

Description

The present invention relates to an ink jet printer in which ink is jetted selectively from a number of nozzles.

An ink jet printer for jetting ink from a selected one or plural nozzles to record characters, patterns, etc., on a recording sheet is advantageous in that it makes no noise while in operation and it can record data on an ordinary recording sheet at low operating cost.

In general, an ink jet printer of this type uses water-soluble ink in order to stabilize the writing operation. As a result, the printer may suffer from the difficulty that the water contained in the water-soluble ink may make the recording sheet wavy or swell it during a printing operation, as a result of which it becomes rather difficult to convey the recording sheet to the following work position.

In order to eliminate the difficulty, Japanese Unexamined Published Patent Application No. 156536/1979 has disclosed a device in which hot air is blown against the recording sheet on the platen to dry the ink. Also, U.S. Patent No. 4,340,893 has disclosed a device in which hot air is blown against the recording sheet directly through the carriage to dry the ink on the recording sheet as soon as data is recorded on it. However, those conventional devices are still disadvantageous in that, in general, characters or patterns recorded on a recording sheet often vary in density, and sometimes they may be solid black. Hence, even if a hot air dryer is set downstream of the recording section to dry the recording sheet, it is rather difficult to sufficiently dry parts of the recording sheet having a high pixel density. As a result, wet parts of the recording sheet may be brought into contact with the back side of the following recording sheet, thus spoiling the recorded image. Also, parts of the recording sheet swelled and buckled by the ink may be brought into contact with the printing head, thus wearing the latter.

US-A-4 566 014, showing an ink jet printer according to the preamble of claim 1, relates to a sheet drying technique in which the intersheet spacing or gaps between successive sheets of printed paper and the time during which a given sheet is effectively exclusively within the dryer and receiving substantially the entire drying energy available from the dryer, can be adjusted according to the amount of ink to be deposited. The conveying speed remains thereby constant.

This sheet drying scheme develops an average print density value for an entire sheet and then subjects the entire sheet to a corresponding drying interval, even if the detected print density only applies to a small section of the recording sheet. Thus, the mechanism of the cited document is not adapted for printing a high contrast image, such as a graphic image, and may not dry the densely printed portion of the medium sufficiently or may overdry less densely printed areas of the medium, thereby slowing the printing process and possibly damaging the medium due to over exposure to heat.

Accordingly, an object of this invention is to provide an ink jet printer in which, even when an image to be

printed includes a part having a relatively high density requiring a relatively large quantity of ink, the recording medium is uniformly dried in its entirety.

This object is solved by the ink jet printer of independent claim 1. Further advantageous features of the printer are evident from the dependent claims, the description and the drawings. The claims are intended to be a first non-limiting approach of defining the invention in general terms.

According to the invention, an ink jet printer is provided in which the speed of conveyance of the recording medium is controlled according to the image density.

The invention also provides an ink jet printer in which the distance between the recording medium and the recording head is maintained constant to eliminate the difficulty of a printed image being spoiled by contact of the head with the recording medium, whereby the resultant image is maintained high in accuracy.

For this purpose, in the ink jet printer a pair of sheet retaining means are provided before and behind in the direction of travel of recording means, and the one of the pair of sheet retaining means which is located before in the direction of travel is allowed to push the recording medium against the platen to form a gap between the recording medium and the printing head.

The invention also provides an ink jet printer in which the recording medium is conveyed with the recorded image unaffected.

For this purpose, cylindrical rollers relatively small in wall thickness and plate-shaped rollers with peripheral teeth are provided downstream of the recording means and mounted in such a manner that the rollers are confronted with each other.

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate preferred embodiment(s) of the invention and, together with the description, serve to explain the objects, advantages and principles of the invention.

In the drawings;

Fig. 1 is a side view of a typical example of an ink jet printer according to this invention;

Fig. 2 is a side view showing essential components of the ink jet printer in detail;

Fig. 3 is an explanatory diagram showing a paper bail mechanism in the printer of the invention;

Figs. 4, 5a and 5b are diagrams showing examples of intermediate sheet discharging rollers in the printer of the invention;

Fig. 6 is a diagram showing sheet discharging rollers in the printer of the invention;

Fig. 7 is a perspective view showing a carriage in the printer of the invention;

Figs. 8a and 8b are diagram showing examples of sheet retaining levers and their operations;

Figs. 9a and 9b are diagrams for a description of the dust removing operation of a duct-integrated fan in the printer of the invention;

Fig. 10 is an external view of the printer of the invention, showing its hot air drying unit;

Fig. 11 is an explanatory diagram, partly as a block diagram, showing a control circuit in the printer of the invention;

Fig. 12 is an explanatory diagram showing writing regions in a line;

Fig. 13 is a diagram showing a print drying table indicating quantities of ink per unit area with corresponding ink drying time periods; and

Fig. 14 is a diagram showing a drying control table indicating ink drying completion time instants determined from ink drying time periods for a plurality of lines.

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

Fig. 1 shows a typical example of an ink jet printer constructed according to the invention, and Fig. 2 shows essential components of the printer of Fig. 1 in detail.

The ink jet printer of Fig. 1 includes a recording sheet conveying mechanism extended between a sheet supplying section 10 and a sheet discharging section 60, a printing head 82 disposed along the sheet conveying path, and a hot air drying unit 90.

A sheet supplying stand 12 is disposed in the sheet supplying section 10. The sheet supplying stand is urged upwardly by a hopper spring 11 in such a manner that it is movable vertically, whereby the top of the recording sheet S stacked on the sheet supplying stand 12 is held in abutment 20 with a sheet supplying roller 13. A sheet conveying guide board 14 extends from the sheet supplying roller 13 to a gate roller 21. A separating pawl operating lever 17, which is operated up and down by a manual operating lever (not shown), and a separating pawl 16, which is operated by the lever 17, are arranged on the guide board 14. A web inserting guide board 19 is provided above the sheet supplying stand 12 confronting the sheet supplying opening 3 formed in the front board 2 of a printer body 1 (Fig. 10), so that the recording sheet on the web is directly fed into the gate roller 21 with the aid of a tractor 15.

The guide board 19 is followed by a sheet conveying section 20. In the sheet conveying section 20, the gate roller 21 engaged with a drive force transmitting mechanism (not shown) is arranged beside a carriage 80 on the upstream side of the travel path of the latter. The gate roller 21 is designed so that it performs an intermittent feed operation at a speed corresponding to the pixel density of a character or pattern recorded on the recording sheet S. A driven roller 22 is provided behind a platen 46, and a sheet conveying belt 23 is laid over the driven roller 22 and the gate roller 21. The gate roller 21 rotates the driven roller 22 through the sheet conveying belt 23 at the same peripheral speed. The sheet feed belt 23 contacts an idler 25 directly below the platen 46. The idler 25 is supported on one end portion of an idler lever 26. A tension spring 27 is connected to the idler lever 26 so

as to apply a predetermined tension to the sheet conveying belt 23.

A sheet retaining roller lever 29 is supported above the gate roller 21 in such a manner that it is swingable about a fulcrum 31. The sheet retaining roller lever 29 is designed so as to change the contact pressure between the sheet conveying belt 23 and a sheet retaining roller 32 separately according to the kinds of recording media to be conveyed, i.e., according to whether the recording medium is conveyed by the frictional force produced between the sheet conveying belt 23 and the sheet conveying roller 32, as in the case of a recording sheet or envelop, or whether the recording medium is conveyed by the tractor 15, as in the case of a web. A strong retaining spring 33 is connected to one end of the upper arm 29a of the sheet retaining roller lever 29 to turn the lever 29 counterclockwise in Fig. 1, while a cam 34 is engaged with the upper arm 29a to turn the lever 29 clockwise in Fig. 1 against the elastic force of the spring 33.

When, as indicated by the solid lines, the cam 34 is released to cause the strong spring 33 to act directly on the lever 29, the sheet retaining roller 32, positioned in an arcuate groove 30 formed in the lower arm 29b of the lever 29, is strongly pushed against the sheet conveying belt 23. On the other hand, when, as indicated by the two-dot chain lines in Fig. 2, the cam 34 lowers the lever 29 to release the strong spring 33, the sheet retaining roller 32 is weakly pushed against the sheet conveying belt 23 by one end portion 35 of a weak coil spring 35a, the other end of which is connected to the sheet retaining roller lever 29.

A paper bail 37 provided above the driven roller 22 is moved into or out of engagement with the sheet conveying belt 23. The paper bail 37 is composed of a shaft 36 and a plurality of plate-shaped rollers with peripheral teeth, which are fixedly mounted on the shaft 36. The paper bail 37 is supported on one end portion of a paper bail lever 38, which is secured to a supporting shaft 39 provided downstream of the driven roller 22. As shown in Fig. 3, a sector gear 40 engaged with a pinion 41 is secured to the supporting shaft 39. The sector gear 40 is turned clockwise in Fig. 3, immediately before the recording sheet S passes through the gate roller 21, to push the paper bail 37 (supported by the end of the paper bail lever 38) against the sheet conveying belt 23 thereby to convey the recording sheet S.

A recording sheet carry-in side guide board 43 is provided upstream of the platen 46. The start edge of the guide board 43 coterminous with the meeting point of the web inserting guide board 19 and the sheet conveying guide board 14 extended from the sheet supplying roller 13, and the end edge is located immediately before the printing section connected to the platen 46. At that position, a sheet retaining board 45 is held abutted against the guide board 43 by its own elasticity.

The platen 46 is disposed directly below the travel path of the carriage 80. The base end of the platen 46 is secured to a fulcrum shaft 47 provided downstream of the platen 46. The platen 46 is lowered, or retracted, to

the position indicated by the two-dot chain line in Fig. 2 by a lever (not shown) coupled through a link to the manual operating lever adapted to operate the separating pawl operating lever 17, thereby to allow the passage of a recording medium such as an envelope relatively large in thickness.

A pair of intermediate sheet discharging roller shafts 62 and 65 are arranged downstream of the driven roller 22 in such a manner that they are adjacent to the driven roller 22. The intermediate sheet discharging roller shaft 62 is located below the other intermediate sheet discharging roller shaft 65 and below a sheet discharging guide board 61. As shown in Fig. 4, a plurality of short intermediate sheet discharging rollers 63 made of an elastic material are fixedly mounted on the shaft 62 spaced from one another. Each of the rollers 63 has cylindrical rollers 64 and 64 having a small wall thickness at both ends. On the other hand, the upper intermediate sheet discharging roller shaft 65 on the side of the head 82 has a plurality of thin-plate-shaped toothed rollers 66. More specifically, the toothed rollers 66 are mounted on the roller shaft 65 in such a manner as to confront with the cylindrical rollers 64 of the intermediate sheet discharging rollers 63 so that they, together with the cylindrical rollers 64, gently nip the wet recording sheet S to discharge it.

The intermediate sheet discharging rollers 63 and 66 may be designed as shown in Fig. 5a. A plurality of intermediate sheet discharging rollers 63 are mounted on the lower intermediate sheet discharging roller shaft 62 spaced from one other another, and the cylindrical rollers 64 of adjacent ones of the sheet discharging rollers 63 are confronted with each other. A plurality of thin-plate-shaped toothed rollers 66 are mounted on the upper roller shaft 65, which is located on the side of the head 82, in such a manner that each toothed roller 66 is located between the adjacent cylindrical rollers 64 and 64 extending slightly into the space between the cylindrical rollers 64 and 64. This eliminates the difficulty of, in the conveyance of the recording sheet, ink on the teeth of the toothed rollers 66 sticking to the intermediate sheet discharging rollers 63 and thus staining the back side of the recording sheet S.

A pair of sheet discharging roller shafts 68 and 71 are provided downstream of the hot air drying unit 90 (described later in detail). The upper shaft discharging roller shaft 68 is disposed below the sheet discharging board 61. A plurality of sheet discharging rollers 69 made of an elastic material are fixedly mounted on the upper sheet discharging roller shaft 68. Each of the sheet discharging rollers 69, as shown in Fig. 6, has a cylindrical roller 70 only at one end thereof. The upper sheet discharging roller shaft 71 on the side of the head 82 has a plurality of thin-plate-shaped toothed rollers 72. More specifically, the toothed rollers 72 are mounted on the roller shaft 71 in such a manner that they are spaced from the cylindrical rollers 70 and are slightly overlapped with the latter as viewed in the axial direction. These rollers 69 and 72 strongly wave the dried recording sheet S

in the direction of conveyance so that the recording sheet S is delivered flat onto a sheet discharging tray 74 while being stiffened.

The carriage 80 is moved while being guided by two guide rails 81 and 81 which are laid perpendicular to the recording sheet conveyance direction. The carriage 80 is provided with the ink jet head 82, which jets ink through at least one nozzle onto the recording sheet S.

As shown in Figs. 7 and 8a, a pair of solenoids 88 and 88 are provided on both sides of the carriage 80. A pair of sheet retaining levers 86 and 86, which are driven by respective ones of the solenoids 88 and 88, are swingably supported on both sides of the lower surface of the carriage 80 in such a manner that the end portion 82a of the head 82 is positioned between them. When the carriage 80 travels, the end portions 86a of the sheet retaining levers 86 are alternately moved up and down, as indicated in Fig. 8a, in such a manner that the end portion 86a located before the other lever 86 in the direction of travel is lowered while the end portion 86a of the other sheet retaining lever 86 is raised, whereby printing is carried out while the front part of the recording sheet S is being pushed against the platen 46 with the end portions 86a of the sheet retaining levers 86.

As shown in Fig. 8b, rollers 87 may be coupled to the end portions 86a of the sheet retaining levers 86 so that the end portions 86a of the sheet retaining levers 86 can push the recording sheet S against the platen 46 while smoothly moving on the recording sheet S.

As shown in Fig. 7, an integral-duct type fan 83 with an inverted-V-shaped air blowing outlet is provided downstream of the carriage 80 in the sheet conveyance direction. The fan 83 is designed so that, as shown in Figs. 9a and 9b, air streams are applied to the recording sheet S while being deflected right and left by a baffle plate 84 set vertically on one side of the carriage 80, and then directed to the other side, thus blowing dust, paper powder or the like off the recording sheet.

As shown in Fig. 2, an upward movement regulating piece 89 is mounted upstream of and below the carriage 80 in such a manner that it forms a small gap with the end of a retaining board 45. When a relatively thick recording sheet S such as an envelope is delivered to the printing section, the regulating piece 89 prevents the retaining board 45 from being moved upwardly.

The hot air drying unit 90 operates to dry the recording sheet S, on which data have been recorded, by applying hot air to it. As shown in Fig. 10, the drying unit 90 is mounted on two side boards 4 and 4 of the printer body 1. The drying unit 90 includes a duct 91 confronting a sheet discharging guide board 61 (Fig. 2), a heater 93 accommodated in the duct 91, and a fan 94 (Fig. 11) installed at a suitable location in the printer body 1. Air which is introduced into the duct 91 through an air pipe 96 from the fan 94 is heated by the heater 93, and the air thus heated is directed against the recording sheet through a number of small air blowing holes 92 formed in the lower board of the duct 91 and directed in the sheet conveyance direction.

A control circuit for the printer is arranged as shown in Fig. 11.

In Fig. 11, a host computer 50 provides recording data for one page, for instance, to be printed. The recording data are applied through an interface 51 to a buffer 52 so as to be stored in the latter 52. In accordance with an input signal provided by the buffer 52, and a preset program, a control means 53 applies control signals to a sheet conveyance drive means 55, a head drive means 56, and a heater drive means 57, so that a drive motor 58, the printing head 82, and a heater 93 and a fan motor 95 perform sheet conveyance, a recording operation, and a recording sheet drying operation, respectively.

In the printer, the recording data stored in the buffer 52 are applied to a printing pattern analyzing means 54. The latter 54 determines from the input recording data the quantity of ink, or the number of dots, for printing each of several regions 1' through 6', as shown in Fig. 12, defined along a printing line. More specifically, the printing pattern analyzing circuit 54 detects the region having the largest number of dots in each line, i.e., the region having the largest pixel density in each line (in the case of Fig. 12, the fourth region, indicated by shading) and, for every line, applies the number of dots together with the region, as data, to the control means 53. On the other hand, a print drying table indicating relationships between quantities of ink per unitary area and corresponding ink drying time periods, as shown in Fig. 13, is stored in a ROM (not shown). Referring to the print drying table and the largest number of dots of the region thus inputted, the control means 53 determines an ink drying time period (Dx). In this manner, ink drying time periods (Dx) for all lines are obtained. These ink drying time periods (Dx) are added successively to determine estimated ink drying completion time instants (Tx) for all the lines. The ink drying time periods (Dx) and the estimated ink drying completion time instants (Tx) are written, as a drying control table, in a RAM (not shown) as indicated in Fig. 14. Referring to the drying control table, the control means 53 calculates an estimated drying completion time instant, and compares the time instant thus calculated with the present time instant, thereby to control the drive motor 58 to intermittently convey the recording sheet S.

Next, the operation of the ink jet printer will be described.

In a sheet conveying mode, in which a recording sheet is being conveyed, in the sheet supply section 10, the separating pawl operating lever 17 is positioned as shown in Fig. 1 with a manual operating lever (not shown), so that the separating pawl 16 is abutted against the front end of the top one of the recording sheets S stacked on the sheet supplying stand 12. On the other hand, the lever (not shown) coupled to the manual operating lever lifts the platen 46 until the latter 46 becomes flush with the sheet conveyance guide board 43, and turns the cam 34 to the position indicated by the solid line in Fig. 2 to release the sheet retaining roller lever 29. As a result, the strong spring 33 acts on the sheet retain-

ing roller lever 29 to strongly push the sheet retaining roller 32 coupled to the latter 29 against the sheet conveying belt 23.

When, under this condition, the sheet supplying roller 13 is rotated, the top one of the recording sheets S stacked on the sheet supplying stand 12 is separated from the remaining sheets with the separating pawl 16, and moved along the sheet conveyance guide board 14 and the sheet conveyance guide board 43 to the gate roller 21. Since the gate roller 21 is strongly pushed against the sheet retaining roller 32 through the sheet conveying belt 23, the recording sheet S is conveyed to the printing section.

When the recording sheet S is delivered to the printing section, the carriage 80 starts traveling along two guide rails 81 and 81, while the sheet retaining lever 86 located forwardly in the direction of travel of the carriage is turned by the solenoid 88 so that its end portion 86a pushes the recording sheet S against the platen 46. That is, the front end portion of the recording sheet S is pushed by the sheet retaining lever 86 to form a predetermined clearance between the recording sheet S and the printing head 82. Under this condition, characters, patterns, etc., are recorded on the recording sheet according to the inputted recording data. At the same time, the integral-duct type fan 83 on the carriage 80 operates to blow air against the recording sheet S through the inverted-V-shaped air blowing outlet to form air streams which are directed from one side to the other while being deflected right and left, thus blowing dust, paper powder or the like off the recording sheet in order to prevent the sticking of such foreign matter to the nozzle.

On the other hand, at the beginning of the sheet conveyance, the paper bail lever 38 is turned upwardly by the pinion 41 engaged with the sector 40, so that the paper bail 37 coupled to the end of the paper bail lever 38 is spaced away from the sheet conveying belt 23. That is, the recording sheet S on which dot image has been recorded is moved under the paper bail 37. Hence, the recording sheet S is delivered to the sheet discharging section 60 without spoiling the dot image.

At the same time, the thin toothed rollers 66 arranged immediately after the driven roller 22 are rotated while in contact with the cylindrical rollers 64 of the intermediate sheet discharging rollers 13. Hence, the recording sheet S wetted through the data writing operation is delivered into the hot air drying unit 90 while being in contact with the teeth of the thin toothed rollers 66 in a dotted form and being gently held between the toothed rollers 66 and the cylindrical rollers 64 of the intermediate sheet discharging rollers 13. Therefore, in this operation, the dot image on the recording sheet S is not spoiled at all. In the hot air drying section 90, the recording sheet S is dried with hot air as required. The recording sheet S thus processed is delivered into the sheet discharging tray 74 by the sheet discharging rollers 69 and 72.

When, in the above-described operation, the rear edge of the recording sheet S arrives at a position immediately before the gate roller 21, a sheet edge detecting sensor (not shown) detects the rear edge to output a detection signal. In response to the detection signal, the pinion 41 is rotated to swing the paper bail lever 38 downwardly through the sector 40. As a result, the paper bail 37 at the end of the paper bail lever 38 is pushed against the sheet conveying belt 23, thus holding the recording sheet S. Thus, the recording sheet S released from the gate roller 21 is forwarded to the hot air drying unit 90 with the recorded image maintained unaffected.

In the case where, in the above-described dot image recording operation, pixels forming a pattern, etc., are extremely large in density, the part of the recording sheet S to which a large quantity of ink has been applied is greatly wetted to the extent that the part is greatly made wavy or swelled. The printing pattern analyzing means 54, receiving data to be recorded from the buffer 52, detects this phenomenon in advance, detects the region having the largest number of dots in every line, and applies numerical data indicative of the regions and the numbers of dots to the control means 53. The control means 53, referring to the relationships between quantities of ink per unitary area and corresponding ink drying time periods stored in advance, forms a drying control table (as shown in Fig. 14), and compares the present time instant with the estimated ink drying completion time instant for each line, thereby to determine whether or not sheet conveyance is permissible. When it is determined that the present time instant is after the estimated ink drying completion time instant, the drive motor 58 is operated, and if not, the drive motor 58 is held in a standby state. That is, the drive motor 58 is operated intermittently at intervals corresponding to the printing densities of those regions in the lines.

In the case where the printing operation is carried out for stacked envelopes or the like, the separating pawl operating lever 17 is operated with the manual operating lever to disengage the separating pawl 16 from the envelopes, and the platen 46 is retracted to the position indicated by the two-dot chain line in Fig. 2 with a lever which is operated in association with the manual operating lever. As a result, the envelope taken out of the stack with the sheet supplying roller 13 is delivered to the gate roller 21 while being guided by the slope 14a provided before the sheet conveying board 14, and then conveyed into the printing section while being strongly nipped by the sheet retaining roller 32 and the sheet conveying belt 23. Thus, the envelope is placed on the retracted platen, whereupon the sealing flap of the envelope is smoothly passed through the clearance over the platen 46, so that, similarly as in the case of the recording sheet, necessary data are recorded thereon.

In conveyance of a web with the tractor 15, the cam 34 is turned to the position indicated by the two-dot chain line in Fig. 2, and the sheet retaining roller lever 29 is turned clockwise in Fig. 2. As a result, the strong spring 33 acting on the lever 29 is released. Hence, the sheet

retaining roller 32 together with the sheet conveying belt 23 supports the web with the aid of the weak spring 35, thus smoothly conveying the web into the printing section.

Claims

1. An ink jet printer, comprising:
 recording means (80,82) for jetting ink droplets while moving in a direction perpendicular to the direction of conveyance of a recording medium (S), to form a dot image on said recording medium according to input data;
 recording medium drying means (90) arranged downstream of said recording means (80,82);
 conveying means (58) for conveying said recording medium (S) through said recording means (80,82) and said recording medium drying means (90);
 means (54) for detecting pixel density by counting total print dot number; and
 control means (53) for controlling the speed or timing of conveyance of said recording medium (S) by said conveying means (58) in response to an output of said detecting means (54);
 characterized in that,
 said means (54) is further adapted for detecting regions to be printed on said recording medium (S) having a large pixel density; and
 said control means (53) is capable of comparing an estimated ink drying completion time instant for each line to be printed with a present time instant.
2. The ink jet printer as claimed in claim 1, further comprising a pair of sheet retaining means (86,88) respectively arranged before and behind in the direction of travel of said recording means, said pair of sheet retaining means (86,88) being operated in such a manner that the one of said pair of sheet retaining means arranged before in the direction of travel is displaced to push against said recording medium (S), while the other is displaced to leave from said recording medium.
3. The ink jet printer as claimed in claim 2, wherein each of said sheet retaining means (86) comprises: a solenoid (88) and a swingable sheet retaining lever (86) for swingably moving said swingable lever (86).
4. The ink jet printer as claimed in claim 3, wherein each of said sheet retaining means (86) further comprises a wheel (87) at a free end (86a) of said swingable sheet retaining lever (86).
5. The ink jet printer as claimed in one of the preceding claims, further comprising air stream directing means (83,84) move together with said recording means (80,82) for directing air streams along said recording medium in a predetermined direction.



When, in the above-described operation, the rear edge of the recording sheet S arrives at a position immediately before the gate roller 21, a sheet edge detecting sensor (not shown) detects the rear edge to output a detection signal. In response to the detection signal, the pinion 41 is rotated to swing the paper bail lever 38 downwardly through the sector 40. As a result, the paper bail 37 at the end of the paper bail lever 38 is pushed against the sheet conveying belt 23, thus holding the recording sheet S. Thus, the recording sheet S released from the gate roller 21 is forwarded to the hot air drying unit 90 with the recorded image maintained unaffected.

In the case where, in the above-described dot image recording operation, pixels forming a pattern, etc., are extremely large in density, the part of the recording sheet S to which a large quantity of ink has been applied is greatly wetted to the extent that the part is greatly made wavy or swelled. The printing pattern analyzing means 54, receiving data to be recorded from the buffer 52, detects this phenomenon in advance, detects the region having the largest number of dots in every line, and applies numerical data indicative of the regions and the numbers of dots to the control means 53. The control means 53, referring to the relationships between quantities of ink per unitary area and corresponding ink drying time periods stored in advance, forms a drying control table (as shown in Fig. 14), and compares the present time instant with the estimated ink drying completion time instant for each line, thereby to determine whether or not sheet conveyance is permissible. When it is determined that the present time instant is after the estimated ink drying completion time instant, the drive motor 58 is operated, and if not, the drive motor 58 is held in a standby state. That is, the drive motor 58 is operated intermittently at intervals corresponding to the printing densities of those regions in the lines.

In the case where the printing operation is carried out for stacked envelopes or the like, the separating pawl operating lever 17 is operated with the manual operating lever to disengage the separating pawl 16 from the envelopes, and the platen 46 is retracted to the position indicated by the two-dot chain line in Fig. 2 with a lever which is operated in association with the manual operating lever. As a result, the envelope taken out of the stack with the sheet supplying roller 13 is delivered to the gate roller 21 while being guided by the slope 14a provided before the sheet conveying board 14, and then conveyed into the printing section while being strongly nipped by the sheet retaining roller 32 and the sheet conveying belt 23. Thus, the envelope is placed on the retracted platen, whereupon the sealing flap of the envelope is smoothly passed through the clearance over the platen 46, so that, similarly as in the case of the recording sheet, necessary data are recorded thereon.

In conveyance of a web with the tractor 15, the cam 34 is turned to the position indicated by the two-dot chain line in Fig. 2, and the sheet retaining roller lever 29 is turned clockwise in Fig. 2. As a result, the strong spring 33 acting on the lever 29 is released. Hence, the sheet

retaining roller 32 together with the sheet conveying belt 23 supports the web with the aid of the weak spring 35, thus smoothly conveying the web into the printing section.

Claims

1. An ink jet printer, comprising:
 recording means (80,82) for jetting ink droplets while moving in a direction perpendicular to the direction of conveyance of a recording medium (S), to form a dot image on said recording medium according to input data;
 recording medium drying means (90) arranged downstream of said recording means (80,82);
 conveying means (58) for conveying said recording medium (S) through said recording means (80,82) and said recording medium drying means (90);
 means (54) for detecting pixel density by counting total print dot number; and
 control means (53) for controlling the speed or timing of conveyance of said recording medium (S) by said conveying means (58) in response to an output of said detecting means (54);
 characterized in that,
 said means (54) is further adapted for detecting regions to be printed on said recording medium (S) having a large pixel density; and
 said control means (53) is capable of comparing an estimated ink drying completion time instant for each line to be printed with a present time instant.
2. The ink jet printer as claimed in claim 1, further comprising a pair of sheet retaining means (86,88) respectively arranged before and behind in the direction of travel of said recording means, said pair of sheet retaining means (86,88) being operated in such a manner that the one of said pair of sheet retaining means arranged before in the direction of travel is displaced to push against said recording medium (S), while the other is displaced to leave from said recording medium.
3. The ink jet printer as claimed in claim 2, wherein each of said sheet retaining means (86) comprises: a solenoid (88) and a swingable sheet retaining lever (86) for swingably moving said swingable lever (86).
4. The ink jet printer as claimed in claim 3, wherein each of said sheet retaining means (86) further comprises a wheel (87) at a free end (86a) of said swingable sheet retaining lever (86).
5. The ink jet printer as claimed in one of the preceding claims, further comprising air stream directing means (83,84) move together with said recording means (80,82) for directing air streams along said recording medium in a predetermined direction.

6. The inkjet printer as claimed in one of the preceding claims, further comprising web supplying means (15) and sheet supplying means (10) provided upstream of said recording means (80, 82).
7. The inkjet printer as claimed in one of the preceding claims further comprising sheet retaining means (29-35) provided upstream of said recording means (80, 82) for adjusting a contact pressure according to whether individual sheets are supplied or whether a continuous web is supplied.
8. The inkjet printer as claimed in one of the preceding claims, further comprising a roller (37) provided downstream of said recording means (80, 82) said roller (37) being operated after the rear edge of said recording medium (S) passes through sheet conveying means (21) located upstream of said recording means (80, 82), to convey said recording medium (S) while in contact with a dot image forming surface of said recording medium, said roller (37) being movable into and out of engagement of said recording medium (S).
9. The inkjet printer as claimed in one of the preceding claims further comprising a cylindrical roller (64) having a small wall thickness and which contacts the back side of said recording medium (S), and a plate-shaped roller (66) with peripheral teeth and which contacts a dot image forming side of said recording medium, said cylindrical roller (64) and said plate-shaped roller (66) being provided downstream of said recording means (80, 82) in such a manner that said roller (64, 66) are confronted with each other.

Patentansprüche

1. Tintenstrahldrucker mit:
einem Aufzeichnungsmittel (80, 82) zum Ausstoß von Tintentropfen während der Bewegung in einer Richtung senkrecht zur Beförderungsrichtung eines Aufzeichnungsmediums (S) zur Ausbildung eines Punktbildes auf dem Aufzeichnungsmedium gemäß Eingabedaten;
einem dem Aufzeichnungsmittel (80, 82) nachgeschalteten Aufzeichnungsmediumtrocknungsmittel (90);
einem Beförderungsmittel (58) zur Beförderung des Aufzeichnungsmediums (S) durch das Aufzeichnungsmittel (80, 82) und das Aufzeichnungsmediumtrocknungsmittel (90);
einem Mittel (54) zur Erfassung der Pixeldichte durch Zählen der Gesamtdruckpunktanzahl; und
einem Steuermittel (53) zur Steuerung der Geschwindigkeit oder der zeitlichen Abstimmung der Beförderung des Aufzeichnungsmediums (S) durch das Beförderungsmittel (58) in Abhängigkeit von einer Ausgabe des Erfassungsmittels (54);
dadurch gekennzeichnet, daß

das Mittel (54) des weiteren auf die Erfassung von auf das Aufzeichnungsmedium (S) zu druckenden Bereichen mit einer großen Pixeldichte ausgerichtet ist; und

das Steuermittel (53) einen geschätzten Zeitpunkt der Beendigung der Tintentrocknung für jede zu druckende Zeile mit einem jetzigen Zeitpunkt vergleichen kann.

2. Tintenstrahldrucker gemäß Anspruch 1, der des weiteren ein Paar Blattrückhaltemittel (86, 88) aufweist, welche in der Bewegungsrichtung des Aufzeichnungsmittels davor bzw. dahinter angeordnet sind, wobei das Paar Blattrückhaltemittel (86, 88) so betrieben ist, daß das eine, in Bewegungsrichtung davor angeordnete Paar Blattrückhaltemittel so versetzt ist, daß es gegen das Aufzeichnungsmedium (S) schiebt, während das andere so versetzt ist, daß es von dem Aufzeichnungsmedium entfernt ist.
3. Tintenstrahldrucker gemäß Anspruch 2, bei dem jedes der Blattrückhaltemittel (86) folgendes aufweist: ein Solenoid (88) und einen schwingbaren Blattrückhaltehebel (86) zur schwingbaren Bewegung des schwingbaren Hebels (86).
4. Tintenstrahldrucker gemäß Anspruch 3, bei dem jedes der Blattrückhaltemittel (86) des weiteren ein Rad (87) an einem freien Ende (86a) des schwingbaren Blattrückhaltehebels (86) aufweist.
5. Tintenstrahldrucker gemäß einem der vorhergehenden Ansprüche, der des weiteren ein zusammen mit dem Aufzeichnungsmittel (80, 82) bewegtes Luftstromleitmittel (83, 84) zum Leiten von Luftströmen entlang des Aufzeichnungsmediums in einer vorbestimmten Richtung aufweist.
6. Tintenstrahldrucker gemäß einem der vorhergehenden Ansprüche, der des weiteren Bahnzuführmittel (15) und Blattzuführmittel (10), welche dem Aufzeichnungsmittel (80, 82) vorgeschaltet sind, aufweist.
7. Tintenstrahldrucker gemäß einem der vorhergehenden Ansprüche, der des weiteren dem Aufzeichnungsmittel (80, 82) vorgeschaltete Blattrückhaltemittel (29-35) zur Einstellung eines Kontaktdrucks abhängig davon, ob Einzelblätter zugeführt sind oder ob eine Endlosbahn zugeführt ist, aufweist.
8. Tintenstrahldrucker gemäß einem der vorhergehenden Ansprüche, der des weiteren eine dem Aufzeichnungsmittel (80, 82) nachgeschaltete Walze (37) aufweist, wobei die Walze (37) betätigt ist, nachdem das hintere Ende des Aufzeichnungsmediums (S) sich durch das Blattbeförderungsmittel

(21) bewegt, welches dem Aufzeichnungsmittel (80, 82) vorgeschaltet ist, um das Aufzeichnungsmedium (S) während der Kontaktierung einer Punktbildausbildungsoberfläche des Aufzeichnungsmediums zu befördern, wobei die Walze (37) in und aus dem Eingriff mit dem Aufzeichnungsmedium (S) bringbar ist.

9. Tintenstrahldrucker gemäß einem der vorhergehenden Ansprüche, der des weiteren eine zylindrische Walze (64), welche eine geringe Wanddicke aufweist und mit der Rückseite des Aufzeichnungsmediums (S) in Kontakt steht, sowie eine plattenförmige Walze (66), welche Umfangszähne aufweist und mit einer Punktbildausbildungsseite des Aufzeichnungsmediums in Kontakt steht, umfaßt, wobei die zylindrische Walze (64) und die plattenförmige Walze (66) dem Aufzeichnungsmittel (80, 82) so nachgeschaltet sind, daß sich die Walzen (64, 66) gegenüberliegen.

Revendications

1. Imprimante à jet d'encre, comprenant :
 - des moyens d'enregistrement (80, 82) pour projeter des gouttelettes d'encre pendant leur déplacement dans une direction perpendiculaire à la direction d'avance d'un support d'enregistrement (S), pour former sur ledit support d'enregistrement une image de points conforme aux données d'entrée ;
 - des moyens de séchage du support d'enregistrement (90) installés en aval desdits moyens d'enregistrement (80, 82) ;
 - des moyens d'avance (58) pour faire passer ledit support d'enregistrement (S) à travers lesdits moyens d'enregistrement (80, 82) et lesdits moyens de séchage du support d'enregistrement (90) ;
 - des moyens (54) pour détecter la densité en pixels en comptant le nombre total des points imprimés ; et
 - des moyens de commande (53) pour commander la vitesse ou la synchronisation de l'avance dudit support d'enregistrement (S) par l'action desdits moyens d'avance (58) en réponse à une sortie desdits moyens de détection (54) ;
 - caractérisée en ce que :
 - lesdits moyens (54) sont en outre aptes à détecter des régions à imprimer avec une grande densité en pixels sur ledit support d'enregistrement (S) ; et
 - en ce que lesdits moyens de commande (53) sont aptes à comparer un temps estimatif de fin de séchage de l'encre pour chaque ligne à imprimer avec un temps réel.
2. Imprimante à jet d'encre selon la revendication 1, comprenant en outre une paire de moyens de maintien de la feuille (86, 88) respectivement disposés

devant et derrière dans la direction d'avance dudit support d'enregistrement, ladite paire de moyens de maintien de la feuille (86, 88) étant actionnée de manière telle que le moyen de maintien de la feuille placé en avant dans la direction d'avance soit déplacé pour pousser contre ledit support d'enregistrement (S), tandis que l'autre est déplacé pour se dégager dudit support d'enregistrement.

3. Imprimante à jet d'encre selon la revendication 2, dans laquelle chacun desdits moyens de maintien de la feuille (86) comprend : un solénoïde (88) et un levier oscillant (86) de maintien de la feuille pour déplacer ledit levier oscillant (86) en le faisant osciller.
4. Imprimante à jet d'encre selon la revendication 3, dans laquelle chacun desdits moyens (86) de maintien de la feuille comprend en outre une mollette (87) montée à une extrémité libre (86a) dudit levier oscillant (86) de maintien de la feuille.
5. Imprimante à jet d'encre selon une quelconque des revendications précédentes, comprenant en outre des moyens (83, 84) de projection d'un flux d'air qui se déplacent en même temps que lesdits moyens d'enregistrement (80, 82) pour projeter des flux d'air le long dudit support d'enregistrement dans une direction prédéterminée.
6. Imprimante à jet d'encre selon une quelconque des revendications précédentes, comprenant en outre des moyens d'alimentation d'un support continu (15) et des moyens d'alimentation feuille à feuille (10) montés en amont desdits moyens d'enregistrement (80, 82).
7. Imprimante à jet d'encre selon une quelconque des revendications précédentes, comprenant en outre des moyens de maintien de la feuille (29, 35) montés en amont desdits moyens d'enregistrement (80, 82) pour ajuster une pression de contact selon que l'alimentation est du type feuille à feuille ou du type en bande continue.
8. Imprimante à jet d'encre selon une quelconque des revendications précédentes, comprenant en outre un galet (37) monté en aval desdits moyens d'enregistrement (80, 82), ledit galet (37) étant actionné lorsque le bord arrière dudit support d'enregistrement (S) traverse lesdits moyens (21) d'avance des feuilles placés en amont desdits moyens d'enregistrement (80, 82) pour faire avancer ledit support d'enregistrement (S) lorsqu'il est en contact avec une surface de formation d'image de points dudit support d'enregistrement, ledit galet (37) étant mobile pour venir en prise avec, et être dégagé dudit support d'enregistrement (S).

9. Imprimante à jet d'encre selon une quelconque des revendications précédentes, comprenant en outre un galet cylindrique (64) ayant une faible épaisseur de paroi qui vient en contact avec la face arrière dudit support d'enregistrement (S) et un galet plat (66) portant des dents périphériques qui vient en contact avec une face de formation d'une image de points dudit support d'enregistrement, ledit galet cylindrique (64) et ledit galet plat (66) étant montés en aval desdits moyens d'enregistrement (80, 82) de manière que lesdits galets (64, 66) soient placés face à face.

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