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(54) Ink jet recording apparatus.

(57) A recording apparatus for performing recording by ejecting ink from a plurality of discharging ports comprises a control mechanism arranged with plural discharging ports for a plurality of discharging groups to select the conveying amount for a recording medium in accordance with the discharging groups to be used for recording ; hence making it possible to use the discharging ports evenly for recording to restrain the recording quality from being degraded in a long term use as well as to prolong the life of recording means.

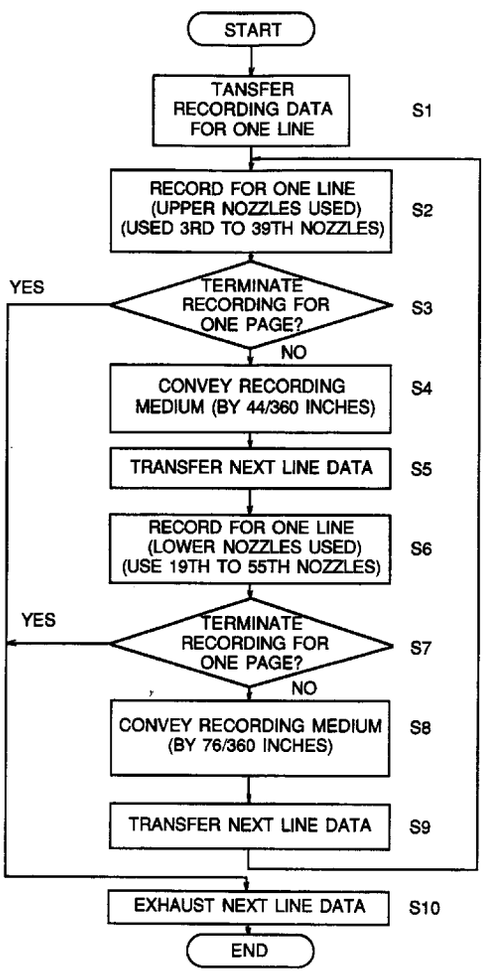

FIG. 4

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BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an ink jet recording apparatus. More particularly, the invention relates to an ink jet recording apparatus capable of suppressing the degradation of recording quality attributable to recording means.

Related Background Art

There have hitherto been developed various recording methods. In particular, the ink jet recording method wherein ink is ejected from nozzles to perform recording in response to the recording signals has been widely used in recent years because this method enables such an apparatus to be built compactly as well as lower any resultant noises in operation with ease.

As recovery means to be applied when the recording quality is lowered in the ink jet recording apparatus, foreign particles and bubbles in the liquid passages are removed by exhausting ink from the nozzles of its recording head by means of suction or pressurization or the adherent ink in the vicinity of the discharging ports is removed by cleaning the ink discharging surface by use of a wiper.

Nevertheless, there is a tendency that the recording quality is degraded when recordings are performed for a long time for the ink jet apparatuses, particularly those adopting a mode whereby to eject ink droplets by foaming ink by the utilization of thermal energy. This arises from the accumulations of the dye stuff and impurity in ink coagulated by heat on the heating surfaces of electrothermal transducers which supply thermal energy to ink.

In order to avoid the generation of the foregoing accumulation on the heating surfaces in the ink jet recording apparatus, the removal of impurities and others are attempted by refining the dye stuff and the like.

However, there are still some cases where the recording quality is degraded despite the fact that almost no accumulation of such substances is observed on the heating surfaces after a long-time operation using the ink the dye stuff of which has been refined as described above.

As a result of precise inspections of the recording heads which have resulted in the aforesaid degradation of recording quality, it is discovered by the present inventor et al that its foaming amounts become smaller than those originally estimated even when there are almost no changes in the resistance values of the heaters arranged to foam ink by supplying thermal energy thereto. In other words, when the foaming amount becomes smaller, the ejecting energy of the ink becomes insufficient accordingly; hence slowing down the velocity at which to eject the ink droplets. Also, unfavorable foaming takes place. It is thus ascertained that these have consequently caused the recording quality to be lowered.

It is also found that the foregoing unfavorable foaming occurs more remarkedly in the nozzles which have rarely been used for recording. For example, when characters are printed using a recording head with 64 nozzles being arranged in line at intervals of 1/360 inches, the unfavorable foamings are generated more conspicuously between the 49th nozzle and 64th nozzle. This is because the ejecting amounts of ink droplets in a group of nozzles from the first to 64th differ from that of nozzles from the 49th to 64th. As a result, the density unevenness occurs linearly in the printing width. Particularly, this linear type density unevenness becomes especially conspicuous in a graphic print of a half tone using the technique of dot thinning; thus causing the recording quality to be degraded significantly.

Also, when the foregoing unfavorable foamings are conspicuous, the ejecting velocity of the ink droplets is slowed down to distort characters or missing dots may take place due to disabled ejections.

The present inventor et al have analyzed the foregoing phenomena of the unfavorable foaming and arrived at the conclusion given below.

In other words, the heating surfaces of the nozzles used for recording receive a kind of cleaning action by the forces exerted at the time of the ink bubbles fading away. On the other hand, the heating surfaces in the nozzles which are not used are eventually covered by a thin film of impurities created as the time elapses with the increasedly viscous ink and other minute dusty particles adhering to the discharging surfaces which are gradually pressed into the nozzles each time the discharging surfaces are wiped by a cleaning blade. Consequently, the heat generated by the heaters are not transferred to ink sufficiently; hence making the foaming amounts of the ink smaller than those originally estimated.

SUMMARY OF THE INVENTION

The present invention is designed in accordance with the aforesaid results of the findings conducted by the present inventor et al. It is an object of the invention to provide an ink jet recording apparatus capable of avoiding the foregoing unfavorable foaming phenomena for the stable recording.

It is another object of the present invention to provide an ink jet recording apparatus capable of preventing the degradation of recording quality for the stable recording by making arrangement so that the ink discharging ports to be used for recording is not biased to any specific portions.

It is still another object of the present invention to provide a recording apparatus for performing record-

ing by ejecting ink from a plurality of discharging ports, wherein a control mechanism is arranged with plural discharging ports for a plurality of discharging groups to select the conveying amount for a recording medium in accordance with the discharging groups to be used for recording.

It is a further object of the present invention to provide an ink jet recording apparatus which comprises:

a conveying mechanism for conveying a recording medium;

a carriage for carrying an ink jet recording head, having a plurality of discharging ports arranged substantially in parallel with the conveying direction of the aforesaid recording medium, in the direction intersecting the conveying direction of the foregoing recording medium; and

a control mechanism arranged with plural discharging ports for a-plurality of discharging groups to select the conveying amount for a recording medium in accordance with the discharging groups to be used for recording, there being mixed in the aforesaid control mechanism the line on which the recording is performed using the discharging port located furthest on the downstream side in the conveying direction of the aforesaid recording medium with respect to the recording signal of the recording signals in one scanning, which is located furthest on the downstream side of the aforesaid recording medium, and the line on which the recording is performed using the discharging port located furthest on the upstream side in the conveying direction of the aforesaid recording medium with respect to the recording signal of the recording signals in one scanning, which is located furthest on the upstream side of the aforesaid recording medium.

It is a further object of the present invention to provide a recording method for performing recording by ejecting ink from a plurality of discharging ports onto a recording medium being conveyed in a given direction, which comprises the following process of:

arranging plural discharging ports for a plurality of discharging groups;

giving the positional interval between the discharging port group N_a, on the downstream side in the conveying direction of the recording medium and the discharging port group N_b, on the upstream side in the conveying direction of the recording medium as L_n, and the line pitch as L_p;

setting the conveying amount of the aforesaid recording medium at $L_p - L_n$ when the discharging port group to be used for recording is switched over from the aforesaid discharging port group N_a to the aforesaid discharging port group N_b; and

setting the conveying amount of the aforesaid recording medium at $L_p + L_n$ when the discharging port group to be used for recording is switched over from the aforesaid discharging port group N_b to the aforesaid discharging port group N_a.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view for explaining the conveying amounts of the nozzles and a recording medium used when character printings are performed by a recording apparatus according to an embodiment of the present invention.

Fig. 2 is a perspective view showing the entire structure of an ink jet recording apparatus.

Fig. 3 is a block diagram showing a control system.

Fig. 4 is a flowchart showing recording procedures.

Fig. 5A is a table showing the nozzles used and the total discharge number in a case of recording using a conventional recording apparatus.

Fig. 5B is a table showing the nozzles used and the total discharge number in a case of recording using a recording apparatus according to an embodiment of the present invention.

Fig. 6 is a view for explaining the conveying amounts of the nozzles and a recording medium used when character printings are performed by a second embodiment according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, with reference to Fig. 1 to Fig. 4, the description will be made of an embodiment of an ink jet recording apparatus to which the present invention is applied. In this respect, Fig. 1 is a view for explaining the nozzles used when character printings are performed. Fig. 2 is a perspective view showing the entire structure of an ink jet recording apparatus. Fig. 3 is a block diagram showing a control system, and Fig. 4 is a flowchart showing recording is procedures.

At first, with reference to Fig. 2, the entire structure of the ink jet recording apparatus will be described. A recording head 1 serving as recording means is mounted on a carriage 2. This carriage 2 is supported slidably along guide rails 3 and 4 and is simultaneously connected to a timing belt 7 tensioned between pulleys 5 and 6. In this way, the carriage 2 is allowed to scan along the guide rails 3 and 4 when a carriage motor 8 coupled to the pulley 5 is driven normally or reversely.

The recording head 1 is driven in synchronism with the foregoing carriage 2 to perform recording. This recording head 1 is provided with the nozzles which serve as fine liquid discharging ports, liquid passages and energy activating portions arranged partially in the liquid passages, and energy generating means for generating the energy which enables the liquid in the aforesaid portions to be activated to form ink droplets.

The recording head in the present embodiment has, as described above, 64th nozzles arranged in a line at intervals of 1/360 inches in upper and lower rows. Also, as energy generating means for generating the energy which enables ink to be ejected from the nozzles, there are a recording method using electromechanical transducers such as piezoelectric elements and others, a recording method using energy generating means wherein heat is generated by irradiation of electromagnetic waves such as laser and liquid droplets are ejected by the effect of heat thus generated, or a recording means using energy generating means wherein liquid is ejected by heating the liquid by electro-thermal transducers such as heat generating elements having exothermic resistive members. Among these, the recording heads used for the ink jet recording method wherein the liquid is ejected by the heat energy are especially effective in performing high resolution recording because the nozzles for discharging recording liquid to form the ejection droplets can be arranged in a high density. Particularly, the recording head which uses electrothermal transducers as energy generating means has advantages that it can be built compactly and at the same time, a high density assembly is possible at a low manufacturing cost because this type of head can utilize sufficiently the excellent aspects of the IC technologies and micromachining techniques which have made remarkable advances in recent years in the field of semiconductor engineering to enhance their reliability significantly.

Also, at the home position of the foregoing carriage 2 (which is outside the recording area. In Fig. 2, it is at the left end position of the guide rails 3 and 4), capping means 9 is arranged. This capping means 9 is to suck unwanted ink from the nozzles of the recording head 1 or to cap the ink discharging ports in order to prevent the vicinity of the ink discharging ports from being dried when the nozzles are not in use. This capping means 9 is structured movable in the direction indicated by an arrow in Fig. 2. When a capping is conducted, the carriage 2 is moved to its home position and then the capping means 9 is advanced forward to cover the ink discharging ports of the recording head 1 airtightly. In this respect, a reference numeral 9a designates a wiper blade.

Conveying means for conveying a recording medium 10 (ordinary sheet, plastic sheet, or the like) comprises a feed roller (not shown) which is connected to a conveying motor 11 and a pinch roller which is in contact with the aforesaid roller under pressure to rotate following the rotation thereof. In other words, the recording medium 10 guided by a paper pan 12 is conveyed in U-turn by means of the feed roller and pinch roller driven by the conveying motor 11. Then, the recording medium 10 which has been conveyed in U-turn is exhausted by means of an exhaust roller 13 and a spur 14.

Now, the description will be made of control means for driving each of the foregoing units. In Fig. 3, a reference numeral 15 designates a control unit comprising a CPU 15a, ROM 15b, and RAM 15c.

The CPU 15a is a central arithmetic processing unit to read programs and various data from the ROM 15b which will be described later and an input equipment and other external equipment and also execute required calculations as well as determinations to perform various controls. The ROM 15b is a read only memory to store for the operations of the CPU 15a various programs represented by a flowchart shown in Fig. 4, for example, and various data required for recording character codes, dot patterns, and the like. The RAM 15c is a random access memory comprising a working area where the foregoing CPU 15a temporarily stores the instructed data and the results of calculation, a buffer area where various data inputted from the external equipment or the like, a text area where documents and the like are stored, and some others.

The foregoing control unit 15 outputs driving signals to a head driving circuit 16 for driving the recording head 1 and motor driving circuits 17 and 18 for driving the carriage motor 8 and conveying motor 11, and provides driving controls as described later for the conveyance of the recording medium 10 and the nozzles of the recording head 1 to be used.

Subsequently, the description will be made of the recording procedures required to conduct recordings by giving driving controls to each of the members through the aforesaid control system. Here, the description will be made of a case where upper-case letters (A B C D E F G) are printed on a certain line and then the recording medium 10 is fed for one-line portion (line pitch 1/6 inches) to record likewise the letters (A B C D E F G).

Conventionally, when the recording is conducted as above, the nozzles used for recording are set so that they are always the same. More specifically, the third to 39th nozzle groups (37 nozzles) are used of the nozzles of the first to 64th and no other nozzles are used.

(First Embodiment)

Against this, as shown in Fig. 4, the present embodiment performs recordings in such a manner that in step S1, the recording data for one-line portion are transferred and in step S2, the carriage 2 is caused to scan and at the same time, the recording head 1 is driven to record the first one-line portion. At this juncture, the third to 39th nozzle groups of the 64th nozzles arranged in a line are used to conduct the recording (this is called "upper side use" (the groups on the downstream side in the conveying direction of the recording medium 10 are used)).

Then, in step S3, whether the second line record-

ing is required or not is discriminated. If the next line recording is required, the recording medium 10 is conveyed in step S4 for 44/360 inches. Then, in step S5, the recording data for the next line are transferred and in step S6, the carriage 2 is caused to scan and at the same time, the recording head 1 is driven to record the second line portion. At this juncture, the 19th to 55th nozzle groups are used for recording (this is called "lower side use" (the groups on the upstream side in the conveying direction of the recording medium 10 are used)).

Subsequently, in step S7, whether the recording for the third line portion is required or not is discriminated. If the next line recording is required, the recording medium 10 will be conveyed for 76/360 inches in step S8. Then, in step S9, the recording data for the next line are transferred. Thus, the process will return to the step S2 to record the third line portion applying the upper side use in the same fashion as described above.

The relation between the conveying amounts of the recording medium 10 and the nozzles to be used when the first to third line portions are recorded is shown in Fig. 1.

As described above, the conveying amounts of the recording medium 10 are set in two different kinds, and the conveying amount of the recording medium 10 is switched over for each of the recording lines. Further, by adopting the upper side use and lower side use for the nozzle groups of the recording head 1 to be operated for ejecting ink in response to the foregoing switch over, the printing pitch for each line becomes 1/6 inches for any one of the lines. Thus, it becomes possible to even off the distribution of the accumulated discharge number for each of the 64 nozzles. As a result, the number of the nozzles which are used only seldom can be reduced significantly.

Here, in Figs. 5A and 5B, there are illustrated the results of comparison with the accumulated discharge number per nozzle when a certain sentence composed of English letters (upper and lower case letters) and numerals having line pitches of 1/6 inches is printed by a conventional recording method in accordance with the same recording procedures as above.

When a recording is conducted according to the conventional method by a recording head which is the same as the present embodiment, the recording medium is conveyed 1/6 inches per line, and the second to 48th nozzle groups are always used for recording lower-case letters (a b c d e f g). The first to 39th nozzle groups are always used for recording numerals (0 1 2 3 4 5 6 7 8 9). Therefore, as shown in Fig. 5A, the nozzles to be used are locally concentrated whereas the 49th to 64th nozzle groups are not used at all.

Against this, if the conveying amount of the recording medium 10 is switched over per line as in the embodiment described above so as to change the nozzle groups to be used accordingly, the using nozzles are spreaded over entirely as shown in Fig. 5B even when the same example of the sentence is recorded. The distribution of the accumulated discharge number is also even off (the discharge number of a nozzle which is used most often is reduced to approximately 2/3 of the result of the recording using the conventional method). Moreover, the nozzles which have not been used at all are no longer observed.

In this way, the nozzles to be used are even off. The nozzles which are rarely used do not exist any longer, either. Hence, it becomes possible to reduce unfavorable foaming at the time of ink ejection. The density unevenness and missing dots can thus be prevented to restrain the recording quality from being degraded even when the apparatus is in use for a long period of time.

(Second Embodiment)

In the foregoing first embodiment, the third to 39th nozzle groups are used when a letter "A" is recorded by the upper side use, for example, while the 19th and 55th nozzle groups are employed in a case of the lower side use. However, as the second embodiment, the description will be made of an example in which the first nozzle is made fiducal for the upper side use while the 64th nozzle is made fiducial for the lower side use.

In other words, in a case of the upper side use, the first to 37th nozzle groups are employed and for the lower side use, the 28th to 64th nozzle groups are employed with the 64th nozzle as reference. Then, when a shifting is executed from the upper side use to the lower side use, a recording medium 10 is conveyed for 33/360 inches. When the shifting is from the lower side use to the upper side use, the recording medium is conveyed for 87/360 inches. Fig. 6 shows the recording state where recordings are controlled so that the upper side use and lower side use are alternately present as a mixture.

When the upper side use is applied as described above, the recording data within a recording line are checked, and the first nozzle positioned at the uppermost end of the recording head 1 (the downstream end in the conveying direction of the recording medium 10) is used for recording the dot positioned at the uppermost end (the downstream end in the conveying direction of the recording medium 10) among those dots thus checked. On the other hand, when the lower side use is applied, the recording data within a recording line are checked, and the 64th nozzle positioned at the lowermost end of the recording head 1 (the upstream end in the conveying direction of the recording medium 10) is used for recording the dot positioned at the lowermost end (the upstream end in the conveying direction of the recording me-

dium 10) among those dots thus checked.

In this way, the distribution of the accumulated discharge number per nozzle of the recording head 1 is made more even than the case of the foregoing first embodiment. This is because whereas in the foregoing first embodiment the first and second nozzles are not used often in a case of the upper side use and the 56th to 64th nozzles are not used often, either, in a case of the lower side use due to the way letters are designed (this does not necessarily mean that they are not used at all as in the case of the conventional printing method), such nozzles are also used evenly if recordings are controlled as in the second embodiment. Accordingly, the degradation of the recording quality can be restrained even when the apparatus is used in a longer period of time.

(Third Embodiment)

In the foregoing second embodiment, when the letters (A B C D E F G) are recorded, the first nozzle is used to record the dot positioned at the uppermost end of the recording data for the upper side use and the 28th nozzle is used to record the dot positioned at the uppermost end of the recording data for the lower side use. Then, the intervals between each of the nozzles are 1/360 inches. The difference between the positions of the nozzles to be used for the upper side use and lower side use is 28/360 - 1/360 = 27/360 inches, and an example in which the line pitches are 1/6 inches is shown. However, the size of the letters and line pitches are not necessarily limited to them as a matter of course. In other words, given a difference in the nozzle positions at the time of the upper side use (the use of the nozzle group on the downstream side in the conveying direction of the recording medium 10) and of the lower side use (the use of the nozzle group on the upstream side in the conveying direction of the recording medium 10) as L_n and the line pitch (the amount of the recording medium apparently conveyed in recording) as L_p, the actual conveying amount of the recording medium is set at $L_p - L_n$ when the upper side use is shifted to the lower side use and such an actual amount should only be set at $L_p + L_n$ when the lower side use is shifted to the upper side use on the contrary.

Also, as described earlier, in the first and second embodiments, the examples are shown, in which the upper side use and lower side use are alternately present as a mixture in recording, but this is not necessarily made alternately. It may be possible to make arrangement so that they are present as a mixture every two lines or three lines or even at random.

Furthermore, in each of the embodiments, the conveying amount of the recording medium 10 is set in two different kinds and the descriptions have been made of the cases of the upper side use and lower side use. However, as the central use, the 11th to 47th nozzle groups of the recording head 1 are used for recording the letter "A", for example and it may be possible to enable three kinds, the upper side use, central use, and lower side use, to be present as a mixture or further, more than three kinds to be present as a mixture.

Also, in the foregoing embodiments, an ink jet recording method is used as recording means. It is preferable to arrange the structure so that in response to recording signals electrothermal transducers are energized to eject ink from the discharging ports for recording by the effect of growing bubbles exothermically created by the foregoing electrothermal transducers which generate film boiling.

Regarding the typical structure and operational principle of such a method, it is preferable to adopt those which can be implemented using the fundamental principle disclosed in U.S. Patent Nos. 4,723,129 and 4,740,796. This method is applicable to a so-called on-demand type recording system and a continuous type recording system. Particularly, however, it is suitable for the on-demand type because the principle is such that at least one driving signal, which provides a rapid temperature rise beyond a departure from nucleation boiling point in response to recording information, is applied to an electrothermal transducer disposed on a liquid (ink) retaining sheet or liquid passage whereby to cause the electrothermal transducer to generate thermal energy to produce film boiling on the thermoactive portion of the recording head for the effective formation of a bubble in the recording liquid corresponding to each of the driving signals. By the production, development and contraction of the bubble, the liquid is ejected through a discharging port to produce at least one droplet. The driving signal is preferably in the form of a pulse because the development and contraction of the bubble can be effected instantaneously, and therefore, the liquid is ejected with quick response. The driving signal in the form of the pulse is preferably such as disclosed in U.S. Patent Nos. 4,463,359 and 4,345,262.

In addition, the temperature increasing rate of the thermoactive surface is preferably such as disclosed in U.S. Patent No. 4,313,124.

The structure of the recording head may be as shown in U.S. Patent Nos. 4,558,333 and 4,459,600 wherein the thermoactive portion is disposed at a bent portion, as well as the structure of the combination of the discharging port, liquid passage, and the electrothermal transducer as disclosed in the above-mentioned patents (linear type liquid passage or right angle liquid passage).

In addition, the present invention is applicable to the disclosed in Japanese Laid-Open Patent Application No. 59-123670 (123670/1984) wherein a common slit is used as the discharging port for plural electrothermal transducers, and to the structure dis-

closed in Japanese Laid-Open Patent Application No. 59-138461 (138461/1984) wherein an opening for absorbing pressure wave of the thermal energy is formed corresponding to the ejecting portion. This is because the present invention is effective to perform the recording operation assuredly at high efficiency irrespective of the types of the recording head.

In addition, the present invention is applicable to a serial type recording head wherein the recording head is fixed on the main assembly, to a replaceable chip type recording head which is connected electrically with the main apparatus and can be supplied with the ink when it is mounted in the main assembly, or to a cartridge type recording head having an integral ink container.

As regards the kind and number of the recording heads mountable on the carriage, it may be a single head corresponding to a single color ink, or may be plural heads corresponding to a plurality of ink materials having different recording color or density. The present invention is effectively applicable to an apparatus having at least one of a monochromatic mode mainly with black, a multicolor mode with different color ink materials and/or a fullcolor mode using the mixture of the colors, which may be an integrally formed recording unit or a combination of plural recording heads.

Furthermore, in the foregoing embodiments, the ink has been liquid. However, it may be an ink material which is solidified below the room temperature but liquefied at the room temperature. Since the ink is controlled within the temperature not lower than 30°C and not higher than 70°C to stabilize the viscosity of the ink to provide the stabilized ejection in usual recording apparatus of this type, the ink may be such that it is liquid when the recording signal to be used is applied. Besides, by preventing the temperature rise due to thermal energy from being used positively as energy to cause the ink to change its state from solid to liquid or by using the ink which will be solidified when it is left in tact for the purpose of preventing the ink evaporation, the present invention is applicable to an ink material having the property that the ink is liquefied only when thermal energy is applied, such as an ink to be liquefied by the thermal energy applied in accordance with recording signals in any way or an ink to start being solidified immediately when it arrives at a recording sheet.

The ink material adopted in such a case as this may be retained as a liquid or solid material in through holes or recesses formed in a porous sheet as disclosed in Japanese Laid-Open Patent Application No. 54-56847 and Japanese Laid-Open Patent Application No. 60-71260 and may be faced to the electrothermal transducers. The film boiling system is the most effective one for the ink materials described above.

The ink jet recording apparatus may be used as an output terminal of an information processing apparatus such as a computer, as a copying apparatus combined with an image reader or the like, or as a facsimile apparatus having information transmitting and receiving functions.

As described earlier, the present invention is capable of controlling recording operations so that the discharging ports to be used are not locally biased. Consequently, the accumulated discharge number of the ink discharging ports is even off to a certain extent; hence making it difficult to generate any unfavorable foaming due to the accumulation of dye stuff and impurities in the ink material on the exothermic elements. This leads to a significant reduction of record omission and recording distortion. It is thus possible to restrain the recording quality from being degraded in a long term use as well as to prolong the life of recording means.

Also, by using the discharging ports evenly, it becomes unnecessary to move the recording head to the position facing capping means from time to time during the recording operation for ejecting ink in order to prevent any disabled ejection when the ink must be discharged for recording as in the conventional case where the solvent in the ink in the unused nozzles is evaporated to increase its viscosity. Therefore, there is an advantage that the slow down of the recording speed as well as any useless consumption of ink can be prevented among others.

Claims

1. A recording apparatus for performing recording by ejecting ink from a plurality of discharging ports, comprising:

   a control mechanism arranged with plural discharging ports for a plurality of discharging groups to select the conveying amount for a recording medium in accordance with the discharging groups to be used for recording.

2. A recording apparatus according to Claim 1, wherein

   said recording apparatus is provided with ink recording means for energizing electrothermal transducers in accordance with recording signals to generate film boiling in ink by thermal energy generated by said electrothermal transducers to eject ink for performing recording.

3. A recording apparatus according to Claim 2, wherein

   said ink recording means contains ink used for recording.

4. A recording apparatus comprising the following:

   a conveying mechanism for conveying a

recording medium;

a carriage for carrying a recording head for performing recording by ejecting ink from a plurality of discharging ports onto said recording medium in the direction intersecting the conveying direction of said recording medium; and

a control mechanism for setting plural discharging ports for a plurality of discharging groups to select the conveying amount of the recording medium in accordance with the discharging groups to be used for recording.

5. A recording apparatus according to Claim 4, wherein

said recording head performs recording by energizing electrothermal transducers in accordance with recording signals to eject ink for recording by utilizing film boiling generated in the ink by thermal energy generated by said electrothermal transducers.

6. A recording apparatus according to Claim 4, wherein

said ink recording head contains ink used for recording.

7. An ink jet recording apparatus comprising the following:

a conveying mechanism for conveying a recording medium;

a carriage for carrying an ink jet recording head having a plurality of discharging ports arranged substantially in parallel with the conveying direction of said recording medium in the direction intersecting the conveying direction of said recording medium; and

a control mechanism for setting plural discharging ports for a plurality of discharging groups to select the conveying amount of the recording medium in accordance with the discharging groups to be used for recording.

8. An ink jet recording apparatus according to Claim 7, wherein

said ink jet recording head performs recording by energizing electrothermal transducers in accordance with recording signals to eject ink for recording by utilizing film boiling generated in the ink by thermal energy generated by said electrothermal transducers.

9. An ink jet recording apparatus according to Claim 7, wherein

said ink jet recording head contains ink used for recording.

10. An ink jet recording apparatus comprising the following:

a conveying mechanism for conveying a recording medium;

a carriage for carrying an ink jet recording head, having a plurality of discharging ports arranged substantially in parallel with the conveying direction of said recording medium, in the direction intersecting the conveying direction of said recording medium; and

a control mechanism arranged with plural discharging ports for a plurality of discharging groups to select the conveying amount for a recording medium in accordance with the discharging groups to be used for recording, there being present as mixture in said control mechanism the line on which the recording is performed using the discharging port located furthest on the downstream side in the conveying direction of said recording medium in response to the recording signal of the recording signals in one scanning, which is located furthest on the downstream side of the said recording medium, and the line on which the recording is performed using the discharging port located furthest on the upstream side in the conveying direction of the said recording medium in response to the recording signal of the recording signals in one scanning, which is located furthest on the upstream side of said recording medium.

11. An ink jet recording apparatus according to Claim 10, wherein

said ink jet recording head performs recording by energizing electrothermal transducers in accordance with recordings signals to eject ink for recording by utilizing film boiling generated in the ink by thermal energy generated by said electrothermal transducers.

12. An ink jet recording apparatus according to Claim 11, wherein

said ink jet recording head contains ink used for recording.

13. A recording method for performing recording by ejecting ink from a plurality of discharging ports onto a recording medium conveying in a given direction, comprising the following process of:

setting plural discharging ports for a plurality of discharging groups to select the conveying amount of the recording medium in accordance with the discharging groups to be used for recording.

14. A recording method for performing recording by ejecting ink from a plurality of discharging ports onto a recording medium being conveyed in a given direction, which comprises the following process of:

arranging plural discharging ports for a plurality of discharging groups;

giving the positional interval between the discharging port group N_a on the downstream side in the conveying direction of the recording medium and the discharging port group N_b on the upstream side in the conveying direction of the recording medium as L_n, and the line pitch as L_p;

setting the conveying amount of the said recording medium at $L_p - L_n$ when the discharging port group to be used for recording is switched over from the said discharging port group N_a to the said discharging port group N_b; and

setting the conveying amount of the said recording medium at $L_p + L_n$ when the discharging port group to be used for recording is switched over from the said discharging port group N_b to the said discharging port group N_a.

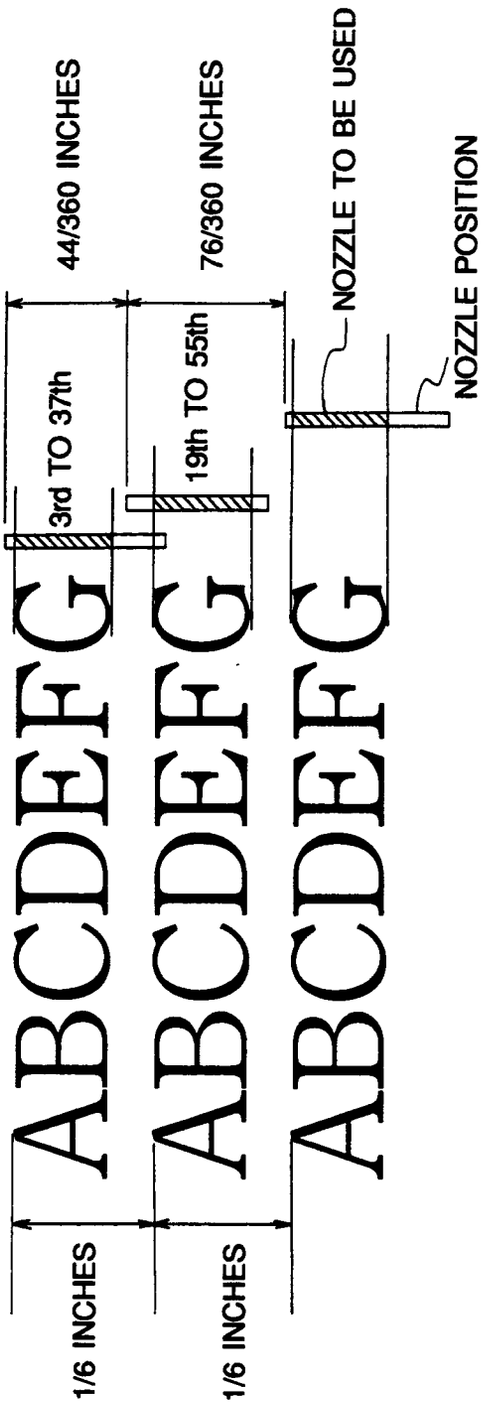
44/360 INCHES
76/360 INCHES
NOZZLE TO BE USED
NOZZLE POSITION
3rd TO 37th
19th TO 55th
1/6 INCHES
1/6 INCHES
ABCDEFG
ABCDEFG
ABCDEFG

FIG. 1

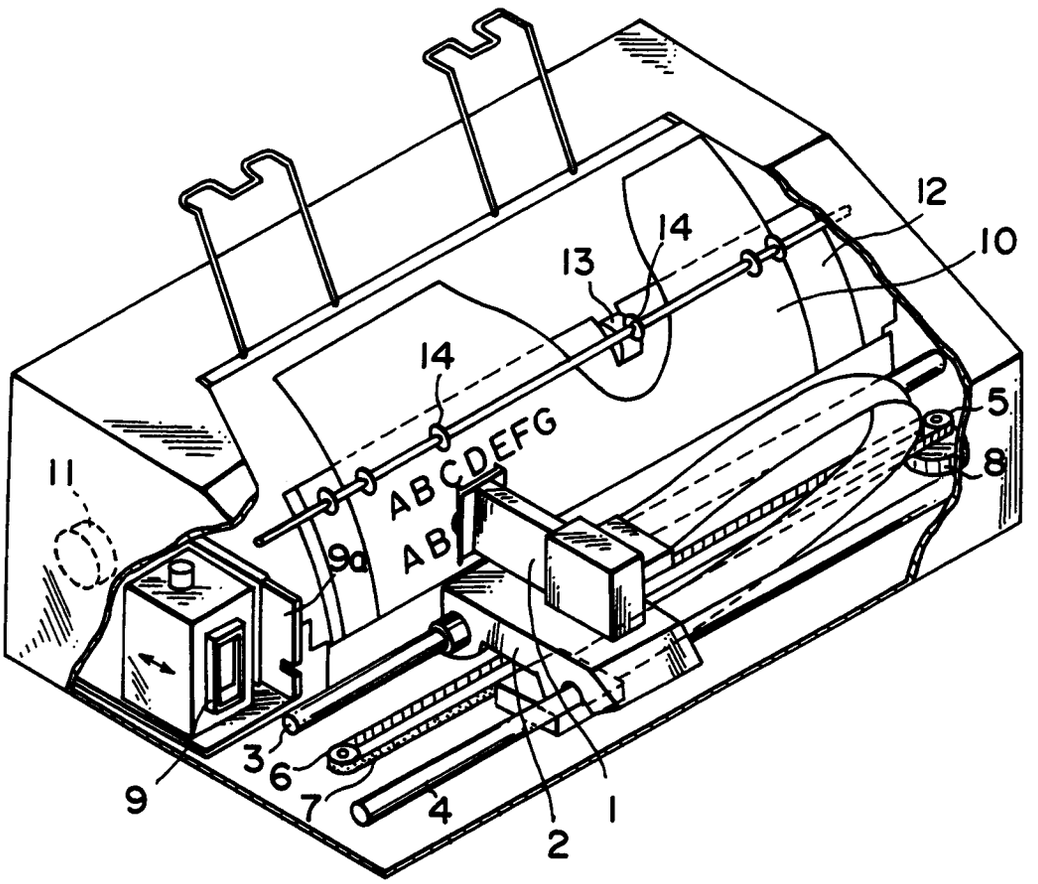

FIG. 2

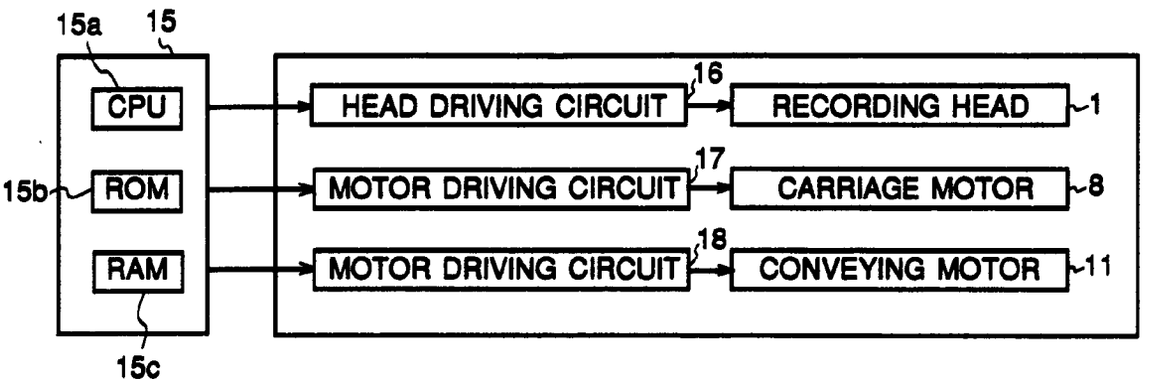
15a
15
CPU
15b
ROM
RAM
15c
HEAD DRIVING CIRCUIT
16
RECORDING HEAD
1
MOTOR DRIVING CIRCUIT
17
CARRIAGE MOTOR
8
MOTOR DRIVING CIRCUIT
18
CONVEYING MOTOR
11

FIG. 3

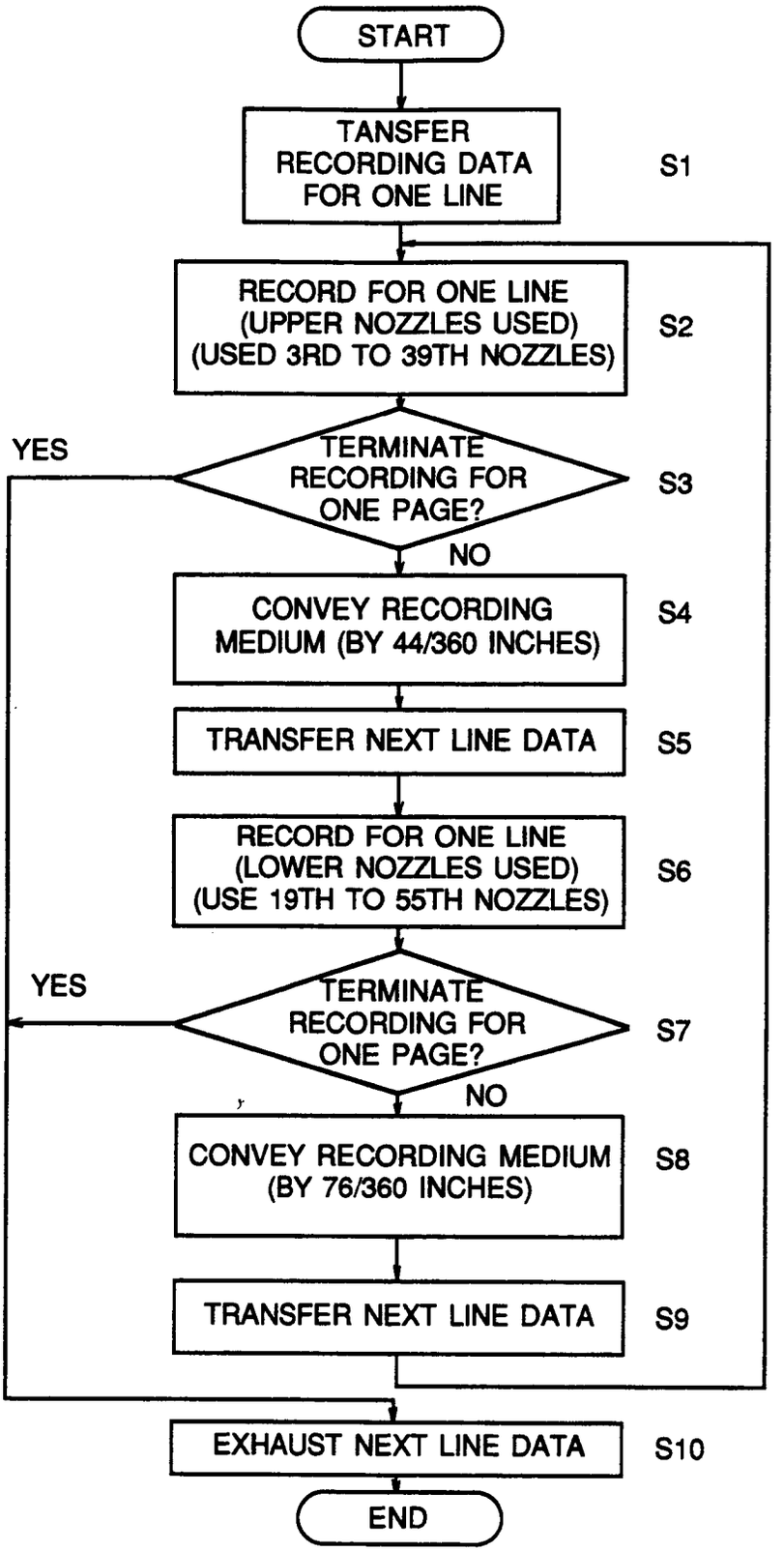
START
TANSFER RECORDING DATA FOR ONE LINE
S1
RECORD FOR ONE LINE (UPPER NOZZLES USED) (USED 3RD TO 39TH NOZZLES)
S2
YES
TERMINATE RECORDING FOR ONE PAGE?
S3
NO
CONVEY RECORDING MEDIUM (BY 44/360 INCHES)
S4
TRANSFER NEXT LINE DATA
S5
RECORD FOR ONE LINE (LOWER NOZZLES USED) (USE 19TH TO 55TH NOZZLES)
S6
YES
TERMINATE RECORDING FOR ONE PAGE?
S7
NO
CONVEY RECORDING MEDIUM (BY 76/360 INCHES)
S8
TRANSFER NEXT LINE DATA
S9
EXHAUST NEXT LINE DATA
S10
END

FIG. 4

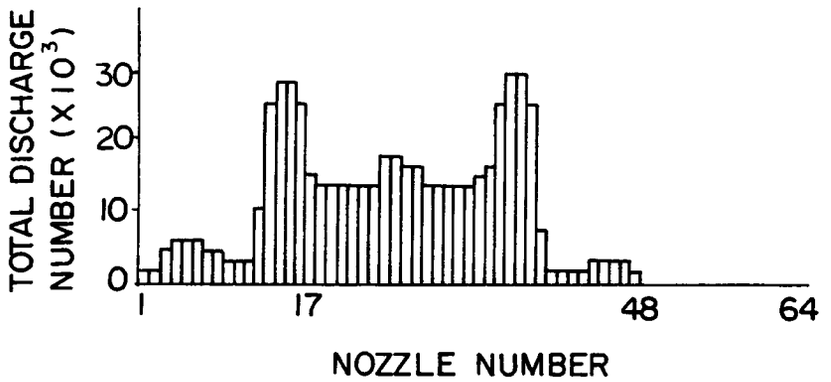
TOTAL DISCHARGE NUMBER (X10³)
30
20
10
0
1
17
48
64
NOZZLE NUMBER

FIG. 5A

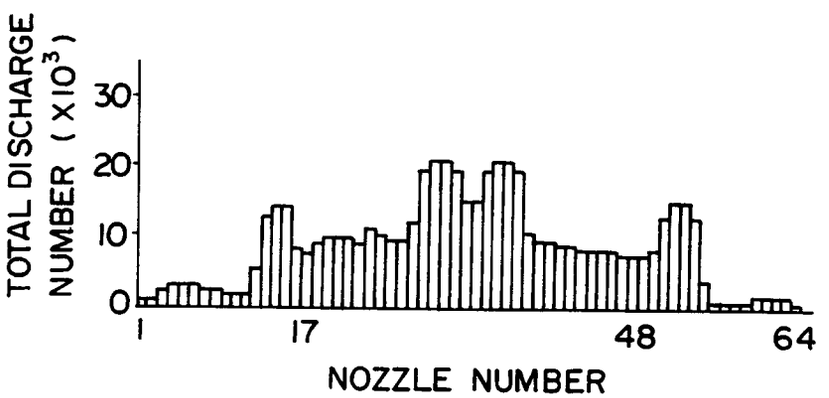
TOTAL DISCHARGE NUMBER (X10³)
30
20
10
0
1
17
48
64
NOZZLE NUMBER

FIG. 5B

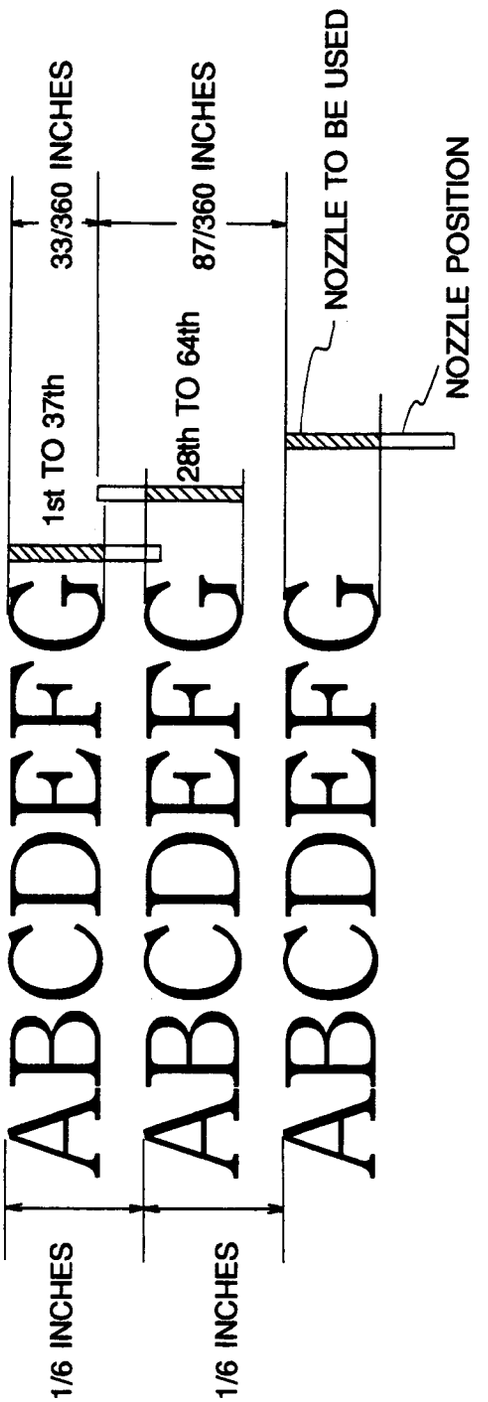
ABCDEFG
ABCDEFG
ABCDEFG
1/6 INCHES
1/6 INCHES
1st TO 37th
33/360 INCHES
28th TO 64th
87/360 INCHES
NOZZLE TO BE USED
NOZZLE POSITION

FIG. 6