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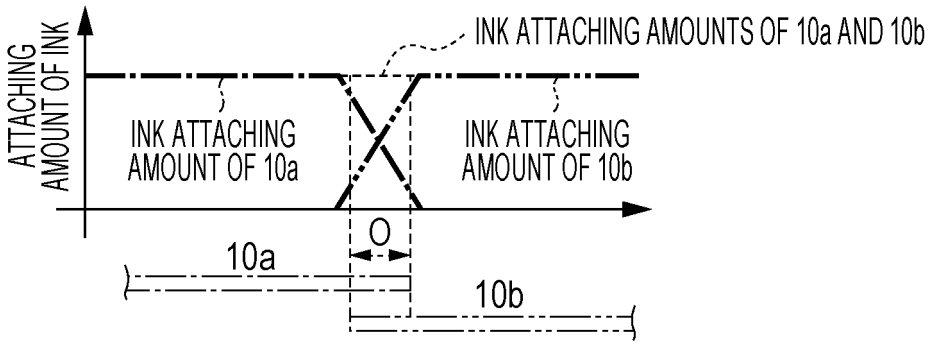
(54) RECORDING APPARATUS AND RECORDING METHOD

(57) A recording apparatus which includes a recording head including a first nozzle column and a second nozzle column in which nozzles which eject ink are aligned in a first direction, and in which partial regions of the first nozzle column and the second nozzle column overlap each other when viewed in a second direction which intersects the first direction; a transport unit which intermittently transports a medium for recording in the first direction; and a carriage which is attached with the recording head, and moves in the second direction at a time of stopping of a relative movement in the intermittent transport, the apparatus further including a unit for changing the number of nozzles which changes the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column and the second nozzle column at a periphery of the partial region, based on a movement speed of the carriage.

FIG. 10C



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Description

BACKGROUND

1. Technical Field

[0001] The present invention relates to a recording apparatus and a recording method.

2. Related Art

[0002] In the related art, a recording apparatus which includes a recording head having a plurality of nozzle columns has been used. For example, as disclosed in JP-A-2007-98866, a recording apparatus which includes a recording head in which a plurality of nozzle columns are arranged by being deviated when viewed from a transport direction of a medium for recording, and which performs bidirectional recording by performing a reciprocating movement in a direction which intersects the transport direction has been used.

[0003] Meanwhile, in recent years, a recording apparatus which can perform recording on a various types of mediums for recording has been used.

[0004] As described above, in recent years, the recording apparatus which can perform recording on various types of mediums for recording has been used; however, in such a recording apparatus, it is necessary to set a gap (referred to as paper gap (PG), working gap (WG), or the like) between a recording head and a medium for recording which face each other to be large in order to correspond to various types of mediums for recording.

[0005] However, when the gap is set to be large, a landing position of ink ejected from a recording head with respect to a medium for recording is easily deviated. In particular, ink is apt to be ejected in a radially expanded manner in a nozzle column direction. For this reason, when the gap is set to be large, in a recording apparatus in the related art which includes a recording head in which a plurality of nozzle columns are arranged by being deviated in a relative movement direction with respect to a medium for recording, there is a case in which a stripe-shaped defect in image quality (for example, portion which is recorded at boundary portion is recorded to be thick compared to another portion) occurs at a portion which is recorded at the boundary portion between each of the nozzle columns of the recording head.

SUMMARY

[0006] An advantage of some aspects of the invention is to prevent or reduce a stripe-shaped defect in image quality from occurring in a medium for recording.

[0007] According to an aspect of the invention, there is provided a recording apparatus which includes a recording head including a first nozzle column and a second nozzle column in which nozzles which eject ink are aligned in a first direction, and in which partial regions of the first nozzle column and the second nozzle column overlap each other when viewed in a second direction which intersects the first direction; a transport unit which intermittently transports a medium for recording in the first direction; a carriage which is attached with the recording head, and moves in the second direction at a time of stopping of a relative movement in the intermittent transport; and a unit for changing the number of nozzles which changes the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column and the second nozzle column at a periphery of the partial region, based on a movement speed of the carriage.

[0008] The recording apparatus may further include a calculation unit which calculates an attaching amount of the ink per unit volume of the medium for recording based on recording data; and a unit for changing the number of nozzles which changes the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column and the second nozzle column at the periphery of the partial region, based on the movement speed of the carriage, and a calculation result of the calculation unit.

[0009] The recording apparatus may further include a storage unit which stores the number of nozzles of which ejecting amounts are controlled which is changed using the unit for changing the number of nozzles.

[0010] In the recording apparatus, a nozzle forming unit of the recording head may protrude from the carriage.

[0011] In the recording apparatus, the transport unit may change a movement amount of the relative movement per one time in the intermittent transport based on the movement speed of the carriage.

[0012] In the recording apparatus, the unit for changing the number of nozzles may change the number of nozzles of which the ejecting amounts are controlled corresponding to a boundary portion of an image which is formed before and after the relative movement in the intermittent transport, based on the movement speed of the carriage.

[0013] In the recording apparatus, the calculation unit may calculate an average attaching amount of the ink in the entire recording head based on the recording data.

[0014] In the recording apparatus, the recording head may eject ink droplets of a plurality of sizes, the recording apparatus may perform recording in a plurality of recording modes for each of the ink droplets, and the unit for changing the number of nozzles may change the number of nozzles of which the ejecting amounts are controlled in each of the recording modes.

[0015] According to another aspect of the invention, there is provided a recording method which is performed using a recording apparatus which includes a recording head including a first nozzle column and a second nozzle column in which nozzles which eject ink are aligned in a first direction, and in which partial regions of the first nozzle column and the second nozzle column overlap each other when viewed in a second direction which intersects the first direction; a transport unit which intermittently

transports a medium for recording in the first direction; and a carriage which is attached with the recording head, and moves in the second direction at a time of stopping of a relative movement in the intermittent transport, the method including changing of the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column and the second nozzle column at a periphery in the partial region, based on a movement speed of the carriage.

[0016] According to the invention, it is possible to prevent or reduce a stripe-shaped defect in image quality from occurring in a medium for recording.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings, wherein like numbers reference like elements.

Fig. 1 is a schematic side view which illustrates a recording apparatus according to an embodiment of the invention.

Fig. 2 is a schematic rear view which illustrates a carriage of the recording apparatus according to the embodiment of the invention.

Fig. 3 is a block diagram of the recording apparatus according to the embodiment of the invention.

Figs. 4A and 4B are diagrams which describe a mechanism in which a stripe-shaped defect in image quality occurs.

Fig. 5 is a diagram which describes a mechanism in which the stripe-shaped defect in image quality occurs.

Fig. 6 is a graph which denotes a deviation amount of a landing position of ink with respect to a recording duty.

Fig. 7 is a graph which denotes a deviation amount of a landing position of ink with respect to a carriage speed.

Fig. 8 is a conceptual diagram of the stripe-shaped defect in image quality.

Figs. 9A to 9C are diagrams which describe a control for suppressing the stripe-shaped defect in image quality.

Figs. 10A to 10C are diagrams which describe a control for suppressing the stripe-shaped defect in image quality.

Fig. 11 is a flowchart of a recording method according to the embodiment.

Fig. 12 is a flowchart of the recording method according to the embodiment.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0018] Hereinafter, a recording apparatus according to an embodiment of the invention will be described in detail with reference to the accompanying drawings.

[0019] Fig. 1 is a schematic side view which illustrates a recording apparatus 1 according to the embodiment of the invention.

[0020] The recording apparatus 1 according to the embodiment includes an adhesive belt 2 which is stretched between a transport roller 3 which rotates in a rotation direction C and a driven roller 4, and transports a medium for recording P in a transport direction A by supporting the medium.

[0021] Here, the "adhesive belt" is a belt on which an adhesive which holds a medium for recording by bonding the medium for recording onto a face on which the medium for recording is supported so as to be separated is applied.

[0022] In addition, a carriage 5 onto which a recording head 9 which ejects ink onto the medium for recording P from an ink ejecting face (nozzle forming unit) F is attached is provided on a transport path of the medium for recording P using the adhesive belt 2. The carriage 5 can perform a reciprocating movement in a scanning direction B which intersects the transport direction A.

[0023] Here, in the recording apparatus with such a configuration, an air current (air current in which ink ejected from recording head 9 is radiated (expanded) in a transport direction A, and is easily ejected) which is denoted in a direction E is easily generated accompanied with the reciprocating movement of the carriage 5 in the scanning direction B.

[0024] The recording head 9 is configured of a first recording head 9a (refer to Fig. 2), and a second recording head 9b (refer to Fig. 2), and the first recording head 9a and the second recording head 9b are arranged by being shifted in the transport direction A. In addition, the recording head 9 moves accompanying the reciprocating movement of the carriage 5 in the scanning direction B, causes ink to be ejected onto the medium for recording P from the ink ejecting face F, and forms a desired image.

[0025] In addition, the recording apparatus 1 according to the embodiment includes the recording head 9 which performs recording while performing the reciprocating movement; however, the recording apparatus may be a recording apparatus which includes a so-called line head in which a plurality of nozzles which eject ink are provided in a direction intersecting the transport direction A.

[0026] Here, the "line head" is a recording head in which a region of nozzles which is formed in a direction intersecting the transport direction A of the medium for recording P is provided so as to cover the entire portion in the direction intersecting the transport direction A of the medium for recording P, and is used in a recording apparatus which forms an image by relatively moving the recording head or the medium for recording P. In addition, the region of the nozzles in the direction intersecting the transport direction A of the line head need not cover the entire portion in the direction intersecting the transport direction A of the medium for recording P.

[0027] Here, as illustrated in Fig. 1, in the recording apparatus 1 according to the embodiment, the ink eject-

ing face F which is the nozzle forming unit of the recording head 9 protrudes from the carriage 5.

[0028] For this reason, a strong air current is easily generated accompanying the reciprocating movement of the recording head 9 in the scanning direction B; however, it is possible to change an attaching amount of ink (recording duty) per unit volume of the medium for recording using a control which will be described later. That is, it is possible to adjust image density at the periphery of an overlapping portion O (refer to Fig. 2) between the first recording head 9a and the second recording head 9b to an appropriate value.

[0029] In addition, the recording apparatus has a configuration in which it is possible to improve stability in recording when performing continuous recording since the air current moves ink mist from the recording head 9.

[0030] In the recording apparatus 1 according to the embodiment, the medium for recording P is separated from the adhesive belt 2 in a predetermined range, and is wound up using a winding unit 8 through a driven roller 7 which is fixed to a predetermined position. In addition, the winding unit 8 causes the medium for recording P to rotate in a rotation direction C when winding up the medium for recording P.

[0031] However, the recording apparatus is not limited to a recording apparatus which includes a transport mechanism with such a configuration, and for example, may be a recording apparatus with a configuration in which the medium for recording P is transported by being interposed between a pair of transport rollers.

[0032] In addition, the recording apparatus 1 according to the embodiment has a configuration in which it is possible to perform recording on the medium for recording P of a roll shape; however it is not limited to such a configuration, and it may be a configuration in which it is possible to perform recording on a medium for recording P of a cut sheet.

[0033] With such a configuration, the recording apparatus 1 according to the embodiment intermittently transports the medium for recording P in the transport direction A using the adhesive belt 2 as the transport unit, and performs recording by causing the carriage 5 to perform reciprocating movement in the scanning direction B when transporting of the medium for recording P in the intermittent transport is stopped.

[0034] In such a configuration, since the recording head 9 moves in the scanning direction B, a strong air current is easily generated accompanying a movement of the recording head 9, and a landing position of ink ejected from the recording head 9 onto the medium for recording P is easily deviated. However, it is a configuration in which it is possible to adjust image density at the periphery of the overlapping portion O between the first recording head 9a and the second recording head 9b to an appropriate value using a control which will be described later, and to suppress an occurrence of the stripe-shaped defect in image quality on the medium for recording P.

[0035] Subsequently, the carriage 5 in the recording apparatus 1 according to the embodiment will be described.

[0036] Fig. 2 is a schematic rear view which illustrates the carriage 5 of the recording apparatus 1 according to the embodiment.

[0037] The carriage 5 according to the embodiment is attached with the first recording head 9a which includes a first nozzle column 10a in which nozzles N (refer to Figs. 9A to 9C) which eject ink are aligned in the transport direction A of the medium for recording P, and the second recording head 9b which includes a second nozzle column 10b in which nozzles N which eject ink are aligned in the transport direction A of the medium for recording P. In addition, the first recording head 9a and the second recording head 9b are arranged so as to configure the overlapping portion O at which the first nozzle column 10a of the first recording head 9a and the second nozzle column 10b of the second recording head 9b overlap each other when viewed in the scanning direction B. In addition, it is possible to perform bidirectional recording when the carriage 5 with such a configuration performs reciprocating movement in the scanning direction B which intersects the transport direction A, and ink is ejected from the first recording head 9a and the second recording head 9b.

[0038] Here, when a direction in which nozzles N (refer to Figs. 9A to 9C) which eject ink are aligned is set to a first direction, and a direction which intersects the first direction is set to a second direction, in the recording apparatus 1 according to the embodiment, the transport direction A corresponds to the first direction, and the scanning direction B corresponds to the second direction.

[0039] Meanwhile, in a recording apparatus which includes an immovable line head as a recording head, since nozzles of the line head are aligned in a direction intersecting a transport direction of a medium for recording P, the transport direction of the medium for recording P corresponds to the second direction.

[0040] Here, as illustrated in Fig. 2, the recording head 9 according to the embodiment can be expressed as a recording head which includes the first nozzle column 10a and the second nozzle column 10b in which nozzles which eject ink are aligned in the first direction, and the overlapping portion O in which partial regions of the first nozzle column 10a and the second nozzle column 10b overlap each other when viewed from the second direction which intersects the first direction in which the nozzles are aligned.

[0041] In addition, the carriage 5 according to the embodiment includes the first recording head 9a and the second recording head 9b, and in the first recording head 9a, four nozzle columns 10a which are provided corresponding to each ink of black, cyan, magenta, and yellow mounted on the recording apparatus 1 according to the embodiment are provided. In addition, in the second recording head 9b, four nozzle columns 10b which are provided corresponding to each of the inks are provided.

[0042] However, it is not limited to such a configuration, and it may be a configuration in which only on or more of the ink colours may be mounted, or ink of other colors may be mounted in addition to those.

[0043] In addition, it may be a configuration in which many more recording heads 9 are provided, or a configuration in which a plurality of nozzle columns which are aligned in the first direction are included in one recording head, and the partial regions of the plurality of nozzle columns overlap each other when viewed in the second direction.

[0044] Subsequently, an electrical configuration of the recording apparatus 1 according to the embodiment will be described.

[0045] Fig. 3 is a block diagram of the recording apparatus 1 according to the embodiment.

[0046] The CPU 14 which is in charge of controlling of the entire recording apparatus 1 is provided in the control unit 13. The CPU 14 is connected to a ROM 16 in which various control programs, a maintenance sequence, and the like, which are executed by the CPU 14 are stored, and a RAM 17 which can temporarily store data through a system bus 15.

[0047] In addition, the CPU 14 is connected to a head driving unit 18 for driving the first recording head 9a and the second recording head 9b through the system bus 15.

[0048] In addition, the CPU 14 is connected to a carriage motor 20 for moving the carriage 5, a transport motor 21 as a driving source of a driving roller 3 as a movement mechanism of the adhesive belt 2 which transports the medium for recording P by supporting the medium, and a winding motor 22 as a driving source of the winding unit 8 through the system bus 15 and a motor driving unit 19.

[0049] In addition, the CPU 14 is connected to an input-output unit 6 through the system bus 15, and the input-output unit 6 is connected to a sensor 12 which can detect a gap between the recording head and the medium for recording (referred to as paper gap (PG), working gap (WG), or the like), and a PC 11 which is an external device which inputs recording data, or the like, to the recording apparatus 1 through the system bus 15.

[0050] Subsequently, a mechanism in which the stripe-shaped defect in image quality occurs will be described.

[0051] Figs. 4A to 5 are diagrams which describe the mechanism in which the stripe-shaped defect in image quality occurs.

[0052] Since an air current is generated accompanying a movement of the carriage 5 or a transport of the medium for recording P, and a flight direction of ink which is ejected from the nozzle columns 10a and 10b of the first recording head 9a and the second recording head 9b is changed, there is a case in which an ejecting width in an aligning direction of the nozzle N (direction which goes along transport direction A in the embodiment) is changed. Figs. 4A and 4B are diagrams which schematically illustrate the fact, and Fig. 4A illustrates an ideal ejecting state in which the ejecting width L1 is approximately the same as the nozzle column width. In addition, Fig. 4B illustrates an ejecting state in which the ejecting width is changed, and the ejecting width L2 becomes longer than the nozzle column width.

[0053] As is understood when comparing the state in Fig. 4A to the state in Fig. 4B, the ejecting width L2 in Fig. 4B becomes longer than the ejecting width L1 in Fig. 4A. A state of an air current is changed according to a recording duty, a movement speed of the carriage 5, a size of ink droplets which are ejected from the nozzle columns 10a and 10b, a gap between the recording head and the medium for recording, or the like. For this reason, the ejecting width is changed. For this reason, there is a case in which a dot position is not adjusted to a correct position even when adjusting of a dot position of ink which is ejected from the first recording head 9a and the second recording head 9b is performed.

[0054] Fig. 5 illustrates a state in which the stripe-shaped defect in image quality (black stripe D: stripe-shaped defect of dark color in image quality which is caused when ink ejected from first recording head 9a overlaps ink ejected from second recording head 9b in overlapping portion O) occurs in a case in which a recording duty in a forward movement of the carriage 5 in the reciprocating movement is set to be small (for example, average duty 20%), and a recording duty in a return movement is set to be large (for example, average duty 80%). In a different perspective, the ejecting width which is illustrated in Fig. 4A becomes L1 in the recording in the forward direction; however, the ejecting width which is illustrated in Fig. 4B becomes L2 (longer than ejecting width L1) in the recording in the return direction, and it is a state in which the black stripe D occurs in recording in the return direction.

[0055] In addition, in Fig. 5, in a recording image I which is recorded in the recording apparatus 1, which portion in the recording image I is recorded in which stages of reading scanning (pass) of the first recording head 9a and the second recording head 9b is illustrated.

[0056] In addition, it is set so that the recording image I is completed when the same portion is subjected to recording scanning four times.

[0057] The image portion I1 in the recording image I in Fig. 5 is a portion which is recorded using the second recording head 9b using recording in the forward direction which is the first pass, is recorded using the second recording head 9b using recording in the return direction which is the second pass, is recorded using the first recording head 9a using recording in the forward direction which is the third pass, and is recorded using the first recording head 9a using recording in the return direction which is the fourth pass.

[0058] In addition, the image portion I2 in the recording image I is a portion which is recorded using the second recording head 9b using recording in the return direction which is the second pass, is recorded using the second recording head 9b using recording in the forward direction which is the third pass, is recorded using the first

recording head 9a using recording in the return direction which is the fourth pass, and is recorded using the first recording head 9a using recording in the forward direction which is the fifth pass.

[0059] The image portion I3 in the recording image I is a portion which is recorded using the second recording head 9b using recording in the forward direction which is the third pass, is recorded using the second recording head 9b using recording in the return direction which is the fourth pass, is recorded using the first recording head 9a using recording in the forward direction which is the fifth pass, and is recorded using the first recording head 9a using recording in the return direction which is the sixth pass.

[0060] In addition, the image portions I4 to I9 are also similarly recorded according to the correspondence illustrated in Fig. 5.

[0061] As described above, when a recording duty is large, and an ejecting width is larger than a desired ejecting width L1 (when performing recording in return direction), the black stripe D occurs.

[0062] Specifically, the black stripe D occurs at a boundary between the image portion I2 and the image portion I3 which is recorded at the overlapping portion O when performing recording in the return direction which is the fourth pass.

[0063] In addition, the black stripe D occurs at a boundary between the image portion I4 and the image portion I5 which is recorded at the overlapping portion O when performing recording in the return direction which is the sixth pass.

[0064] The black stripe D occurs at a boundary between the image portion I6 and the image portion I7 which is recorded at the overlapping portion O when performing recording in the return direction which is the eighth pass.

[0065] In addition, the black stripe D occurs at a boundary between the image portion I8 and the image portion I9 which is recorded at the overlapping portion O when performing recording in the return direction which is the tenth pass.

[0066] Here, Fig. 6 is a graph which denotes a deviation amount of a landing position of ink with respect to a recording duty. In Fig. 6, the horizontal axis denotes a recording duty (average duty which is obtained by calculating average attaching amount of ink in the entire recording head 9 based on recording data), and the vertical axis denotes a deviation amount of a landing position of ink using the number of nozzles (correction value (nozzle)).

[0067] As illustrated in Fig. 6, when the average duty is approximately 20%, there is almost no deviation of a landing position of ink; however, in contrast to this, there is a deviation of an amount of three nozzles when the average duty is approximately 50%, and, there is a deviation of an amount of six nozzles when the average duty is approximately 100%. In this manner, the larger the recording duty, the larger the deviation amount of the landing position of ink.

[0068] Therefore, the control unit 13 according to the embodiment can calculate a recording duty based on recording data which is input from the PC 11, and can change the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the overlapping portion O based on a calculation result thereof. That is, the control unit 13 according to the embodiment also functions as a calculation unit of a recording duty, and the unit for changing the number of nozzles which changes the number of nozzles at the periphery of the overlapping portion O.

[0069] As denoted in Fig. 6, a deviation of the landing position of ink which is ejected from the recording head 9 on the medium for recording P corresponds to a recording duty. For this reason, the recording apparatus 1 according to the embodiment has a configuration in which a recording duty is calculated based on recording data, it is possible to adjust image density at the periphery of the overlapping portion O to an appropriate value, by changing the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the overlapping portion O based on a calculation result thereof, and to suppress an occurrence of the stripe-shaped defect in image quality such as the black stripe D on the medium for recording P.

[0070] Meanwhile, the deviation of the landing position of ink also depends on a carriage speed.

[0071] Fig. 7 is a graph which denotes a deviation amount of the landing position of ink with respect to a carriage speed. In Fig. 7, the horizontal axis denotes a carriage speed (which is expressed using ratio to the maximum carriage speed), and the vertical axis denotes a deviation amount of the landing position of ink (radiation amount (μm)).

[0072] As denoted in Fig. 7, when the carriage speed is approximately 20%, there is almost no deviation of landing position of ink; however, in contrast to this, there is a deviation of approximately 100 μm in the landing position when the carriage speed is approximately 50%, and there is a deviation of approximately 230 μm in the landing position when the carriage speed is approximately 100%. In this manner, the larger the carriage speed, the larger the deviation amount of the landing position of ink.

[0073] Therefore, the control unit 13 according to the embodiment can change the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the overlapping portion O based on the movement speed of the carriage 5 as the unit for changing the number of nozzles.

[0074] As denoted in Fig. 7, a deviation of the landing position of ink which is ejected from the recording head 9 on the medium for recording P corresponds to a carriage speed. The reason for this is that, in the configuration which includes the carriage 5 which is attached with

the recording head 9, and performs reciprocating movement, since the recording head 9 moves, a strong air current is easily generated accompanying the movement of the recording head 9, and the landing position of ink which is ejected from the recording head 9 on the medium for recording P is easily deviated. For this reason, the recording apparatus 1 according to the embodiment has a configuration in which it is possible to adjust image density at the periphery of the overlapping portion O to an appropriate value, and to suppress the occurrence of a stripe-shaped defect in image quality such as the black stripe D on the medium for recording P, by changing the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the overlapping portion O based on the movement speed of the carriage 5.

[0075] In other words, the recording apparatus 1 according to the embodiment has a configuration in which it is possible to adjust image density at the periphery of the overlapping portion O to an appropriate value, and to suppress the occurrence of a stripe-shaped defect in image quality such as the black stripe D on the medium for recording P, by changing the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the overlapping portion O based on at least one of a recording duty and the movement speed of the carriage 5.

[0076] In addition, it may be a configuration in which the number of nozzles of which ejecting amounts are controlled is changed based on a gap between the recording head and the medium for recording, or the like, in addition to a recording duty or the carriage speed.

[0077] Subsequently, how to specifically make the number of nozzles, in which ejecting amounts are controlled, at the periphery of the overlapping portion O different in order to suppress the stripe-shaped defect in image quality (black stripe D, for example,) in the recording apparatus 1 according to the embodiment, will be described. However, it is not limited to the following embodiment.

[0078] Fig. 8 is a conceptual diagram of the black stripe D, Figs. 9A to 9C are diagrams which denote the nozzles N at the periphery of the overlapping portion O of the first nozzle column 10a and the second nozzle column 10b, and Figs. 10A to 10C are diagrams which denote an attaching amount of ink (ejecting amount) using the first nozzle column 10a and the second nozzle column 10b.

[0079] Among the nozzles N in Figs. 9A to 9C, a nozzle N1 denotes a nozzle which is subjected to controlling of an ejecting amount, and a nozzle N2 denotes a nozzle which is not subjected to controlling of an ejecting amount. In the overlapping portion O, ink can be ejected from both of the first nozzle column 10a and the second nozzle column 10b. That is, when controlling of an ejecting amount is not performed with respect to the nozzle at the overlapping portion O, an attaching amount of ink at a portion which is recorded at the overlapping portion O becomes two times that in a portion which is recorded in another region. For this reason, in the overlapping portion O, controlling of an ejecting amount is performed so that a sum of ejecting amounts of ink of the first nozzle column 10a and the second nozzle column 10b becomes appropriate.

[0080] The controlling of an ejecting amount in the recording apparatus 1 according to the embodiment is performed so that, in the overlapping portion O, ink is ejected from any one of the first nozzle column 10a and the second nozzle column 10b. In other words, controlling is performed so that a total recording duty at the overlapping portion O which is obtained by adding a recording duty of the first nozzle column 10a to a recording duty of the second nozzle column 10b becomes 100% of the required recording duty.

[0081] Fig. 9A illustrates arrangements of the nozzle N1 which is subjected to controlling of an ejecting amount, and nozzle N2 which is not subjected to controlling of an ejecting amount in a normal state (state in which ejecting width and nozzle column width are approximately the same as denoted in Fig. 4A)

[0082] In such a state, as denoted in Fig. 10A, an attaching amount of ink of the first nozzle column 10a, a sum of attaching amounts of ink of the first nozzle column 10a and the second nozzle column 10b at the overlapping portion O, and an attaching amount of ink of the second nozzle column 10b are approximately constant.

[0083] That is, since a recording duty of the overlapping portion O is controlled so as to be linearly changed from 100% to 0% for the first nozzle column 10a and the second nozzle column 10b, respectively, the closer the nozzle N1 in the overlapping portion O is towards the end of the respective nozzle column. In this way, a total recording duty becomes 100% in the overlapping portion O.

[0084] However, in the state in which the ejecting width becomes larger than the nozzle column width as denoted in Fig. 4B, when a nozzle arrangement which is denoted in Fig. 9A is performed, an attaching amount of ink at the periphery of the overlapping portion O becomes larger than the appropriate value, as denoted in Fig. 10B.

[0085] For this reason, the recording apparatus 1 according to the embodiment can change the arrangement to the nozzle arrangement which is denoted in Fig. 9B, or the nozzle arrangement which is denoted in Fig. 9C using a control of the control unit 13. That is, the number of nozzles N1 is increased by changing a part of the nozzles N2 to the nozzle N1. In this manner, as denoted in Fig. 10C, by changing the nozzle arrangements of the nozzle N1 and the nozzle N2, it is possible to make an attaching amount of ink of the first nozzle column 10a, a sum of attaching amounts of ink of the first nozzle column 10a and the second nozzle column 10b at the periphery of the overlapping portion O, and an attaching amount of ink of the second nozzle column 10b approximately constant.

[0086] In addition, in Fig. 9B, the nozzles N1 in the first

nozzle column 10a and the second nozzle column 10b are increased by 1, and in Fig. 9C, the nozzles N1 in the first nozzle column 10a and the second nozzle column 10b are increased by 3; however, it is preferable to adopt a configuration in which the number of nozzles N1 can be adjusted according to the ejecting width.

[0087] In other words, the recording apparatus 1 according to the embodiment can change the number of nozzles N1 which are subjected to controlling of an ejecting amount at the periphery of the overlapping portion O based on at least one of a recording duty and a movement speed of the carriage 5.

[0088] Here, the number of nozzles N1 when the nozzle N1 is increased as denoted in Fig. 9B or 9C is referred to as the logical number of nozzles, and the number of nozzles N1 at the overlapping portion in Fig. 9A is referred to as the physical number of nozzles.

[0089] Specifically, it can be said that Fig. 9B denotes a state in which, in each of the first nozzle column 10a and the second nozzle column 10b, recording control is performed by setting the nozzles N1 of which the physical number is 5 to nozzles N1 of which the logical number is 6. In addition, it can be said that Fig. 9C denotes a state in which recording control is performed by setting the nozzles N1 of which the physical number is 5 to nozzles N1 of which the logical number is 8 in each of the first nozzle column 10a and the second nozzle column 10b.

[0090] In Figs. 9B and 9C, the logical number of nozzles N is increased with respect to the physical number of nozzles N1 in both of the first nozzle column 10a and the second nozzle column 10b; however, the increasing may be performed in any one of the first nozzle column 10a and the second nozzle column 10b, and in such a case, in case of Fig. 9B, the logical number of nozzles may be set to 5 (that is, the physical number of nozzles N1 is 5, as is) in the second nozzle column 10b, by setting the logical number of nozzles N to 7 only in the first nozzle column 10a, and in case of Fig. 9C, the logical number of nozzles may be set to 5 (that is, the physical number of nozzles N1 is 5, as is) in the second nozzle column 10b, by setting the logical number of nozzles N to 11 only in the first nozzle column 10a.

[0091] In other words, it may be a configuration in which a total value of the logical number of nozzles N1 in the first nozzle column 10a and the logical number of nozzles N1 in the second nozzle column 10b becomes 12 in case of Fig. 9B, and 16 in case of Fig. 9C.

[0092] In addition, in the recording apparatus 1 according to the embodiment, the number of nozzles of which ejecting amounts are controlled which is changed by the control unit 13 is stored in the ROM 16 as a storage unit in advance. Specifically, a database (storage data) in which a recording duty, a movement speed of the carriage 5, the number of nozzles (the number of nozzles of which ejecting amounts are controlled at the periphery of the overlapping portion O) are correlated with each other is stored in the ROM 16.

[0093] In this manner, for example, by storing the number of nozzles of which ejecting amounts are controlled prior to shipping, in advance, it is possible to omit work to be performed in advance by a user such as inputting of the number of nozzles of which ejecting amounts are controlled from the PC 11, or the like, by obtaining the number of nozzles of which ejecting amounts are controlled by the user. That is, it is possible to reduce a load of a user.

[0094] In addition, the adhesive belt 2 as the transport unit can change a movement amount of the medium for recording P per one time in the intermittent transport, based on at least one of a calculation result of an attaching amount of ink at the periphery of the landing position which is calculated by the control unit 13 and a movement speed of the carriage, using a control of the control unit 13. That is, it is possible to change an amount of line break (transport amount) when performing a line break which is accompanied with intermittent recording to an appropriate value according to an assumed ejecting width. For this reason, the recording apparatus 1 according to the embodiment has a configuration in which it is possible to suppress the stripe-shaped defect in image quality which occurs at a time of line break in the intermittent recording.

[0095] In addition, the control unit 13 can change the number of nozzles of which ejecting amounts are controlled at a boundary portion accompanying the line break (before and after movement of medium for recording P in intermittent transport of medium for recording P) based on at least one of a calculation result of an attaching amount of ink at the periphery of the overlapping portion O and a movement speed of the carriage 5, instead of changing the amount of line break. That is, it is possible to change the number of nozzles to be used (recording duty) which correspond to a boundary portion of an image which is formed before and after an intermittent transport of one time which can be performed accompanying the line break of the intermittent recording according to an assumed ejecting width. For this reason, the recording apparatus 1 according to the embodiment has a configuration in which it is possible to adjust image density at the boundary portion to an appropriate value, and to suppress an occurrence of the stripe-shaped defect in image quality on the medium for recording.

[0096] In addition, the control unit 13 can calculate an average attaching amount of ink in the entire recording head 9 (first recording head 9a and second recording head 9b) based on the recording data which is input from the PC 11. For this reason, it is possible to easily calculate the attaching amount of ink.

[0097] In addition, in the control unit 13 according to the embodiment, it is also possible to calculate an attaching amount of ink at the periphery of the overlapping portion O in every movement of the carriage 5 in the forward direction and return direction, in each ink, or in each recording head. In addition, a calculation method of an attaching amount of ink is not particularly limited.

[0098] The recording head 9 according to the embodiment can eject ink droplets of a plurality of sizes. In addition, the recording apparatus 1 according to the embodiment can perform recording in a plurality of recording modes in each of ink droplets of the plurality of sizes. The control unit 13 can change the number of nozzles at the periphery of the overlapping portion O in each recording mode.

[0099] A deviation of a landing position of ink which is ejected from the recording head 9 onto the medium for recording P corresponds to a size of ink droplets which are ejected from the recording head 9. Specifically, the smaller the size of ink droplets, the larger the ejecting width. However, the recording apparatus 1 according to the embodiment can change the number of nozzles of which ejecting amounts are controlled by corresponding to a size of ink droplets. For this reason, the recording apparatus has a configuration in which it is possible to effectively suppress an occurrence of the stripe-shaped defect in image quality on the medium for recording P.

Embodiment of recording method (Figs. 11 and 12)

[0100] Subsequently, a recording method according to an embodiment will be described with reference to Figs. 11 and 12.

[0101] In addition, the recording method in the embodiment is an embodiment of a recording method which is executed using the recording apparatus 1 according to the embodiment.

[0102] First, a recording method which is described in the flowchart in Fig. 11 will be described.

[0103] When the recording method in the embodiment is started, first, recording data is received (input) from the PC 11 in step S110.

[0104] Subsequently, in step S120, an average duty is determined by the control unit 13. In other words, the step is a calculation process in which an attaching amount of ink per unit volume of the medium for recording P is calculated based on recording data.

[0105] Subsequently, in step S130, the control unit 13 changes the number of nozzles based on a database (storage data) in which the average duty and the number of nozzles (the number of nozzles in which ejecting amount is controlled at periphery of overlapping portion O) are correlated with each other, and which is stored in the ROM 16. In other words, the step is a process of changing the number of nozzles of which ejecting amounts are controlled, in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the overlapping portion O based on the calculation result in step S120.

[0106] Subsequently, in step S140, an amount of line break (transport amount) when performing line break which is accompanied with the intermittent transport is changed based on the calculation result in the calculation process in step S120. In addition, a process may be executed, in which the number of nozzles of which ejecting amounts are controlled is changed at the boundary portion before and after an intermittent transport of one time which is performed accompanying the line break of intermittent recording. The process may be based on a calculation result in the calculation process in step S120, instead of the step (changing of amount of line break).

[0107] Subsequently, imaging process is executed based on recording data in step S150, a recording process is executed in step S160, and processes in the recording method according to the embodiment are finished.

[0108] In the recording method according to the embodiment, an attaching amount of ink per unit volume of the medium for recording P is calculated based on recording data, and the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the overlapping portion O is changed based on the calculation result. For this reason, it is possible to adjust image density at the boundary portion between the first nozzle column 10a and the second nozzle column 10b which is the periphery of the overlapping portion O to an appropriate value, and to suppress an occurrence of the stripe-shaped defect in image quality on the medium for recording P.

[0109] Subsequently, a recording method which is described in the flowchart in Fig. 12 will be described.

[0110] Since processes in steps S110, S150, and S160 are the same as those in the recording method which is described in the flowchart in Fig. 11, descriptions thereof will be omitted.

[0111] In the recording method according to the embodiment, in step S125 which is a continuous process of step S110, a carriage speed is determined by the control unit 13.

[0112] Subsequently, in step S135, the control unit 13 changes the number of nozzles based on a database (storage data) in which the carriage speed and the number of nozzles (the number of nozzles of which ejecting amounts are controlled at the periphery of overlapping portion O) are correlated with each other, and which is stored in the ROM 16. In other words, the step is a process of changing the number of nozzles of which ejecting amounts are controlled, in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the overlapping portion O based on the movement speed of the carriage 5.

[0113] Subsequently, in step S145, an amount of line break (transport amount) at a time of line break which is accompanied with intermittent transport is changed to an appropriate value based on the movement speed of the carriage 5, and the process proceeds to step S150. In addition, a process in which the number of nozzles of which ejecting amounts are controlled is changed at the boundary portion before and after an intermittent transport of one time which is performed accompanying the line break of intermittent recording may be executed, based on the movement speed of the carriage 5, instead

of the step (changing of amount of line break).

[0114] In the recording method according to the embodiment, the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the overlapping portion O is changed based on the movement speed of the carriage 5. That is, it is possible to change a recording duty at the boundary portion between the first nozzle column 10a and the second nozzle column 10b which is the periphery of the overlapping portion O, based on the movement speed of the carriage 5. For this reason, it is possible to adjust image density at the boundary portion to an appropriate value, and to suppress an occurrence of the stripe-shaped defect in image quality on the medium for recording P.

[0115] In addition, the invention is not limited to the above described embodiments, can be variously modified in the scope of the invention which is described in claims, and naturally, those are also included in the scope of the invention.

[0116] For example, controlling of an ejecting amount in the above described embodiment is performed so that a recording duty at the overlapping portion O is linearly changed from 100% to 0% of the first nozzle column 10a and the second nozzle column 10b, respectively; however, it is not limited to this, and an ejecting weight itself of ink droplets which are ejected from nozzles in one ejecting operation may be changed.

[0117] Hitherto, the invention has been described in detail, based on specific embodiments. Here, the invention will be collectively described once again.

[0118] A recording apparatus 1 according to a first aspect of the invention includes a recording head 9 which includes a first nozzle column 10a and a second nozzle column 10b in nozzles N which eject ink are aligned in a first direction A, and in which partial regions O of the first nozzle column 10a and the second nozzle column 10b overlap each other when viewed in a second direction B which intersects the first direction A, a transport unit 2 which intermittently transports a medium for recording P in the first direction A, and a carriage 5 which is attached with the recording head 9, and moves in the second direction B at a time of stopping of a relative movement in the intermittent transport, and further includes a unit for changing the number of nozzles 13 which changes the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the partial region O, based on a movement speed of the carriage 5.

[0119] A deviation of a landing position of ink which is ejected from the recording head 9 on the medium for recording P corresponds to the movement speed of the carriage 5 to which the recording head 9 is attached. In a configuration which includes the carriage 5 which is attached with the recording head 9, and performs reciprocating movement, since the recording head 9 moves, a strong air current is easily generated accompanying the movement of the recording head 9, and the landing position of ink which is ejected from the recording head 9 on the medium for recording P is easily deviated.

[0120] However, according to the aspect, the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the partial region O is changed based on the movement speed of the carriage 5. That is, it is possible to change a recording duty at the boundary portion between the first nozzle column 10a and the second nozzle column 10b at the periphery of the partial region O, based on the movement speed of the carriage 5. For this reason, it is possible to adjust image density at the boundary portion, and to suppress an occurrence of the stripe-shaped defect in image quality on the medium for recording P.

[0121] A second aspect of the invention provides the recording apparatus 1 according to the first aspect which further includes a calculation unit 13 which calculates an attaching amount of the ink per unit volume of the medium for recording P based on recording data; and a unit for changing the number of nozzles 13 which changes the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery in the partial region O, based on the movement speed of the carriage 5 and a calculation result of the calculation unit 13, in the first embodiment.

[0122] A deviation of the landing position of ink which is ejected from the recording head 9 on the medium for recording P corresponds to an attaching amount of ink (recording duty) per unit volume of the medium for recording P.

[0123] According to the aspect, an attaching amount of ink per unit volume of the medium for recording P is calculated based on recording data, and the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the partial portion O is changed based on a calculation result thereof. That is, it is possible to change a recording duty at the boundary portion between the first nozzle column 10a and the second nozzle column 10b which is the periphery of the partial region O. For this reason, it is possible to adjust image density at the boundary portion to an appropriate value, and to suppress an occurrence of the stripe-shaped defect in image quality on the medium for recording P.

[0124] A third aspect of the invention provides the recording apparatus 1 according to the first or second aspect which further includes a storage unit 16 which stores the number of nozzles which are changed using the unit for changing the number of nozzles 13.

[0125] According to the aspect, the storage unit 16 which stores the number of nozzles which are changed using the unit for changing the number of nozzles 13 is included. For this reason, for example, by storing the number of nozzles of which ejecting amounts are con-

trolled prior to shipping, in advance, it is possible omit work to be performed in advance by a user, such as inputting of the number of nozzles of which ejecting amounts are controlled, or the like, by the user, and to reduce a load of the user.

[0126] A fourth aspect of the invention provides the recording apparatus 1 according to any one of the first to third aspects, in which a nozzle forming unit F of the recording head 9 protrudes from the carriage 5.

[0127] According to the aspect, the nozzle forming unit F of the recording head 9 protrudes from the carriage 5. For this reason, though a strong air current is easily generated accompanying the movement of the recording head 9, since it is possible to change the recoding duty at the periphery of the partial region O, image density at the periphery of the partial region O can be adjusted to an appropriate value. In addition, it is possible to improve stability in recording when performing continuous recording when the air current moves ink mist from the recording head 9.

[0128] A fifth aspect of the invention provides the recording apparatus 1 according to any one of the first to fourth aspects, in which the transport unit 2 changes a movement amount of the relative movement per one time in the intermittent transport based on the movement speed of the carriage 5.

[0129] According to the aspect, the transport unit 2 changes the movement amount of the relative movement per one time in the intermittent transport based on the movement speed of the carriage 5. That is, it is possible to set an amount of line break (transport amount) when performing line break which is accompanied with intermittent recording to an appropriate value. For this reason, it is possible to suppress the stripe-shaped defect in image quality which occurs at a time of line break in the intermittent recording.

[0130] A sixth aspect of the invention provides the recording apparatus 1 according to any one of the first to fourth aspects, in which the unit for changing the number of nozzles 13 changes the number of nozzles of which ejecting amounts are controlled which correspond to the boundary portion of an image which is formed before and after the relative movement in the intermittent transport based on the movement speed of the carriage 5.

[0131] According to the aspect, the unit for changing the number of nozzles 13 changes the number of nozzles of which ejecting amounts are controlled which correspond to the boundary portion of an image which is formed before and after the relative movement in the intermittent transport based on the movement speed of the carriage 5. That is, it is possible to change a recording duty at the boundary portion before and after the intermittent transport of one time which can be performed accompanying the line break of the intermittent recording, and to suppress an occurrence of the stripe-shaped defect in image quality on the medium for recording P.

[0132] A seventh aspect of the invention provides the recording apparatus 1 according to the second aspect, in which the calculation unit 13 calculates an average attaching amount of ink in the entire recording head 9 based on the recording data.

[0133] According to the aspect, the calculation unit 13 calculates an average attaching amount of ink in the entire recording head 9 based on the recording data. For this reason, it is possible to easily calculate an attaching amount of the ink.

[0134] An eighth aspect of the invention provides the recording apparatus 1 according to any one of the first to seventh aspects, in which the recording head 9 can eject ink droplets of a plurality of sizes, the recording apparatus 1 can perform recording in a plurality of recording modes in each of the ink droplets, and the unit for changing the number of nozzles 13 can change the number of nozzles of which ejecting amounts are controlled in each of the recording modes.

[0135] According to the aspect, the recording head 9 can eject ink droplets of the plurality of sizes, the recording apparatus 1 can perform recording in the plurality of recording modes in each of the ink droplets, and the unit for changing the number of nozzles 13 can change the number of nozzles of which ejecting amounts are controlled in each of the recording modes. A deviation of a landing position of ink which is ejected from the recording head 9 on the medium for recording P corresponds to a size of ink droplets which are ejected from the recording head 9; however, it is possible to change the number of nozzles of which ejecting amounts are controlled corresponding to the size. For this reason, in the recording apparatus 1 which can eject ink droplets of a plurality of sizes, it is possible to effectively suppress an occurrence of the stripe-shaped defect in image quality on the medium for recording P.

[0136] A recording method according to a ninth aspect of the invention which is performed using the recording apparatus 1 which includes the recording head 9 including the first nozzle column 10a and the second nozzle column 10b in which nozzles N which eject ink are aligned in the first direction A, and in which partial regions O of the first nozzle column 10a and the second nozzle column 10b overlap each other when viewed in the second direction B which intersects the first direction A, the transport unit 2 which intermittently transports the medium for recording P in the first direction A, and a carriage 5 which is attached with the recording head 9, and moves in the second direction B at a time of stopping of a relative movement in the intermittent transport, the method includes changing the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the partial region O based on the movement speed of the carriage 5.

[0137] According to the aspect, the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column 10a and the second nozzle column 10b at the periphery of the partial region O is changed based on the movement speed of the carriage

5. That is, it is possible to change a recording duty at the boundary portion between the first nozzle column 10a and the second nozzle column 10b which is the periphery of the partial region O based on a movement speed of the carriage 5. For this reason, it is possible to adjust image density at the boundary portion to an appropriate value, and to suppress the occurrence of a stripe-shaped defect in image quality on the medium for recording P.

Claims

1. A recording apparatus (1) comprising:

a recording head (9) including a first nozzle column (10a) and a second nozzle column (10b) in which nozzles for ejecting ink are aligned in a first direction (A), and in which partial regions (O) of the first nozzle column and the second nozzle column overlap each other when viewed in a second direction (B) which intersects the first direction;
a transport unit (2) which is configured to intermittently transport a medium (P) for recording in the first direction;
a carriage (5) to which the recording head is attached, and which is configured to move in the second direction at a time of stopping of a relative movement in the intermittent transport; and
a unit (14) for changing the number of nozzles which is configured to change the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column and the second nozzle column at a periphery of the partial region, based on a movement speed of the carriage.

2. The recording apparatus according to claim 1, further comprising:

a calculation unit (14) which is configured to calculate an attaching amount of the ink per unit volume of the medium for recording based on recording data; and
a unit (14) for changing the number of nozzles which is configured to change the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column and the second nozzle column at the periphery of the partial region, based on the movement speed of the carriage, and a calculation result of the calculation unit.

3. The recording apparatus according to claim 1 or claim 2, further comprising:

a storage unit (16) which stores the number of nozzles of which ejecting amounts are controlled which is changed using the unit for changing the number of nozzles.

4. The recording apparatus according to any one of the preceding claims,
wherein a nozzle forming unit (F) of the recording head protrudes from the carriage.

5. The recording apparatus according to any one of the preceding claims,
wherein the transport unit is configured to change a movement amount of the relative movement per one time in the intermittent transport based on the movement speed of the carriage.

6. The recording apparatus according to any one of the preceding claims,
wherein the unit for changing the number of nozzles is configured to change the number of nozzles of which the ejecting amounts are controlled corresponding to a boundary portion of an image which is formed before and after the relative movement in the intermittent transport, based on the movement speed of the carriage.

7. The recording apparatus according to any one of the preceding claims,
wherein the calculation unit is configured to calculate an average attaching amount of the ink in the entire recording head based on the recording data.

8. The recording apparatus according to any one of the preceding claims,
wherein the recording head is configured to eject ink droplets of a plurality of sizes,
wherein the recording apparatus is configured to perform recording in a plurality of recording modes for each of the ink droplets, and
wherein the unit for changing the number of nozzles is configured to change the number of nozzles of which the ejecting amounts are controlled in each of the recording modes.

9. A recording method which is performed using a recording apparatus (1) which includes
a recording head (9) including a first nozzle column (10a) and a second nozzle column (10b) in which nozzles which eject ink are aligned in a first direction (A), and in which partial regions (O) of the first nozzle column and the second nozzle column overlap each other when viewed in a second direction (B) which intersects the first direction;
a transport unit (2) which intermittently transports a medium (P) for recording in the first direction; and
a carriage (5) to which the recording head is attached, and which moves in the second direction at a time of stopping of a relative movement in the intermittent transport, the method comprising:

changing the number of nozzles of which ejecting amounts are controlled in at least one of the first nozzle column and the second nozzle column at a periphery in the partial region, based on a movement speed of the carriage.

FIG. 1

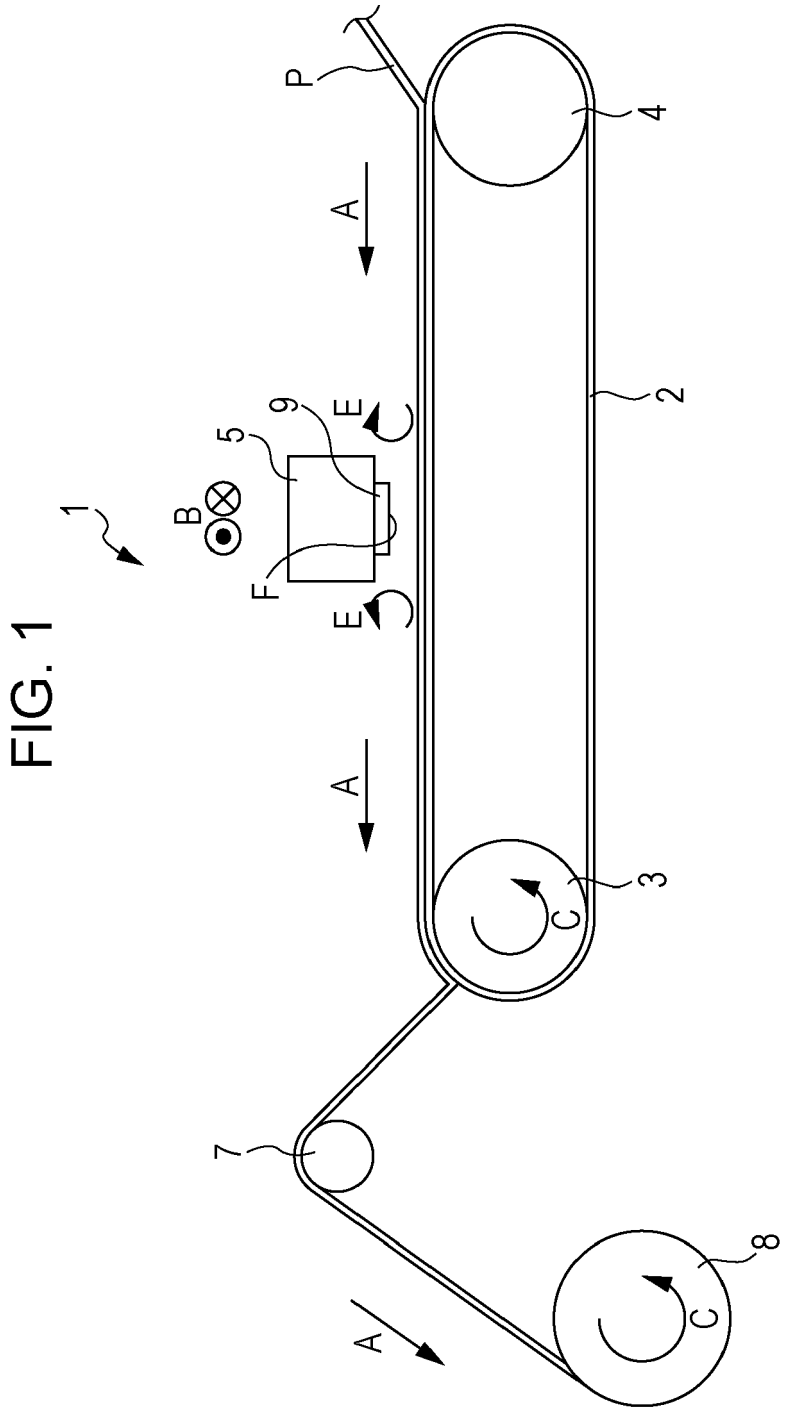


FIG. 2

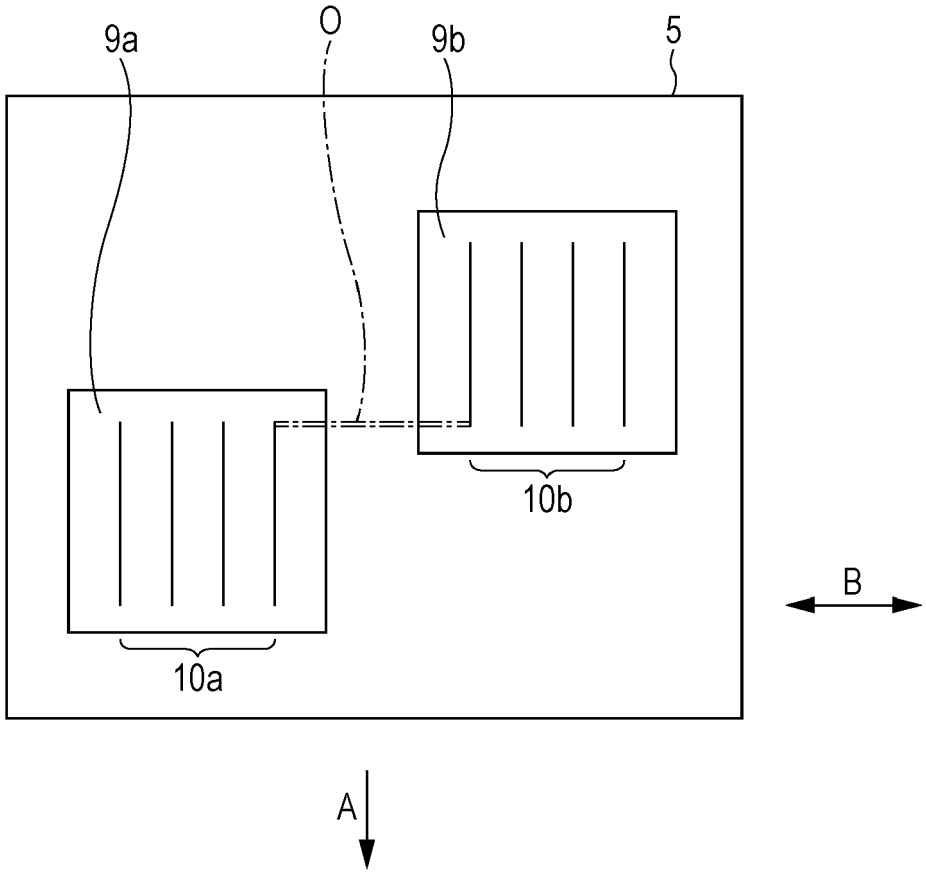


FIG. 3

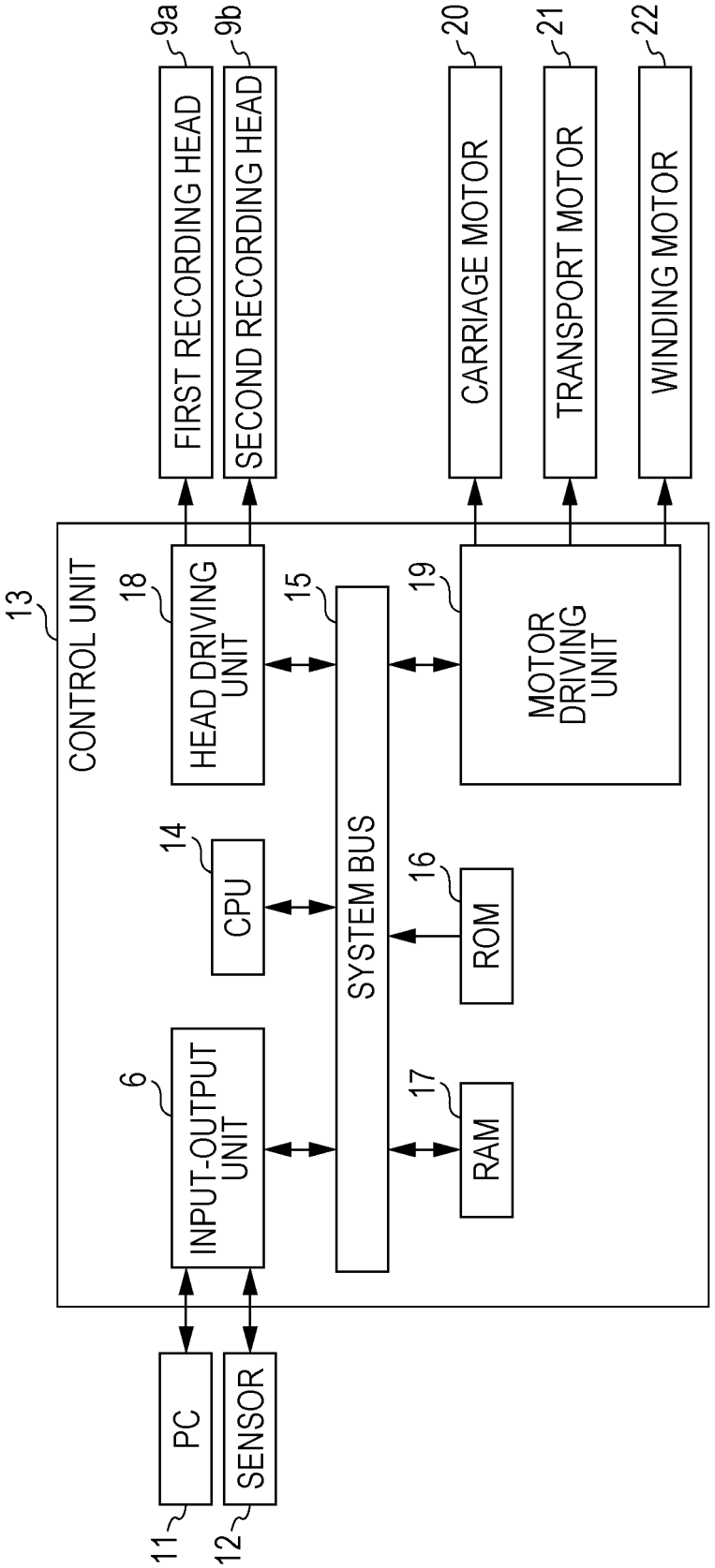

9a
9b
20
21
22
FIRST RECORDING HEAD
SECOND RECORDING HEAD
CARRIAGE MOTOR
TRANSPORT MOTOR
WINDING MOTOR
13
CONTROL UNIT
18
HEAD DRIVING UNIT
15
19
MOTOR DRIVING UNIT
14
CPU
SYSTEM BUS
16
ROM
6
INPUT-OUTPUT UNIT
17
RAM
PC
SENSOR
11
12

FIG. 4A

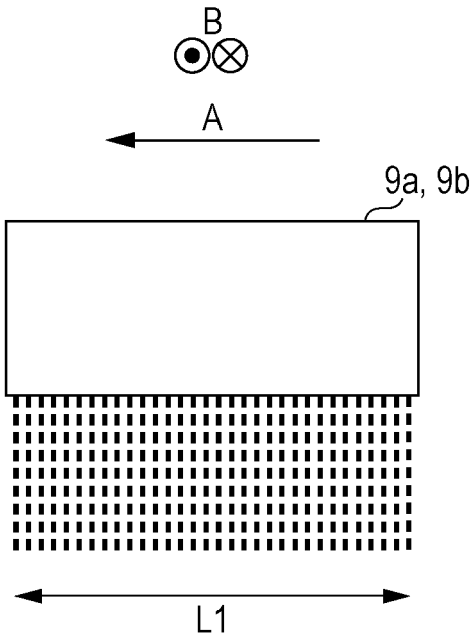


FIG. 4B

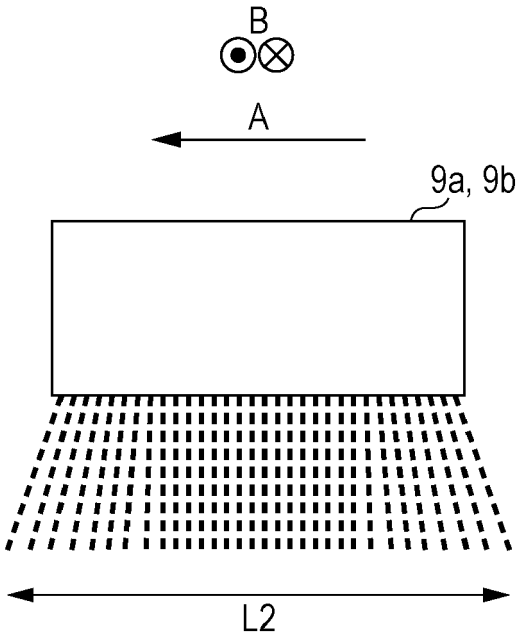


FIG. 5

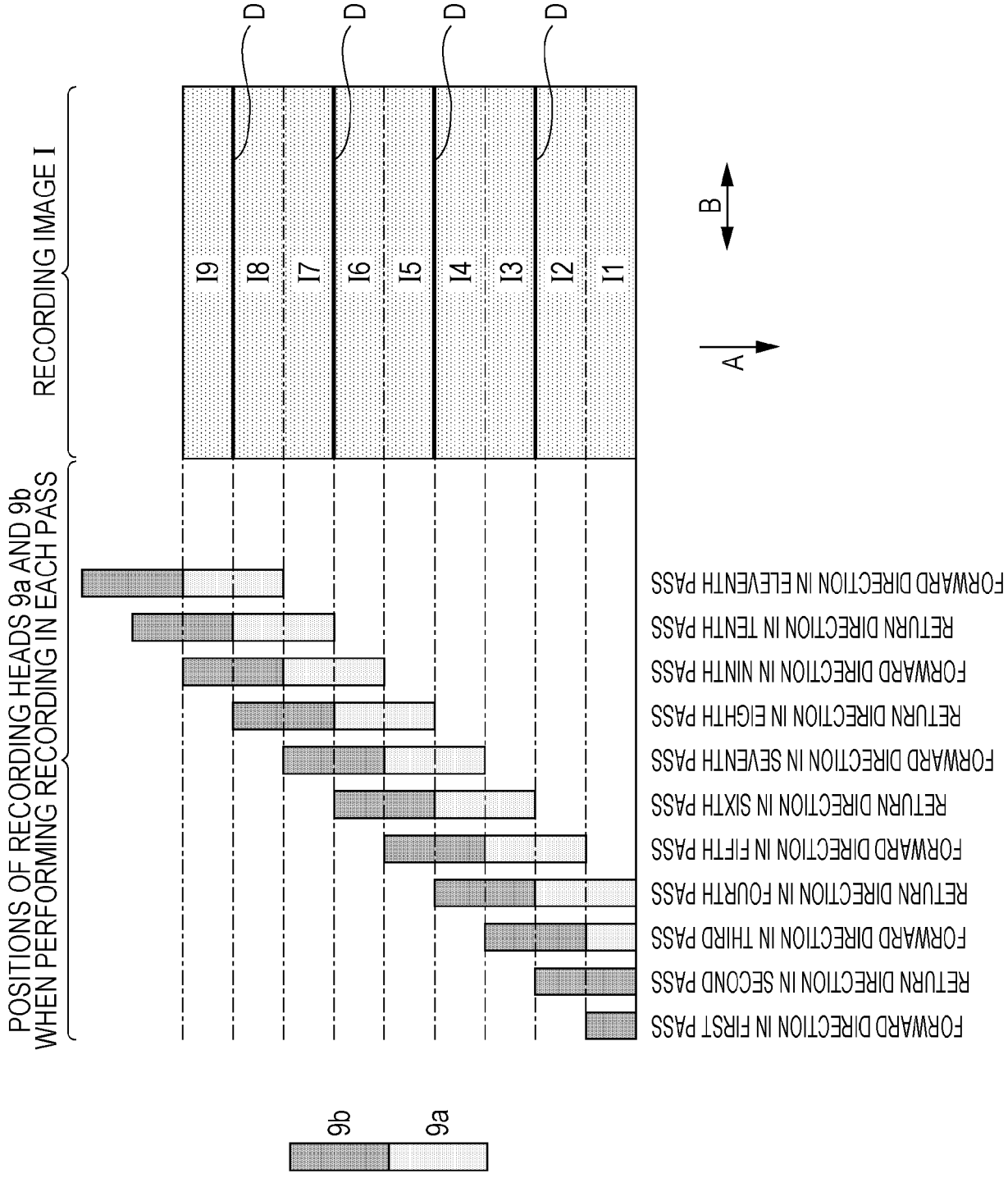

RECORDING IMAGE I
POSITIONS OF RECORDING HEADS 9a AND 9b WHEN PERFORMING RECORDING IN EACH PASS
I9
I8
I7
I6
I5
I4
I3
I2
I1
D
A
B
9b
9a
FORWARD DIRECTION IN FIRST PASS
RETURN DIRECTION IN SECOND PASS
FORWARD DIRECTION IN THIRD PASS
RETURN DIRECTION IN FOURTH PASS
FORWARD DIRECTION IN FIFTH PASS
RETURN DIRECTION IN SIXTH PASS
FORWARD DIRECTION IN SEVENTH PASS
RETURN DIRECTION IN EIGHTH PASS
FORWARD DIRECTION IN NINTH PASS
RETURN DIRECTION IN TENTH PASS
FORWARD DIRECTION IN ELEVENTH PASS

FIG. 6

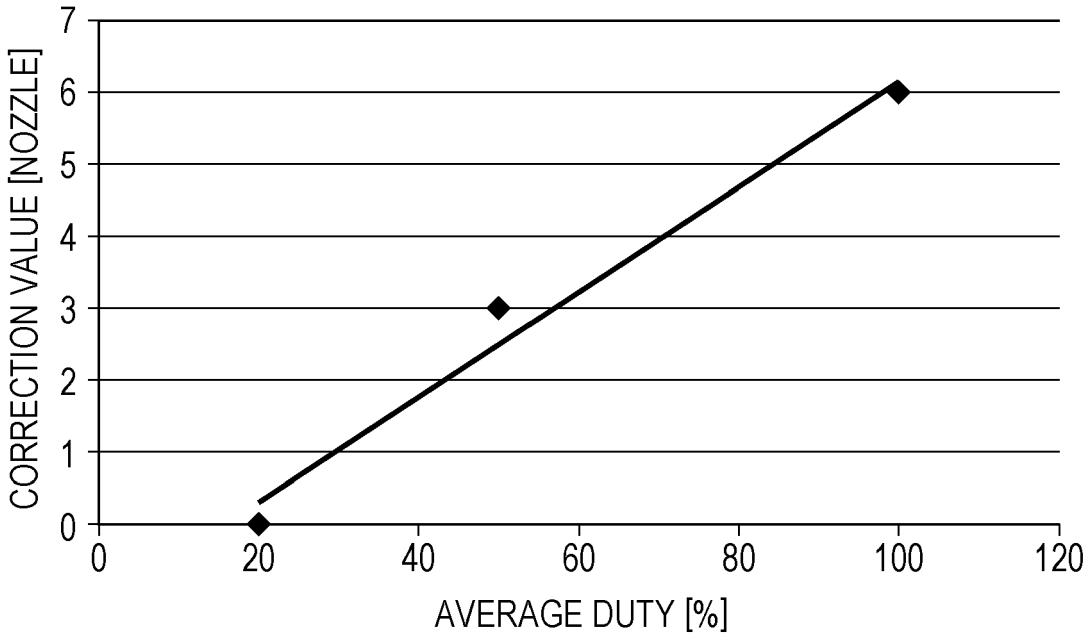

CORRECTION VALUE [NOZZLE]
0
1
2
3
4
5
6
7
0
20
40
60
80
100
120
AVERAGE DUTY [%]

FIG. 7

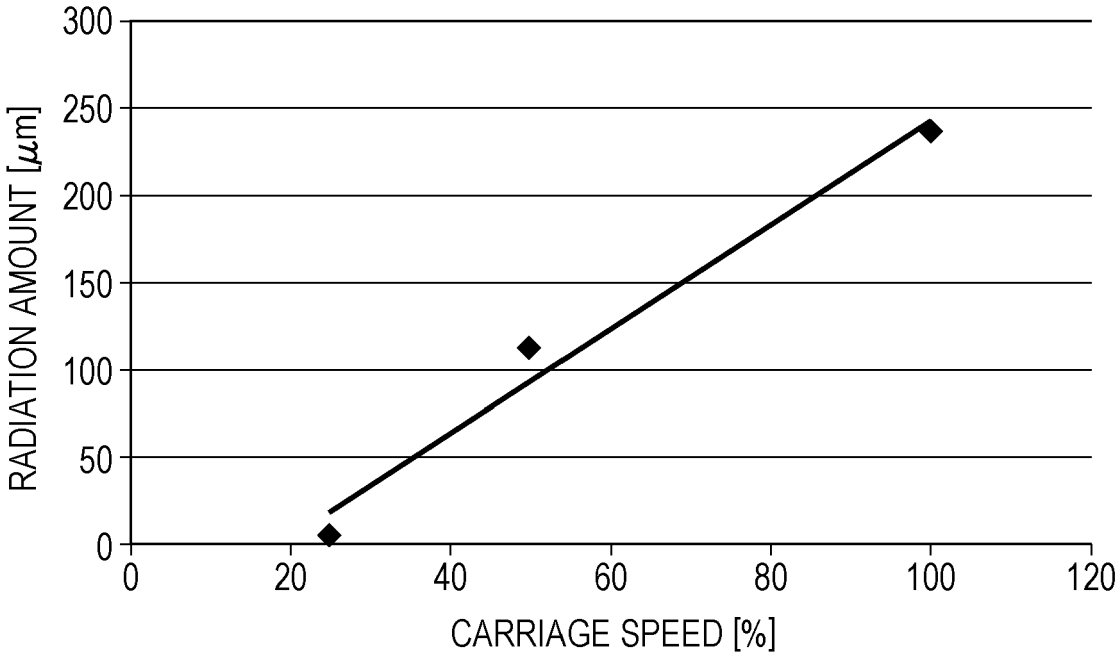

RADIATION AMOUNT [μm]
0
50
100
150
200
250
300
0
20
40
60
80
100
120
CARRIAGE SPEED [%]

FIG. 8

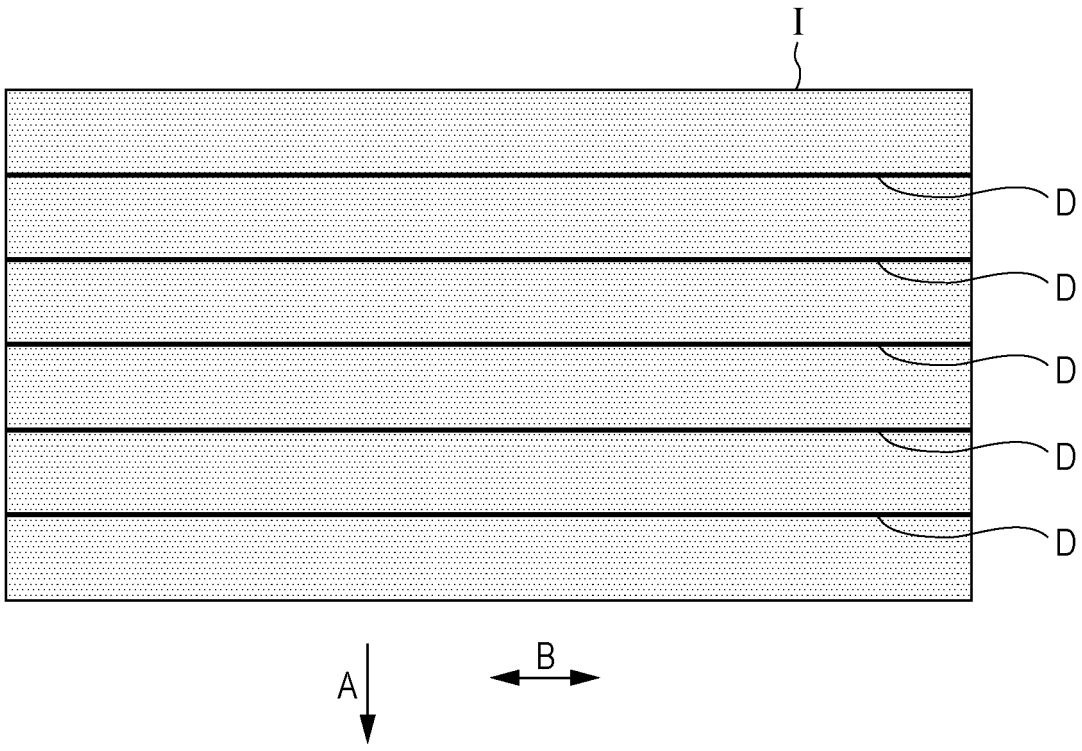


FIG. 9C

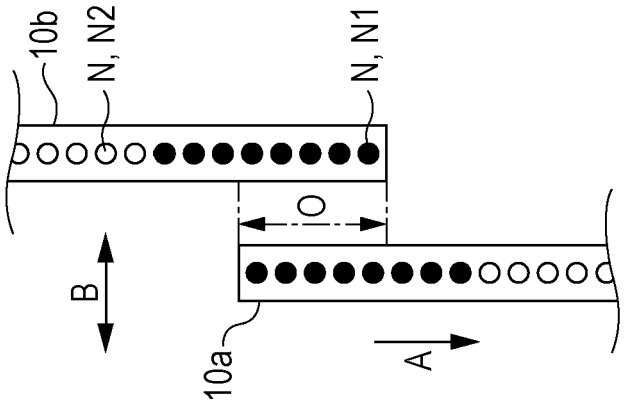


FIG. 9B

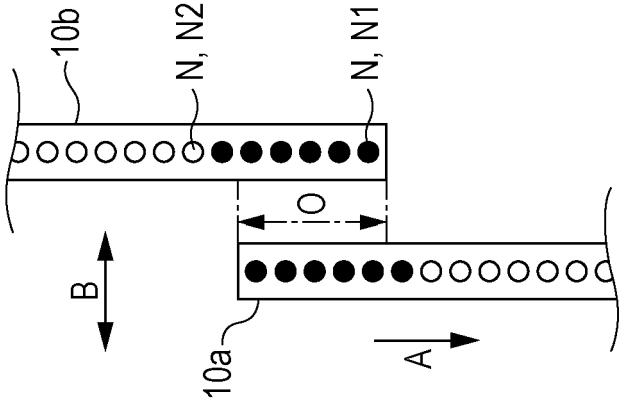


FIG. 9A

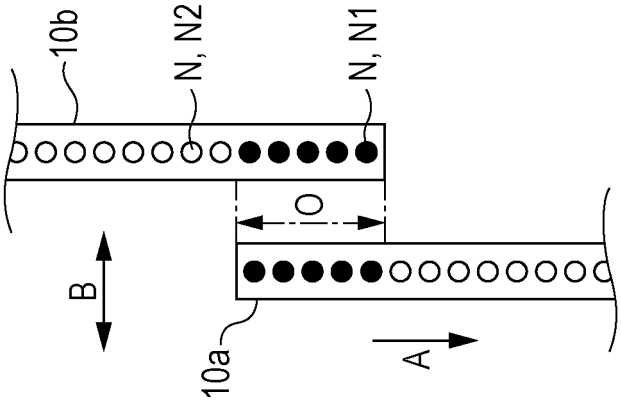


FIG. 10A

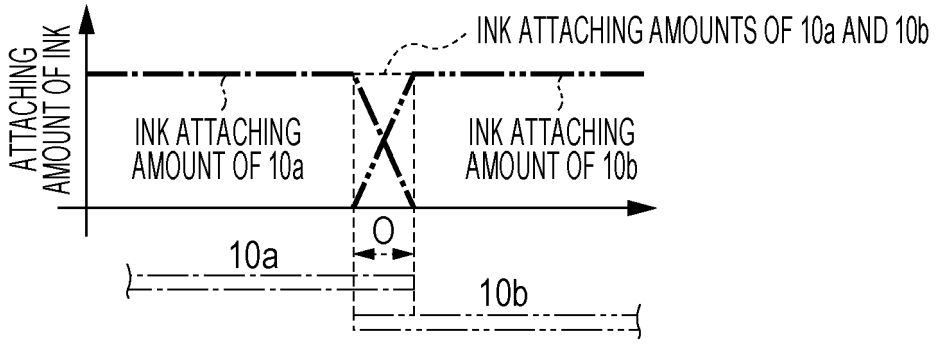


FIG. 10B

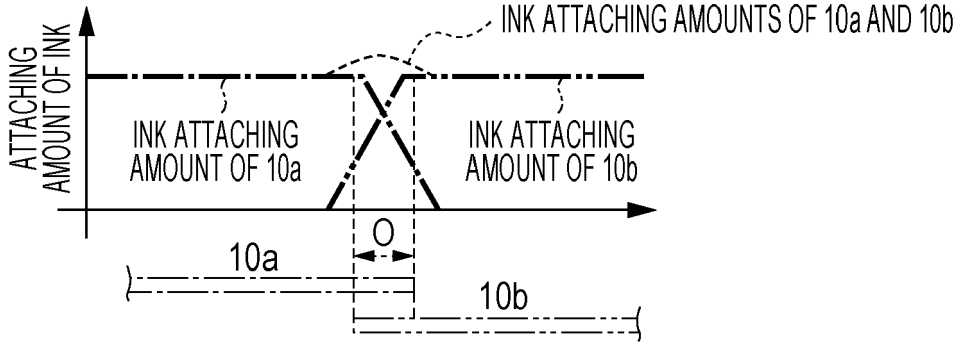


FIG. 10C

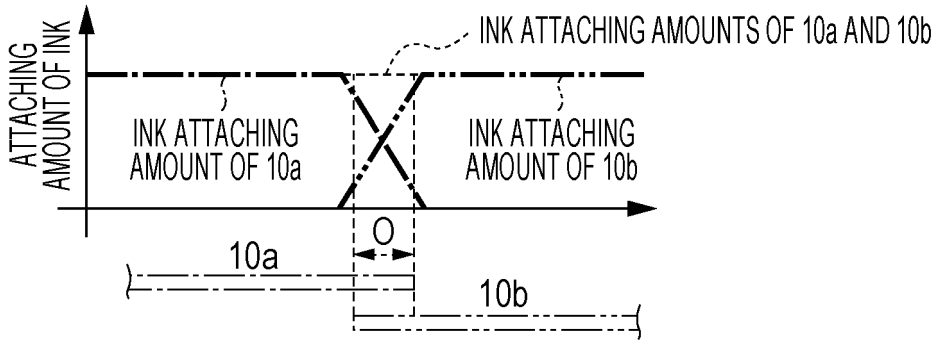


FIG. 11

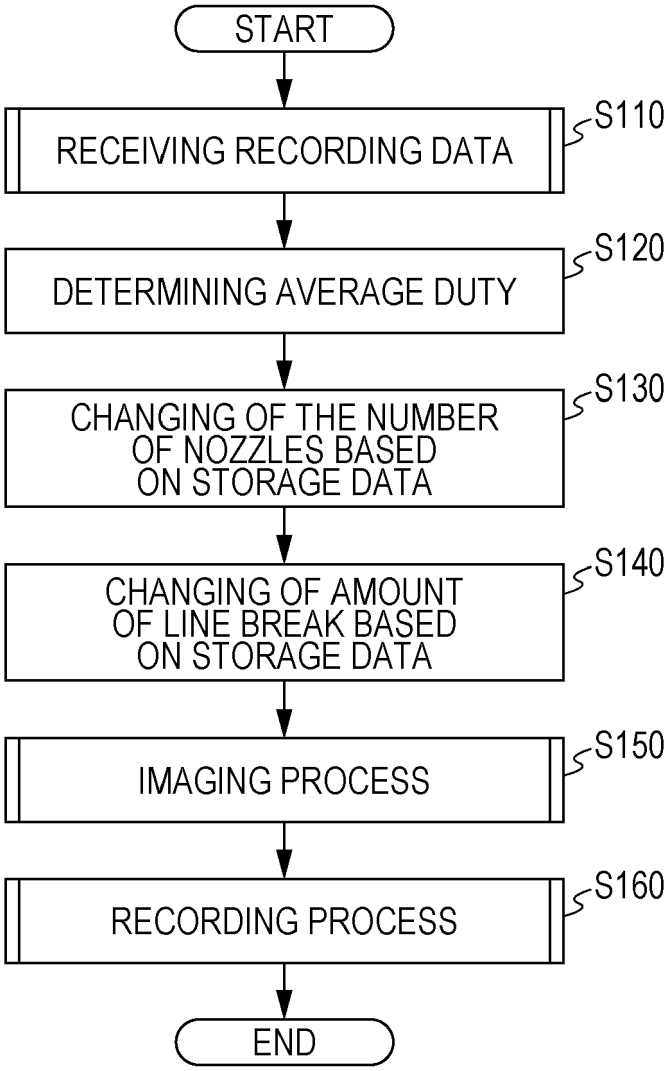
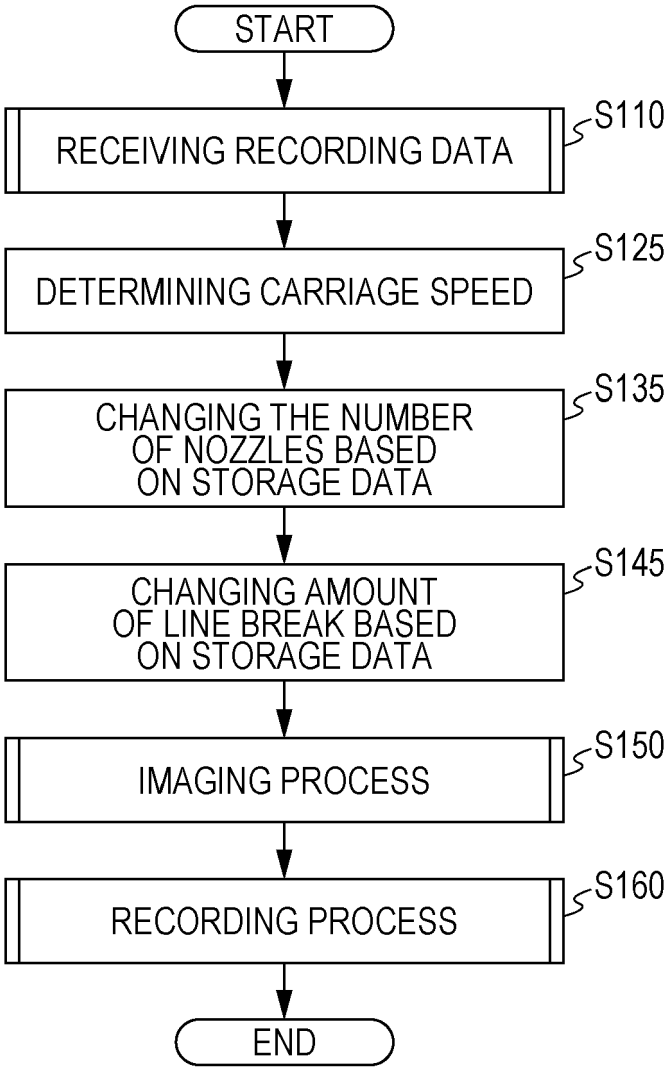

START
RECEIVING RECORDING DATA
S110
DETERMINING AVERAGE DUTY
S120
CHANGING OF THE NUMBER OF NOZZLES BASED ON STORAGE DATA
S130
CHANGING OF AMOUNT OF LINE BREAK BASED ON STORAGE DATA
S140
IMAGING PROCESS
S150
RECORDING PROCESS
S160
END

FIG. 12


START
RECEIVING RECORDING DATA
S110
DETERMINING CARRIAGE SPEED
S125
CHANGING THE NUMBER OF NOZZLES BASED ON STORAGE DATA
S135
CHANGING AMOUNT OF LINE BREAK BASED ON STORAGE DATA
S145
IMAGING PROCESS
S150
RECORDING PROCESS
S160
END

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

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The Hague	21 April 2016	Hartmann, Mathias

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EUROPEAN SEARCH REPORT

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