of 80 characters/line. Therefore, in the print-start positions, the print head 5a is located in the home position or initial position, and the print head 5b is located at the 24th character, and thereafter the print heads 5a, 5b are moved to the right so that they finish their printing operations simultaneously.

FIG. 5 is an enlarged exploded perspective view of the self-propelled carriage in the multihead serial printer according to the present invention. Since the carriages 3a, 3b are of the same construction, only the carriage 3a is illustrated.

The spacing motor 11a comprises a flat DC brushless motor fixed by screws or the like to the underside of the carriage 3. Designated as 18 is a photosensor for detecting a rotational angle of the spacing motor 11a, 19 a pinion mounted on a rotor shaft of the spacing motor 11a, 20 a rack held in mesh with the pision 19, and 21 a frame supporting the rack 20. The rack 20 is shared by the carriage 3b.

A flexible cable 22 is attached to the spacing motor and the carriage 3a and connected to the control circuit 14

shown in FIG. 2. Electric power is supplied through the flexible cable 22 to circuit components on the carriage 3a, and signals are delivered also through the flexible cable 22 between the circuit components and the control circuit 14.

The mechanism shown in FIG. 5 operates as follows: When electric power is supplied from the control circuit 14 through the flexible cable 22, the spacing motor 11a is rotated to rotate the pinion 19 mounted on the rotor shaft thereof. As the spacing motor 11a rotates, the photosensor 18 issues a signal indicative of a rotational angle of the motor 11a to the control circuit 14. At the same time, the carriage 3a, the spacing motor 11a, the photosensor 18, the pinion 19, and the flexible motor 22 are moved in unison under a reactive force from the rack 20 meshing with the pinion 19.

The present invention is not limited to the foregoing embodiment, but various changes and modifications may be made therein. For example, the carriages 3a, 3b may be driven independently by two motors and two transmission mechanisms fixed to the frame. Although three or more print heads may be employed, two or three print heads are preferred to avoid a complex arrangement of the mechanism and the control circuit.

In the first embodiment, the print heads are movable only in the character-spacing direction along the platen. According to a second embodiment of the invention, the

print heads can be shifted in a paper-feeding direction across the platen.

FIG. 6 illustrates in perspective a multihead serial printer according to a second embodiment. Designated as 101 is a sheet of print paper, 102 a platen, 103a and 103b print heads, 104 an ink ribbon cartridge, 105a and 105b shift mechanisms for vertically moving the print heads 103a and 103b along the surface of the platen 102, 106 and 107 guide shafts, and 108 a rack. The print heads 103a, 103b are arranged in a character-spacing direction, and can be independently shifted in a paper-feeding, or line-spacing, or column direction and moved in the character-spacing or line direction.

FIG. 7 fragmentarily shows a mechanism for shifting the print head 103a in the column direction and moving the same in the line direction. The mechanism includes a shifting motor 109a for actuating the shift mechanism 105a to shift the print head 103a in the column direction, and a flat DC brushless motor 110a having a gear meshing with the rack 108, the motor 110a being attached to a carriage 111a. The carriage 111a is supported on the guide shafts 106, 107 for movement in the character-spacing direction.

Operation of the multihead serial printer according to the second embodiment is as follows: When the flat DC brushless motor 110a is rotated, the carriage 111a is moved under a reactive force since a pinion mounted on a rotatable shaft of the motor is held in mesh with the rack

108. As the carriage 111a is guided and supported by the guide shafts 106, 107, the carriage 111a moves in a character-spacing or line direction. As the shifting motor 109a is rotated, the print head 108a is caused by the shift mechanism 105a to move in a paper-feeding or column direction along the surface of the platen 102. The print head 103a can thus be shifted in the column direction and moved in the line direction. When print wires are projected while the print head 103a is moved in the line direction, ink is transferred thereby from an ink ribbon of the ink ribbon cartridge 104 to form dots on the sheet 101.

Although the above operation has been described as being related to the print head 103a, the print head 103b can also be shifted in the column direction and moved in the line direction in the same manner as described above. Since the print heads 103a, 103b are shifted and moved by the separate motors, they can be controlled independently of each other. This advantage will be described with reference to FIGS. 8 and 9.

FIG. 8 shows various shifted positions of the print heads 103a, 103b. FIG. 8(a) illustrates a position in which the print heads are horizontally aligned for printing one line. FIG. 8(b) shows a position in which one of the print heads is shifted for printing two lines. FIG. 8(c) is illustrative of a position in which one of the print heads is shifted by a pitch of 1/2 dot for high-density printing.

Printing procedures for various print formats will be described with reference to FIG. 9.

(1) When a print area spreads all over the sheet of print paper (see a data list shown in FIG. 17(a)): The print heads 103a, 103b are positioned in the one-line printing position illustrated in FIG. 8(a), and moved in the character-spacing directions indicated by the arrows from the positions (1) and (2) in FIG. 9(a).

(2) When a print area lies on one side or is localized on the sheet (see a program list in FIG. 17(b)): The print heads 103a, 103b are positioned in the two-line printing position illustrated in FIG. 8(b), and moved in the character-spacing directions indicated by the arrows from the positions (1) and (2) in FIG. 9(b).

The printing operation may be effected as shown in FIG. 9(c), employing movements similar to those in FIG. 9(a). However, the printing procedure of FIG. 9(b) is better inasmuch as two line feed operations for one line spacing are faster than one line feed operation for two line spacings.

(3) When print areas are divided on both sides of the sheet (see an account book sheet in FIG. 9(c)): The print heads 103a, 103b are positioned in the one-line printing position illustrated in FIG. 8(a), and moved in the character-spacing directions indicated by the arrows from the positions (1) and (2) in FIG. 9(d). Line feed is effected when both print heads complete one line printing,

and the print head which has completed one line printing faster than the other is shifted to a print position for a next line and waits for the other print heat to complete its printing.

(4) When print areas are dispersed on one line or in the column direction (see a deposit item change table in FIG. 17(d)): The print heads 103a, 103b are positioned in the one-line printing position illustrated in FIG. 8(a), and moved in the character-spacing directions indicated by the arrows from the positions (1) and (2) in FIG. 9(d) for shortest printing intervals.

(5) For high-density printing:

The print heads 103a, 103b are positioned in the high-density printing position illustrated in FIG. 8(c), and moved in the character-spacing directions indicated by the arrows from the mutually close positions (1) and (2) in FIG. 9(e) for printing. At this time, each print head is shifted in the column direction for an interval obtained by dividing one dot pitch of the print head by the number of print heads used (in the illustrated example, two print heads are employed, and they are shifted by 1/2 dot pitches).

FIG. 10 is a perspective view of the shift mechanism which has side frames 112a, 113a and the shifting motor 109a, which are mounted on the carriage 111a. The side frames 112a, 113a have in their inner surfaces grooves 114a, 115b defined respectively therein and having a center

of curvature equal to the center of the platen. A guide 116a has ridges 117a, 118a fitted respectively in the grooves 114a, 115a so that the guide 116a can be angularly moved along the surface of the platen. The guide 116a also has a substantially inverted U-shaped cam follower surface 119a in its central lower portion, and an eccentric cam 120a mounted on the rotatable shaft of the shifting motor 109a is held in contact with the cam follower surface 119a. The print head 103a is fixed to the guide 116a and sandwiched between the side frames 112a, 112b. The guide 116a is normally urged downwardly by a reset spring 121a.

In operation, when the eccentric cam 120a is rotated in response to rotation of the shifting motor 109a, the guide 116a contacting the cam 120a through the cam follower surface 119a is moved up and down. As the ridges 117a, 118a of the guide 116a are fitted in the grooves 114a, 115a in the side frames 112a, 113a, the guide 116a and the print head 103a are angularly moved along the surface of the platen. Therefore, the distance between the platen 102 and the print head 103a remains constant irrespective of the interval of shifting movement of the print head 103a. FIG. 11 shows the print head 103a in an unshifted position, and FIG. 12 illustrates the print head 103a in a shifted position.

FIGS. 13 and 14 show a carriage drive mechanism. The flat DC brushless motor 110a is disposed below the carriage 111a and has a shaft on which there is mounted a pinion

122a held in mesh with the rack 108.

FIG. 15 illustrates the carriage drive mechanism in greater detail. The rotational angle of the flat DC brushless motor 110a is detected by a photosensor 123a. The rack 108 is fixed to a lower frame 124a. The print head 103a, the shifting motor 109a, the flat DC brushless motor 110a and the photosensor 123a, all mounted on the carriage 111a, are electrically connected to a control circuit, not shown, by a flexible cable 125a.

The carriage drive mechanism operates by rotating the flat DC brushless motor 110a with electric power supplied through the flexible cable 125a, thus rotating the pinion 122a. Upon rotation of the pinion 122a, the photosensor 123a issues a signal indicative of an angle of rotation of the motor 110a, and the carriage 111a is moved under a reactive force from the rack 108.

The shift mechanism shown in FIGS. 10, 11, and 12, and the carriage drive mechanism illustrated in FIGS. 13, 14, and 15 have been described as being associated with the print head 103a. The print head 103b is also associated with the same mechanisms.

The present invention is not limited to the above embodiment, but many changes and modifications may be made therein. For example, two ink ribbon cartridges 104a, 104b may be used as shown in FIG. 16 in place of the ink ribbon cartridge 104, and may be mounted on carriages 111a, 111b, respectively. In this modification, a righthand arm of the

ink ribbon cartridge 104a and a lefthand arm of the ink ribbon cartridge 104b should be as thin as possible to position the print heads 103a, 103b closely together. This reduces distances which the print heads have to move in approaching the print-start positions in the print formats shown in FIGS. 9(b) and (e). Although the self-propelled carriage drive mechanism with the drive motor mounted on the carriage is simpler in construction, the drive motor may be mounted on the frame, and the carriage may be moved by the drive motor through a belt or a wire.

Where the platen is of a flat shape rather than a cylindrical shape, the print head may be moved perpendicularly to the carriage. With this alternative, the grooves 114a, 115a and the ridges 116a, 117a are straight in configuration.

According to the second embodiment, as described above, since the plurality of print heads is arranged in the character-spacing direction, a space required therefor may be of substantially the same dimensions as those for the space for a single head, and the pair of guide shafts is sufficient. In the high-density printing, the print heads are only shifted in the paper-feeding direction, and there is no paper feeding operation which would feed the sheet in an unstable interval. Therefore, any positional error is small to maintain good printing quality.

According to a third embodiment of the present invention, at least one of print heads comprises a pen

head.

FIG. 18 illustrates in perspective a multihead serial printer according to a third embodiment of the present invention. Designated as 201 is a sheet of print paper, 202 a platen around which the sheet 201 is wound to provide a print surface, and 203a, 203b guide shafts extending parallel to the platen 202, the platen 202 and the guide shafts 203a, 203b being supported at their ends by frames. Denoted as 204, 205 are carriages slidably mounted on the guide shafts 203a, 203b, 206 an ordinary print head mounted on the carriage 204 and having dot-matrix wires, 207 an ink ribbon cartridge mounted on the carriage 204, 208 a pen head mounted on the carriage 205 and having a plurality of pens, 209 a vertical shift mechanism (described later) for moving the pen head 208 in a direction in which the sheet 201 is fed, i.e., in the column direction, and 210 a rack held in mesh with pinions on spacing motors mounted respectively on the carriages 204, 205. The carriages 204, 205 can therefore be selectively moved independently or together in the character-spacing direction.

The vertical shift mechanism 209 for the pen head 208 will be described.

FIG. 19 is an enlarged exploded perspective view of the vertical shift mechanism 209. The pens are designated as 211 and may comprise ball-point pens or ink pens. The pens 211 are horizontally supported by guides 212 so as to

be directed toward the platen 202. The guides 212 are sandwiched by and between guides 213 having grooves 214a, 214b, having a center of curvature equal to the center of the platen 202. The guides 212 are fitted endwise in the grooves 214a, 214b for sliding movement therein. With the guides 212 thus slidably moved, the tip ends of the pens 211 can be moved along the surface of the platen 202 in the paper-feeding or column direction for a desired interval.

Designated as 215 is a cam follower supporting thereon the guides 212 and urged by a reset spring 216 toward the carriage 205. An eccentric cam 217 is disposed in the cam follower 215 and rotatable by a drive motor 218. When the eccentric cam 217 is rotated by the drive motor 218, the cam follower 215 is moved up and down.

An actuator 219 has one end engaging in slots 211a in the pens 211 and is magnetically attracted by a magnet 220. The actuator 219 is moved under magnetic attraction of the magnet 220 to press the pens 211 toward the platen 202.

The vertical shift mechanism 209 is thus constructed, and its operation will not be described as it is the same as the operation of the second embodiment described with reference to FIGS. 11 and 12.

With the third embodiment, only one print head is supported on each carriage, and hence can be moved at a high speed. Characters are printed by the dot-matrix print head at a high speed, while graphic patterns are plotted as smooth lines by the pen head. As a consequence, the

printing speed is increased, and the printing quality is improved.

Although certain preferred embodiments have been shown and described, it should be understood that many changes and modifications may be made therein without departing from the scope of the appended claims.

Claims:

1. A multihead serial printer having a plurality of print heads (5a, 5b) arranged along the character-spacing or horizontal direction of a platen (1), c h a r a c t e r - i z e d in that said print heads (5a, 5b) are mounted respectively on a plurality of movable carriages (3a,3b) and a plurality of motors (11a, 11b) is operatively coupled with said carriages (3a, 3b) respectively, for independently moving said carriages (3a, 3b).

2. A multihead serial printer according to claim 1, c h a r a c t e r i z e d in that said motors (11a, 11b) are mounted on said carriages (3a, 3b) respectively, for enabling said carriages (3a, 3b) to be self-propelled.

3. A multihead serial printer according to claims 1 or 2, c h a r a c t e r i z e d in that a shift mechanism (105 a, 105b) is mounted on at least one of said carriages (111a, 111b) and a plurality of motors (109a, 109b) is operatively coupled with said shift mechanism (105a, 105b) respectively, for independently moving said print heads (103a, 103b) in a paper-feeding or vertical direction along the surface of the platen (1).

4. A multihead serial printer according to claim 3, c h a r a c t e r i z e d in that at least one of said print heads (103a, 103b) is movable along the surface of the platen (1) in the column and/or in the line direction, independently of the other print heads (103a, 103b).

5. A multihead serial printer according to claim 4, c h a r a c t e r i z e d in that the movement of each print head (103a, 103b) is controllable by two motors (109a, 109b; 110a, 110b), one for the horizontal and one for the line-feeding direction along the surface of the platen (1).

6. A multihead serial printer according to claims 3 to 5, c h a r a c t e r i z e d in that at least one of said print heads (206) comprises a pen head (208).

7. A multihead serial printer according to claim 6, c h a r a c t e r i z e d in that the pen head (206) comprises a plurality of pens (211), being arranged along the horizontal direction of the platen (1) and being supported by a guide means (212).

Fig. 1

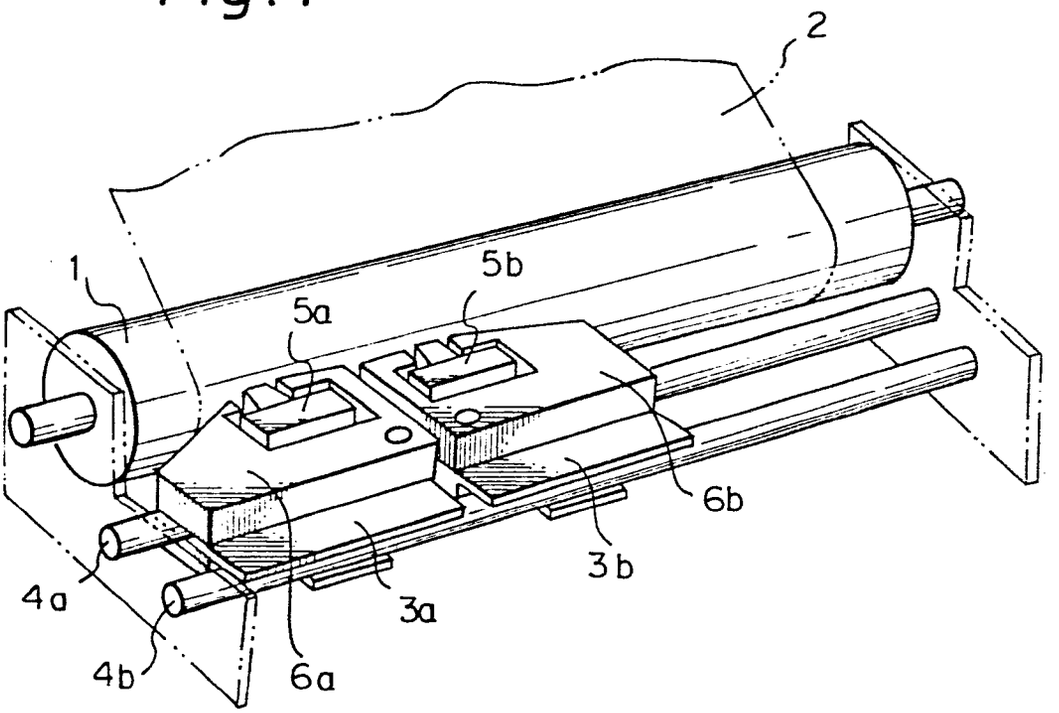
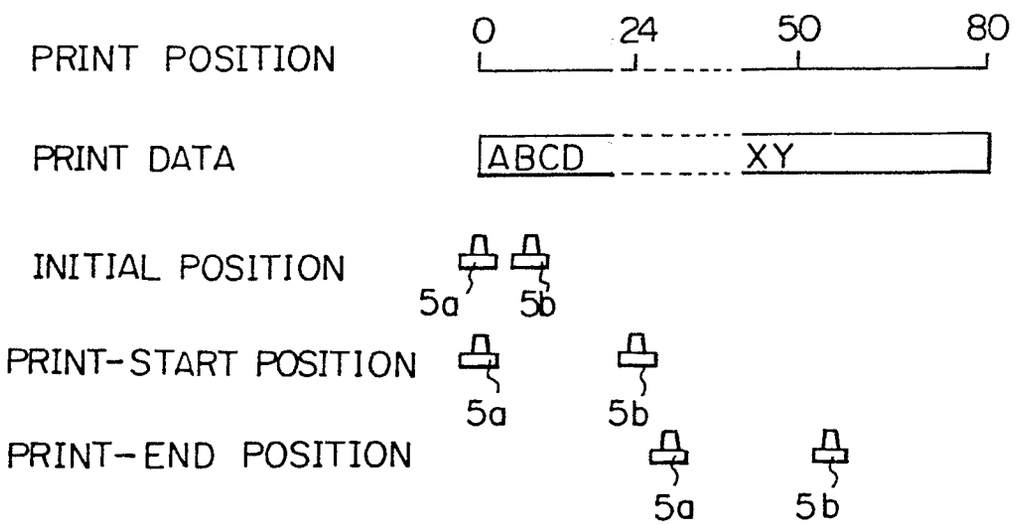

2
1
5a
5b
6b
3b
3a
4a
4b
6a

Fig. 4


PRINT POSITION
0
24
50
80
PRINT DATA
ABCD
XY
INITIAL POSITION
5a
5b
PRINT-START POSITION
5a
5b
PRINT-END POSITION
5a
5b

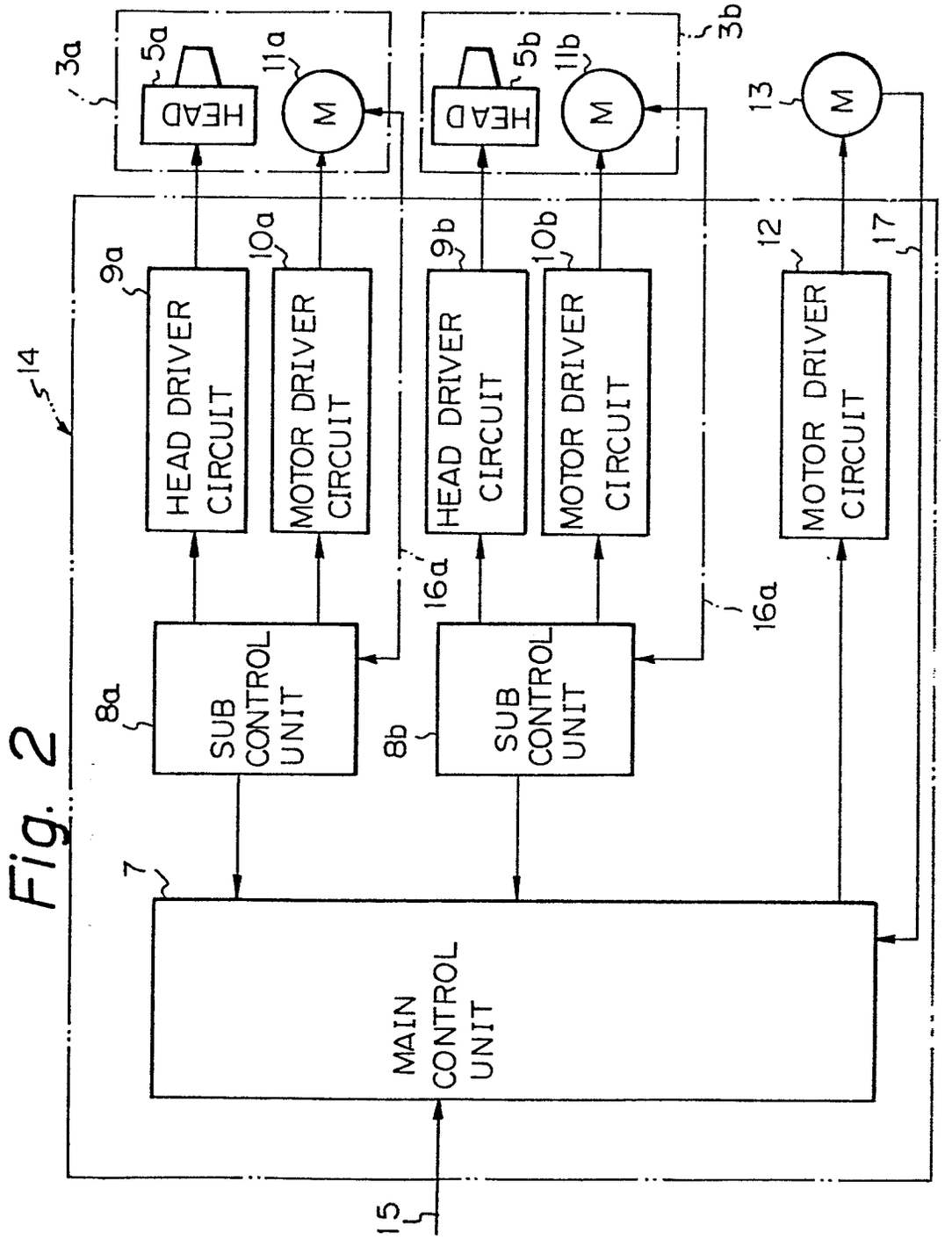

3a
5a
HEAD
11a
M
5b
HEAD
11b
M
3b
13
M
14
9a
HEAD DRIVER CIRCUIT
10a
MOTOR DRIVER CIRCUIT
9b
HEAD DRIVER CIRCUIT
10b
MOTOR DRIVER CIRCUIT
12
MOTOR DRIVER CIRCUIT
17
16a
16a
8a
SUB CONTROL UNIT
8b
SUB CONTROL UNIT
7
MAIN CONTROL UNIT
15

Fig. 2

Fig. 3

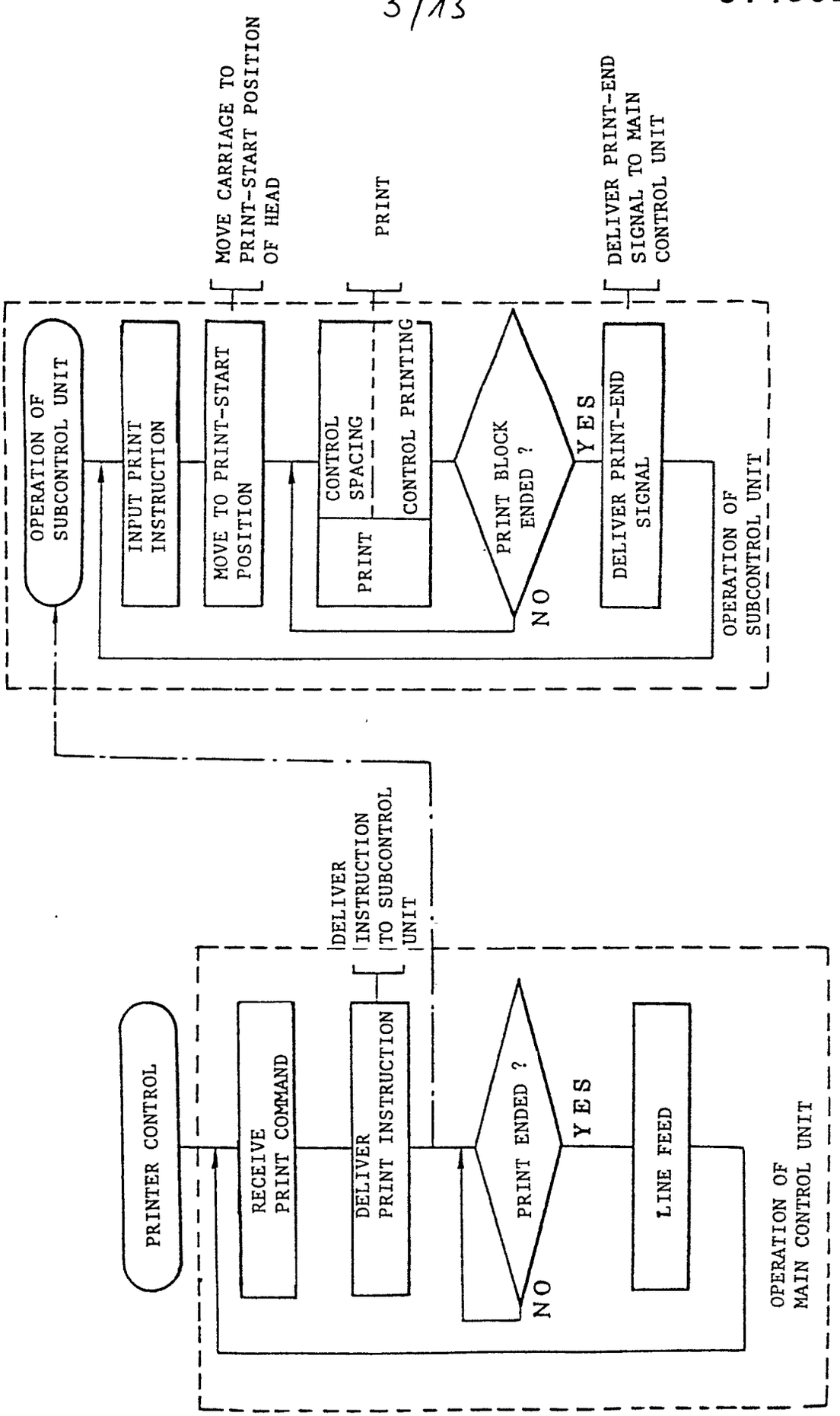

PRINTER CONTROL
RECEIVE PRINT COMMAND
DELIVER PRINT INSTRUCTION
DELIVER INSTRUCTION TO SUBCONTROL UNIT
PRINT ENDED ?
NO
YES
LINE FEED
OPERATION OF MAIN CONTROL UNIT
OPERATION OF SUBCONTROL UNIT
INPUT PRINT INSTRUCTION
MOVE TO PRINT-START POSITION
MOVE CARRIAGE TO PRINT-START POSITION OF HEAD
CONTROL SPACING
PRINT
CONTROL PRINTING
PRINT
PRINT BLOCK ENDED ?
NO
YES
DELIVER PRINT-END SIGNAL
DELIVER PRINT-END SIGNAL TO MAIN CONTROL UNIT
OPERATION OF SUBCONTROL UNIT

Fig. 5

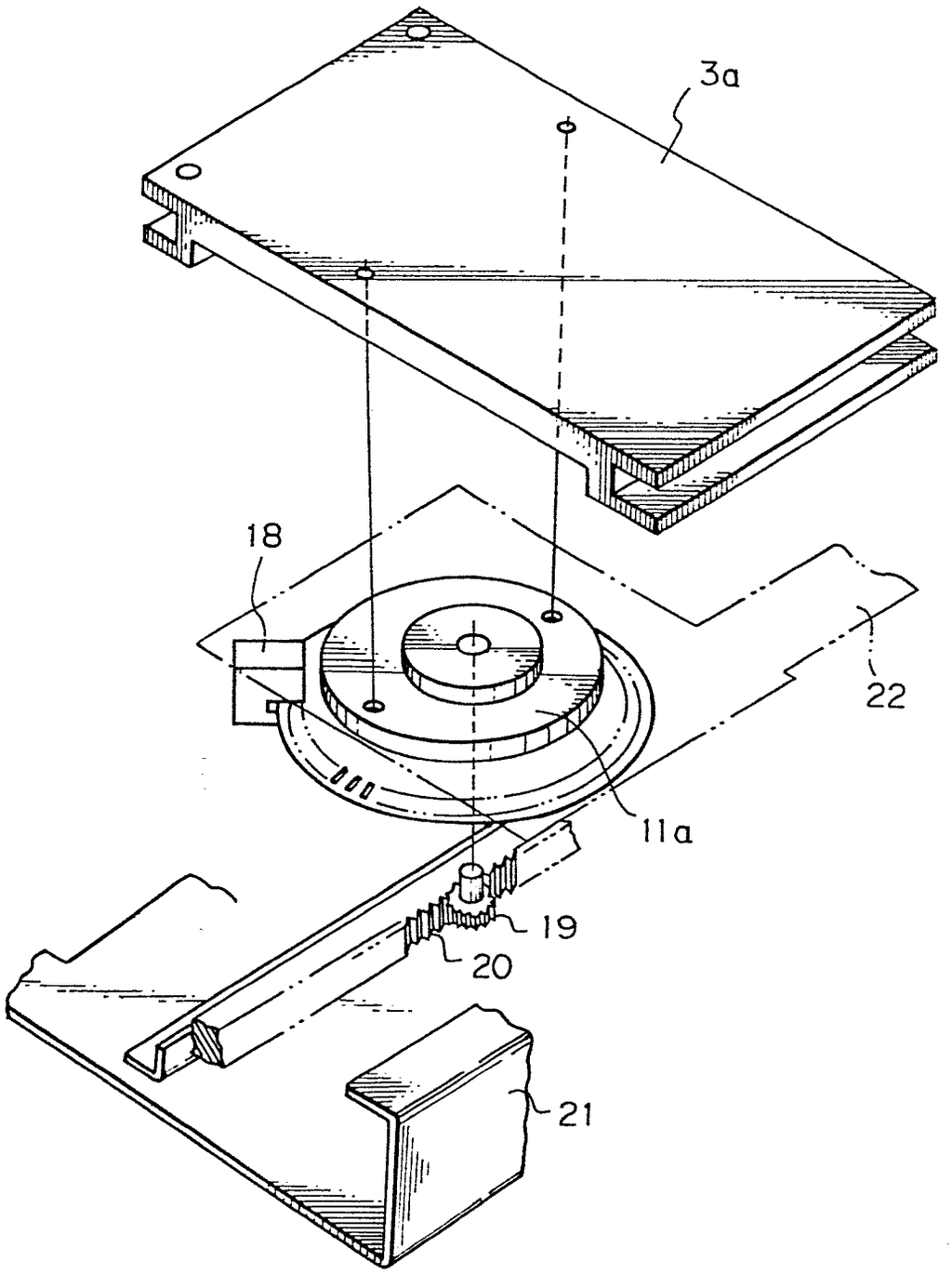


Fig. 6

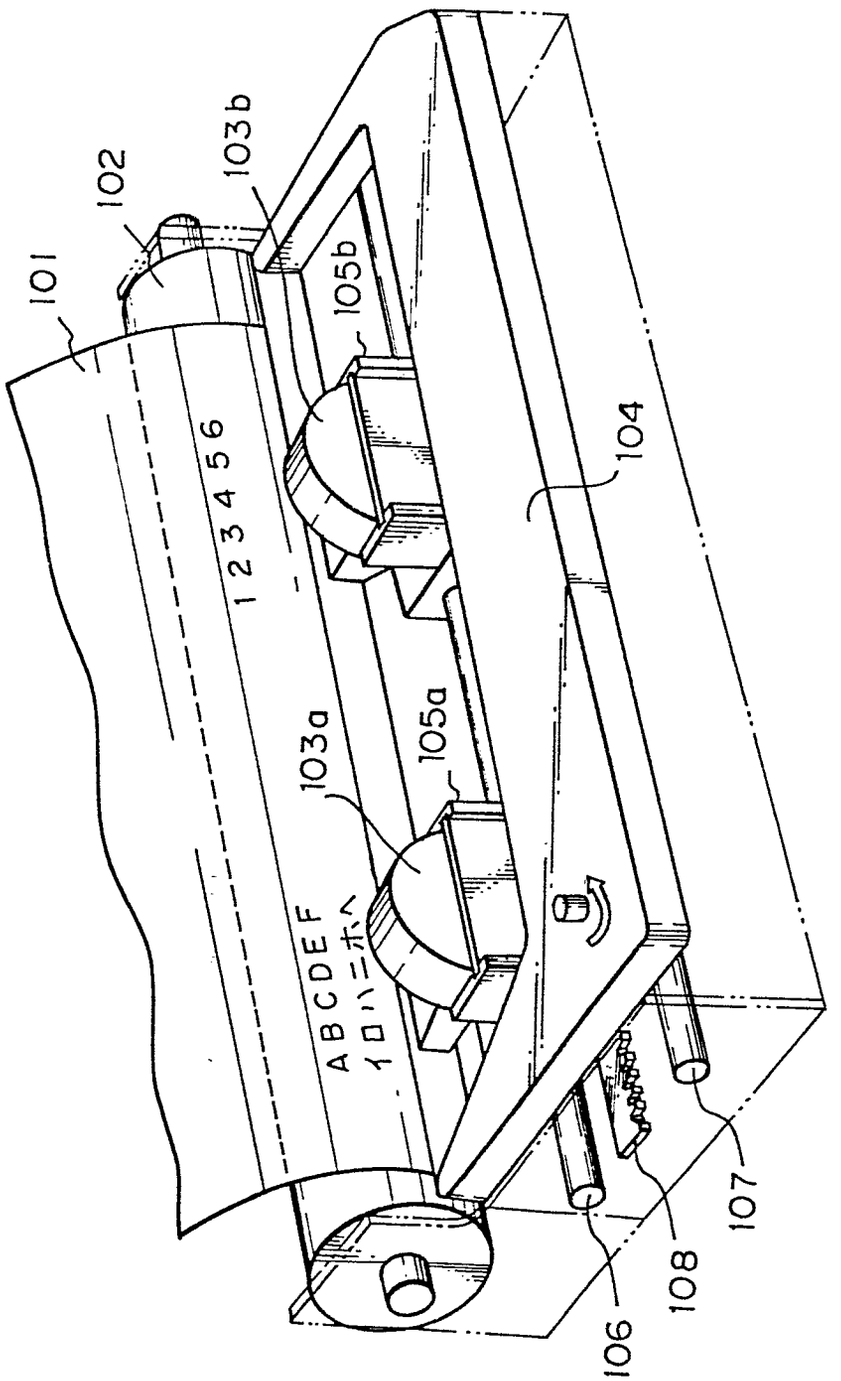


Fig. 7

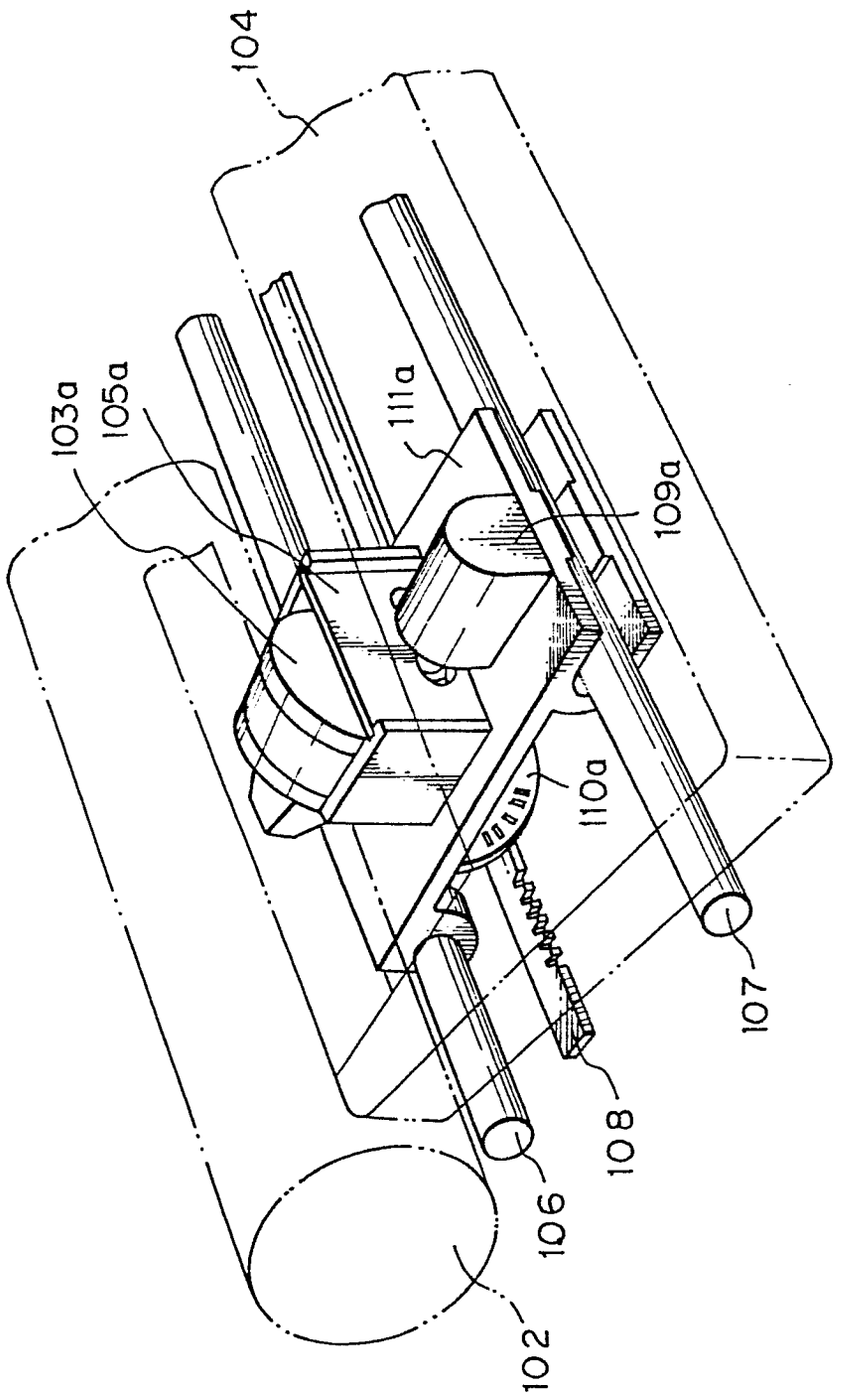


Fig. 8

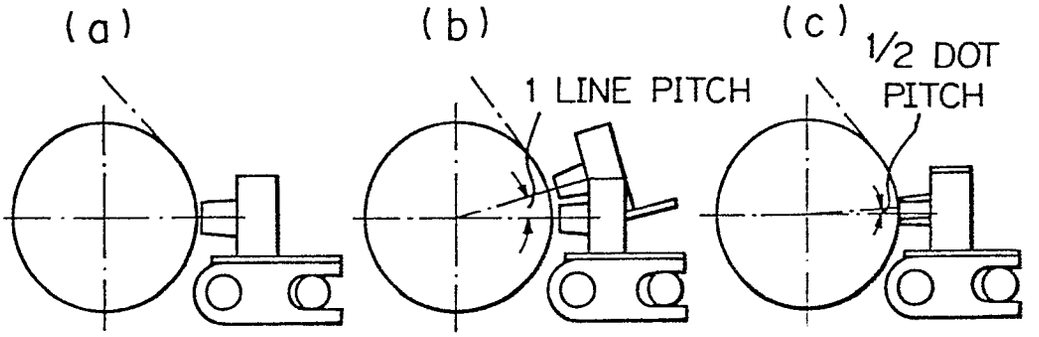


Fig. 9

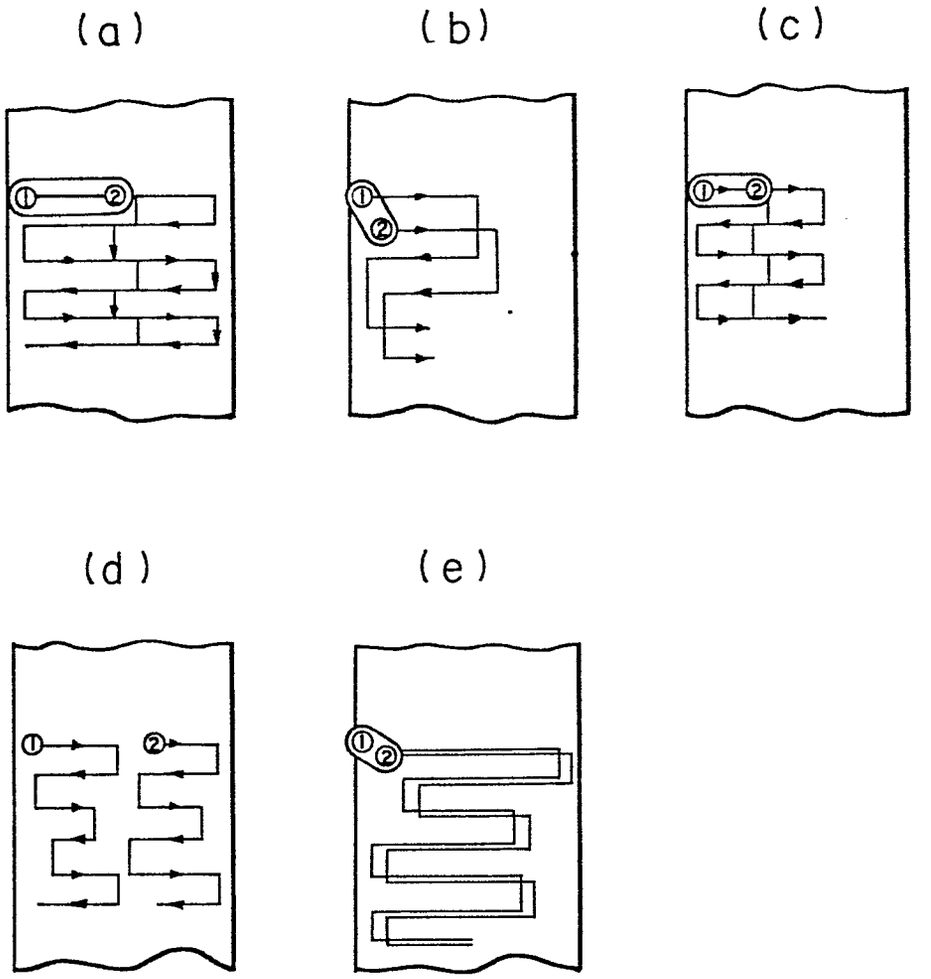


Fig. 10

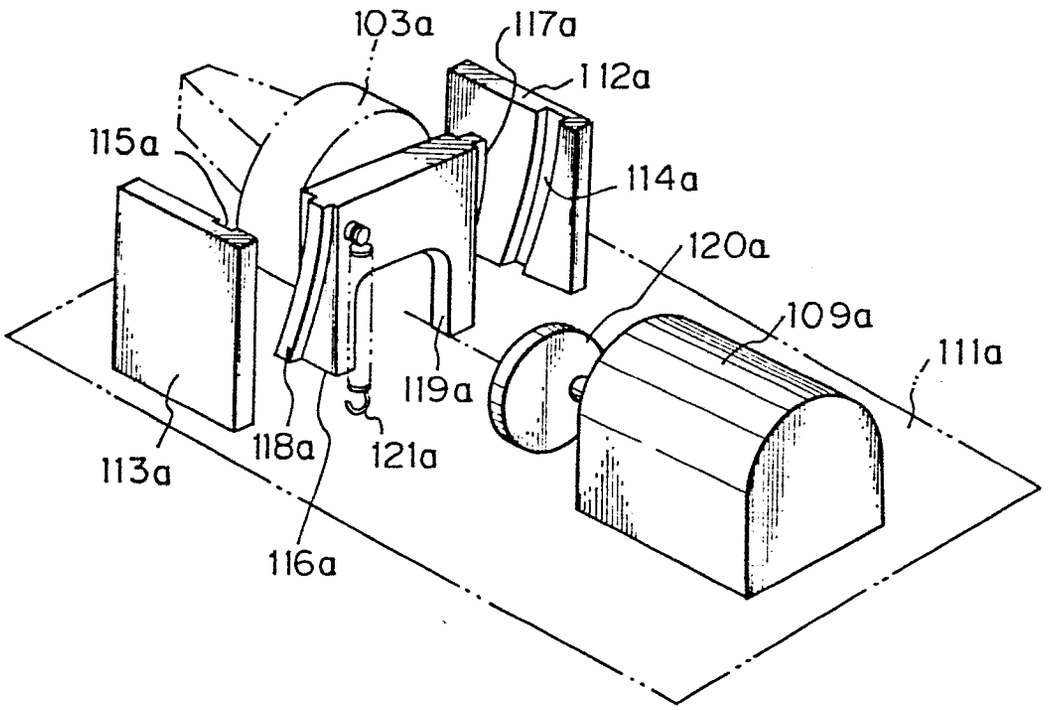


Fig. 11

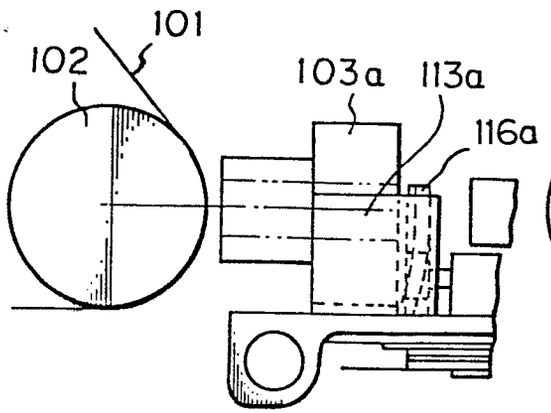


Fig. 12

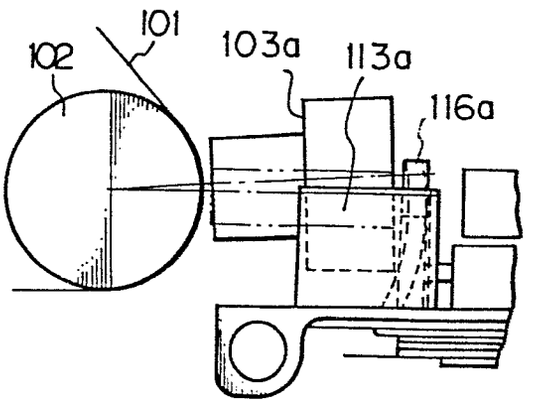


Fig. 13

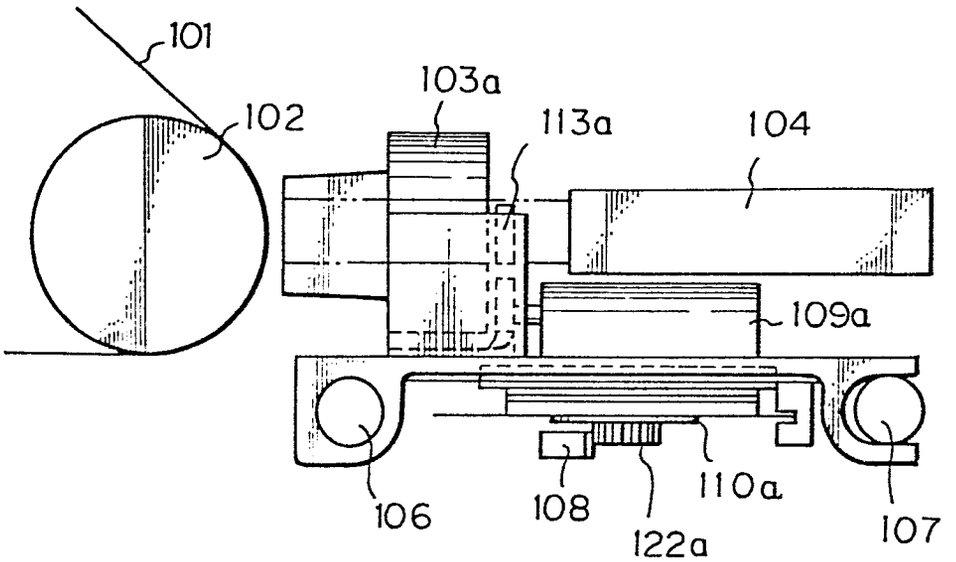

101
102
103a
113a
104
109a
106
108
110a
122a
107

Fig. 14

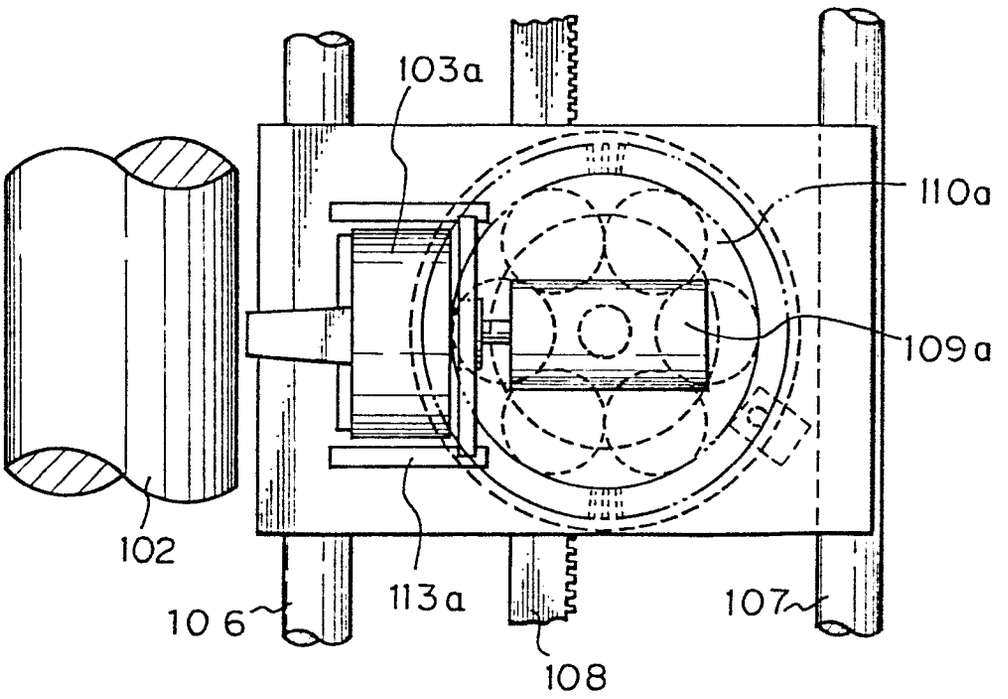

103a
110a
109a
102
106
113a
108
107

Fig. 15

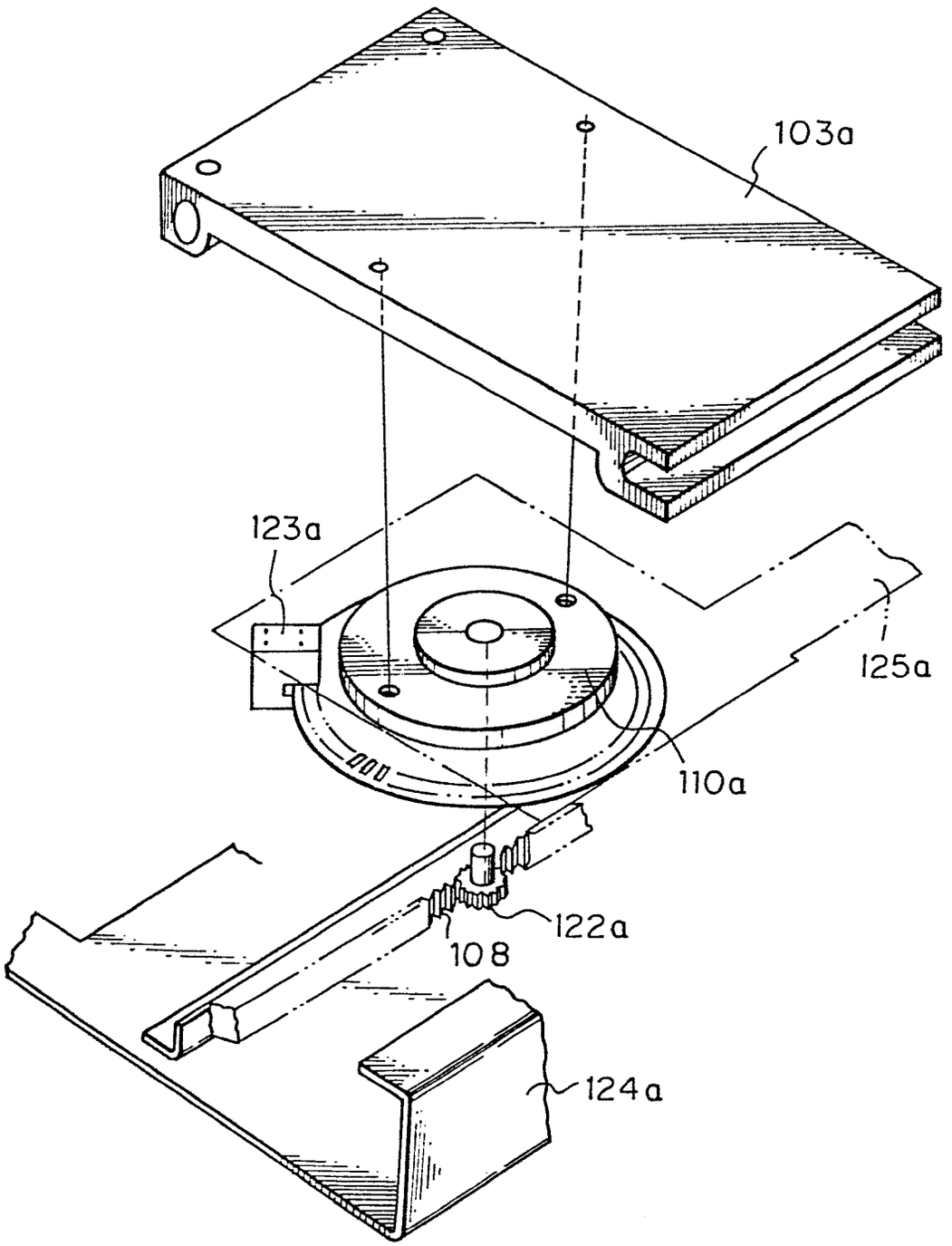


Fig. 16

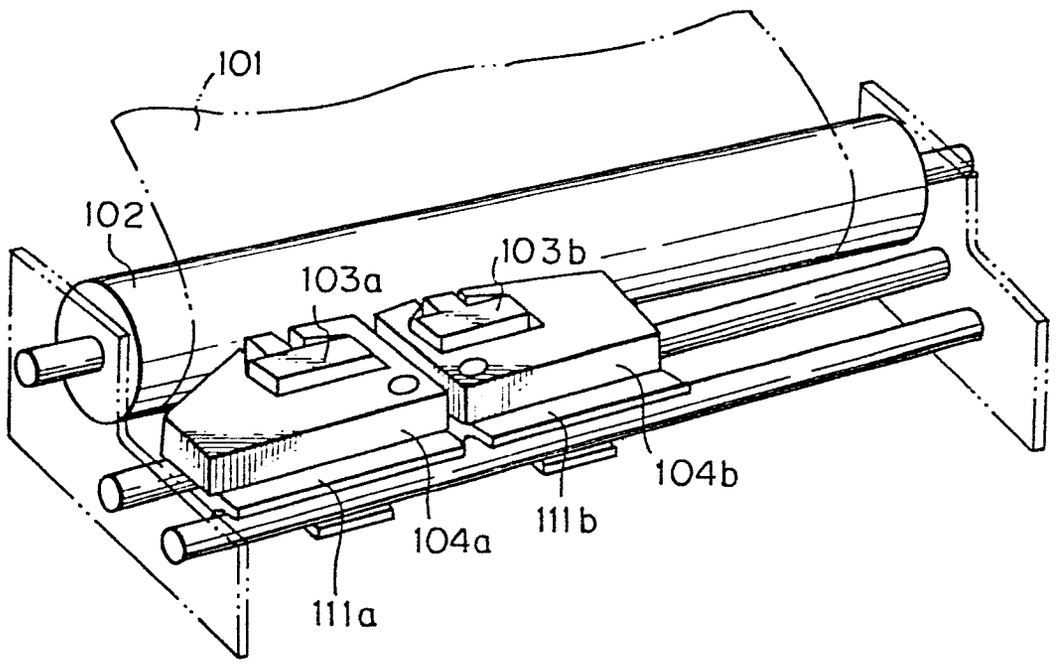

101
102
103a
103b
104a
104b
111a
111b

Fig. 18

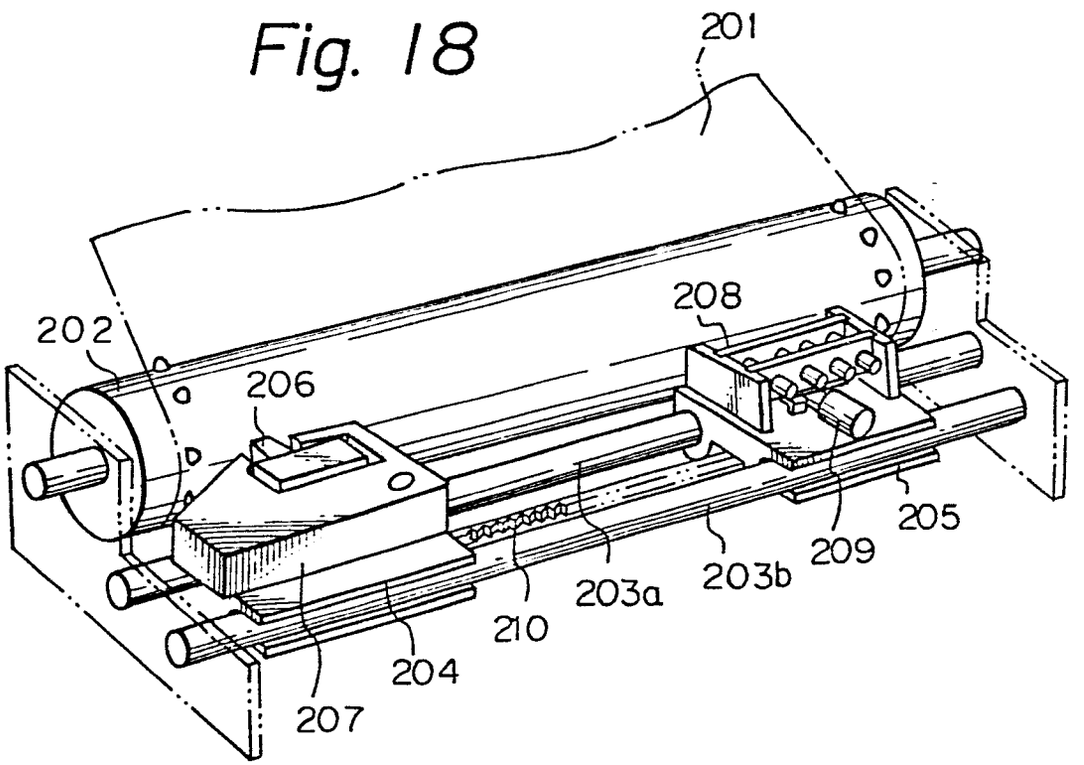

201
202
206
208
203a
203b
204
205
207
209
210

Fig. 17

(a)

```
810103 BLUE  STEREO SYSTEM 96755
801216 BLUE  COLOR TV      84361
810203 YELLOW TOASTER      71344
```

(b)

```
1000 REM  ADD
1010 A=0: B=0: C=0
1020 INPUT A
1030 INPUT B
1040 C=A+B
```

(c)

PAYMENT		ITEM	RECEIPT	
NO.	SUM		NO.	SUM
		CASH		
		TRANSFER		
		- - - -		
		- - - -		

(d)

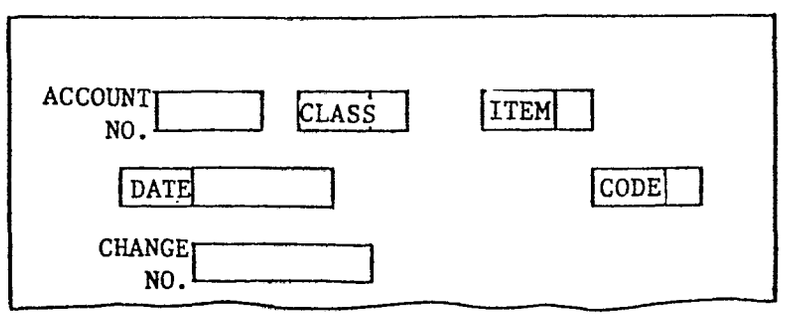
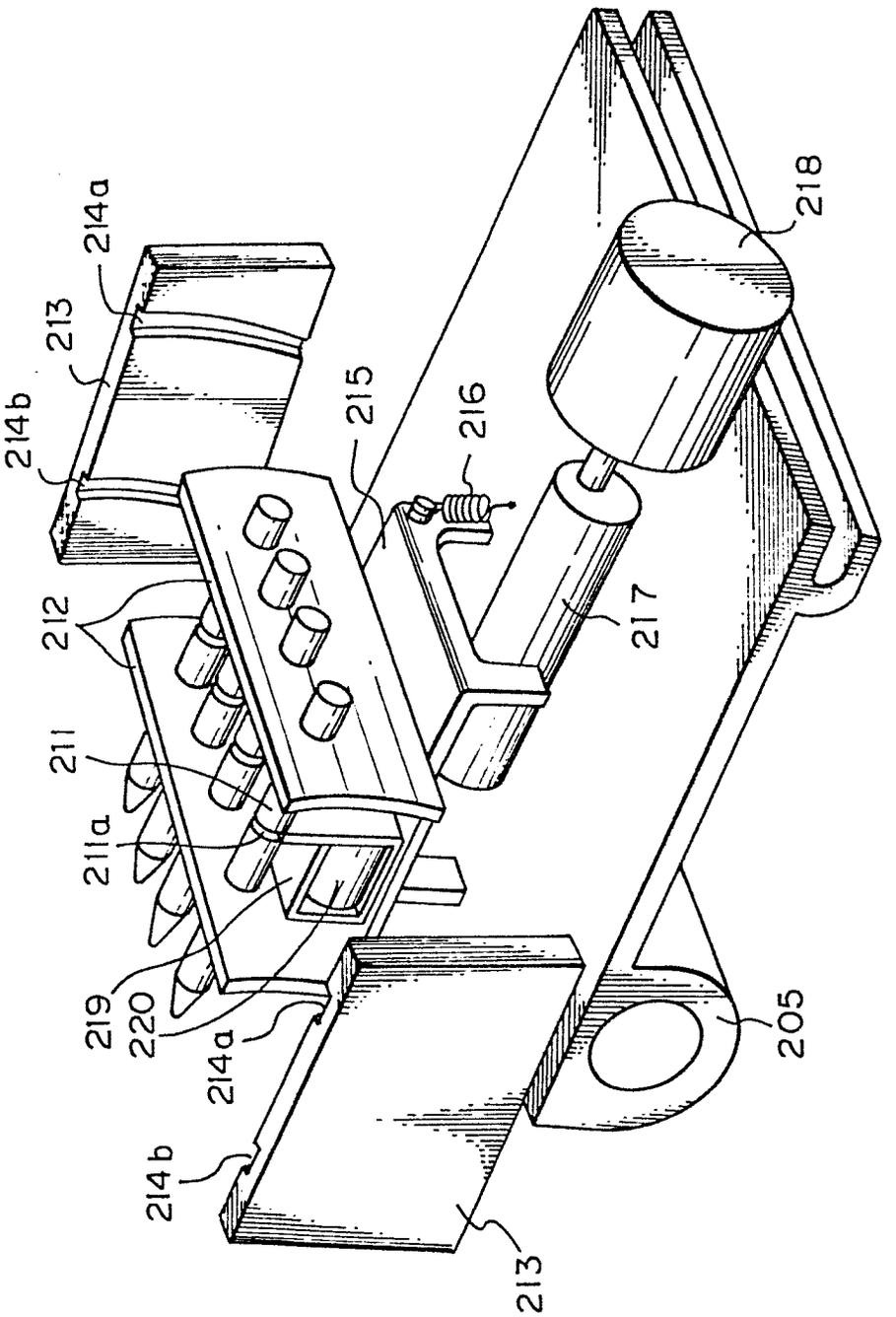


Fig. 19


214a
213
214b
215
216
218
212
217
211
211a
219
220
214a
214b
205
213