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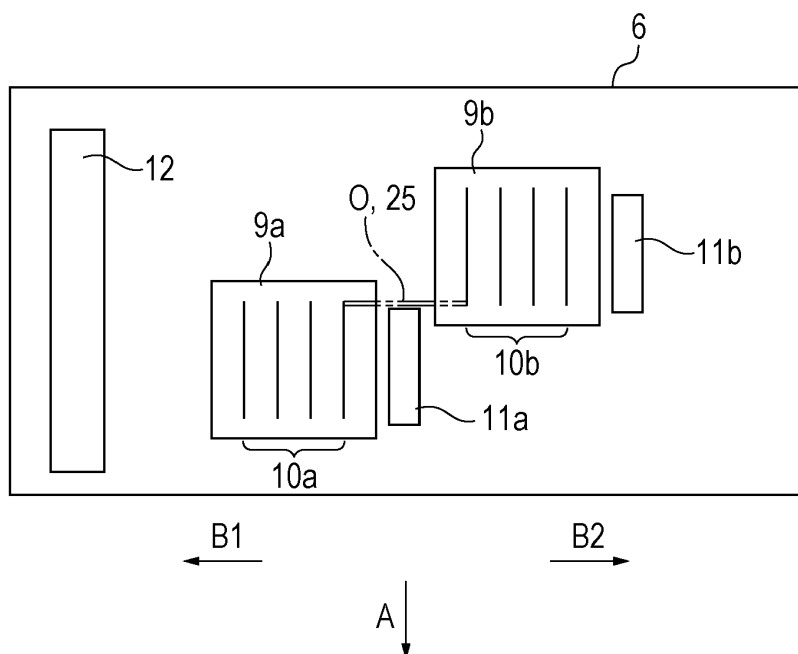
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(54) **Recording apparatus and recording method**

(57) A recording apparatus which includes a multi-head in which a first recording head and a second recording head perform bidirectional recording by reciprocating in a direction intersecting a transport direction, in which the first recording head and the second recording head including nozzle columns in which nozzles which eject ink are aligned in the transport direction of a medium

for recording are aligned in the direction intersecting the transport direction of the medium for recording, and an amount of ink per unit time which is ejected from nozzles at the border portion is set to be different in recording in one direction in the bidirectional recording, and in recording in the other direction in the bidirectional recording.

FIG. 2



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, recording apparatuses which include a multihead having a plurality of recording heads have been used. Among these, for example, as disclosed in JP-A-2007-98866, a recording apparatus in which a plurality of recording heads are arranged by being deviated in a transport direction of a medium for recording, and which includes a multihead performing a bidirectional recording by reciprocating in a direction intersecting the transport direction has been used.

[0003] On the other hand, in recent years, a recording apparatus which can perform recording with respect to various types of media for recording has been used.

[0004] As described above in recent years, a recording apparatus which can perform recording with respect to various types of media to be recorded has been used, however, in such a recording apparatus, it is necessary to make a so-called paper gap (PG) which is a gap between a recording head (multihead) and a medium for recording which are facing each other large, since the apparatus corresponds to various types of media for recording.

[0005] However, when the PG becomes large, there is a problem in that a landing position of ink which is ejected from a recording head with respect to a medium for recording is easily deviated. For this reason, inventors have found a new problem in that, when the PG becomes large, a stripe shape which causes a poor image quality occurs at a portion which is recorded using a border portion between each of recording heads of a multihead, in a recording apparatus in the related art in which a plurality of recording heads are arranged by being deviated in the transport direction of a medium for recording, and which includes the multihead which performs bidirectional recording by reciprocating in a direction intersecting the transport direction.

SUMMARY

[0006] An advantage of some aspects of the invention is to suppress an occurrence of a stripe shape which causes a poor image quality when performing bidirectional recording using a multihead.

[0007] According to an aspect of the invention, there is provided a recording apparatus which includes a multihead in which a first recording head and a second recording head perform bidirectional recording by reciprocating in a direction intersecting a transport direction, in

which the first recording head and the second recording head including nozzle columns in which nozzles which eject ink are aligned in the transport direction of a medium for recording are aligned in the direction intersecting the transport direction of the medium for recording, and the nozzle column of the first recording head and the nozzle column of the second recording head are arranged so as to configure a border portion in which the nozzle columns are close in the transport direction, and an amount of ink per unit time which is ejected from nozzles at the border portion is set to be different in recording in one direction in the bidirectional recording, and in recording in the other direction in the bidirectional recording.

[0008] Here, the expression "a nozzle at a border portion" does not only mean only one nozzle on the border portion side of the first recording head and the second recording head, and also means a number of nozzles of five nozzles, or the like, for example.

[0009] In addition, the expression "the nozzle column of the first recording head and the nozzle column of the second recording head configure a border portion in which the nozzle columns are close in the transport direction" includes a configuration of an arrangement in which the nozzle column of the first recording head and the nozzle column of the second recording head are not overlapped when viewed from a direction intersecting the transport direction when both are not too far from each other, in addition to a configuration in which the nozzle column of the first recording head and the nozzle column of the second recording head are arranged so as to overlap with each other when viewed from the direction intersecting the transport direction.

[0010] According to the aspect, an amount of ink per unit time which is ejected from the nozzle at the border portion is set to be different in recording in the one direction and in recording in the other direction. That is, when a poor image quality with a stripe shape of a dark color (black stripe) is generated due to overlapping of ink which is ejected from the first recording head and ink which is ejected from the second recording head at the border portion by setting the PG to be large, it is possible to reduce an amount of ink per unit time which is ejected from the nozzle at the border portion. On the other hand, when the ink which is ejected from the first recording head and the ink which is ejected from the second recording head at the border portion are separated due to the PG which is set to be large, and a poor image quality with a stripe shape of a light color (white stripe) occurs, it is possible to increase an amount of ink per unit time which is ejected from the nozzle at the border portion. For this reason, it is possible to suppress an occurrence of a poor image quality with a stripe shape when performing bidirectional recording using a multihead.

[0011] In the recording apparatus, the amount of ink per unit time which is ejected from the nozzle at the border portion may be set to be different in recording in one direction in the bidirectional recording, and in recording in the other direction in the bidirectional recording, by

changing a use rate of the nozzles at the border portion.

[0012] Here, the expression "recording in the one direction" means that the recording may be recording in either a going direction or a return direction in the bidirectional recording.

[0013] According to the aspect, the amount of ink per unit time which is ejected from the nozzle at the border portion is set to be different in recording in one direction in the bidirectional recording, and in recording in the other direction in the bidirectional recording by changing a use rate of the nozzles at the border portion. For this reason, it is possible to suppress an occurrence of a poor image quality with a stripe shape when performing the bidirectional recording using the multihead by adopting such a simple method.

[0014] In the recording apparatus, in at least one of the first recording head and the second recording head, the amount of ink per unit time which is ejected from the nozzle at the border portion may be set to be different from an amount of ink per unit time which is ejected from a nozzle at a portion other than the border portion in recording in the one direction.

[0015] According to the aspect, in at least one of the first recording head and the second recording head, the amount of ink per unit time which is ejected from the nozzle at the border portion is set to be different from the amount of ink per unit time which is ejected from the nozzle at the portion other than the border portion in recording in the one direction. For this reason, it is possible to suppress the occurrence of the poor image quality with the stripe shape when performing the bidirectional recording using the multihead by adopting such a simple method.

[0016] In the recording apparatus, the amount of ink per unit time which is ejected from the nozzle at the border portion may be large in recording in an opposite direction, compared to recording in a direction from a home position of the multihead to the other side.

[0017] Here, the expression "home position of the multihead" means a standby position when starting recording of the multihead.

[0018] According to the aspect, the amount of ink per unit time which is ejected from the nozzle at the border portion is large in recording in the opposite direction compared to in recording in the direction from the home position side of the multihead to the other side. That is, the amount of ink per unit time which is ejected from the nozzle at the border portion is set to be large in recording in the return direction in the reciprocating, compared to recording in the going direction in the reciprocating. For this reason, for example, when the black stripe occurs in recording in the going direction, it is possible to eliminate the black stripe by reducing the amount of ink per unit time which is ejected from the nozzle at the border portion in recording in the going direction compared to the recording in the return direction. On the other hand, for example, when the white stripe occurs in recording in the return direction, it is possible to eliminate the white stripe

by increasing the amount of ink per unit time which is ejected from the nozzle at the border portion in recording in the return direction compared to the recording in the going direction.

[0019] In the recording apparatus, the amount of ink per unit time which is ejected from the nozzle at the border portion may be small in recording in the opposite direction compared to recording in the direction from the home position of the multihead to the other side.

[0020] According to the aspect, the amount of ink per unit time which is ejected from the nozzle at the border portion is small in recording in the opposite direction compared to recording in the direction from the home position of the multihead to the other side. That is, the amount of ink per unit time which is ejected from the nozzle at the border portion is set to be small in recording in the return direction in the reciprocating, compared to recording in the going direction in the reciprocating. For this reason, for example, when the white stripe occurs in recording in the going direction, it is possible to eliminate the white stripe by increasing the amount of ink per unit time which is ejected from the nozzle at the border portion in recording in the going direction compared to recording in the return direction. On the other hand, for example, when the black stripe occurs in recording in the return direction, it is possible to eliminate the black stripe by decreasing the amount of ink per unit time which is ejected from the nozzle at the border portion in recording in the going direction compared to recording in the return direction.

[0021] In the recording apparatus, the first recording head and the second recording head may be arranged so that partial nozzles are overlapped with each other when viewed in a direction intersecting the transport direction.

[0022] According to the aspect, the first recording head and the second recording head are arranged so that partial nozzles are overlapped with each other in the transport direction. For this reason, when the white stripe occurs, it is possible to simply increase the amount of ink per unit time which is ejected from the nozzle at the border portion due to the nozzles which are arranged so as to overlap with each other. For this reason, it is possible to simply suppress the occurrence of poor image quality with the stripe shape when performing the bidirectional recording using the multihead.

[0023] In the recording apparatus, the amount of ink per unit time which is ejected from the nozzle at the border portion may be set to be different in recording in the one direction, and in recording in the other direction according to a gap between the multihead and the medium for recording which are facing each other.

[0024] According to the aspect, the amount of ink per unit time which is ejected from the nozzle at the border portion is set to be different in recording in the one direction, and in recording in the other direction according to a gap (PG) between the multihead and the medium for recording which are facing each other. That is, the amount of ink is set to be different in recording in the one

direction, and in recording in the other direction according to the PG. For this reason, since the poor image quality with the stripe shape easily occurs when the PG is large, it is possible to make the amount of ink per unit time which is ejected from the nozzle at the border portion remarkably different in recording in the one direction, and in recording in the other direction. On the other hand, since the poor image quality with the stripe shape hardly occurs when the PG is small, it is possible to make the amount of ink per unit time which is ejected from the nozzle at the border portion different to a small extent, or to be the same between recording in the one direction and recording in the other direction.

[0025] According to another aspect of the invention, there is provided a recording method which includes aligning a first recording head and a second recording head which include nozzle columns in which nozzles which eject ink are aligned in a transport direction of a medium for recording in a direction intersecting the transport direction of the medium for recording, and arranging the nozzle column of the first recording head and the nozzle column of the second recording head so as to configure a border portion in which the nozzle columns are close in the transport direction; using a multihead in which the first recording head and the second recording head reciprocate in a direction intersecting the transport direction, and perform the bidirectional recording; and performing bidirectional recording by setting an amount of ink per unit time which is ejected from the nozzle at the border portion to be different in recording in one direction in the bidirectional recording, and in recording in the other direction in the bidirectional recording.

[0026] According to the aspect, the amount of ink per unit time which is ejected from the nozzle at the border portion is set to be different in recording in the one direction, and in recording in the other direction. That is, when the ink which is ejected from the first recording head and the ink which is ejected from the second recording head at the border portion are overlapped with each other due to the large PG, and the black stripe occurs, it is possible to reduce the amount of ink per unit time which is ejected from the nozzle at the border portion. On the other hand, when the ink which is ejected from the first recording head and the ink which is ejected from the second recording head at the border portion are separated from each other due to the large PG, and the white stripe occurs, it is possible to increase the amount of ink per unit time which is ejected from the nozzle at the border portion. For this reason, it is possible to suppress the occurrence of the poor image quality with the stripe shape when performing the bidirectional recording using the multihead.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings, wherein like numbers refer-

ence like elements.

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

Fig. 2 is a schematic rear view which illustrates a multihead 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 poor image quality with a stripe shape occurs.

Fig. 5 is a diagram which describes the mechanism in which the poor image quality with the stripe shape occurs.

Fig. 6 is a conceptual diagram of black stripes.

Figs. 7A to 7D are diagrams which illustrate used nozzles in a border portion for suppressing the black stripe.

Fig. 8 is a conceptual diagram of white stripes.

Figs. 9A to 9D are diagrams which illustrate use nozzles at the border portion for suppressing the white stripe.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0028] Hereinafter, a recording apparatus according to one embodiment will be described in detail with reference to accompanying drawings.

[0029] Fig. 1 is a schematic side view which illustrates the recording apparatus 1 according to the embodiment of the invention.

[0030] The recording apparatus 1 according to the embodiment includes an adhesive belt 2 which is stretched on a transport roller 3 which rotates in a rotation direction C and a driven roller 4, and transports a medium to be recorded P in a transport direction A by supporting the medium for recording P.

[0031] Here, the "adhesive belt" means a belt on which an adhesive which bonds the medium for recording to a surface supporting the medium for recording so as to be separated therefrom, and holds the medium for recording is spread.

[0032] In addition, in the transport path of the medium for recording P using the adhesive belt 2, a first recording head 9a (refer to Fig. 2), and a second recording head 9b (refer to Fig. 2) which eject ink on the medium for recording P are arranged by being deviated in the transport direction A, and a multihead 6 which performs bidirectional recording using the first recording head 9a and the second recording head 9b by reciprocating in a direction B which intersects the transport direction A is provided. The recording apparatus 1 forms a desired image by ejecting ink onto the medium for recording P from an ink ejecting face F of the multihead 6 (first recording head 9a and second recording head 9b) while causing the multihead 6 to reciprocate in the direction B through a car-

riage 5.

[0033] 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 rotates the medium for recording P in the rotation direction C when winding up the medium for recording P.

[0034] However, the recording apparatus is not limited to a recording apparatus which includes a transport mechanism with such a configuration, and for example, the recording apparatus 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.

[0035] In addition, the recording apparatus 1 according to the embodiment has a configuration in which recording can be performed on a roll-shaped medium for recording P, however, the recording apparatus is not limited to such a configuration, and may have a configuration in which recording can be performed on a single-form medium for recording P.

[0036] Subsequently, the multihead 6 in the recording apparatus 1 according to the embodiment will be described in detail.

[0037] Fig. 2 is a schematic rear view which illustrates the multihead 6 of the recording apparatus 1 in the embodiment.

[0038] In the multihead 6 according to the embodiment the first recording head 9a and the second recording head 9b which include nozzle columns 10a and 10b in which nozzles N (refer to Figs. 7 and 9) which eject ink are arranged in the transport direction A of the medium for recording P so as to configure a border portion 25 to which the nozzle column 10a of the first recording head 9a, and the nozzle column 10b of the second recording head 9b are close in the transport direction A. In addition, the first recording head 9a and the second recording head 9b reciprocate in the direction B intersecting the transport direction A, and perform bidirectional recording.

[0039] In addition, though it will be described later, an amount of ink per unit time which is ejected from the nozzle N of the border portion 25 is set to be different in recording in one direction in the bidirectional recording (for example, going direction B1 of reciprocating directions B of multihead 6), and recording in the other direction in the bidirectional recording (for example, return direction B2 of reciprocating directions B of multihead 6).

[0040] Here, the "nozzle N in border portion 25" is not limited to only one nozzle on the border portion side of the first recording head 9a and the second recording head 9b, and also includes a number of nozzles of five nozzles, or the like, for example.

[0041] In addition, the recording apparatus 1 according to the embodiment has a configuration in which the nozzle columns 10a and the nozzle columns 10b are arranged so as to overlap with each other (includes overlap

region O) when viewed from the direction intersecting the transport direction A (direction B1 or B2), however, the recording apparatus may have a configuration in which both the nozzle columns are arranged so as not to overlap with each other when viewed from the direction intersecting the transport direction A (direction B1 or B2) when both are not too far from each other.

[0042] In this manner, the recording apparatus 1 according to the embodiment sets the amount of ink per unit time of the border portion 25 to be different in recording in the one direction, and in recording in the other direction. That is, it is possible to reduce the amount of ink per unit time which is ejected from the nozzle N of the border portion 25, when ink which is ejected from the first recording head 9a, and ink which is ejected from the second recording head 9b at the border portion 25 are overlapped with each other, and the poor image quality with the dark stripe shape (black stripe) occurs due to the large PG. On the other hand, when the ink which is ejected from the first recording head 9a, and the ink which is ejected from the second recording head 9b at the border portion 25 are separated at the border portion 25, and the poor image quality with a stripe shape of a light color (white stripe) occurs due to the large PG, it is possible to increase the amount of ink per unit time which is ejected from the nozzle N at the border portion 25. For this reason, it becomes a configuration in which the occurrence of the poor image quality with the stripe shape is suppressed when performing the bidirectional printing using the multihead 6.

[0043] In addition, as illustrated in the overlapped region O in Fig. 2, the first recording head 9a and the second recording head 9b are arranged so that partial regions of the nozzle N or the nozzle columns 10a, 10b are overlapped with each other when viewed from the direction intersecting the transport direction A.

[0044] For this reason, though it which will be described later, when the white stripe occurs in recording in the going direction B1, and recording in the return direction B2, it is possible to simply increase the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 using the nozzles which are arranged so as to overlap with each other. For this reason, it is possible to simply suppress the occurrence of poor image quality with the stripe shape when the bidirectional recording is performed using the multihead.

[0045] In addition, the multihead 6 according to the embodiment has the first recording head 9a and the second recording head 9b, and the first recording head 9a is provided with four nozzle columns 10a which are provided in the recording apparatus 1 according to each ink of black, cyan, magenta, and yellow. In addition, the second recording head 9b is provided with four nozzle columns 10b which are provided corresponding to each of the inks.

[0046] However, the configuration is not limited to such a configuration, and it may be a configuration in which only heads for ink of some of the colors may be mounted, or a configuration in which ink of yet another color is

mounted.

[0047] A wall portion 11a is provided on the front side in the return direction B2 of the first recording head 9a, and a wall portion 11b is provided on the front side in the return direction B2 of the second recording head 9b. The wall portions 11a and 11b are portions for suppressing flight curves of ink droplets ejected from the first recording head 9a and the second recording head 9b which are bent due to an influence of airflow which is caused when the first recording head 9a and the second recording head 9b move. However, there is no limitation to the configuration.

[0048] In addition, a sensor 12 is provided on the front side in the going direction B1 of the first recording head 9a and the second recording head 9b. The sensor 12 is a sensor for measuring the gap (PG) between the multihead 6 and the medium for recording P which are facing each other.

[0049] The recording apparatus 1 according to the embodiment can make the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 different in recording in the going direction B1, and recording in the return direction B2 according to the PG which is measured by the sensor 12, through control of the control unit 13 (refer to Fig. 3).

[0050] For this reason, since the poor image quality with the stripe shape easily occurs when the PG is large, it is possible to make the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 remarkably different between the recording in the going direction B1 and the recording in the return direction B2. On the other hand, since the poor image quality with the stripe shape hardly occurs when the PG is small, it is possible to make the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 slightly different, or the same between the recording in the going direction B1 and the recording in the return direction B2.

[0051] As described above, in the multihead 6 according to the embodiment, the recording heads are not symmetric in the reciprocating direction B of the multihead 6. In addition, recording heads in a general multihead are not symmetric in the reciprocating direction, like the multihead 6 in the embodiment.

[0052] Subsequently, an electrical configuration of the recording apparatus 1 according to the embodiment will be described.

[0053] Fig. 3 is a block diagram of the recording apparatus 1 according to the embodiment.

[0054] A CPU 14 which performs control of the entire recording apparatus 1 is provided in the control unit 13. The CPU 14 is connected to a ROM 16 which stores various control programs which are executed by the CPU 14, maintenance sequences, or the like, and a RAM 17 which can temporarily store data through a system bus 15.

[0055] In addition, a head driving unit 18 for driving the first recording head 9a and the second recording head

9b of the multihead 6 is connected to the CPU 14 through the system bus 15.

[0056] In addition, the CPU 14 is connected to a motor driving unit 19 for driving a carriage motor 20 for moving the carriage 5, a transport motor 21 which is a power source of the 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 which is a power source of the winding unit 8 through the system bus 15.

[0057] In addition, the CPU 14 is connected to an input-output unit 23 through the system bus 15, and the input-output unit 23 is connected to the sensor 12, and a PC 24 which is an external device for inputting recording data, or the like, to the recording apparatus 1.

[0058] Subsequently, a mechanism of an occurrence of the poor image quality with the stripe shape will be described.

[0059] Figs. 4A to 5 are diagrams which describe the mechanism of the occurrence of the poor image quality with the stripe shape.

[0060] As illustrated in Fig. 2, in the multihead 6 according to the embodiment, the recording heads are not symmetric in the reciprocating direction B of the multihead 6. For this reason, since airflow which is generated due to the movement of the first recording head 9a and the second recording head 9b is changed in recording in the going direction B1, and recording in the return direction B2, and a state of the flight curve of ink droplets which are 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 the ejecting width in a direction which goes along the transport direction A is changed. Figs. 4A and 4B are diagrams which schematically illustrate the case, in which Fig. 4A illustrates a state in which the ejecting width L1 is approximately the same as the nozzle column width as an ideal ejecting state, and Fig. 4B illustrates an ejecting state in which the ejecting width is changed, and the ejecting width L2 is longer than the nozzle column width.

[0061] As understood when comparing Fig. 4A and Fig. 4B, the ejecting width L2 in Fig. 4B is larger than the ejecting width L1 in Fig. 4A. Since a state of airflow is changed when the layout of the multihead 6 is not symmetric in the reciprocating direction B, for example, there is a case in which the ejecting width becomes L1 which is illustrated in Fig. 4A in recording in the going direction B1, however, the ejecting width becomes L2 which is illustrated in Fig. 4B in recording in the return direction B2.

[0062] In a general recording apparatus, a position adjustment of ink dots ejected from the first recording head 9a, or the second recording head 9b is performed using any one of recording in the going direction B1, or recording in the return direction B2. However, when ejecting widths are different between the recording in the going direction B1 and recording in the return direction B2, a position of the dots becomes accurate in recording in a direction in which the position adjustment of ink dots is

performed in the going direction B1 or the return direction B2, but the position of the dots becomes inaccurate in recording in the opposite direction.

[0063] Fig. 5 illustrates a state in which the ejecting width becomes L1 as illustrated in Fig. 4A in recording in the going direction B1, and in which the ejecting width becomes L2 as illustrated in Fig. 4B (larger than ejecting width L1) in recording in the return direction B2, and a case in which the position adjustment of the dots is performed due to recording in the going direction B1, so a state in which the poor image quality with the stripe shape (black stripe D) occurs in recording in the return direction B2 is denoted.

[0064] In addition, in Fig. 5, a portion in a recorded image I which is recorded in the recording apparatus 1 is caused to correspond to a portion which is recorded in recording-scanning (pass) in any stage of the first recording head 9a and the second recording head 9b.

[0065] In addition, the recorded image I is completed by performing recording-scanning four times with respect to the same portion.

[0066] An image portion I1 in the recorded image I in Fig. 5 is recorded in recording in the going direction B1 which is the first pass using the second recording head 9b, is recorded in recording in the return direction B2 which is the second pass using the second recording head 9b, is recorded in recording in the going direction B1 which is the third pass using the first recording head 9a, and is recorded in recording in the return direction B2 which is the fourth pass using the first recording head 9a.

[0067] In addition, an image portion I2 in the recorded image I is recorded in recording in the return direction B2 which is the second pass using the second recording head 9b, is recorded in recording in the going direction B1 which is the third pass using the second recording head 9b, is recorded in recording in the return direction B2 which is the fourth pass using the first recording head 9a, and is recorded in recording in the going direction B1 which is the fifth pass using the first recording head 9a.

[0068] In addition, an image portion I3 in the recorded image I is recorded in recording in the going direction B1 which is the third pass using the second recording head 9b, is recorded in recording in the return direction B2 which is the fourth pass using the second recording head 9b, is recorded in recording in the going direction B1 which is the fifth pass using the first recording head 9a, and is recorded in recording in the return direction B2 which is the sixth pass using the first recording head 9a.

[0069] In addition, image portions I4 to I9 are also recorded corresponding to Fig. 5, similarly to the above descriptions.

[0070] As described above, the recorded image I is a recorded image which is formed when the ejecting width in recording in the return direction B2 is larger than that in recording in the going direction B1, and the position adjustment of dots is performed using recording in the going direction B1. For this reason, the black stripe D

occurs at a portion in the recorded image I which is recorded at the border portion 25 between the first recording head 9a and the second recording head 9b, when performing recording in the return direction B2.

[0071] Specifically, the black stripe D occurs at a border between the image portions I2 and I3 which are recorded at the border portion 25 in recording in the return direction B2 which is the fourth pass.

[0072] In addition, the black stripe D occurs at a border between the image portions I4 and I5 which are recorded at the border portion 25 in recording in the return direction B2 which is the sixth pass.

[0073] In addition, the black stripe D occurs at a border between the image portions I6 and I7 which are recorded at the border portion 25 in recording in the return direction B2 which is the eighth pass.

[0074] In addition, the black stripe D occurs at a border between the image portions I8 and I9 which are recorded at the border portion 25 in recording in the return direction B2 which is the tenth pass.

[0075] In addition, in Fig. 5, since the recorded image is formed when the ejecting width in recording in the return direction B2 is larger than that in recording in the going direction B1, and the position adjustment of dots is performed using recording in the going direction B1, the black stripe D occurs at a portion in the recorded image I which is recorded at the border portion 25 in the return direction B2.

[0076] On the other hand, in a recorded image which is formed when the ejecting width in recording in the return direction B2 is larger than that in recording in the going direction B1, and when the position adjustment of dots is performed in recording in the return direction B2, the white stripe occurs at a portion in the recorded image I which is recorded at the border portion 25 in the going direction B1.

[0077] In addition, also in a recorded image which is formed when the ejecting width in recording in the return direction B2 is shorter than that in recording in the going direction B1, and when the position adjustment of dots is performed in recording in the going direction B1, the white stripe occurs at a portion in the recorded image I which is recorded at the border portion 25 in the return direction B2.

[0078] In addition, in a recorded image which is formed when the ejecting width in recording in the return direction B2 is smaller than that in recording in the going direction B1, and when the position adjustment of dots is performed in recording in the return direction B2, the black stripe occurs at a portion in the recorded image I which is recorded at the border portion 25 in the going direction B1.

[0079] Subsequently, in the recording apparatus 1 according to the embodiment, a specific method of making the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 different in recording in one direction in the bidirectional recording to recording in the other direction in the bidirectional recording in order

to suppress the poor image quality with the stripe shape will be described. However, the method is not limited to the following embodiment.

[0080] First, a specific method of making the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 different in recording in one direction in the bidirectional recording to recording in the other direction in the bidirectional recording in order to suppress the black stripe D will be described.

[0081] Fig. 6 is a conceptual diagram of the black stripe D, and Fig. 7 is a diagram which illustrates a used nozzle at the border portion 25 for suppressing the black stripe D.

[0082] In Fig. 7A, among the nozzles N of the first recording head 9a and the second recording head 9b, used nozzles Nu and non-used nozzles Nn are illustrated at the border portion 25 in a normal state. As described above, in the multihead 6 according to the embodiment, an overlap region O in which partial portions of the first recording head 9a and the second recording head 9b are arranged so as to overlap with each other when viewed from a direction intersecting the transport direction A (direction B1 or B2) is provided. The overlap region O in the multihead 6 of the embodiment corresponds to four nozzles N.

[0083] In the normal state illustrated in Fig. 7A, when the black stripe D occurs along the reciprocating direction B of the multihead 6, as illustrated in Fig. 6, in the recording apparatus 1 according to the embodiment, it is possible to set nozzles illustrated in Figs. 7B, 7C, and 7D to be the used nozzles in recording in the direction in which the black stripe D occurs.

[0084] Specifically, in Fig. 7B, the non-used nozzles Nn in the second recording head 9b are set to four nozzles N which are continuous from the end portion, the number of non-used nozzles Nn being increased from the normal state in Fig. 7A.

[0085] In addition, also in Fig. 7C, the non-used nozzles Nn in the second recording head 9b are increased from the normal state in Fig. 7A. However, in Fig. 7C, non-used nozzles Nn which are not continuous from the end portion are provided, without setting the nozzles N which are continuous from the end portion as the non-used nozzles Nn.

[0086] In addition, in Fig. 7D, the non-used nozzles Nn are increased from the normal state in Fig. 7A in both the first recording head 9a and second recording head 9b.

[0087] In other words, in any of Figs. 7B, 7C and 7D, the use rate of the nozzles N at the border portion 25 decreases compared to the normal state in Fig. 7A.

[0088] In addition, according to the embodiment, the use rate of nozzles N is decreased by providing the non-used nozzle Nozzle Nn, and by causing the nozzle N which is set to the non-used nozzle Nn not to eject ink through control of the control unit 13. However, a configuration in which the amount of ink per unit time which is ejected from the nozzles N of the border portion 25 is decreased may be adopted using a configuration in which a frequency of ejecting ink from a nozzle N, or a weight

of ink droplets which are ejected in one ejection operation is decreased, rather than a configuration in which ink is not ejected from the nozzles N which are set to the non-used nozzles Nn.

[0089] Subsequently, a specific method of making the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 different in recording in one direction to recording in the other direction in order to suppress a white stripe L will be described.

[0090] Fig. 8 is a conceptual diagram of the white stripe L, and Figs. 9A to 9D are diagrams which illustrate used nozzles for suppressing the white stripe L at the border portion 25.

[0091] Fig. 9A is the same as Fig. 7A, and illustrates the used nozzles Nu which are used, and the non-used nozzles Nn which are not used at the border portion 25 among the nozzles N of the first recording head 9a and the second recording head 9b in the normal state.

[0092] In the normal state illustrated in Fig. 9A, when the white stripe L occurs along the reciprocating direction B of the multihead 6 as illustrated in Fig. 8, in the recording apparatus 1 according to the embodiment, it is possible to set nozzles illustrated in Figs. 9B, 9C, and 9D to be the used nozzles in recording in the direction in which the white stripe L occurs.

[0093] Specifically, in Fig. 9B, the number of used nozzles Nu in the first recording head 9a is increased from the normal state in Fig. 9A.

[0094] In addition, in Figs. 9C and 9D, the used nozzles Nu are increased from the normal state in Fig. 9A in both the first recording head 9a and the second recording head 9b. Specifically, in Fig. 9C, the end most nozzles N are set to the nozzles Nu in both the first recording head 9a and second recording head 9b. On the other hand, in Fig. 9D, nozzles N which are not at the end are set to the used nozzles Nu in both the first recording head 9a and second recording head 9b.

[0095] In other words, in any of Figs. 9B, 9C and 9D, the use rate of the nozzles N at the border portion 25 increases compared to the normal state in Fig. 9A.

[0096] In addition, according to the embodiment, ink is ejected from a nozzle N which is newly set to be a used nozzle Nu at a normal ejecting frequency through control of the control unit 13. However, a configuration in which an ink ejecting frequency from the nozzle N which is newly set to be a used nozzle N is set to be smaller or larger than the ink ejecting frequency from the nozzle N which is originally set to be a used nozzle Nu may be adopted.

[0097] As described above, in the recording apparatus 1 according to the embodiment, it is possible to make the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 different from an amount of ink per unit time which is ejected from a nozzle N at portions other than the border portion 25 in recording in one direction of the reciprocating direction of the multihead 6, in at least one of first recording head 9a and the second recording head 9b through control of the control unit 13.

[0098] Here, the "recording in the one direction" means that the recording may be any one of the going direction B1 and the return direction B2 in recording in the bidirectional recording of the multihead 6.

[0099] For this reason, it is possible to prevent the poor image quality with the stripe shape from occurring, simply, and with high precision when performing the bidirectional recording using the multihead, by performing recording in a direction which is not a direction in which the position adjustment of dots is performed in the one direction, in particular.

[0100] In addition, in the recording apparatus 1 according to the embodiment, it is possible to make the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 large in recording in the opposite direction (return direction B2 of reciprocating directions B of multihead 6) compared to recording in the direction from the home position of the multihead 6 to the other side (going direction B1 of reciprocating directions B of multihead 6) due to a control of the control unit 13.

[0101] Here, the "home position of the multihead 6" means a standby position at a time of starting recording of the multihead 6.

[0102] For this reason, for example, when the black stripe occurs in recording in the going direction B1, it is possible to eliminate the black stripe by making the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 small in recording in the going direction B1 compared to recording in the return direction B2. On the other hand, for example, when the white stripe occurs in recording in the return direction B2, it is possible to eliminate the white stripe by making the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 large in recording in the return direction B2 compared to recording in the going direction B1.

[0103] In addition, in the recording apparatus 1 according to the embodiment, it is possible to make the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 small in recording in the opposite direction (return direction B2 of reciprocating directions B of multihead 6) compared to recording in the direction from the home position of the multihead 6 to the other side (going direction B1 of reciprocating directions B of multihead 6) due to a control of the control unit 13.

[0104] For this reason, for example, when the white stripe occurs in recording in the going direction B1, it is possible to eliminate the white stripe L by making the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 large in recording in the going direction B1 compared to recording in the return direction B2. On the other hand, for example, when the black stripe occurs in recording in the return direction B2, it is possible to eliminate the black stripe by making the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 small in recording in the return direction B2 compared to recording in the going direction B1.

[0105] In addition, it is possible to perform the bidirectional recording using the recording apparatus 1 according to the embodiment by aligning the first recording head 9a and the second recording head 9b which include the nozzle columns 10a and 10b in which nozzles N which eject ink are aligned in the transport direction A of the medium for recording P in a direction intersecting the transport direction of the medium for recording, arranging the nozzle columns 10a of the first recording head 9a, and the nozzle columns 10b of the second recording head 9b so as to configure the border portion 25 in which the nozzle columns are close in the transport direction A, using the multihead 6 which performs the bidirectional recording by causing the first recording head 9a and the second recording head 9b to reciprocate in the direction B which intersects the transport direction A, and by making the amount of ink per unit time which is ejected from the nozzle N of the border portion 25 different in recording in one direction in the bidirectional recording to recording in the other direction in the bidirectional recording.

[0106] In this manner, it is possible to suppress the poor image quality with the stripe shape when performing recording in the bidirectional recording using the multihead 6.

[0107] The foregoing description has been given by way of example only and it will be appreciated by a person skilled in the art that modifications can be made without departing from the scope of the present invention.

Claims

1. A recording apparatus (1) comprising:

a multihead (6) in which a first recording head (9a) and a second recording head (9b) are arranged to perform bidirectional recording by reciprocating in a direction (B) intersecting a transport direction (A),

wherein the first recording head and the second recording head include nozzle columns (10a, 10b) in which nozzles (N) which eject ink are aligned in the transport direction of a medium for recording and are aligned in the direction intersecting the transport direction of the medium for recording,

wherein the nozzle column of the first recording head and the nozzle column of the second recording head are arranged so as to configure a border portion (25) in which the nozzle columns are close in the transport direction (A), and wherein an amount of ink per unit time which is ejected from nozzles at the border portion is set to be different in recording in one direction in the bidirectional recording to recording in the other direction in the bidirectional recording.

2. The recording apparatus according to claim 1,

wherein the amount of ink per unit time which is ejected from the nozzle at the border portion is set to be different in recording in one direction in the bidirectional recording to recording in the other direction in the bidirectional recording, by changing a use rate of the nozzles at the border portion. 5

3. The recording apparatus according to claim 1, wherein, in at least one of the first recording head (9a) and the second recording head (9b), the amount of ink per unit time which is ejected from the nozzle at the border portion (25) is set to be different from an amount of ink per unit time which is ejected from a nozzle at a portion other than the border portion in recording in the one direction. 10 15
4. The recording apparatus according to any one of the preceding claims, wherein the amount of ink per unit time which is ejected from the nozzle at the border portion (25) is large in recording in an opposite direction, compared to recording in a direction from a home position of the multi head (6) to the other side. 20
5. The recording apparatus according to any one of claims 1 to 3, wherein the amount of ink per unit time which is ejected from the nozzle at the border portion (25) is small in recording in the opposite direction compared to recording in the direction from the home position of the multihead to the other side. 25 30
6. The recording apparatus according to any one of the preceding claims, wherein the first recording head (9a) and the second recording head (9b) are arranged so that partial nozzles are overlapped with each other when viewed in a direction intersecting the transport direction. 35
7. The recording apparatus according to any one of the preceding claims, wherein the amount of ink per unit time which is ejected from the nozzle at the border portion is set to be different in recording in the one direction to recording in the other direction according to a gap between the multihead (6) and the medium (P) for recording which are facing each other. 40 45
8. A recording method using a multihead (6) in which a first recording head (9a) and a second recording head (9b) reciprocate in a direction (B) intersecting a transport direction (A) of a medium (P) for recording, the first recording head (9a) and the second recording head (9b) being aligned in the intersecting direction (B) and including nozzle columns (10a, 10b) in which nozzles (N) which eject ink are aligned in the transport direction (A), the nozzle column of the first recording head and the nozzle column of the 50 55

second recording head being arranged so as to configure a border portion (25) in which the nozzle columns are close in the transport direction, the method comprising:

performing bidirectional recording by setting an amount of ink per unit time which is ejected from a nozzle at the border portion to be different in recording in one direction in the bidirectional recording to recording in the other direction in the bidirectional recording.

FIG. 1

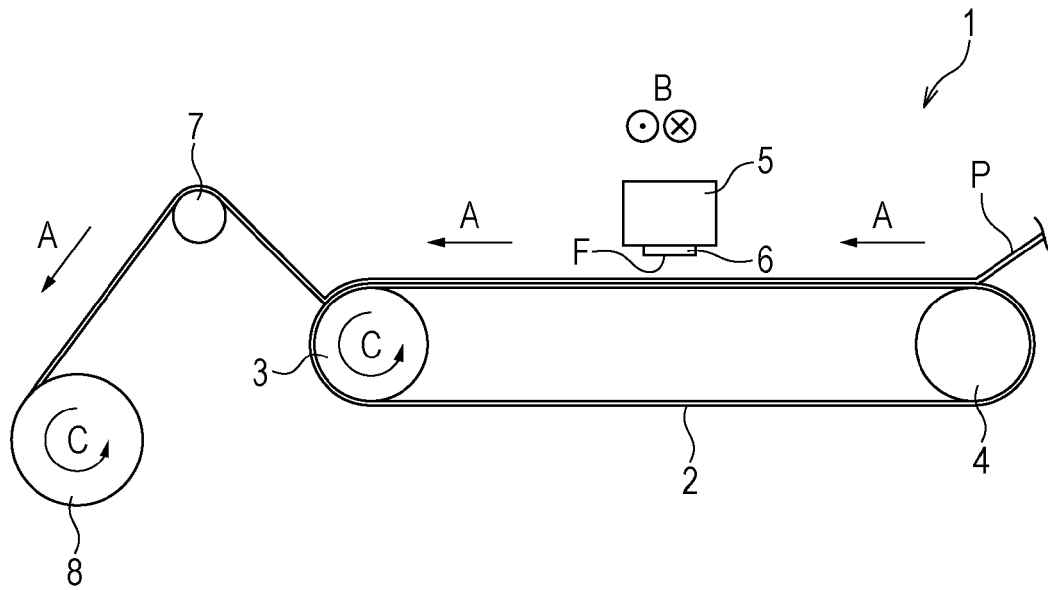


FIG. 2

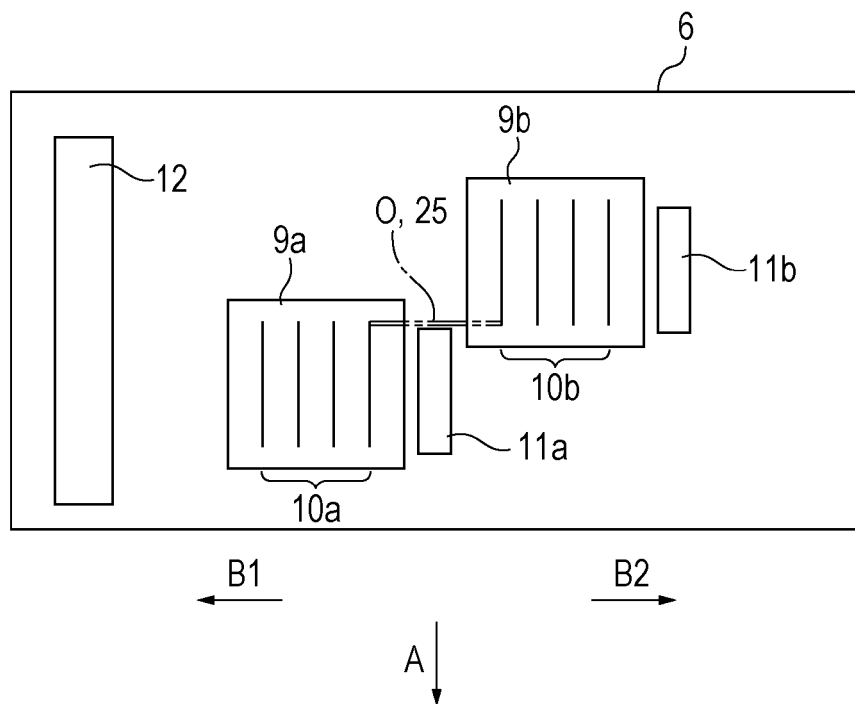


FIG. 3

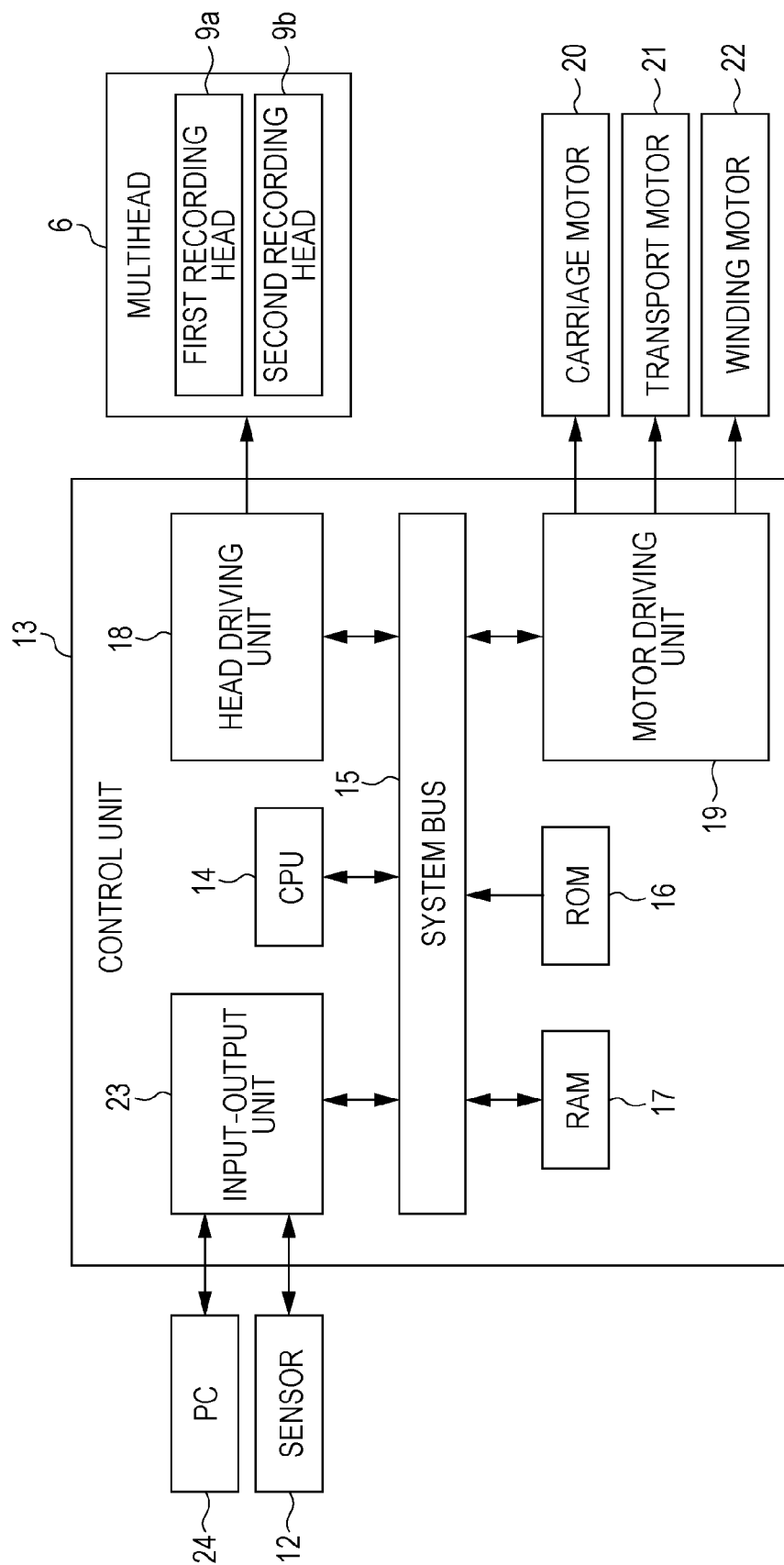


FIG. 4A

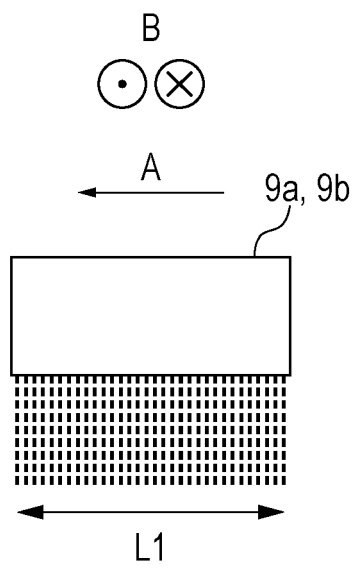
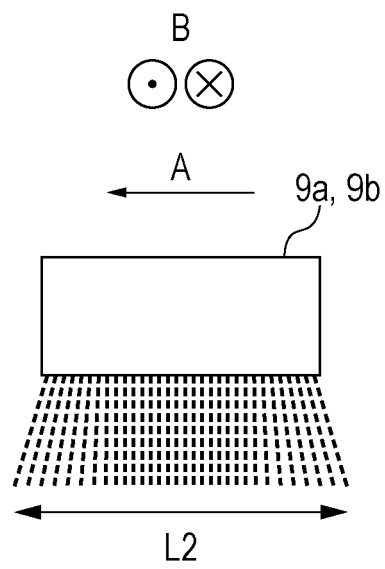


FIG. 4B



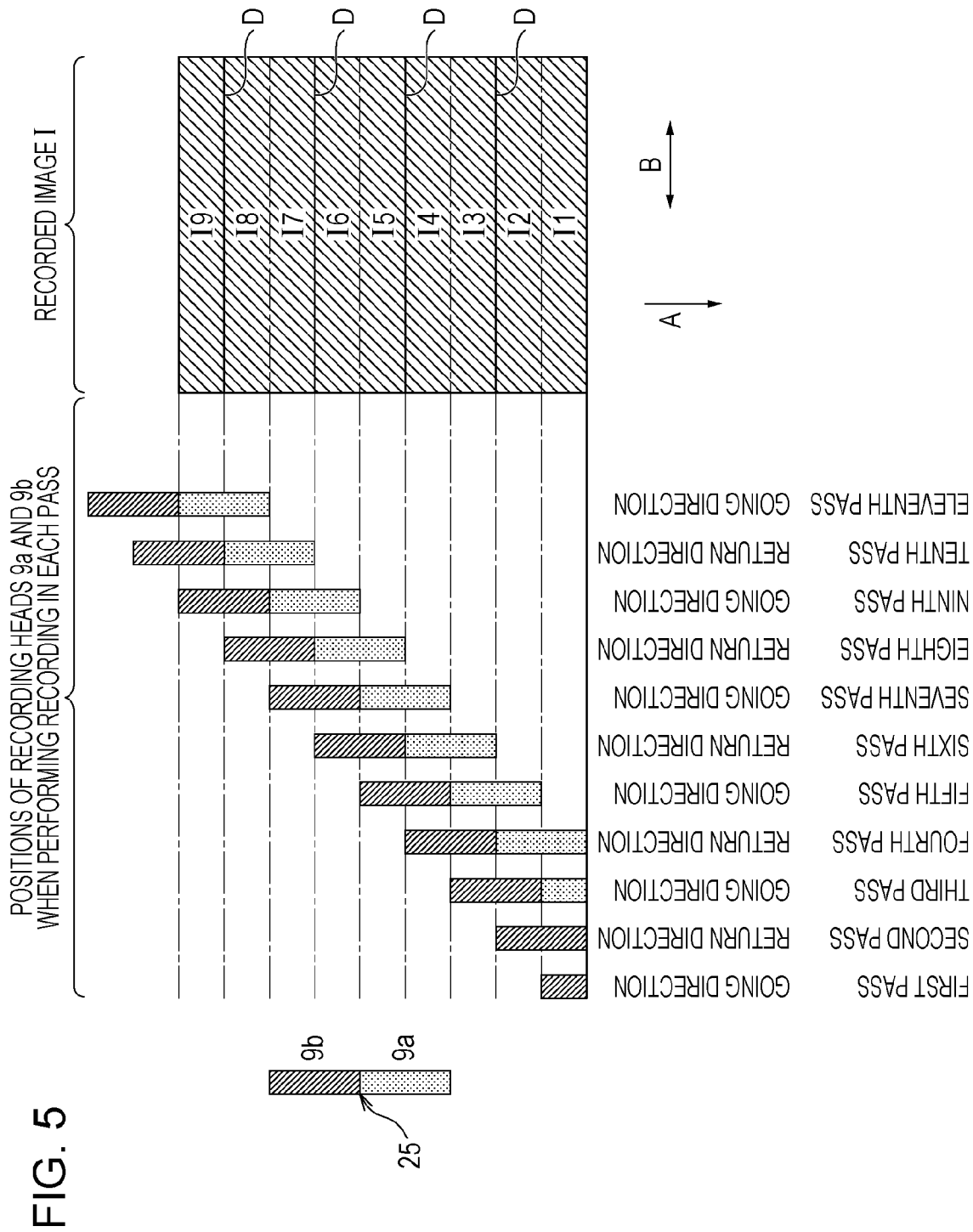


FIG. 6

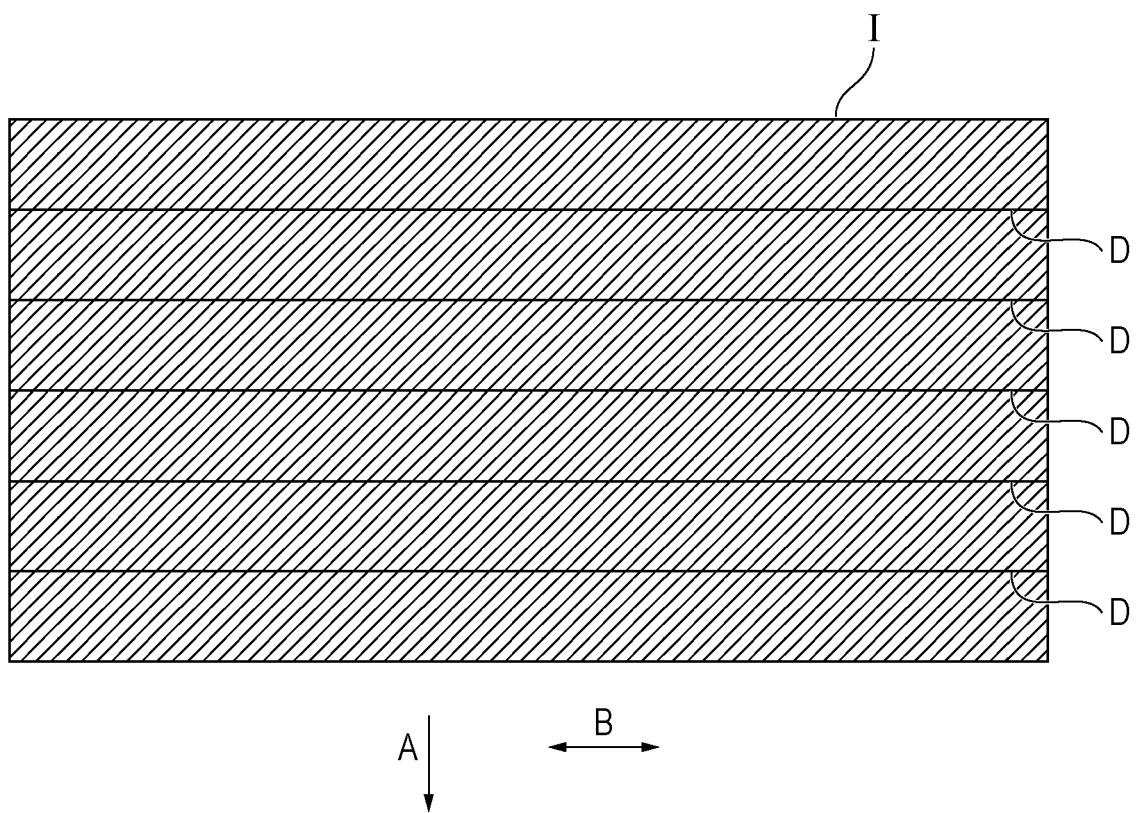


FIG. 7A

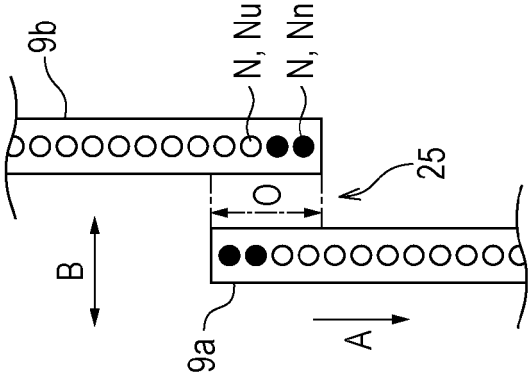


FIG. 7B

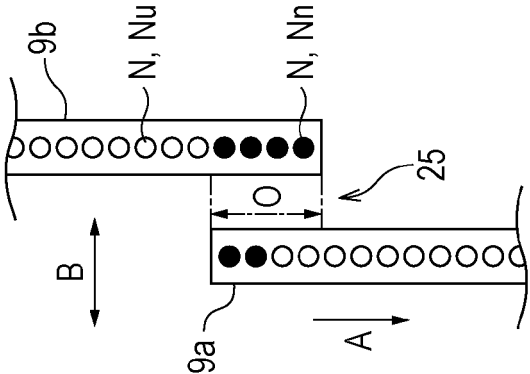


FIG. 7C

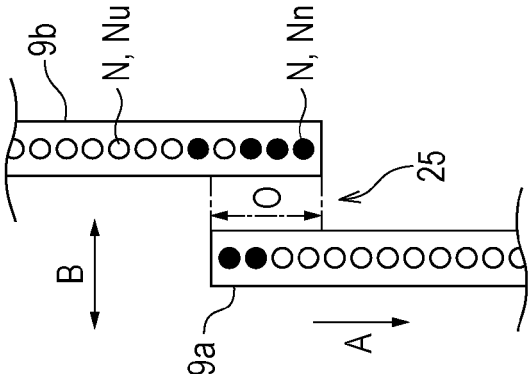


FIG. 7D

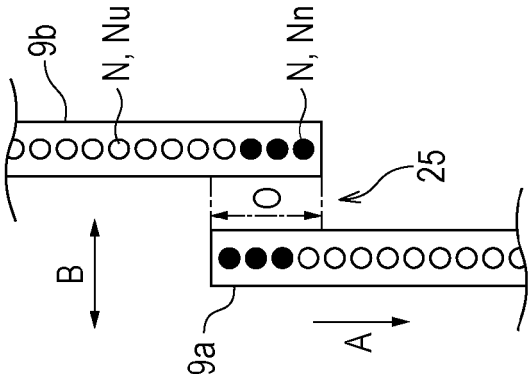


FIG. 8

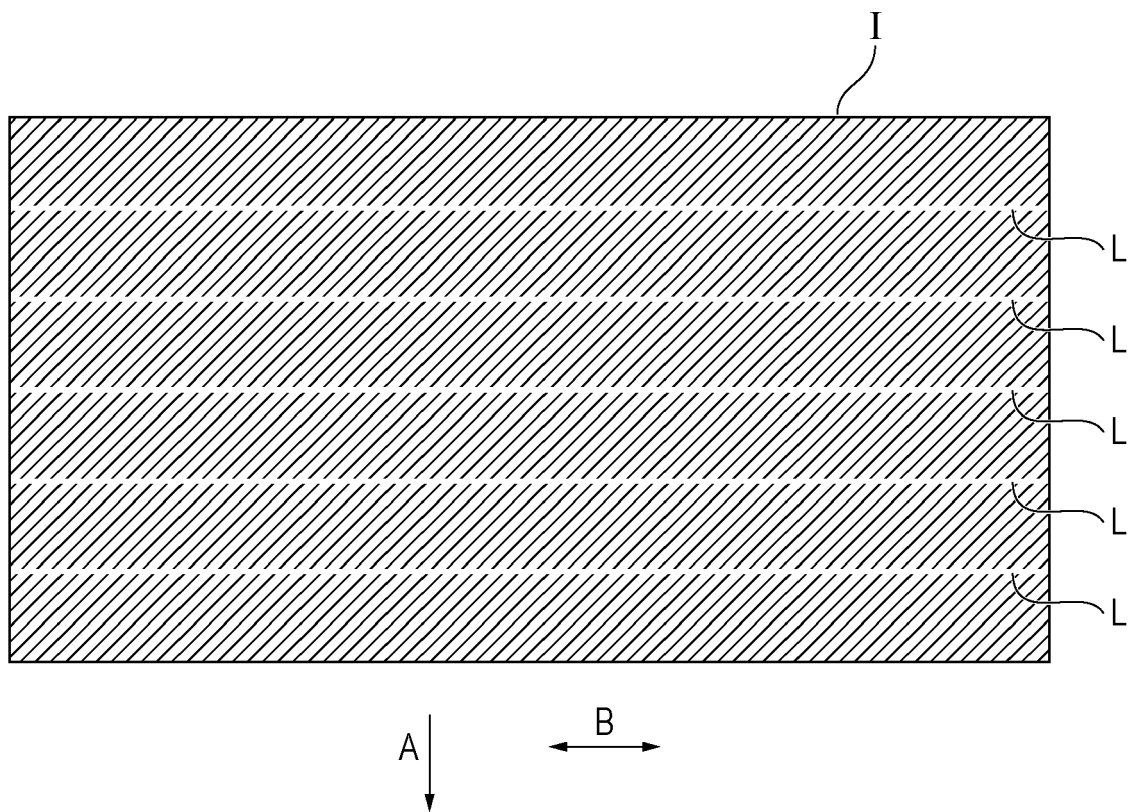


FIG. 9A

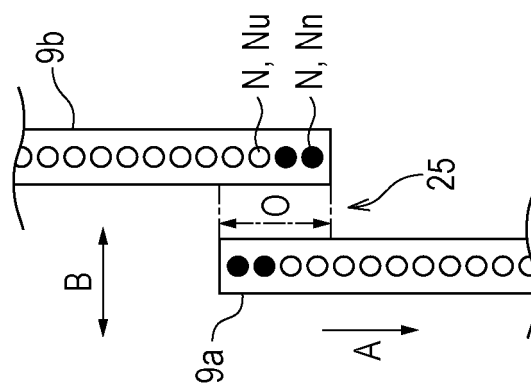


FIG. 9B

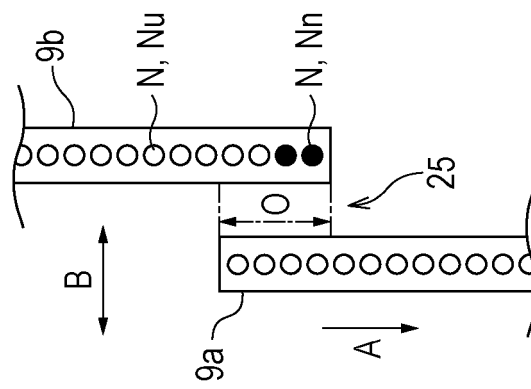


FIG. 9C

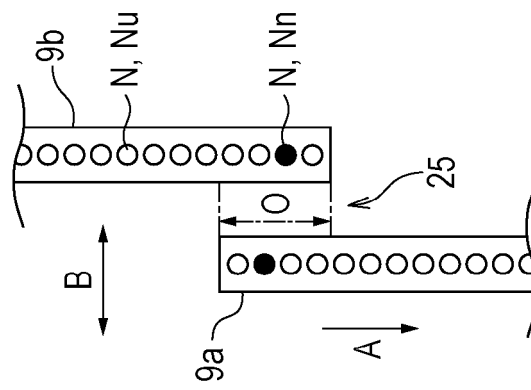
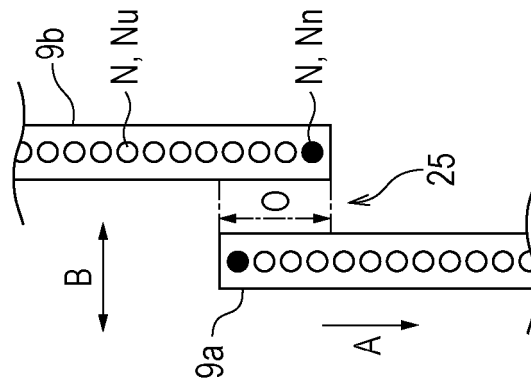


FIG. 9D





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			B41J
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Place of search		Date of completion of the search	Examiner
The Hague		26 February 2015	Gavaza, Bogdan
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