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(54) Transfer type ink jet printer

Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker

Imprimante à jet d'encre du type transfert

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(56) References cited:
EP-A- 0 126 479
US-A- 4 293 866
US-A- 5 099 256

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Description

The present invention relates to a transfer type ink jet printer.

Ink jet printers are known in which an ink jet type line recording head adapted to jet ink droplets from its nozzles is driven according to printing data to be recorded, and ink droplets jetted from the nozzles are received by a recording medium (recording sheet) so that a pattern corresponding to the printing data is recorded thereon.

An ink jet printer of this type wherein ink droplets are directly jetted onto a recording sheet is advantageous in that it is simple in construction. However, it is disadvantageous in that it is necessary for the printer to use a recording sheet which is receptive to ink adhering thereto, but which does not cause the ink to spread in a blotting effect. Hence, with the printer, improvements of the printing quality are limited by the quality of the printing sheet.

In order to overcome the above-described difficulty, an ink jet printer has been proposed in which ink droplets jetted according to printing data are received by an ink image holding drum made of a material from which ink can be readily removed, thereby to form an ink pattern on the ink image holding drum, and the ink pattern thus formed, after being partially dried, is transferred onto a recording sheet (see, for example, U.S. Patents Nos. 4,538,156 and 5,099,256).

The above-described method in which an ink pattern (ink image) is partially dried and then transferred onto a recording sheet is advantageous in that the ink image can be printed without the ink running on the recording sheet. In addition, a printer employing the method is also advantageous in that it is free from the difficulty that the ink jetting nozzles are clogged through unintentional contact with the recording sheet or by paper powder. That is, the printer is high in reliability.

However, the printer is still disadvantageous in that, in transferring the ink image onto the printing sheet, the ink is already partially dried, which lowers the adhesion of the ink to the recording sheet. Hence, in the case where the ink image is a pattern such as a segment made up of a series of dots, the ink image may not completely be transferred onto the printing sheet, so that the resultant print is low in quality.

Japanese Patent Application (OPI) No. 70785/1992 has disclosed a technique wherein, in a printer of the type that an image is formed on an image holding drum and then transferred onto a recording sheet, a speed difference is provided between the speed of rotation of the image holding drum and the speed of movement of the recording sheet, thereby to improve the image transferring efficiency.

In this technique, the image is held by an electrostatic force, and it is transferred onto the recording sheet by an electrostatic force. Hence, the technique cannot be applied to a printing system in which, as in the case of an ink jet printer, no electrostatic force is used to transfer the image onto the recording sheet.

It is therefore the object of the present invention to provide a transfer type ink jet printer which avoids the abovementioned drawbacks of known printers. This object is solved by ink jet printers according to independent claim 1.

Further advantageous features, aspects and details of the invention are evident from the dependent claims, the description and the drawings.

The present invention relates to transfer type ink jet printers, and more particularly to a transfer type ink jet printer of the type wherein ink droplets are jetted from nozzles to ink image holding device according to printing data to form an ink image thereon, and the ink image thus formed is transferred onto a recording medium. The invention also relates to an image transferring technique used in such a transfer type ink jet printer.

In view of the foregoing, an aspect of this invention is to provide a transfer type ink jet printer in which an ink image formed on ink image holding means can be positively transferred onto a recording sheet irrespective of the degree of dryness of the ink.

The foregoing aspect and other aspects of the invention have been achieved by the provision of a transfer type ink jet printer which, according to the invention, comprises: an ink jet recording head for jetting ink droplets according to recording data; ink image holding means for receiving ink droplets jetted from the ink jet recording head, the ink image holding means being elastically deformable; and a push roller arranged movable to and from the ink image holding means, the speed of rotation of which is so set that the push roller slips on the ink image holding means with a nipping pressure applied thereto.

Preferably, the printer further comprises data size increasing or decreasing means for increasing or decreasing the recording data in size according to a slip factor between the ink image holding means and the push roller and applying the recording data thus increased or decreased to the recording head, and/or means for determining the timing of jetting ink droplets from the recording head according to the slip factor.

The nature, utility and principle of the invention will be more clearly understood from the following detailed description and the appended claims when read in conjunction with the accompanying drawings.

In the accompanying drawings:

Fig. 1 is an explanatory diagram showing the arrangement of a transfer type ink jet printer, which constitutes a first embodiment of this invention;

Figs. 2(I), 2(II) and 2(III) are explanatory diagrams for a description of the operation of the first embodiment;

Fig. 3 is an enlarged explanatory diagram showing a part of the first embodiment, for a description of the operation of the first embodiment;

Fig. 4 is a graphical representation indicating nipping pressures with slip factors and transfer effects;

Fig. 5 is a block diagram showing the arrangement of one example of a control unit in the first embodiment;

Fig. 6 is a block diagram showing the arrangement of another example of the control unit;

Fig. 7 is an explanatory diagram showing an example of a pushing roller in the first embodiment;

Fig. 8 is an explanatory diagram showing the arrangement of a second embodiment of the invention;

Fig. 9 is a perspective view showing the arrangement of a third embodiment of the invention;

Figs. 10(a) and 10(b) are explanatory diagrams for a description of the operation of the third embodiment;

Fig. 11 is a perspective view showing the arrangement of a fourth embodiment of the invention;

Figs. 12(a) and 12(b) are explanatory diagrams for a description of the operation of the fourth embodiment;

Fig. 13 is a perspective view showing the arrangement of a fifth embodiment of the invention;

Fig. 14 is a front view of an ink image holding drum and a push roller in the fifth embodiment as viewed in the direction of an arrow J in Fig. 13; and

Fig. 5 is a plan view of the ink image holding drum and the push roller.

Preferred embodiments of this invention will be described with reference to the accompanying drawings.

First Embodiment

A transfer type ink jet printer, which constitutes a first embodiment of the invention, is constructed as shown in Fig. 1.

In Fig. 1, reference numeral 1 designates an ink image holding drum, which is rotatably supported by a frame (not shown). The shaft 21 of the drum 1 is coupled through a transmission mechanism 20 such as an endless belt to a pulse motor 23, so that the drum 1 is rotated at a predetermined speed in the direction of the arrow A in Fig. 1. The ink image holding drum 1 includes a drum body 24 made of metal in the form of a cylinder, and an elastic layer 25 formed on the cylindrical surface of the drum body 24 using a material such as silicone rubber which is excellent in ink wettability. The elastic layer 25 may be made of fluorosilicon rubber or fluororubber.

Further in Fig. 1, reference numeral 2 designates an ink jet type recording head. In this embodiment, in order to print each horizontal line of a recording sheet of maximum size in one scan, for instance 2000 nozzle openings are arranged on a straight line, or they are arranged staggered up and down between two adjacent lines.

The ink jet type recording head 2 may be such that a plurality of nozzles, for instance 400 nozzles, are arranged at intervals of a few dots (for instance five dots), in a main scanning direction (in the direction of the axis of the ink image holding drum 1 in the embodiment), and the recording head is moved one dot every revolution of the ink image holding drum so that an ink image corresponding to one page is formed on the ink image holding drum 1 as the latter undergoes plural revolutions (for instance, five revolutions).

The nozzles of the recording head 2 are communicated with pressure chambers to which, similarly to the case of an ordinary serial printer, ink is supplied from an ink tank. In the pressure chambers, energy generating sources such as piezoelectric elements or heat generating elements are operated according to printing data to be recorded to jet ink droplets from the pressure chambers.

The ink jet printer further includes a push roller 3 having a friction layer 3a on its surface, which is made of a material which has a larger coefficient of friction with respect to a recording sheet than the ink image holding drum 1. The push roller 3 is rotatably mounted through a shaft 30 on a base stand 31, and is coupled through a transmission mechanism 32 such as a timing belt to a pulse motor 33 which is fixedly mounted on the base stand 31. The push roller 3 is driven by the pulse motor 33 at a peripheral speed V_2 which differs by a value ΔV (hereinafter referred to as "a peripheral speed difference ΔV", when applicable) from the peripheral speed V_1 of the ink image holding drum 1 so that it slips on the latter. The base stand 31 is mounted on a pushing mechanism 34 so that it is moved back and forth, or in the directions of the arrow C in Fig. 1.

The ink jet printer further includes a control unit 35 which detects a rotational position of the ink image holding drum 1, and applies printing data to the recording head 2 when the home position of the drum 1 reaches the recording head 2. After the formation of an ink image has been accomplished, the control unit 35 operates to convey a recording sheet P to the space between the ink image holding drum 1 and the push roller 3 in synchronization with the arrival of the home position of the ink image holding drum 1 at the transfer region, and to move the pushing mechanism 34 so that the push roller 3 is pushed against the cylindrical surface of the ink image holding drum 1 with a predetermined nipping pressure. In addition, the control unit controls the pulse motor 33 so that the predetermined peripheral speed difference ΔV is provided between the peripheral speeds of the ink image holding drum 1 and the push roller 3.

Further in Fig. 1, reference numeral 38 designates a pair of sheet feeding rollers for supplying a recording sheet P to the transfer region.

The operation of the printer thus constructed will be described with reference to Fig. 2.

With the push roller 3 spaced away from the ink image holding drum 1 (as shown in Fig. 2(I)) the latter is rotated at the steady speed V_1. When the home position of the ink image holding drum 1 confronts the ink jet recording head 2, a host computer or the like applies printing data to the ink jet recording head 2. Ink droplets jetted from the recording head 2 form an ink image on the cylindrical surface of the ink image holding drum 1 in correspondence to the printing data.

As the ink image is formed on the ink image holding drum 1 rotated in the above-described manner, then it is partially dried because the solvent of the ink evaporates. When the required ink image is formed, for instance, an image of one page, the sheet feeding rollers 38 supply the recording sheet P to the transfer region in synchronization with the arrival of the home position of the ink image holding drum 1 at the transfer region. When the front edge of the recording sheet P reaches the transfer region, the pushing mechanism 34 moves the push roller 3 in the direction of the arrow D so that the latter is pushed against the ink image holding drum 1 at the predetermined nipping pressure (as shown in Fig. 2(II)).

As a result, the recording sheet P is held between the ink image holding drum 1 and the push roller 3, so that it is pushed against the ink image holding drum 1 with a predetermined force F attributed to the pushing force of the push roller 3 (as shown in Fig. 2(III)). Under this condition, the ink image is transferred from the ink image holding drum 1 onto the recording sheet P.

When one page of the ink image has been transferred, the pushing mechanism 34 is released, so that the push roller 3 is moved away from the ink image holding drum 1. Thus, the recording operation for one page is completed.

In the above-described ink image transferring operation, the recording sheet P is moved at a speed V_2 which is substantially equal to the periphery speed V_2 of the push roller 3, because the latter has a larger coefficient of friction with respect to the recording sheet P than the ink image holding drum 1. Hence, the recording sheet P has a speed difference $\Delta V = |V_1 - V_2|$ with respect to the peripheral speed V_1 of the ink image holding drum 1, so that the ink image 37 slips on the ink image holding drum, that is, a shearing force occurs to separate the ink image 37 from the cylindrical surface of the ink image holding drum 1. In other words, the shearing force accelerates the separation of the ink image from the cylindrical surface of the ink image holding drum 1. On the other hand, since the cylindrical surface of the ink image holding drum is made of an elastic material such as silicone rubber as described above, as shown in Fig. 3 a recess is formed in the cylindrical surface of the ink image holding drum 1 at the region where the ink image holding drum 1 contacts the push roller 3, *i.e.*, at the region where the recording sheet is in contact with the drum 1 and the roller 3. More specifically, convex portions K and L, and a concave portion J are formed in the narrow transfer region, so that the ink image on the cylindrical surface of the ink image holding drum is bent, thus causing fine cracks to form. This contributes greatly to improving the ink image transferring efficiency.

The inventors have carried out research on the effects of the above-described ink image slipping and bending actions on the ink image transferring efficiency, and found that the nipping pressure relates greatly to the slip factor as shown in Fig. 4.

That is, in order to obtain a certain transferring efficiency which is satisfactory in practice, the slip factor may be small when the nipping pressure is large, and the slip factor must be increased when the nipping pressure is small. In Fig. 4, the curve M indicates the lower limit values under those conditions. Therefore, where both the slip factor and the nipping pressure are above the curve M, then the ink image can be satisfactorily transferred onto the recording sheet.

It is true that, where both the slip factor and the nipping pressure are above the curve M, then the ink image transferring characteristic is satisfactory. However, if, in this case, the slip factor is larger than 5%, then the image transferred onto the recording sheet tends to be distorted; that is, the resultant print is low in quality.

On the other hand, in the case where the printer is of practical size, the upper limit of the nipping pressure is about 14.7 N/cm (about 1500 gf/cm), because application of a maximum of 50 kg to a recording sheet having a width of 35 cm is allowable.

In practice, there is a limit to the slipping of the ink image under a large nipping pressure. With those conditions taken into consideration, it has been found that if the nipping pressure and the slip factor are selected from the hatched region in Fig. 4 with reference to the paper quality of the recording sheet and the ink holding force of the ink image holding means, then the ink image can be transferred onto the recording sheet with high efficiency.

Particularly in the case where the printing sheet is a sheet of a type often used in offices, it is desirable that the nipping pressure be fixedly set to a value in a range of from 1.47 to 5.9 N/cm (150 to 600 gf/cm), and the slip factor is set to a suitable value with the paper quality of the recording sheet and the ink holding force of the ink image holding means taken into account; that is, the nipping pressure and the slip factor are so selected that the speeds of rotation of the ink image holding drum 1 and the push roller 3 can be adjusted externally.

Fig. 5 shows an example of a data processing device which is used when a large slip factor is required to improve the above-described ink image transferring characteristic.

The data processing device, as shown in Fig. 5, includes a slip factor setting unit 40 which, in response to a speed reference signal from ink image holding drum driving unit (not shown), sets a speed difference ΔV between the speeds of rotation of the ink image holding drum 1 and the push roller 3 to provide a desired slip factor. The data set by the slip factor setting unit is applied to a motor driving unit 41, which is provided for the pulse motor 33 connected to the push roller 3, to control the speed of the pulse motor 33. The data processing device further includes a data size increasing/decreasing unit 43 which receives a printing signal from the host computer, and, in correspondence to the data from the slip factor setting unit 40, increases or decreases the size of bit map data developed in an image buffer 42 in the auxiliary scanning direction, *i.e.*, in the circumferential direction of the ink image holding drum 1. It can be readily realized with software to directionally increase or decrease image data in the above-described manner. Reference numeral 44 designates a driving unit for the ink jet type recording head 2.

The data processing device has the following effects and merits: Even if a high slip factor is set with the slip factor setting unit 40 to make the ink image transferring characteristic sufficiently high, the image obtained upon transferring is free from distortion because the bit map data formed from the printing data is corrected by the data size increasing/decreasing unit 43 with the distortion taken into account.

Fig. 6 shows another example of the data processing device, which includes a position detecting unit 46 and a printing position calculating unit 45. The position detecting unit 46 operates to output a signal corresponding to the position of the ink image holding drum 1 according to an output signal of an encoder 47 adapted to detect the position of the ink image holding drum 1. The printing position calculating unit 45 operates as follows: In order for the image transferred onto the printing sheet to be free from distortion irrespective of a slip factor set by the slip factor setting unit, the printing position calculating unit 45 calculates a dot forming position in the most suitable auxiliary scanning direction, *i.e.*, in the sheet feeding direction, and causes a printing pulse generating unit 48 to output a printing timing signal according to the result of calculation.

The data processing device can be realized with circuits relatively small in scale because only data to be printed are subjected to calculation.

Fig. 7 shows another example of the push roller. The push roller 50 has a braking unit 51 for applying a load to the roller 50. The braking unit 51 is fixedly mounted on the base stand 31, which is driven by the pushing mechanism 34.

The ink jet printer with the push roller 50 operates as follows: When an ink image has been formed on the ink image holding drum 1, a recording sheet P is fed to the transfer region, while the pushing mechanism 34 is operated. As a result, the push roller 50 pushes the recording sheet P against the ink image holding drum 1. The torque of the ink image holding drum 1 is applied through the recording sheet P to the push roller 50, so that the latter tends to turn in synchronization with the ink image holding drum 1. In this operation, a load is applied to the push roller 50 by the braking unit 51, and the friction force with the recording sheet P is larger than that with the ink image holding drum 1, and therefore the push roller slips relative to the recording sheet P on the ink image holding drum 1, thus providing a speed difference ΔV_1 between the speeds of rotation of the push roller and the ink image holding drum. As a result, similarly as in the above-described case, a shearing force occurs to separate the ink image on the ink image holding drum 1 from the cylindrical surface of the latter 1, so that the ink image is positively transferred onto the recording sheet P.

The speed difference ΔV between the speeds of rotation of the push roller 50 and the ink image holding drum 1 depends on the load applied to the push roller 50. Hence, the ink image transferring characteristic can be adjusted by changing the load with the braking unit 51.

Second Embodiment

A second embodiment of the invention will be described with reference to Fig. 8, in which the ink image holder is formed by an endless belt.

In Fig. 8, reference numeral 60 designates the ink image holder, which is composed of an endless belt made of an elastic material such as silicone rubber. The ink image holder 60 is provided with a pair of rollers 61 and 62 to provide a flat surface in the region where it confronts the recording head 2, and it is supported by a driving roller 63 of relatively large diameter in the region where it confronts the push roller 3. The driving roller 63 is coupled through a transmission mechanism 64 to a pulse motor 65.

When the driving roller 63 is turned in the direction of the arrow, the ink image holder 60 passes over the recording head at a predetermined speed. When, under this condition, printing data is applied to the recording head 2, the latter jets ink droplets to form an ink pattern on the outer surface of the ink image holder 60.

When the data has been recorded on the ink image holder 60 as much as required, the push roller 3 is moved towards the ink image holder 60 in synchronization with the arrival of the home position of the holder 60 to the transfer region, while a recording sheet P is fed by the sheet feeding rollers 38 to the transfer region. As a result, the recording sheet P is moved while being pushed against the ink image holder 60 by the push roller 3, so that, similarly as in the case of the first embodiment, the ink image is positively transferred onto the recording sheet P.

In the second embodiment, the distance between the record region and the transfer region can be freely increased. Because of this feature, the period of time between the time when an ink pattern is formed and the time when the ink pattern is transferred onto the recording sheet can be sufficiently long. Hence, the ink image can be sufficiently dried, and it is possible, when necessary, to provide a cleaning device for removing an ink image left on the ink image holder 60, and a heater or air blower for evaporating the solvent from ink which is slow in drying speed.

Third Embodiment

A third embodiment of the invention will be described with reference to Fig. 9.

In Fig. 9, reference numeral 101 designates an ink image holding drum, which is fundamentally the same in construction as the ink image holding drum 1 in the above-described first embodiment.

In this embodiment, the recording head 102 is a line type ink jet recording head having a plurality of nozzles at predetermined intervals extending in the direction of the axis of the ink image holding drum 101.

The recording head 102 has, for instance, 512 nozzles arranged at intervals of 0.67 mm (16/600 inch). The recording head 102 is moved by a head moving device 121 along the axis of the ink image holding drum 101 as much as 0.0423 mm (1/600 inch) per revolution of the drum 101, so that an image of one page is formed on the ink image holding drum 101 when the latter has made sixteen (16) revolutions.

The cylindrical surface of the ink image holding drum 101 is an elastic layer, and it is divided into two regions: a recording region 111 indicated hatched in Fig. 9, and a non-recording region 112. In this embodiment, the ink image holding drum 101 is, for instance, 80 mm in diameter.

The ink image holding drum 101 is provided with a push roller 103, which is fundamentally the same in construction to the push roller 103 of the first embodiment. However, it should be noted that the push roller 103 is rotatably supported by a pushing lever 132 which is swingable about a supporting shaft 131 fixedly secured to a frame (not shown). An eccentric-cam-shaped pushing shaft 134 is rotatably supported on the frame and abutted against the pushing lever 132. Therefore, as the pushing shaft 134 is rotated by an electric motor 135, the pushing lever 132 is swung, being abutted against the pushing shaft 134, so that the push roller 103 is swung up and down in the directions of the arrow C, so that it is pushed against and moved away from the ink image holding drum 101. The pushing force of the push roller 103, namely, an ink image transferring force, is generated by a pressure applying spring 133. The ink image transferring force is, for instance, in a range of 49 to 490N (5 to 50 kg).

The ink image holding drum 103 is coupled through a drum gear 153, a first intermediate gear 152 (on the side of the drum 101), and a motor gear 151 to a pulse motor 105, so that the drum is turned in the direction of the arrow A in Fig. 9.

The push roller 103 is coupled through a roller gear 155, and a second intermediate gear 154 (on the side of the push roller 103) to the first intermediate gear 152. With the aid of the first intermediate gear 152, the push roller 103 is rotated in the direction of the arrow B at a speed V_2 which differs by ΔV from the peripheral speed V_1 of the ink image holding drum 101 so that the push roller 103 slips on the ink image holding drum 101.

The above-described gears form a transmission mechanism, the transmission ratio of which is as follows:

$$(D_1/D_2) \neq (Z_{53}/Z_{55}),$$

where D_1 is the outside diameter of the ink image holding drum 101, D_2 is the outside diameter of the push roller 103, Z_{53} is the number of teeth of the drum gear 153, and Z_{55} is the number of teeth of the roller gear 155.

The transmission mechanism may be replaced by a toothed belt mechanism or a pulley mechanism.

Further in Fig. 9, reference numeral 113 designates a drum origin detecting board, which is fixedly mounted on the shaft of the ink image holding drum 101. The drum origin detecting board 113 operates as follows: As the ink image holding drum 101 rotates, the front edge of the recording region 111 of the ink image holding drum 101 reaches the recording head 102, whereupon the drum origin detecting board 113 causes an origin detector 114 to output an origin signal. In response to the origin signal, printing data is applied to the recording head 102, so that the latter jets ink droplets to form an ink image on the recording region 111 of the ink image holding drum 101.

The operation of the ink jet printer thus constructed will be described with reference to Fig. 10.

Similarly as in the case of the above-described first embodiment, with the push roller 103 spaced away from the ink image holding drum 101 (as shown in Fig. 10(a)), the ink image holding drum 101 is rotated at a predetermined speed V_1.

When the origin signal is produced, that is, when the writing start position confronts the recording head 102, a host computer or the like applies printing data to the recording head 102 to cause the latter to jet ink droplets. The ink droplets thus jetted form an ink image on the recording region 111 of the ink image holding drum 101 according to the printing data.

Similarly as in the case of the first embodiment, the ink image thus formed is partially dried.

After the ink image has been formed on the ink image holding drum 101, for instance, in an amount corresponding to one page, a recording sheet P is fed into the transfer region by sheet feeding rollers 137 in the direction of the arrow D in synchronization with the arrival of the writing start position of the ink image holding drum 101 at the transfer region.

Upon arrival of the front edge of the recording sheet P at the transfer region, the pushing shaft 134 is turned. As a result, the push roller 103 is moved by the pressure applying spring 133 in the direction of the arrow E (Fig. 10(b)), so that it is pushed against the ink image holding drum 101 at a predetermined nipping pressure.

Thus, similarly as in the case of the first embodiment, the recording sheet P is held between the ink image holding drum 101 and the push roller 103, that is, it is pushed against the ink image on the drum 101 by the push roller 103 at a predetermined force E as shown in Fig. 10(b), as a result of which the ink image is transferred onto the recording sheet P.

When one page of the ink image has been transferred, the pushing shaft 134 is turned, so that the push roller 103 is moved away from the ink image holding drum 101. Thus, the printing of one page of the ink image on the recording sheet P is completed.

In the ink image transferring operation, similarly in the case of the first embodiment, the ink image is suitably slipped and bent, thus improving the ink image transferring efficiency.

The third embodiment is advantageous in the following points: Even if the pushing force changes, the speed difference ΔV between the speeds of rotation of the ink image holding drum 101 and the push roller 103 is maintained unchanged owing to the transmission ratio of the transmission. Thus, the ink jet printer is simple in construction, positive in operation, and low in manufacturing cost.

Fourth Embodiment

A fourth embodiment of the invention is constructed as shown in Fig. 11.

In the fourth embodiment, the ink image holder is implemented with a belt 106 having two ends (hereinafter referred to as "an ink image holding belt 106", when applicable). The belt is formed by bonding an elastic material such as silicone rubber to the surface of a thin-plate-shaped material such as a spring steel sheet.

The ink image holding belt 106 has a recording region, the length of which is equal to that of at least one recording sheet P. The ink image holding belt 106 is laid over a feeding drum 165 with one end connected to a supply roll 161 and the other end to a take-up roll 162. When the printer is in standby state, the front edge of the recording region 111 of the ink image holding belt 106 is confronted with a recording head 107, and the ink image holding belt is stretched tight, being wound on the supply roll 161.

The ink image holding belt 106 is held between the feeding drum 165 and a pinch roller 166. That is, the pinch roller 166 is pushed through the belt 106 against the feeding drum 165 by a pressure applying device (not shown), so that the pinch roller 166 is rotated by a frictional force produced between itself and the belt 106.

When the feeding drum 165 is rotated by a pulse motor 105 in the direction of the arrow F in Fig. 11, the ink image holding belt 106 is moved in the direction of the arrow G (this direction being hereinafter referred to as "a main scanning direction, when applicable), and its recording region 111 is unwound from the supply roll 161, while a take-up motor 164 operates to wind the ink image holding belt 106 toward the taken up roll 162 so that the latter is kept stretched tight.

The recording head 107 is a serial type ink jet recording head composed of piezoelectric elements; that is, it has a plurality of nozzles at predetermined intervals in the main scanning direction. For instance, the recording head 107 has sixty-four (64) nozzles at intervals of 0.0423 mm (1/600 inch) in the direction of movement of the ink image holding belt 106. The recording head 107 is set in front of the ink image holding belt 106 with a predetermined space therebetween. The recording head 107 thus set is moved back and forth in a direction perpendicular to the main scanning direction (hereinafter referred to as "an auxiliary scanning direction", when applicable).

The feeding drum 165 is coupled through a drum gear 153, a first intermediate gear 152 (on the side of the drum 165) and a motor gear 151 to a pulse motor 105, so that it is rotated in the direction of the arrow F. A push roller 103 is coupled through a roller gear 155, a second intermediate gear 154 (on the side of the push roller 103) to the first intermediate gear 152. With the aid of the first intermediate gear 152, the push roller 103 is rotated in the direction of the arrow H at a speed V_2 which differs by ΔV from the peripheral speed V_1 of the ink image holding belt 106 so that the push roller 103 slips on the ink image holding belt 106. The transmission mechanism according to the present invention, other than as described above, may also be a belt-mechanism having sprockets or a pulley mechanism. The above-described gears form a transmission mechanism, the transmission ratio of which is as follows:

$$(V_1/V_2) \neq (Z_{53}/Z_{55}),$$

where V_1 is the peripheral speed of the ink image holding belt 106, V_2 is the peripheral speed of the pushing roller 103, Z_{53} is the number of teeth of the drum gear 153, and Z_{55} is the number of teeth of the roller gear 155.

The operation of the fourth embodiment thus constructed will be described with reference to Fig. 12.

When the printer is in a standby state, as was described before the front edge of the recording region 111 of the ink image holding belt 106 is held confronted with the recording head 107, and the push roller 103 is held spaced away from the ink image holding belt 106, as shown in Fig. 12(a).

Upon provision of a recording start instruction, a head driving device 171 causes the recording head 107 to move in the auxiliary scanning direction, while a host computer or the like applies printing data to the recording head 107 in correspondence to the position of the recording head 107 which is being moved in the auxiliary scanning direction, so that writing (forming) of an ink image is started from its first line.

When the movement of the recording head 107 in the auxiliary scanning direction in this manner has been accomplished, that is, when the first line of the ink image has been formed, the ink image holding belt 106 is fed by the feeding drum 165 by one pitch (for instance, 2.7 mm (64/600 inch)), and held there. Then, the head driving device 171 causes the recording head 107 to return in the auxiliary scanning direction, while a host computer or the like applies printing data to the recording head 107 in correspondance to the position of the recording head 107 which is in the auxiliary scanning direction, so that writing (forming) of an ink image is started from its second line.

When the return movement of the recording head 107 has been accomplished, that is, when the second line of the ink image has been formed, the ink image holding belt 106 is fed by the feeding drum 165 by one pitch (2.7 mm (64/600 inch)). Thereafter, the recording head 107 is reciprocated while the ink image holding belt 106 is fed intermittently until the printing data is printed out as required; that is, the desired ink image is formed on the ink image holding belt 106.

While the ink image is being formed in the above-described manner, the solvent is evaporated from the ink image, so that the latter is partially dried.

A recording sheet P is fed into the transfer region by sheet feeding rollers 137 in the direction of the arrow D in synchronization with the arrival of the writing start position of the ink image holding belt 106 at the transfer region.

Upon arrival of the front edge of the recording sheet P at the transfer region, a pushing shaft 134 is turned. As a result, the push roller 103 is moved by the pressure applying spring 133 in the direction of the arrow E in Fig. 12(b), so that it is pushed against the ink image holding belt 106 at a predetermined nipping pressure.

Thus, similarly as in the case of the first embodiment, the recording sheet P is held between the ink image holding belt 106 and the push roller 103, that is, it is pushed against the ink image on the belt 106 by the push roller 103 at a predetermined force F, as shown in Fig. 12(b), as a result of which the ink image is transferred onto the recording sheet P.

When one page of the ink image has been transferred, the pushing shaft 134 is turned, so that the push roller 103 is moved away from the ink image holding belt 106. Thus, the ink image of one page has been printed on the recording sheet P.

Thereafter, the ink image holding belt 106 is moved in the direction opposite to the main scanning direction by the feeding roller 165 while being wound on the supply roll 161 driven by an electric motor 163, and it is stopped when the front edge of the recording region 111 of the ink image holding belt 106 confronts the recording head 107. Thus, the printing operation has been accomplished.

In the ink image transferring operation, similarly as in the case of the first embodiment, the ink image is suitably slipped and bent, which improves the ink image transferring onto the recording sheet P efficiency.

The fourth embodiment is advantageous in the following points: Even when the load (pushing force) changes, the predetermined speed difference ΔV between the speeds of rotation of the ink image holding belt 106 and the push roller 103 is maintained unchanged owing to the transmission ratio of the transmission. Thus, the ink jet printer is simple in construction, positive in operation, and low in manufacturing cost.

Furthermore, in the fourth embodiment, the distance between the recording region and the transferring region can be increased. Hence, the period of time between the time when an ink pattern is formed and the time when the ink pattern is transferred onto the recording sheet can be increased, too. Thus, the ink image can be sufficiently dried, and when necessary it is possible to provide a cleaning device for removing ink image left on the ink image holder 106, and a heater or air blower for evaporating the solvent from ink which is slow in drying speed.

Fifth Embodiment

A fifth embodiment of the invention will be described with reference to Figs. 13 through 15.

A specific feature of the fifth embodiment resides in that the axis of a push roller 108 (hereinafter referred to as "a skewed push roller 108", when applicable) forms an angle θ with the axis of an ink image forming drum 101 when viewed from above.

As is apparent from in Fig. 14, in front view the axis of the ink image holding drum 101 appears to be parallel to the axis of the roller 108; however, in the top view as shown in Fig. 15, these axes cross each other at the middle, forming a skew angle θ.

The ink image holding drum 101 is coupled through a drum gear 153 and a motor gear 151 to a pulse motor 105, so that it is rotated in the direction of the arrow A in Fig. 13.

The operation of the ink jet printer thus constructed will be described.

With the push roller 108 spaced away from the ink image holding drum 101, the drum 101 is rotated at a predetermined speed V_1. When an origin signal is produced with the aid of an origin detecting board 113, that is, when the writing start position of the ink image holding drum 101 confronts the ink jet recording head 102, a host computer or the like applies printing data to the recording head 102 so that an ink image 115 is formed on the ink image holding drum 101, which forms the skew angle θ with the axis of the drum 101 as shown in Fig. 13. Ink droplets jetted from the recording head 102 form an ink image on the recording region 111 of the ink image holding drum 101 in accordance with the printing data.

When the required ink image has been formed on the ink image holding drum 101, as shown in Fig. 15 a printing sheet P is fed into the transfer region forming a right angle with the axis of the skewed push roller 108.

Upon arrival of the front edge of the recording sheet P at the transfer region, the skewed push roller 108 is pushed against the ink image holding drum 101 at a predetermined nipping pressure.

Thus, the recording sheet P is held between the ink image holding drum 101 and the skewed push roller 108, that is, it is pushed against the ink image on the drum 101 by the skewed push roller 108 at a predetermined force F, as a result of which the ink image is transferred onto the recording sheet P.

In the ink image transferring operation, the recording sheet P is moved while forming a right angle with the axis of the skewed push roller 108, because the skewed push roller 108 has a larger coefficient of friction with respect to the recording sheet P than the ink image holding drum 101. That is, the recording sheet P is moved while forming the skew angle θ with a direction perpendicular to the axis of the ink image holding drum 101, so that the recording sheet P slips on the ink image holding drum 101 in the nipping region (*i.e.*, in the transfer region). The amount of slip is $[(\text{nip width}) \times \tan\theta]$. Hence, a shearing force occurs with the ink image to cause the latter to slip between the ink image holding drum 101 and the recording sheet P. In addition, the cylindrical surface of the ink image holding drum 101 is made of a material which permits the easy removal therefrom of an ink image, and the ink image adheres to the recording sheet P. Therefore, the ink image is peeled off the surface of the ink image holding drum 101 and transferred onto the recording sheet P with high efficiency.

When one page of ink image has been transferred onto the recording sheet P, the skewed push roller 108 is moved away from the ink image holding drum 101. Thus, one page of ink image has been printed.

In the ink image transferring operation, similarly as in the first embodiment, the ink image on the cylindrical surface of the ink image holding drum is bent, thus causing fine cracking to occur. This contributes to improve the ink image transferring efficiency.

The skew angle θ is 5 degrees or less (or the axis of the push roller forms an angle of 85° to 95° with respect to the direction of movement of the ink holding medium). If the skew angle is larger than 5°, then both end portions of the skewed push roller 108 will not be in engagement with the ink image holding drum 101, thus not pushing the latter. Preferably, the skew angle should be set to 3° or less (or the axis of the push roller forms an angle of 87° to 93° with respect to the direction of movement of the ink holding medium). In this case, the amount of slip between the skewed push roller 108 and the ink image holding drum 101 is relatively small, and therefore the ink image is scarcely shifted when transferred. Thus, with the inventive ink jet printer, the resultant ink image is high in picture quality.

The fifth embodiment is advantageous in that even when the load, or the pushing force, changes, the slip factor is maintained unchanged because the skewed push roller pushes the ink image holding drum at the predetermined skew angle. Thus, the ink jet printer is simple in construction, positive in operation, and low in manufacturing cost.

Claims

1. A transfer type ink jet printer comprising:

   an ink jet recording head (2; 102; 107) for jetting ink droplets according to recording data;

   ink image holding means for receiving ink droplets jetted from said ink jet recording head (2; 102; 107),

   a push roller (3; 103; 108) arranged movable to and from said ink image holding means,

   characterized in that
   said ink image holding means being elastically deformable and that the speed of rotation of said push roller is so set that said push roller (3; 103; 108) slips on said ink image holding means with a nipping pressure applied thereto.

2. The transfer type ink jet printer according to claim 1 characterized in that
   the speed of rotation of said push roller is so set that said push roller (3; 103; 108) slips through a recording sheet (P) on said ink image holding means with a nipping pressure applied through said recording sheet thereto.

3. The transfer type ink jet printer according to claim 1 or 2, in which the push roller (3; 103; 108) is rotated around an axis which forms a predetermined angle with the axis of said ink image holding means so that said push roller (108) slips on said ink image holding means with a nipping pressure applied thereto.

4. The transfer type ink jet printer according to one of the preceding claims further comprising:

   data size increasing or decreasing means for increasing or decreasing said recording data in size according to a slip factor between said ink image holding means and said push roller, and applying said recording data thus increased or decreased to said recording head.

5. The transfer type ink jet printer according to one of the preceding claims further comprising:

   means for determining the timing of jetting ink droplets from said recording head (12; 102; 107) according to a slip factor between said ink image holding means and said push roller (3; 103; 108).

6. The transfer type ink jet printer according to one of the preceding claims wherein said ink image holding means and said push roller (3; 103; 108) have respective drive mechanisms, which are coupled to each other.

7. The transfer type ink jet printer according to one of

claims 3 to 6 in which said predetermined angle between the axis of said push roller (108) and the direction of movement of said ink image holding means is in a range of from 85° to 95°.

8. The transfer type ink jet printer according to claim 7 in which said predetermined angle between the axis of said push roller (108) and the direction of movement of said ink image holding means is in a range of from 87° to 93°.

9. The transfer type ink jet printer according to one of claims 2 or 4 to 6 in which the surface of said push roller (3; 103; 108) has a larger coefficient of friction with respect to said recording sheet (P) than the surface of said ink image holding means.

10. The transfer type ink jet printer according to one of the preceding claims, in which said ink image holding means comprises a drum (1; 101).

11. The transfer type ink jet printer according to one of claims 1 to 9, in which said ink image holding means comprises an endless belt (60).

12. The transfer type ink jet printer according to one of claims 1 to 9, in which said ink image holding means comprises a belt (106) with two ends, and a pinch roller (166) for supporting said belt (106) provided downstream of a transfer region in the path of movement of said belt (106).

13. The transfer type ink jet printer according to one of claims 2 or 4 to 12, in which a slip factor between said ink image holding means and said recording sheet is in a range of from 0.2% to 5%, and said nipping pressure of said push roller (3; 103; 108) is in a range of from 1.47 to 14.7 N/cm (150 gf/cm to 1500 gf/cm).

14. The transfer type ink jet printer according to one of claims 2 or 4 to 12, in which a slip factor between said ink image holding means and said recording sheet and a nipping pressure of said push roller (3; 103; 108) is within the hatched area of Fig. 4.

Patentansprüche

1. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker mit:

einem Tintenstrahlaufzeichnungskopf (2;102; 107) zum Ausstoßen von Tintentröpfchen in Übereinstimmung mit Aufzeichnungsdaten;

einem Tintenbildhaltemittel zur Aufnahme von Tintentröpfchen, welche von dem Tintenstrahlaufzeichnungskopf (2;102;107) ausgestoßen werden;

einer Schubwalze (3; 103; 108), die so ausgebildet ist, daß sie in Richtung des Tintenbildhaltemittels und von diesem weg bewegbar ist,

dadurch gekennzeichnet, daß
das Tintenbildhaltemittel elastisch verformbar ist, und daß die Drehzahl der Schubwalze derart eingestellt ist, daß die Schubwalze (3;103;108) auf das Tintenbildhaltemittel gleitet, wobei ein Klemmdruck darauf ausgeübt wird.

2. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker nach Anspruch 1,
dadurch gekennzeichnet, daß
die Drehzahl der Schubwalze derart eingestellt ist, daß die Schubwalze (3;103;108) über ein Aufzeichnungspapier (P) auf das Tintenbildhaltemittel gleitet, wobei ein Klemmdruck durch das Aufzeichnungspapier hindurch darauf ausgeübt wird.

3. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker nach Anspruch 1 oder 2, bei dem die Schubwalze (3;103;108) sich um eine Achse dreht, die einen bestimmten Winkel mit der Achse des Tintenbildhaltemittels derart bildet, daß die Schubwalze (108) auf das Tintenbildhaltemittel gleitet, wobei ein Klemmdruck darauf ausgeübt wird.

4. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker nach einem der vorhergehenden Ansprüche, der des weiteren umfaßt:

ein Datengrößenvergrößerungsmittel und/oder Datengrößenverkleinerungsmittel zur Vergrößerung bzw. Verkleinerung der Größe der Aufzeichnungsdaten gemäß einem Gleitfaktor zwischen dem Tintenbildhaltemittel und der Schubwalze und zur Zuführung der solchermaßen vergrößerten oder verkleinerten Aufzeichnungsdaten zu dem Aufzeichnungskopf.

5. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker nach einem der vorhergehenden Ansprüche mit:

Mitteln zur zeitlichen Bestimmung des Ausstoßens von Tintentröpfchen aus dem Aufzeichnungskopf (12;102;107) gemäß einem Gleitfaktor zwischen dem Tintenbildhaltemittel und der Schubwalze (3;103;108).

6. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker gemäß einem der vorhergehenden Ansprüche, bei dem das Tintenbildhaltemittel und die Schubwalze (3;103;108) jeweilige Antriebsmechanismen aufweisen, die miteinander gekoppelt sind.

7. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker gemäß einem der Ansprüche 3 bis 6, bei dem der vorbestimmte Winkel zwischen der Achse der Schubwalze (108) und der Bewegungsrichtung des Tintenbildhaltemittels im Bereich von 85° bis 95° liegt.

8. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker gemäß Anspruch 7, bei dem der vorbestimmte Winkel zwischen der Achse der Schubwalze (108) und der Bewegungsrichtung des Tintenbildhaltemittels im Bereich von 87° bis 93° liegt.

9. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker gemäß einem der Ansprüche 2 oder 4 bis 6, bei dem die Oberfläche der Schubwalze (3;103;108) einen größeren Reibungskoeffizienten aufweist in Bezug auf das Aufzeichnungsblatt (P) als die Oberfläche des Tintenbildhaltemittels.

10. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker gemäß einem der vorhergehenden Ansprüche, bei dem das Tintenbildhaltemittel eine Trommel (1;101) umfaßt.

11. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker gemäß einem der Ansprüche 1 bis 9, bei dem das Tintenbildhaltemittel ein Endlosband (60) umfaßt.

12. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker gemäß einem der Ansprüche 1 bis 9, bei dem das Tintenbildhaltemittel ein Band (106) mit zwei Enden aufweist, sowie eine stromabwärts des Übertragungsbereichs in dem Bewegungspfad des Bandes (106) angeordneten Klemmwalze (166) zur Unterstützung des Bandes (106).

13. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker gemäß einem der Ansprüche 2 oder 4 bis 12, bei dem ein Gleitfaktor zwischen dem Tintenbildhaltemittel und dem Aufzeichnungsblatt in einem Bereich von 0,2% bis 5% liegt und der Klemmdruck der Schubwalze (3;103;108) in einem Bereich von 1,47 bis 14,7 N/cm (100 gf/cm bis 1500 gf/cm) liegt.

14. Nach dem Übertragungsprinzip arbeitender Tintenstrahldrucker gemäß einem der Ansprüche 2 oder 4 bis 12, bei dem der Gleitfaktor zwischen dem Tintenbildhaltemittel und dem Aufzeichnungsblatt und ein Klemmdruck der Schubwalze (3;103;108) innerhalb des in Fig. 4 schraffiert gezeichneten Bereichs liegen.

Revendications

1. Imprimante à jet d'encre du type transfert comprenant :

   une tête d'enregistrement à jet d'encre (2, 102, 107) pour éjecter des gouttes d'encre selon des données d'enregistrement ;
   des moyens de maintien d'image d'encre destinés à recevoir les gouttes d'encre éjectées à partir de ladite tête d'enregistrement à jet d'encre (2, 102, 107) ;
   un cylindre de poussée (3, 103, 108) agencé de manière à pouvoir se rapprocher et s'éloigner desdits moyens de maintien d'image d'encre ;

   caractérisée en ce que
   lesdits moyens de maintien d'image d'encre sont élastiquement déformables et en ce que la vitesse de rotation dudit cylindre de poussée est fixée de telle manière que ledit cylindre de poussée (3, 103, 108) glisse sur lesdits moyens de maintien d'image d'encre avec une pression de serrage appliquée à ceux-ci.

2. Imprimante à jet d'encre du type transfert selon la revendication 1,
   caractérisée en ce que
   la vitesse de rotation dudit cylindre de poussée est fixée de telle manière que ledit cylindre de poussée (3, 103, 108) glisse d'un bout à l'autre d'une feuille d'enregistrement (P) sur lesdits moyens de maintien d'image d'encre avec une pression de serrage appliquée à ceux-ci à travers ladite feuille d'enregistrement.

3. Imprimante à jet d'encre du type transfert selon la revendication 1 ou 2, dans laquelle le cylindre de poussée (3, 103, 108) est mis en rotation autour d'un axe qui forme un angle prédéterminé avec l'axe desdits moyens de maintien d'image d'encre de sorte que ledit cylindre de poussée (108) glisse sur lesdits moyens de maintien d'image d'encre avec une pression de serrage appliquée à ceux-ci.

4. Imprimante à jet d'encre du type transfert selon l'une quelconque des revendications précédentes comprenant, de plus :

   des moyens d'augmentation ou de diminution de taille de données destinés à augmenter ou diminuer la taille desdites données d'enregistrement selon un facteur de glissement entre lesdits moyens de maintien d'image d'encre et ledit cylindre de poussée et destinés à appliquer lesdites données d'enregistrement ainsi augmentées ou diminuées à ladite tête d'enregistrement.

5. Imprimante à jet d'encre du type transfert selon l'une quelconque des revendications précédentes

comprenant, de plus :

des moyens destinés à déterminer la synchronisation d'éjection de gouttes d'encre a partir de ladite tête d'enregistrement (12, 102, 107) selon un facteur de glissement entre lesdits moyens de maintien d'image d'encre et ledit cylindre de poussée (3, 103, 108).

6. Imprimante à jet d'encre du type transfert selon l'une quelconque des revendications précédentes, dans laquelle lesdits moyens de maintien d'image d'encre et ledit cylindre de poussée (3, 103, 108) comportent des mécanismes d'entraînement respectifs, qui sont couplés l'un à l'autre.

7. Imprimante à jet d'encre du type transfert selon l'une quelconque des revendications 3 à 6, dans laquelle ledit angle prédéterminé entre l'axe dudit cylindre de poussée (108) et la direction de mouvement desdits moyens de maintien d'image d'encre est dans une plage de 85° à 95°.

8. Imprimante à jet d'encre du type transfert selon la revendication 7, dans laquelle ledit angle prédéterminé entre l'axe dudit cylindre de poussée (108) et la direction de mouvement desdits moyens de maintien d'image d'encre est dans une plage de 87° à 93°.

9. Imprimante à jet d'encre du type transfert selon l'une quelconque des revendications 2 ou 4 à 6, dans laquelle la surface dudit cylindre de poussée (3, 103, 108) a un plus grand coefficient de frottement par rapport à ladite feuille d'enregistrement (P) que la surface desdits moyens de maintien d'image d'encre.

10. Imprimante à jet d'encre du type transfert selon l'une quelconque des revendications précédentes, dans laquelle lesdits moyens de maintien d'image d'encre comprennent un tambour (1, 101).

11. Imprimante à jet d'encre du type transfert selon l'une quelconque des revendications 1 à 9, dans laquelle lesdits moyens de maintien d'image d'encre comprennent une courroie sans fin (60).

12. Imprimante à jet d'encre du type transfert selon l'un quelconque des revendications 1 à 9, dans laquelle lesdits moyens de maintien d'image d'encre comprennent une courroie (106), avec deux extrémités, et un rouleau pinceur (166), pour supporter ladite courroie (106), prévu en aval d'une région de transfert dans le trajet de mouvement de ladite courroie (106).

13. Imprimante à jet d'encre du type transfert selon l'une quelconque des revendications 2 ou 4 à 12, dans laquelle un facteur de glissement entre lesdits moyens de maintien d'image d'encre et ladite feuille d'enregistrement est dans une plage de 0,2 % à 5 % et ladite pression de serrage dudit cylindre de poussée (3, 103, 108) est dans une plage de 1,47 à 14,7 N/cm (150 gf/cm à 1500 gf/cm).

14. Imprimante à jet d'encre du type transfert selon l'une quelconque des revendications 2 ou 4 à 12, dans laquelle un facteur de glissement entre lesdits moyens de maintien d'image d'encre et ladite feuille d'enregistrement et une pression de serrage dudit cylindre de poussée (3, 103, 108) sont dans la zone hachurée de la figure 4.

FIG. 1

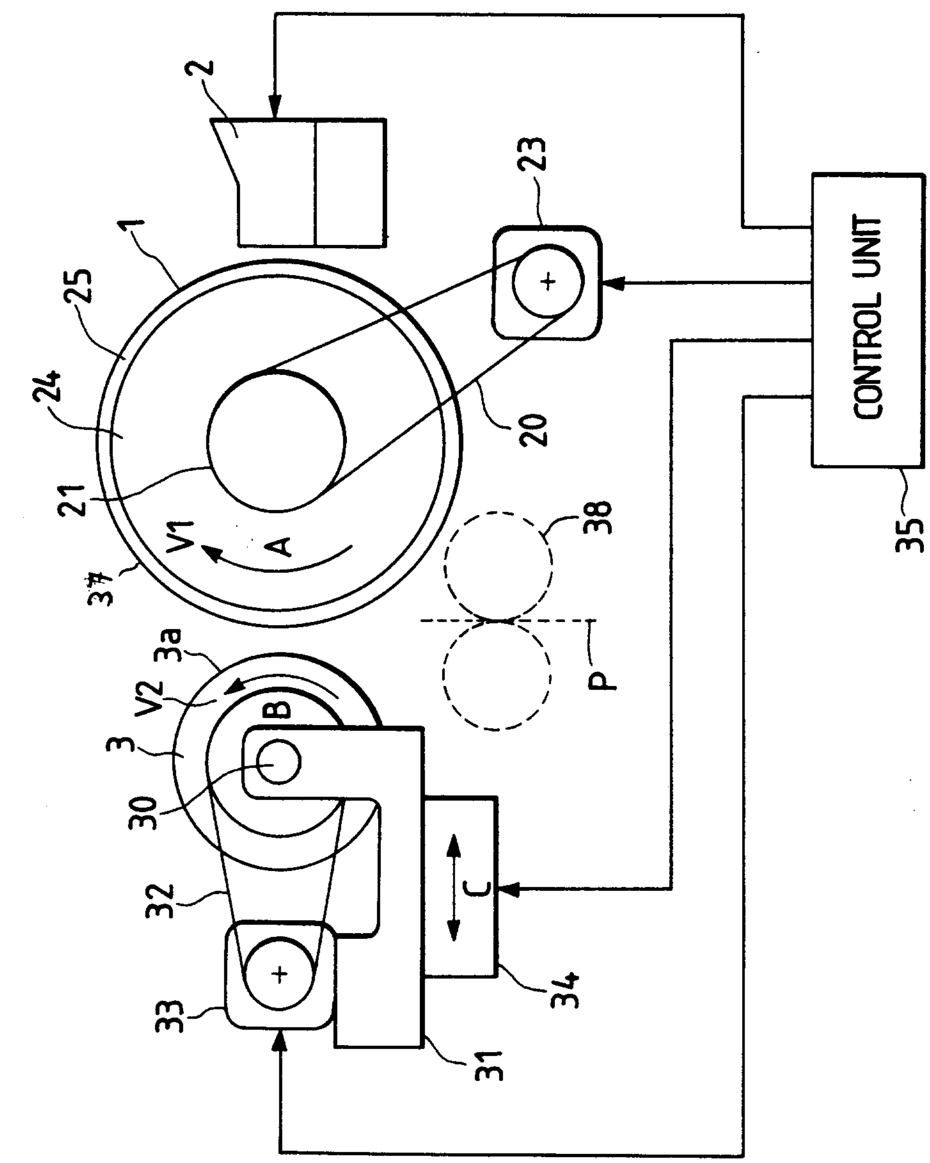


FIG. 2(I)

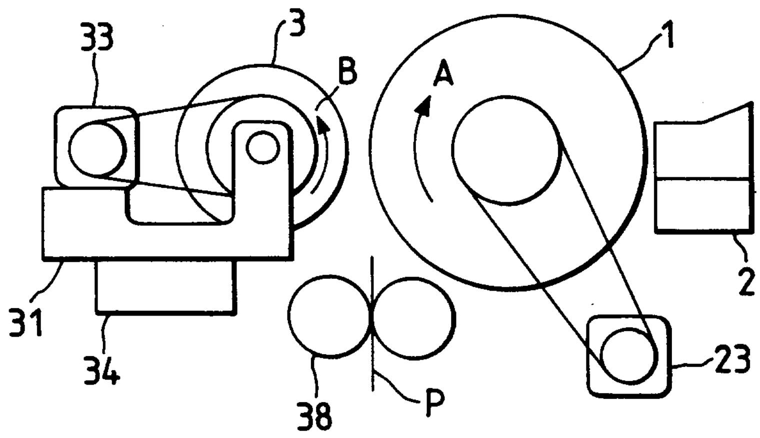


FIG. 2(II)

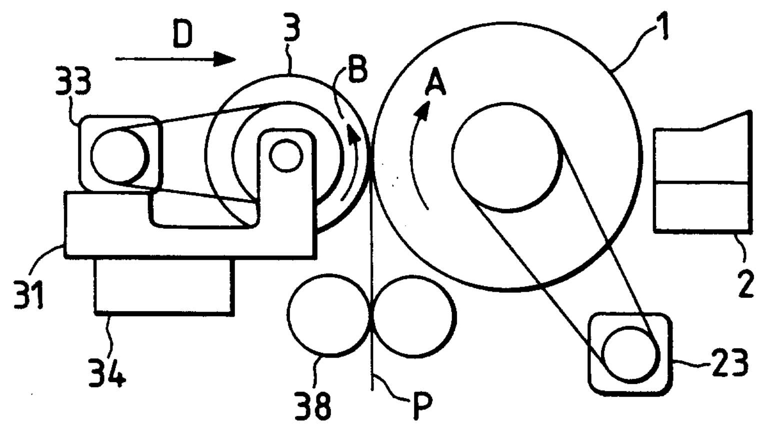


FIG. 2(III)

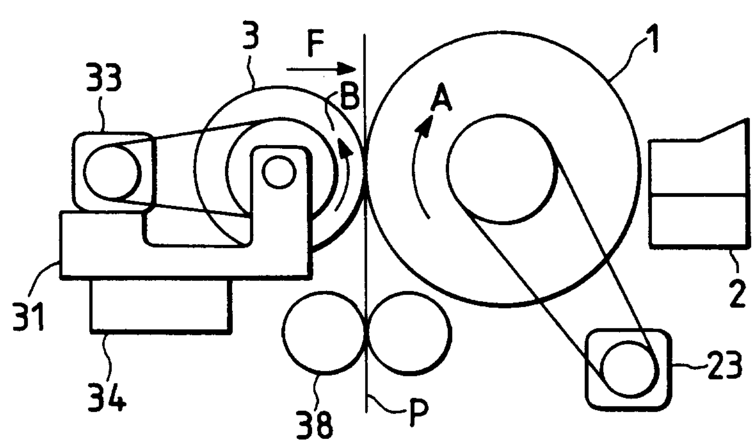


FIG. 3

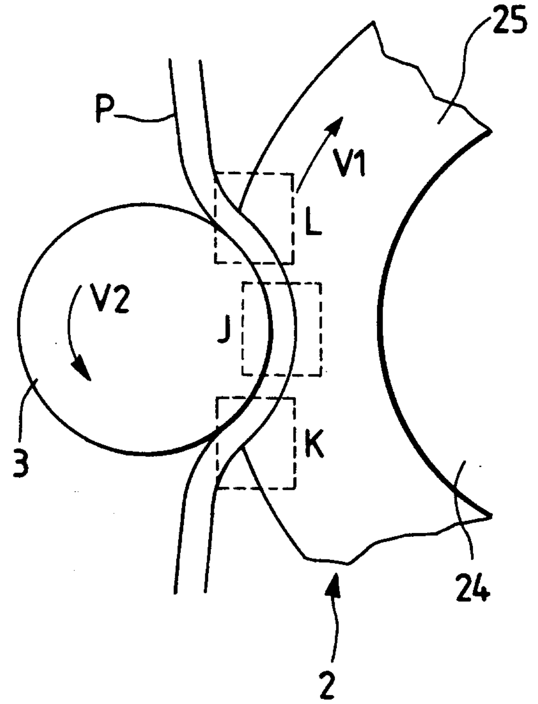


FIG. 7

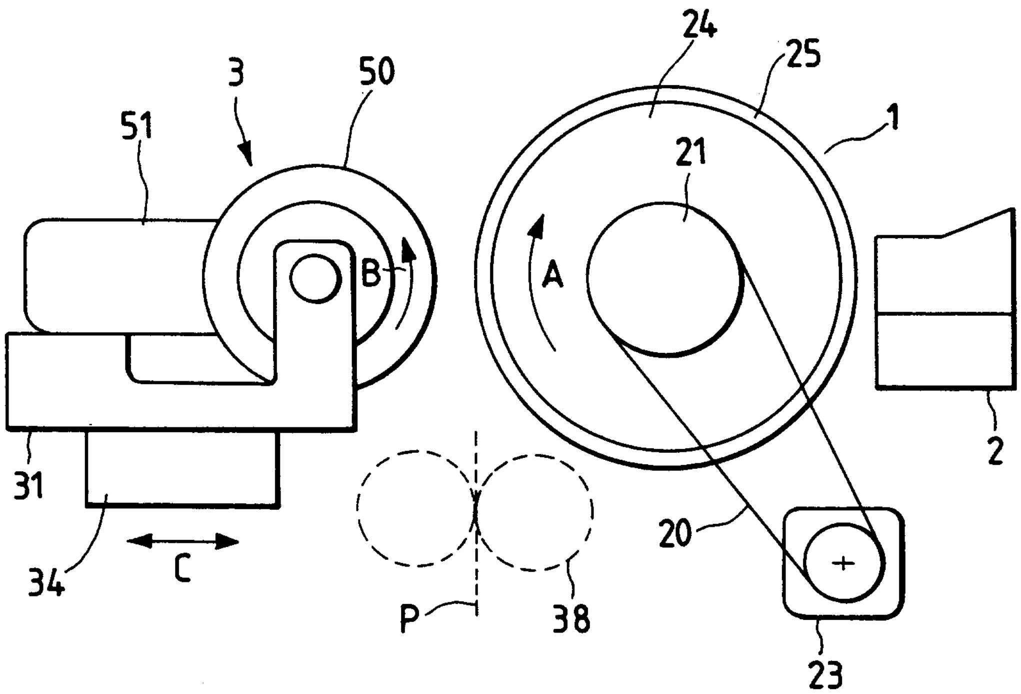
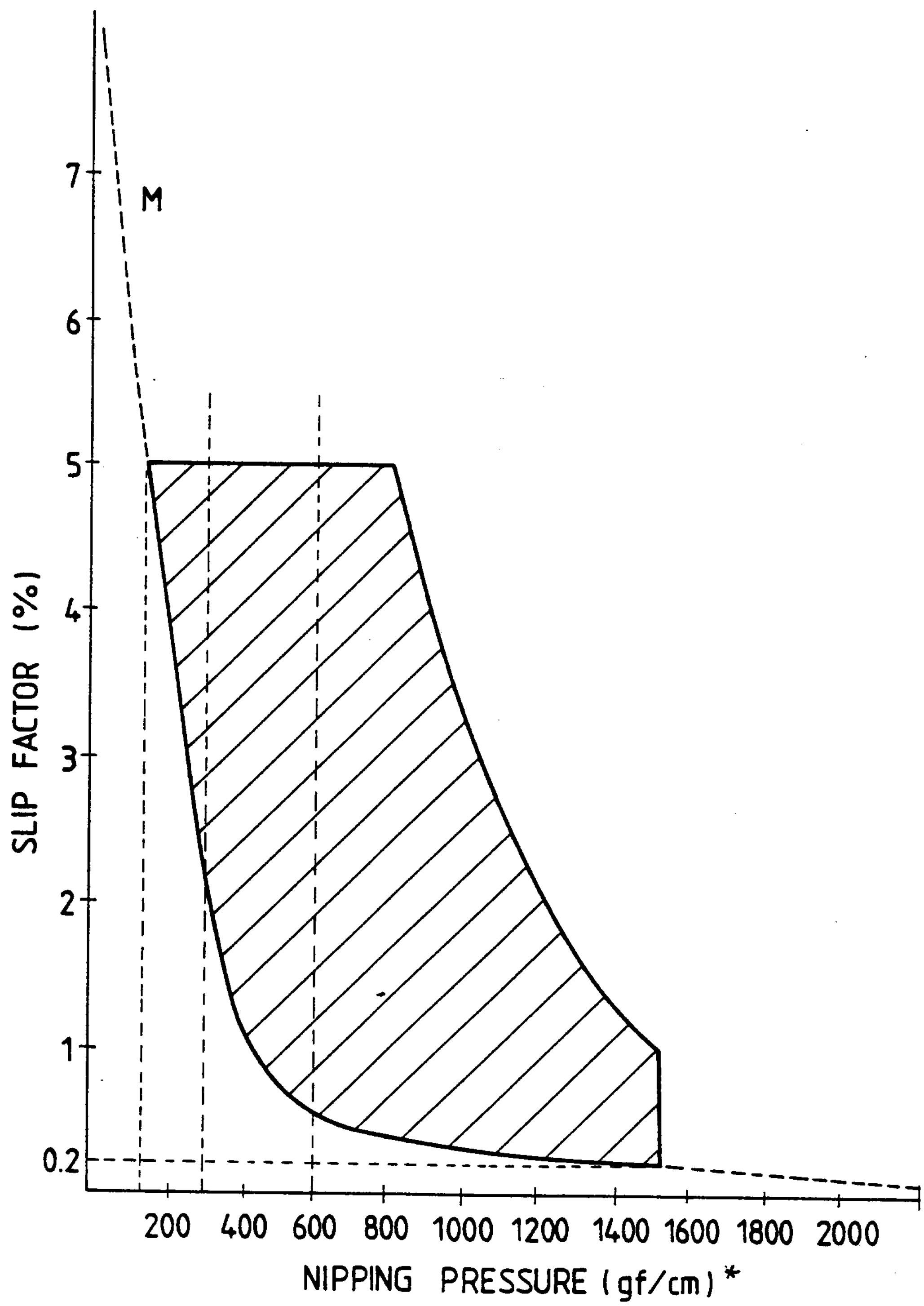


FIG. 4



* 1 gf = 9.8×10^{-3} N

FIG. 5

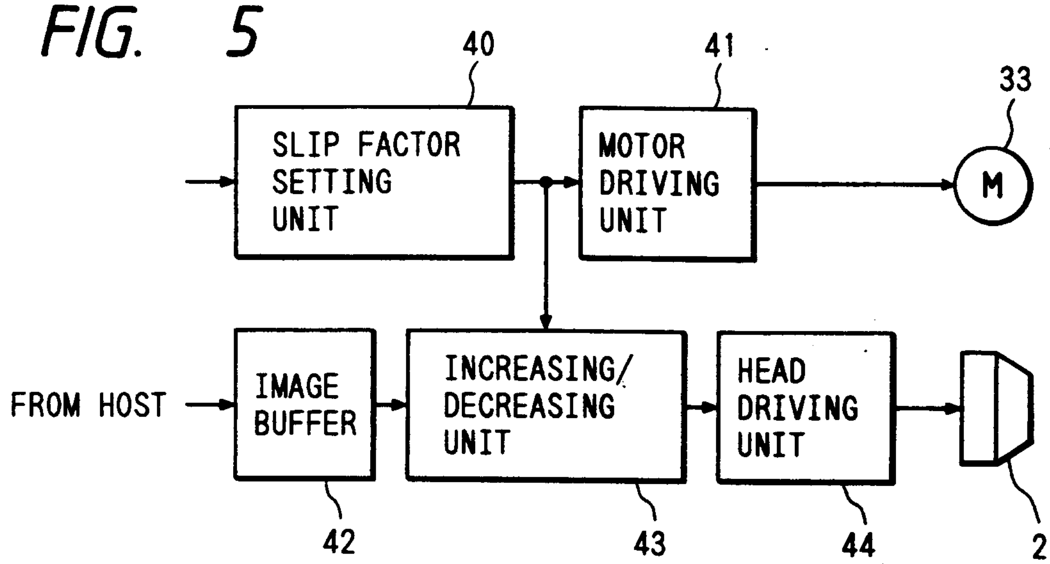

40
41
33
SLIP FACTOR SETTING UNIT
MOTOR DRIVING UNIT
M
FROM HOST
IMAGE BUFFER
INCREASING/ DECREASING UNIT
HEAD DRIVING UNIT
42
43
44
2

FIG. 6

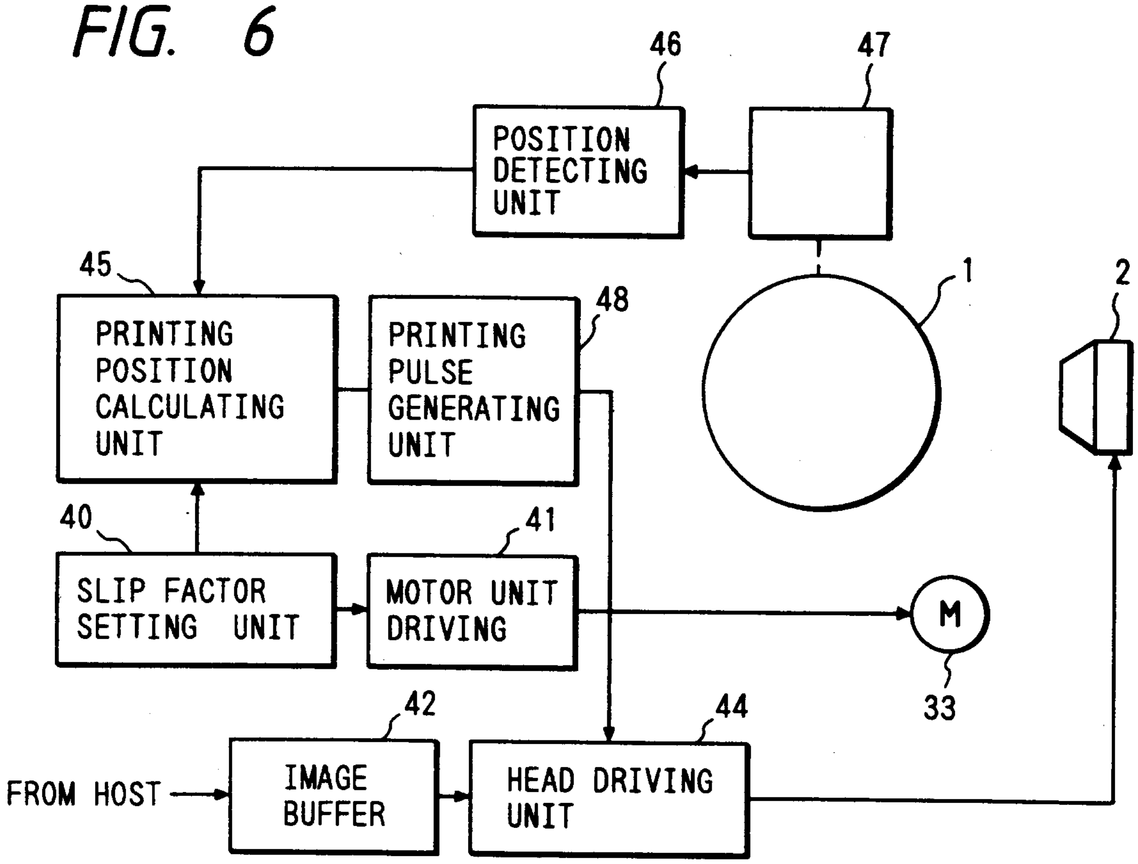

46
47
POSITION DETECTING UNIT
45
1
2
48
PRINTING POSITION CALCULATING UNIT
PRINTING PULSE GENERATING UNIT
40
41
SLIP FACTOR SETTING UNIT
MOTOR UNIT DRIVING
M
42
44
33
FROM HOST
IMAGE BUFFER
HEAD DRIVING UNIT

FIG. 8

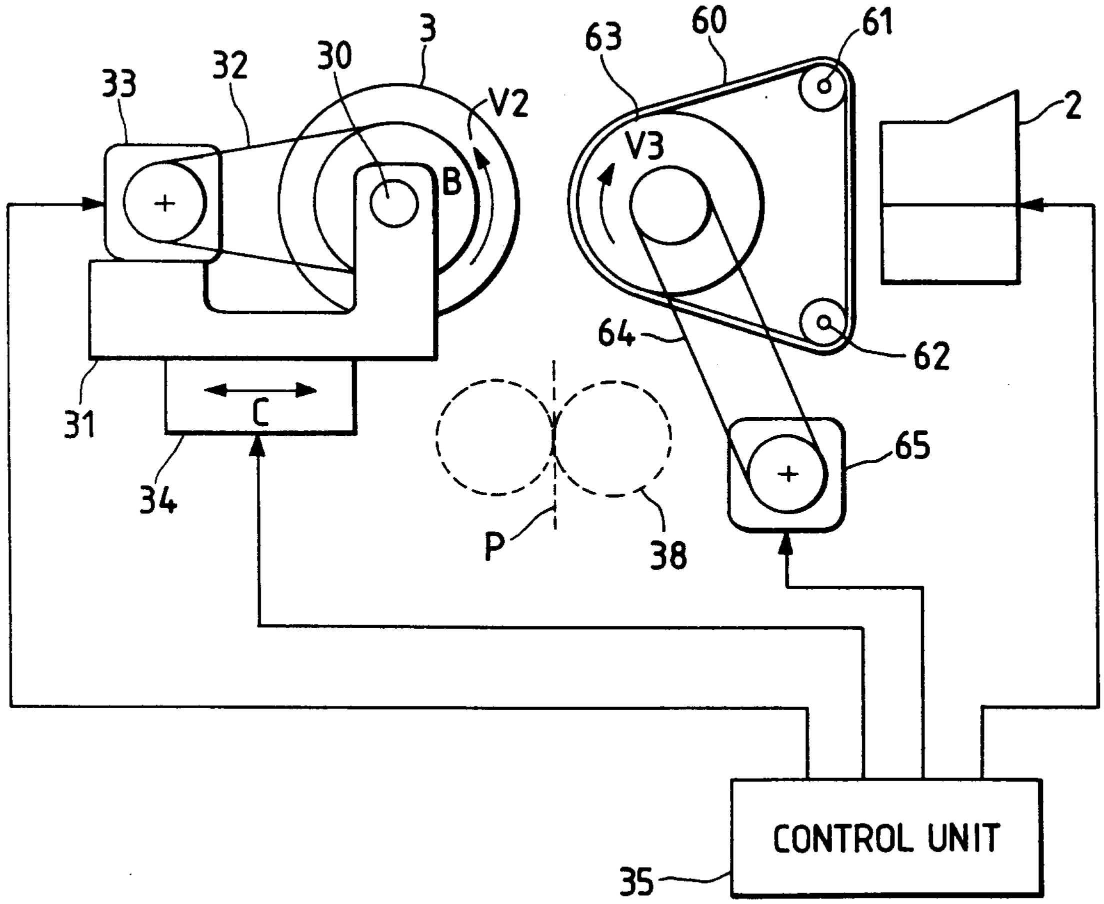
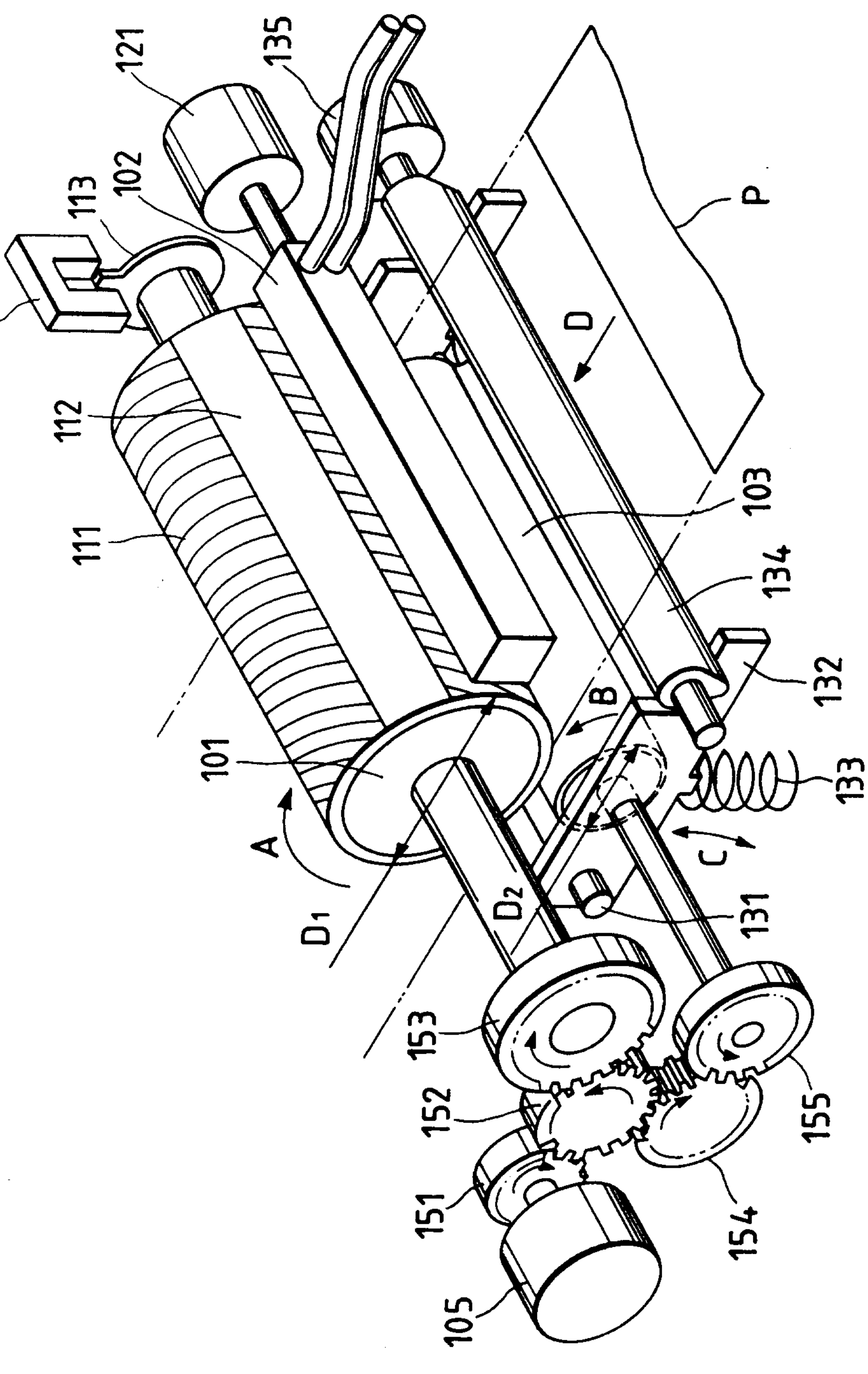


FIG. 9



101
102
103
105
111
112
113
114
121
131
132
133
134
135
151
152
153
154
155
A
B
C
D
D1
D2
P

FIG. 10(a)

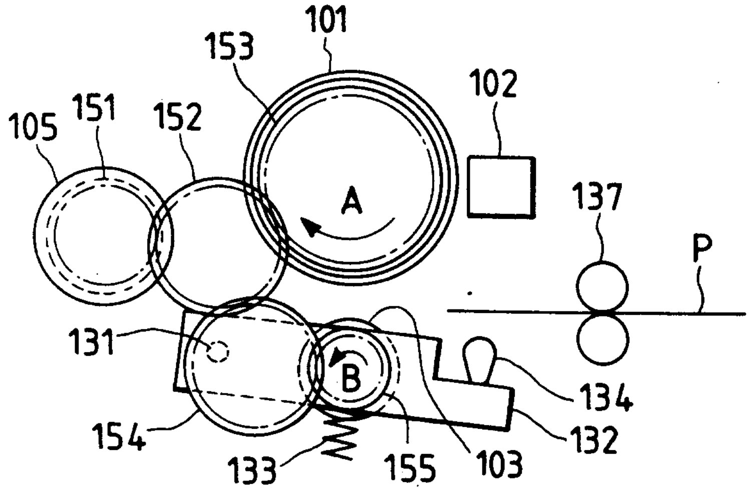


FIG. 10(b)

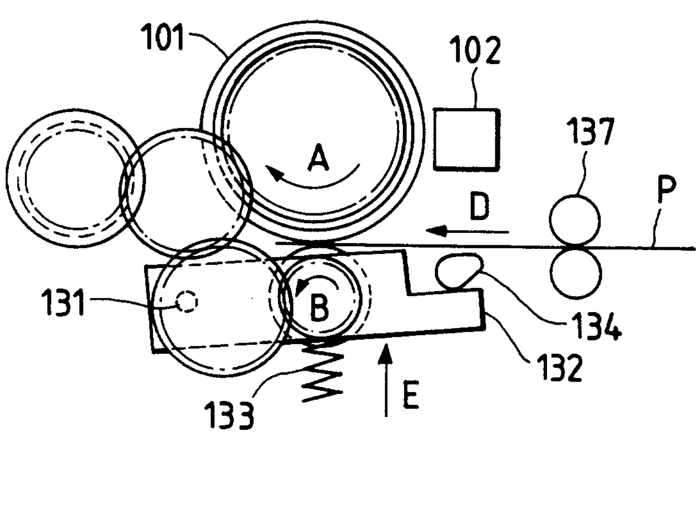


FIG. 11

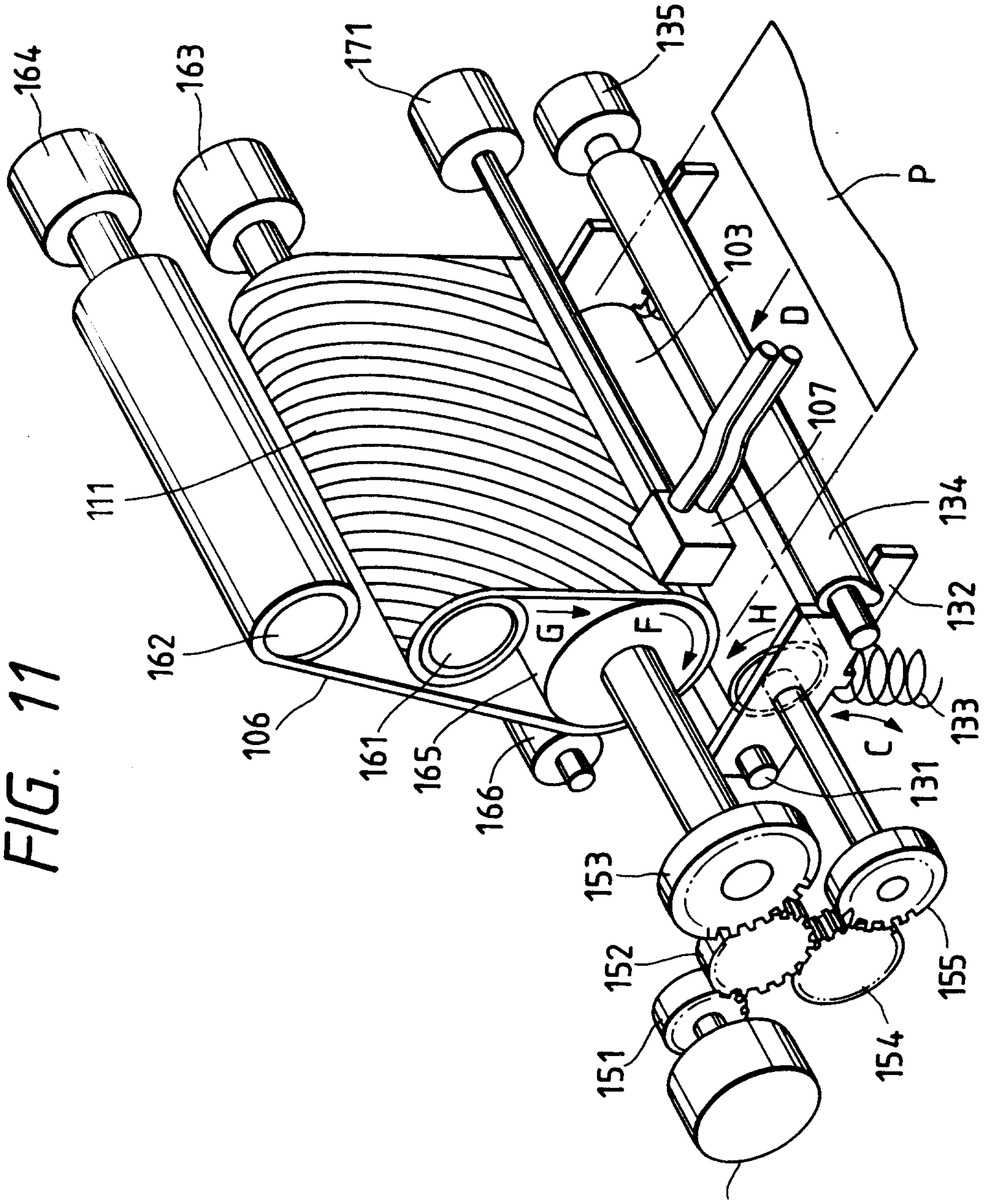

164
163
171
135
111
103
D
107
134
132
162
106
161
165
166
G
F
H
133
C
131
153
152
151
155
154
105
P

FIG. 12(a)

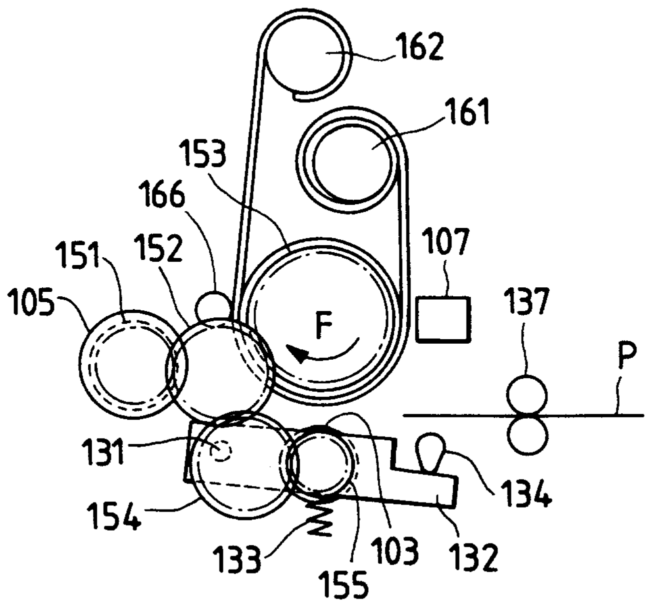


FIG. 12(b)

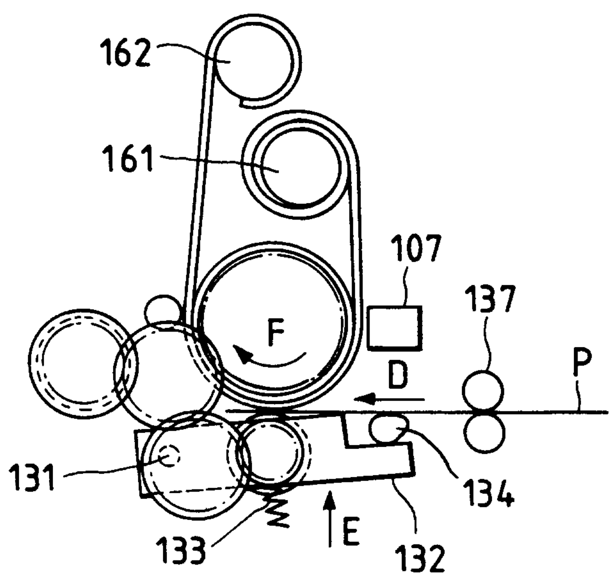


FIG. 13

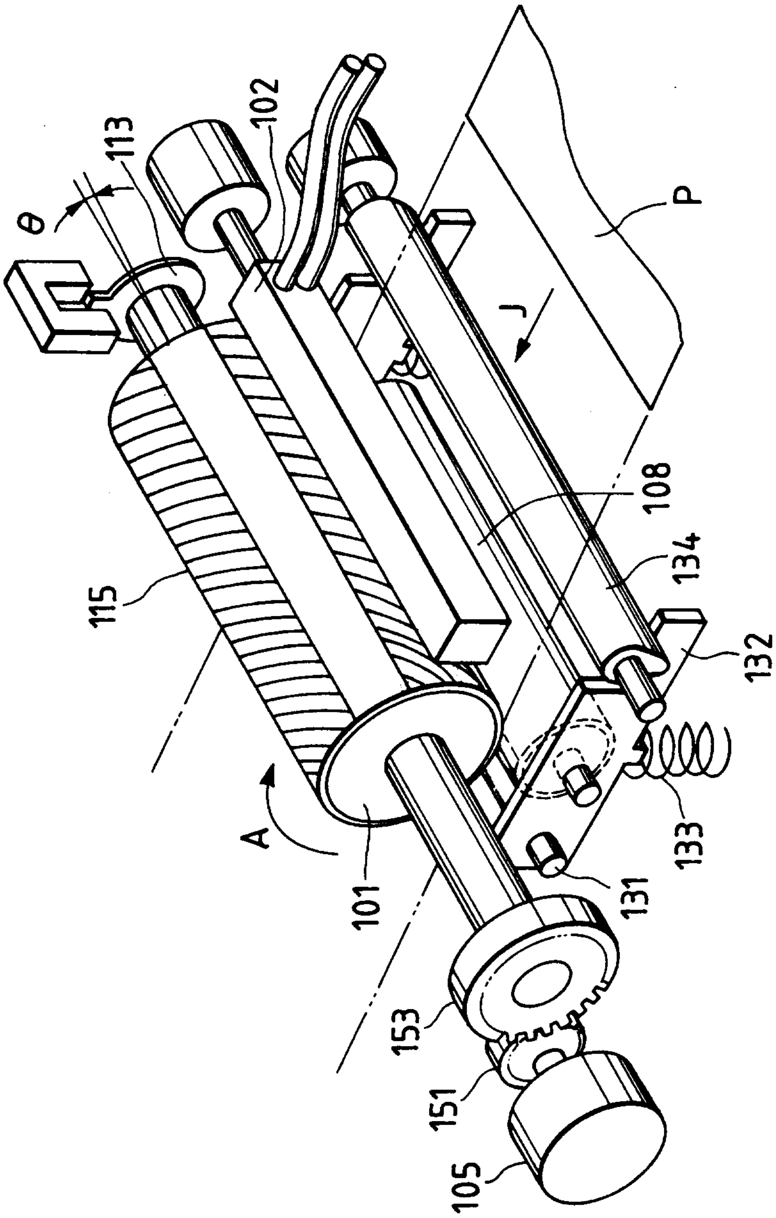


FIG. 14

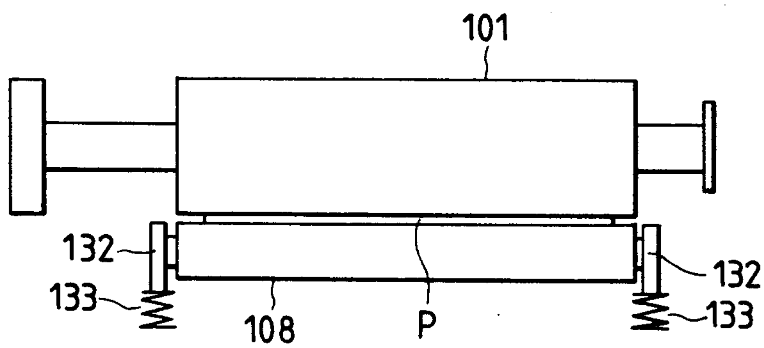


FIG. 15