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(71) Applicant: **SCREEN Holdings Co., Ltd.**
Kyoto 602-8585 (JP)

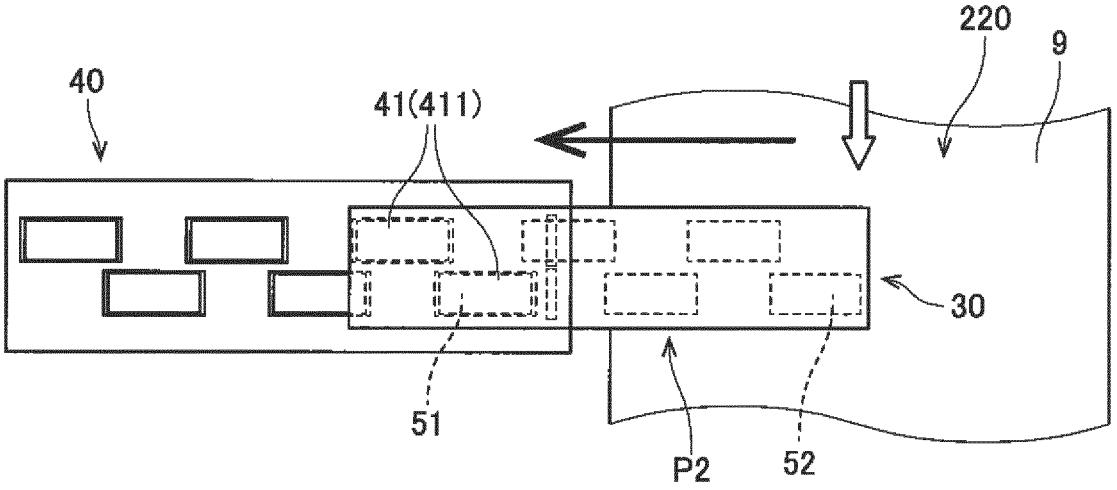
(72) Inventor: **Takeda, Morihiro**
Kyoto, 602-858 (JP)

(74) Representative: **Goddar, Heinz J.**
Boehmert & Boehmert
Anwaltspartnerschaft mbB
Patentanwälte Rechtsanwälte
Pettenkoferstrasse 20-22
80336 München (DE)

(54) PRINTING APPARATUS AND METHOD OF CLEANING PRINTING APPARATUS

(57) A printing apparatus includes a transferring mechanism, at least one head unit having a plurality of recording heads, a plurality of caps, and a moving mechanism that moves the head unit between a printing position and a cleaning position. The recording heads include a terminal head located above a transfer path in the cleaning position. A gap between the head unit and the transfer path in the cleaning position is larger than a gap therebetween in the printing position. This allows transfer of a thick part of a recording medium in the cleaning step. Specifically, the cleaning step can be performed and recording media can be exchanged simultaneously. This can shorten a time of suspension of the printing step, thereby enhancing efficiency of printing operation.

FIG.3B



EP 3 056 346 A2

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a printing apparatus and a method of cleaning the printing apparatus.

Description of the Background Art

[0002] A printing apparatus which prints an image on recording medium like a long strip by discharging droplets to the recording medium transferred by a transferring mechanism has been hitherto used. Such a conventional printing apparatus is described in Japanese Patent Application Laid-Open No. 2008-36865, for example.

[0003] In the printing apparatus (ink-jet apparatus) described in Japanese Patent Application Laid-Open No. 2008-36865, when a recording medium like a long strip is to be exchanged, a rear end portion of this recording medium is connected to a front end portion of a new recording medium with an adhesive tape (paragraph 0020). This forms a thick part at the connection between the recording media thicker than the other parts of the recording media. If a rear end portion of a recording medium printed previously and a front end portion of a new recording medium are affixed with an adhesive agent, a thickness is also increased at the connection between the recording media.

[0004] In the printing apparatus described in Japanese Patent Application Laid-Open No. 2008-36865, the head unit or the recording media are made to retreat when the connection is to pass through under the head unit, thereby suppressing contact of the connection between the recording medium with a head (paragraphs 0022 and 0030). Thus, a printing step is suspended as the printing step cannot be performed in the printing apparatus during exchange of recording media.

[0005] In a printing apparatus employing what is called an ink-jet system of discharging droplets to a recording medium, continuing the printing step for a long time gradually causes discharge failure at a nozzle. Further, if printing is stopped temporarily, ink attached to the nozzle may be solidified to cause discharge failure. Thus, a cleaning step is performed on a head with a nozzle suffering from the discharge failure at regular intervals or before the printing is restarted. However, performing such cleaning step necessitates suspension of the printing step. Specifically, performing the cleaning step leads to reduction in efficiency of printing operation.

SUMMARY OF THE INVENTION

[0006] The present invention is intended to provide a technique capable of suppressing reduction in efficiency of printing operation to be caused by a cleaning step in a printing apparatus of printing an image on a recording medium like a long strip.

[0007] To solve the aforementioned problem, a first aspect of the present invention is intended for a printing apparatus that discharges droplets on a recording medium like a long strip transferred in a longitudinal direction. The printing apparatus comprises: a transferring mechanism that transfers the recording medium while holding the recording medium on a transfer path; a head unit having at least one plurality of recording heads with a plurality of nozzles from which the droplets are discharged to an upper surface of the recording medium; a plurality of caps used for cleaning on ones of the recording heads, the caps being located on one side in a width direction relative to the transfer path; a moving mechanism that changes a relationship in terms of location among the transferring mechanism, the head unit, and the caps between a printing position and a cleaning position by moving at least the head unit; and a controller for operational control on the transferring mechanism, the head unit, the caps, and the moving mechanism. The recording heads include: a target head as a target of cleaning in a cleaning step; and a terminal head located nearest the other side in the width direction among the recording heads. The target head and the terminal head are located above the transfer path in the printing position. The target head is located above one of the caps and the terminal head is located above the transfer path, in the cleaning position. A gap in a vertical direction between the head unit and the transfer path for the recording medium in the cleaning position is larger than a gap in the vertical direction between the head unit and the transfer path for the recording medium in the printing position.

[0008] A second aspect of the present invention is intended for a method of cleaning a recording head implemented in a printing apparatus comprising at least one head unit having a plurality of recording heads including a target head and a terminal head, a transfer path through which a recording medium is transferred, and a cleaning mechanism having a plurality of caps and located in a position not overlapping the transfer path in a vertical direction. The method comprises the steps of: a) changing a relationship in terms of location among the transfer path, the head unit, and the caps from a printing position to a cleaning position by moving at least the head unit, the printing position being a position where all the recording heads of the head unit are located above the transfer path, the cleaning position being a position where at least one of the recording heads is located above at least one of the caps and other one of the recording heads is located above the transfer path; and b) cleaning the at least one recording head located above the at least one cap in the cleaning position. The step b) is performed after the step a). A gap in the vertical direction between the head unit and the transfer path for the recording medium in the cleaning position is larger than a gap in the vertical direction between the head unit and the transfer path for the recording medium in the printing position.

[0009] According to the first and second aspects of the

present invention, while the head unit is cleaned, the gap between the head unit and the transfer path for the recording medium is larger than a gap therebetween in a printing step. This allows transfer of a thick part such as a connection between printing media in the cleaning step. As a result, the recording media can be exchanged and the cleaning step can be performed simultaneously This can shorten a time of suspension of the printing step, thereby enhancing efficiency of printing operation.

[0010] These and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 conceptually shows the structure of a printing apparatus according to a preferred embodiment;
Fig. 2 is a bottom view of a head unit according to the preferred embodiment;
Figs. 3A, 3B, and 3C are top views each showing a recording head, a cleaning mechanism, and a printing sheet in a state when a printing step and a cleaning step are performed in the printing apparatus according to the preferred embodiment;
Figs. 4A, 4B, and 4C are vertical sectional views each showing the recording head, the cleaning mechanism, and the printing sheet in the state when the printing step and the cleaning step are performed in the printing apparatus according to the preferred embodiment;
Fig. 5 is a block diagram showing a control system of the printing apparatus according to the preferred embodiment; and
Fig. 6 is a flowchart showing a flow of the cleaning step according to the preferred embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] A preferred embodiment according to the present invention will now be described with reference to the drawings. In the below, a direction where a printing sheet 9 is transferred is called a "transfer direction" and a horizontal direction perpendicular to the transfer direction is called a "width direction." Further, a side of a cap 41 relative to a transfer path 220 for the printing sheet 9 is called "one side in the width direction" and a side of the transfer path 220 for the printing sheet 9 relative to the cap 41 is called "the other side in the width direction."

<1. Structure of Recording Apparatus>

[0013] Fig. 1 conceptually shows the structure of a printing apparatus 1 according to a preferred embodiment of the present invention. Fig. 2 is a bottom view of a head unit 30. Figs. 3A, 3B, and 3C are top views each showing a head unit 30, a cleaning mechanism 40, and a printing sheet 9 in a state when a printing step and a cleaning step are performed. Figs. 4A, 4B, and 4C are vertical sectional views each showing the head unit 30, the cleaning mechanism 40, and the printing sheet 9 in the state when the printing step and the cleaning step are performed. Fig. 5 is a block diagram showing a control system of the printing apparatus 1.

[0014] The printing apparatus 1 employs an ink-jet system of recording a color image on a printing sheet 9 as a recording medium like a long strip by discharging ink droplets onto the printing sheet 9 from a plurality of recording heads 32 of at least one head unit 30 while transferring the printing sheet 9. As shown in Figs 1, Figs. 3A to 3C, and Figs. 4A to 4C, the printing apparatus 1 includes a transferring mechanism 20, four head units 30, the cleaning mechanism 40, and a controller 10.

[0015] The transferring mechanism 20 is to transfer a printing sheet 9 in the transfer direction corresponding to the longitudinal direction of the printing sheet 9 while holding the printing sheet 9. The transferring mechanism 20 of this preferred embodiment includes an unwinding section 21, a plurality of transferring rollers 22, and a winding section 23.

[0016] The unwinding section 21 includes a first feeding roller 211, a second feeding roller 212, and a buffer part 213 with a plurality of rollers. The unwinding section 21 may be configured as a unit independent of or integral with the other components of the printing apparatus 1.

[0017] The unwinding section 21 can change a source for a printing sheet 9 between the first and second feeding rollers 211 and 212. If only little space is left for printing in a printing sheet 9 fed from the first feeding roller 211, a rear end portion of the printing sheet 9 fed from the first feeding roller 211 can be affixed for example with an adhesive tape to a front end portion of a printing sheet 9 fed from the second feeding roller 212 to continue transfer. This achieves prompt change of a feeding roller.

[0018] The feeding rollers 211 and 212 of the unwinding section 21, the transferring rollers 22, and the winding section 23 are coupled to a motor as a power source (not shown in the drawings). As the controller 10 drives the motor, each of the feeding rollers 211 and 212 of the unwinding section 21, each transferring roller 22, and the winding section 23 rotate. Some of or all of the transferring rollers 22 may be follower rollers that are not coupled to the motor but are caused to rotate in response to movement of a printing sheet 9.

[0019] The transferring rollers 22 form the transfer path 220 for a printing sheet 9. Each transferring roller 22 rotates about a horizontal axis to guide the printing sheet 9 toward a downstream side of the transfer path 220. As the printing sheet 9 contacts the transferring rollers 22, tension is applied to the printing sheet 9. In this way, the printing sheet 9 is fed from the unwinding section 21 and transferred toward the winding section 23 along the transfer path 220 formed of the transferring rollers 22. After

being transferred, the printing sheet 9 is wound and collected at the winding section 23.

[0020] The four head units 30 are located above the transfer path 220 and arranged at interval in the transfer direction. The four head units 30 are to discharge ink droplets of black (K), cyan (C), magenta (M), and yellow (Y) onto the upper surface of a printing sheet 9. The printing apparatus 1 of the preferred embodiment is a recording apparatus employing what is called a one-pass system of recording a desired image pattern on a printing sheet 9 by discharging ink droplets from each head unit 30 while the printing sheet 9 passes through under each head unit 30 only once. The structures of the four head units 30 are substantially the same. Thus, the structure of one head unit 30 is described below.

[0021] As shown in Fig. 2, the head unit 30 includes a case 31 and a plurality of recording heads 32 attached to the case 31. Each recording head 32 has a discharge surface exposed at the lower surface of the case 31. The discharge surface at the lower surface of the recording head 32 is provided with a plurality of nozzles 33 arranged two dimensionally All the nozzles 33 are located in positions shifted in the width direction. Each of the nozzles 33 is allocated to a region having a width corresponding to one pixel on a printing sheet 9.

[0022] As shown in Fig. 2, the recording heads 32 are arranged in a staggered pattern (alternately in diagonally opposite positions) in the width direction. Specifically, the recording heads 32 include a first recording head line 321 extending in the width direction and a second recording head line 322 extending in the width direction and located in a downstream position relative to the first recording head line 321. The recording heads 32 in the first recording head line 321 and the recording heads 32 in the second recording head line 322 are arranged alternately in the width direction. The recording heads 32 are arranged densely in the width direction by being arranged in the aforementioned staggered pattern.

[0023] As conceptually shown in Figs. 3A to 3C and Figs. 4A to 4C, the four head units 30 each include a head moving mechanism 34. For example, the head moving mechanism 34 is achieved by a combination of moving mechanisms such as a linear guide, a timing belt, and a ball screw. The head moving mechanism 34 moves the head unit 30 in a vertical direction and the width direction. In this way, the head unit 30 can be located in a printing position P1, a first cleaning position P2, and a second cleaning position P3. Each of these positions is described later.

[0024] By the presence of the head moving mechanism 34 provided to each head unit 30, one of the four head units 30 can be moved independently of a different one of the head units 30. In this way, only some of the head units 30 can be cleaned in the cleaning step described later. For example, only the head unit 30 corresponding to the color K to be used frequently can be cleaned.

[0025] The cleaning mechanism 40 includes a plurality of caps 41, an ink ejecting mechanism 42, a wiping blade 43, and a wiper driving mechanism 44. As shown in Figs. 3A to 3C and Figs. 4A to 4C, the cleaning mechanism 40 is located in a position adjacent to the transfer path 220 in the width direction (a position not overlapping the transfer path 220 in the vertical direction).

[0026] The caps 41 are arranged in a staggered pattern in the width direction so as to be corresponding to the positions of the recording heads 32 of the head unit 30. Specifically, the caps 41 include a first cap line 401 extending in the width direction and a second cap line 402 extending in the width direction and located in a downstream position relative to the first cap line 401. The caps 41 in the first cap line 401 and the caps 41 in the second cap line 402 are arranged alternately in the width direction.

[0027] The ink ejecting mechanism 42 is to eject ink from the inside of the cap 41. Driving the ink ejecting mechanism 42 with the discharge surface of the recording head 32 covered with the cap 41 achieves suction purge of sucking ink in the recording head 32 through the cap 41 and each nozzle 33.

[0028] As shown in Figs. 3A to 3C and Figs. 4A to 4C, the ink ejecting mechanism 42 includes a suction pump 421, a first solenoid valve 422, and a second solenoid valve 423. Each cap 41 and the suction pump 421 are connected through the first or second solenoid valve 422 or 423.

[0029] A cap 41 belonging to the first cap line 401 and nearest the transfer path 220 and a cap 41 belonging to the second cap line 402 and nearest the transfer path 220 are connected to the first solenoid valve 422 through an ejection tube (not shown in the drawings). These caps 41 connected to the first solenoid valve 422 are called first caps 411 and the other caps 41 are called second caps 412. The second caps 412 are connected to the second solenoid valve 423 through the ejection tube. The first and second solenoid valves 422 and 423 are each connected to the suction pump 421 through the ejection tube.

[0030] If the suction pump 421 is driven while the first solenoid valve 422 is opened, the suction purge is performed on the recording heads 32 covered with the first caps 411 connected to the first solenoid valve 422. If the suction pump 421 is driven while both the first and second solenoid valves 422 and 423 are opened, the suction purge is performed on the recording heads 32 covered with all the caps 41, specifically, all the recording heads 32 in the head unit 30.

[0031] In the cleaning step described below, the suction purge is performed only on the recording heads 32 covered with the first caps 411. Meanwhile, the printing apparatus 1 is capable of conducting an overall cleaning step of performing the suction purge on all the recording heads 32.

[0032] In this preferred embodiment, each of the cap lines 401 and 402 has the three caps 41 and one of these three caps 41 is the first cap 411, to which the present invention is not limited. Each of the cap lines 401 and

402 may have two caps 41 and one of these caps 41 may be the first cap 411. Alternatively, each of the cap lines 401 and 402 may have four caps 41 or more and one or more of these caps 41 may be the first caps 411.

[0033] The wiping blade 43 is a member used for wiping off the discharge surface of the recording head 32. The ink ejecting mechanism 42 of this preferred embodiment includes two wiping blades 43. Each of the wiping blades 43 is located on the other side in the width direction relative to the corresponding one of the cap lines 401 and 402. Specifically, each of the wiping blades 43 is located between the corresponding one of the cap lines 401 and 402 and the transfer path 220.

[0034] The wiper driving mechanism 44 is to move the wiping blades 43 up and down. The wiper driving mechanism 44 is achieved by an air cylinder, for example. The wiper driving mechanism 44 of this embodiment can move the two wiping blades 43 up and down with timings differing between the wiping blades 43.

[0035] In order for the printing apparatus 1 to perform the printing step, while a printing sheet 9 is transferred by the transferring mechanism 20, ink droplets are discharged onto the upper surface of this printing sheet 9 from the recording heads 32 of each head unit 30. Each head unit 30 includes the nozzles 33 located in positions covering an area that faces the substantially entire width of the upper surface of the printing sheet 9 and from which ink droplets are to be discharged. This allows each head unit 30 to discharge ink droplets onto the upper surface of the printing sheet 9 through the substantially entire width thereof.

[0036] Ink droplets of the same color may be recorded on a printing sheet 9 using two or more head units 30. As an example, the two or more head units 30 to discharge ink droplets of the same color may be arranged in combination in the width direction of the printing sheet 9, thereby allowing discharge of ink droplets of this color onto the upper surface of the printing sheet 9 through the substantially entire width thereof.

[0037] The aforementioned process of discharging ink droplets is performed sequentially at the four head units 30 each prepared for a corresponding color, thereby forming a color pattern on the upper surface of a printing sheet 9.

[0038] The controller 10 is to control the operation of each part in the printing apparatus 1. As conceptually shown in Fig. 1, the controller 10 of this preferred embodiment is formed of a computer including an arithmetic processor 11 such as a CPU, a memory 12 such as a RAM, and a storage 13 such as a hard disk drive. As shown in Fig. 5, the controller 10 is electrically connected to the transferring mechanism 20, each of the four head units 30, and the head moving mechanism 34. The controller 10 is further electrically connected to the suction pump 421, each of the first and second solenoid valves 422 and 423, and the wiper driving mechanism 44 of the cleaning mechanism 40.

[0039] The controller 10 reads a computer program 131 and data 132 from the storage 13 and stores the read computer program 131 and data 132 on the memory 12 temporarily. Then, the arithmetic processor 11 performs arithmetic processing based on the computer program 131 and the data 132, thereby controlling the operation of each part in the printing apparatus 1. As a result, the printing step and the cleaning step described later proceed in the printing apparatus 1. The controller 10 may alternatively be formed of an electronic circuit.

<2. Cleaning Step>

[0040] The cleaning step on the recording head 32 in the printing apparatus 1 is described next by referring to Figs. 3A to 3C, Figs. 4A to 4C, and Fig. 6. Fig. 6 is a flowchart showing a flow of the cleaning step according to the preferred embodiment.

[0041] In the printing apparatus 1, for exchange of the feeding rollers 211 and 212 from which printing sheets 9 are to be fed, a rear end portion of a printing sheet 9 printed previously and a front end portion of a printing sheet 9 to be printed next are affixed with an adhesive agent or an adhesive tape, for example. This forms a thick part at the connection between the printing sheets 9 thicker than the other parts of the printing sheets 9. Thus, the printing sheets 9 may warp and protrude upward at the connection and in places near the connection. To suppress contact of the connection between the printing sheets 9 and parts of the printing sheets 9 near the connection with the lower surface of the recording head 32, a gap in the vertical direction should be increased between the head unit 30 and the transfer path 220 for the printing sheets 9.

[0042] In the printing apparatus 1 employing an ink-jet system, performing the printing step for a long time may cause discharge failure at some of the nozzles 33 due to increased viscosity of ink or attachment of a foreign object such as paper dust near the nozzle 33 of the recording head 32. If printing is stopped temporarily, ink attached to the nozzle 33 may be solidified to cause discharge failure at some of the nozzles 33. Thus, the suction purge is performed on the recording head 32 with the nozzle 33 suffering from the discharge failure at regular intervals or before the printing is restarted. Performing the suction purge on all the recording heads 32 consumes ink in large amount. Thus, it is desirable that the suction purge be performed only on some of the recording heads 32 including the recording head 32 with the nozzle 33 suffering from the discharge failure.

[0043] In the printing step, the head unit 30 is located in the printing position P1. In a flow of the cleaning step of this preferred embodiment described below, a recording head 32, which is one of the recording heads 32 of the head unit 30 and nearest the one side in the width direction in the second recording head line 322, is called a target head 51 as a target of cleaning in the cleaning step. A recording head 32, which is one of the recording heads 32 of the head unit 30 and nearest the other side

in the width direction, is called a terminal head 52.

[0044] As shown in Figs. 3A and 4A, in the printing position P1, all the recording heads 32 of the head unit 30 are located above a printing sheet 9 placed on the transfer path 220. Specifically, in the printing position P1, both the target head 51 and the terminal head 52 are located above the printing sheet 9. When a connection between printing sheets 9 is fed from the unwinding section 21 and transferred onto the transfer path 220 in the printing step, the printing step is suspended and the cleaning step is started.

[0045] In the cleaning step, the controller 10 first drives the head moving mechanism 34 to move the head unit 30 to the first cleaning position P2 as shown by an arrow in each of Figs. 3B and 4B (step S101). Specifically, step S101 is a first moving step of changing a relationship in terms of location among the transfer path 220, the head unit 30, and the cap 41 from the printing position P1 to the first cleaning position P2 by moving the head unit 30.

[0046] As shown in Figs. 3B and 4B, in the first cleaning position P2, the target head 51 is located above the first cap 411 and the terminal head 52 is located above the transfer path 220. In the first cleaning position P2, the discharge surface of the target head 51 is housed in the first cap 411.

[0047] As shown in Figs. 4A to 4C, the gap in the vertical direction between the head unit 30 and the transfer path 220 in the first cleaning position P2 is larger than the gap in the vertical direction between the head unit 30 and the transfer path 220 in the printing position P1. As shown in Fig. 4B, this suppresses the contact of a connection 90 between the printing sheets 9 with the discharge surface of each recording head 32 while the connection 90 passes through under the head unit 30, with the head unit 30 located in the first cleaning position P2.

[0048] After the head unit 30 is located in the first cleaning position P2, the controller 10 performs the suction purge on the target head 51 (step S102). More specifically, the controller 10 opens the first solenoid valve 422 and closes the second solenoid valve 423. In this state, the controller 10 drives the suction pump 421. As a result, ink is sucked from the inside of each of the recording heads 32, including the target head 51, with the discharge surface housed in the first cap 411 into the suction pump 421 through the nozzles 33, the first cap 411, the ejection tube, and the first solenoid valve 422. In this way, discharge failure of ink occurring at the target head 51 is resolved.

[0049] In steps S101 and S102, the wiping blades 43 are located in a storage position P4. The wiping blades 43 in the storage position P4 each have an upper end portion located below the upper end portion of the cap 41. This prevents contact of the wiping blades 43 with the recording head 32 in steps S101 and S102.

[0050] Next, the controller 10 drives the head moving mechanism 34 to move the head unit 30 to the second cleaning position P3 higher than the first cleaning position P2 (step S103). The controller 10 further drives the wiper driving mechanism 44 to move the wiping blades 43 to a wiping position P5. The upper end portion of each wiping blade 43 in the wiping position P5 is located above the upper end portion of the cap 41.

[0051] The discharge surface of the recording head 32 in the second cleaning position P3 and the upper end surface of each wiping blade 43 in the wiping position P5 are located in positions substantially the same in the vertical direction. The second cleaning position P3 mentioned herein is a position where the discharge surface of each of the recording heads 32, including the target head 51, subjected to the suction purge in step S102 is located in a position nearest the one side in the width direction where this discharge surface contacts the upper end portion of a corresponding one of the wiping blades 43 located in the wiping position P5.

[0052] After performing step S103, the controller 10 moves the head unit 30 toward the other side in the width direction with the wiping blades 43 located in the wiping position P5. In this way, the discharge surfaces of the recording heads 32 subjected to the suction purge in step S102 are wiped off with the corresponding wiping blades 43 (step S104). As a result, a meniscus of the ink having been broken by the suction purge is formed again in each of the nozzles 33 of the recording heads 32 subjected to the suction purge.

[0053] After the recording heads 32 subjected to the suction purge pass through over the corresponding wiping blades 43, the controller 10 returns the wiping blades 43 to the storage position P4. The controller 10 adjusts timings of moving the wiping blades 43 to the wiping position P5 appropriately in a manner such that the wiping blades 43 will not contact a recording head 32 not subjected to the suction purge.

[0054] As shown in Figs. 4A to 4C, the gap in the vertical direction between the head unit 30 and the transfer path 220 in the second cleaning position P3 is larger than the gap in the vertical direction between the head unit 30 and the transfer path 220 in the printing position P1. As shown in Fig. 4C, this suppresses the contact of a connection 90 between the printing sheets 9 with the discharge surface of each recording head 32 while the connection 90 passes through under the head unit 30, with the head unit 30 located in the second cleaning position P3.

[0055] After the wiping off with the wiping blades 43 is finished, the controller 10 determines whether the connection 90 between the printing sheets 9 has passed through under all the head units 30 (step S105). If the controller 10 determines that the connection 90 has not passed through under all the head units 30, the flow returns to step S105.

[0056] If the controller 10 determines that the connection 90 has passed through under all the head units 30, the flow proceeds to step S106. Then, the controller 10 moves each head unit 30 to the printing position P1 (step S106). Specifically, step S106 is a second moving step of changing the relationship in terms of location among

the transfer path 220, the head unit 30, and the cap 41 from the second cleaning position P3 to the printing position P1 by moving the head unit 30.

[0057] As described above, in the cleaning step of this preferred embodiment, while the increased gap is kept between the head unit 30 and the transfer path 220, the suction purge is performed on some of the recording heads 32. Specifically, the gap between the head unit 30 and the transfer path 220 is larger in the cleaning step than a gap therebetween in the printing step.

[0058] This allows transfer of the thick part such as the connection 90 between the printing sheets 9 during the cleaning step. As a result, the printing sheets 9 can be exchanged and the cleaning step can be performed simultaneously. This can shorten a time of suspension of the printing step, thereby enhancing efficiency of printing operation.

[0059] The first and second cleaning positions P2 and P3 vary in a manner that depends on the position of the target head 51 as a target of cleaning. If the target head 51 includes a plurality of target heads 51 and all these target heads 51 cannot be housed in the first caps 411 simultaneously, steps S101 and S102 may be repeated for these target heads 51 individually. Then, all the heads 32 subjected to the suction purge may be wiped off in step S104.

<3. Modifications>

[0060] While the one embodiment according to the present invention has been described hereinabove, the present invention is not limited to the aforementioned embodiment.

[0061] In the aforementioned embodiment, the height of the transfer path for a printing sheet is fixed and the height of the head unit is changed for changing a gap in the vertical direction between the head unit and the transfer path, to which the present invention is not limited. The head unit may be allowed to move only in the horizontal direction (width direction) and the gap in the vertical direction between the head unit and the transfer path may be changed by moving the transfer path in the vertical direction. Additionally, in the aforementioned embodiment, the height of the cap is fixed. Alternatively, the height of the cap may be changed.

[0062] Specifically, what is required for the moving mechanism of the present invention is to change the relationship in terms of location among the transferring mechanism, the head unit, and the cap between the printing position and the cleaning position by moving at least the head unit.

[0063] The printing apparatus of the aforementioned embodiment includes four head units. Alternatively, the printing apparatus may include one head unit. Still alternatively, the number of the head units may be two or three or five or more.

[0064] The printing apparatus of the aforementioned embodiment is to perform the suction purge on a recording head as a target of cleaning in the cleaning step. Alternatively, according to the present invention, a recording head as a target of cleaning in the cleaning step may be subjected to pressurizing purge or action called spitting or flushing of causing discharge from a nozzle.

[0065] The printing apparatus of the aforementioned embodiment is to print an image on a printing sheet as a recording medium. Alternatively, the printing apparatus of the present invention may be an apparatus to print a pattern such as an image on a sheet-like recording medium (such as a resin film, for example) other than a generally-used recording medium made of paper.

[0066] The components described in the aforementioned embodiment and in the modifications may be consistently combined together, where appropriate.

[0067] While the invention has been described in detail, the foregoing description is in all aspects illustrative and not restrictive. It is understood that numerous other modifications and variations can be devised without departing from the scope of the invention.

Claims

1. A printing apparatus that discharges droplets on a recording medium like a long strip transferred in a longitudinal direction, the printing apparatus comprising:

a transferring mechanism that transfers said recording medium while holding said recording medium on a transfer path;
at least one head unit having a plurality of recording heads with a plurality of nozzles from which said droplets are discharged to an upper surface of said recording medium;
a plurality of caps used for cleaning on ones of said recording heads, the caps being located on one side in a width direction relative to said transfer path;
a moving mechanism that changes a relationship in terms of location among said transferring mechanism, said head unit, and said caps between a printing position and a cleaning position by moving at least said head unit; and
a controller for operational control on said transferring mechanism, said head unit, said caps, and said moving mechanism,
wherein said recording heads include:

a target head as a target of cleaning in a cleaning step; and
a terminal head located nearest the other side in the width direction among said recording heads,
said target head and said terminal head are located above said transfer path in said printing position,

said target head is located above one of said caps and said terminal head is located above said transfer path, in said cleaning position, and

a gap in a vertical direction between said head unit and said transfer path for said recording medium in said cleaning position is larger than a gap in the vertical direction between said head unit and said transfer path for said recording medium in said printing position.

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

an ejecting mechanism connected to said caps; wherein said ejecting mechanism sucks liquid in said target head through corresponding said nozzles and said cap in said cleaning step.

3. The printing apparatus according to claim 2, wherein said caps include:

a first cap used for the suction by said ejecting mechanism in said cleaning step; and

a second cap not used for the suction by said ejecting mechanism in said cleaning step.

4. The printing apparatus according to claim 2 or 3, further comprising:

a wiping blade located on the one side in said width direction relative to said transfer path and on the other side in said width direction relative to said caps,

wherein said wiping blade is used for wiping off said nozzles of said target head after the suction by said ejecting mechanism, in said cleaning step.

5. The printing apparatus according to any one of claims 1 to 4, wherein

said transfer path for said recording medium is placed at a fixed height, and

said moving mechanism changes the height of said head unit.

6. The printing apparatus according to any one of claims 1 to 5, wherein

said at least one head unit includes a plurality of head units, and

said moving mechanism moves at least one of said head units and a different one of said head units independently of each other.

7. A method of cleaning a recording head implemented in a printing apparatus comprising at least one head unit having a plurality of recording heads, a transfer path through which a recording medium is transferred, and a cleaning mechanism having a plurality of caps and located in a position not overlapping said transfer path in a vertical direction,

the method comprising the steps of:

a) changing a relationship in terms of location among said transfer path, said head unit, and said caps from a printing position to a cleaning position by moving at least said head unit, said printing position being a position where all said recording heads of said head unit are located above said transfer path, said cleaning position being a position where at least one of said recording heads is located above at least one of said caps and other one of said recording heads is located above said transfer path; and

b) cleaning said at least one recording head located above said at least one cap in said cleaning position, said step b) being performed after said step a),

wherein a gap in the vertical direction between said head unit and said transfer path for said recording medium in said cleaning position is larger than a gap in the vertical direction between said head unit and said transfer path for said recording medium in said printing position.

8. The method of cleaning a recording head according to claim 7, wherein

said step b) includes the step of:

b1) performing suction purge of sucking ink from the inside of said recording head located above said one cap through said one cap.

9. The method of cleaning a recording head according to claim 8,

wherein said step b) further includes the step of:

b2) wiping off said recording head subjected to said suction purge, said step b2) being performed after said step b1).

10. The method of cleaning a recording head according to any one of claims 7 to 9, further comprising the steps of:

c) letting a thick part of said recording medium thicker than the other part of said recording medium pass through under said head unit, said step c) being performed after said step a); and

d) changing the relationship in terms of location among said transfer path, said head unit, and said caps from said cleaning position to said printing position by moving at least said head unit, said step d) being performed after said steps b) and c).

FIG.1

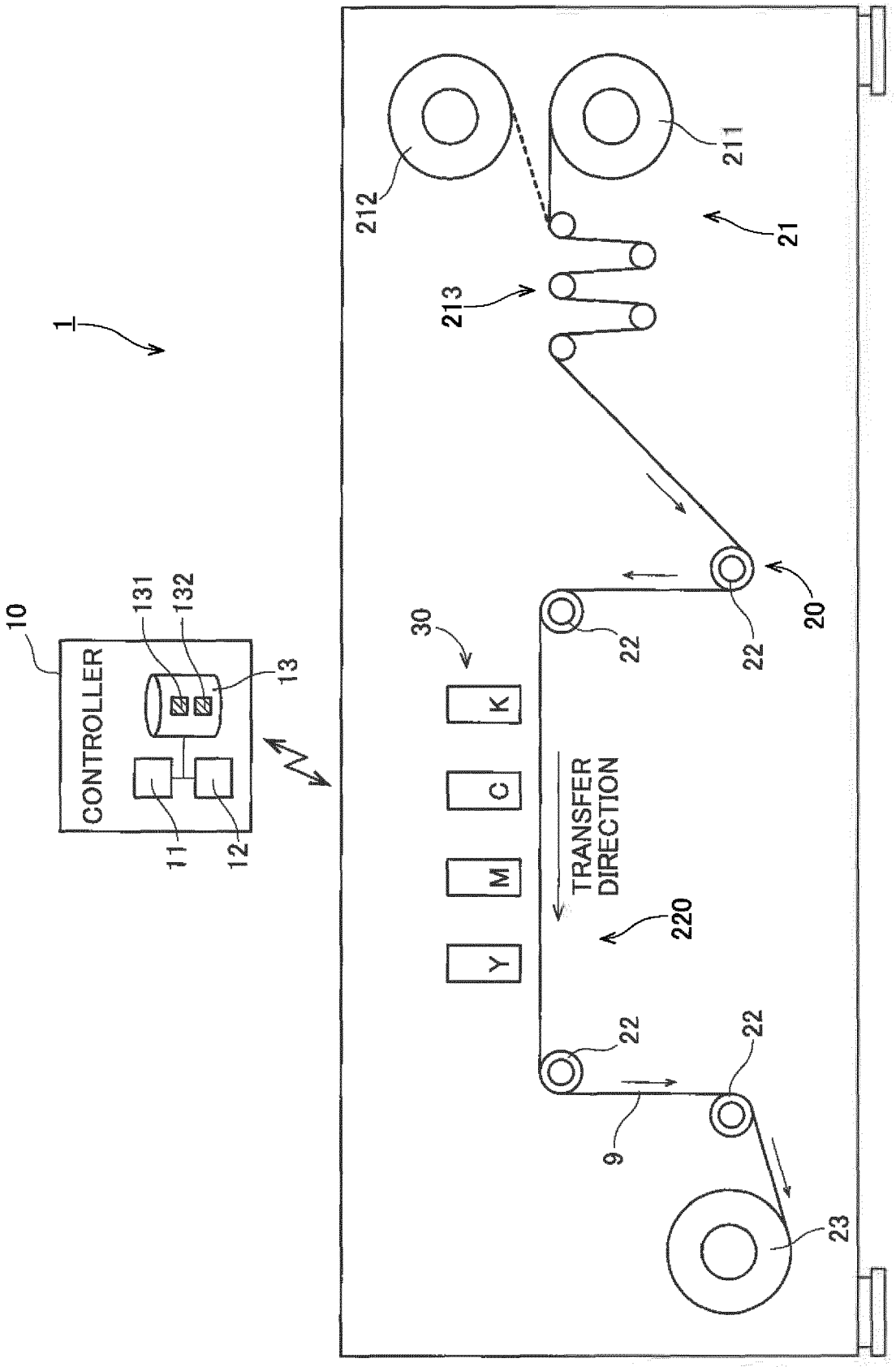

1
10
CONTROLLER
131
132
13
11
12
212
211
21
213
20
22
22
30
K
C
M
Y
TRANSFER DIRECTION
220
22
22
9
23

FIG.2

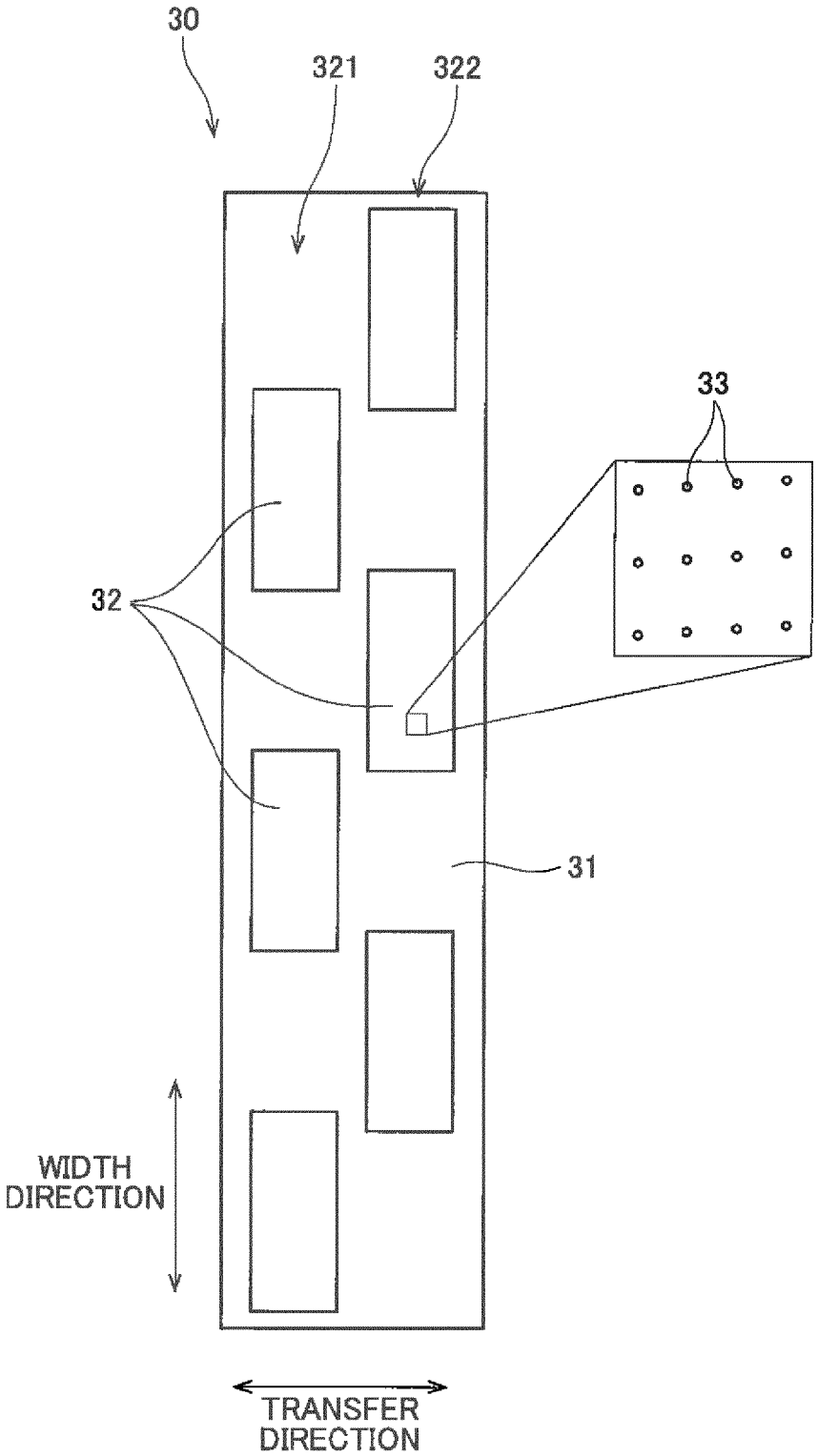


FIG.3A

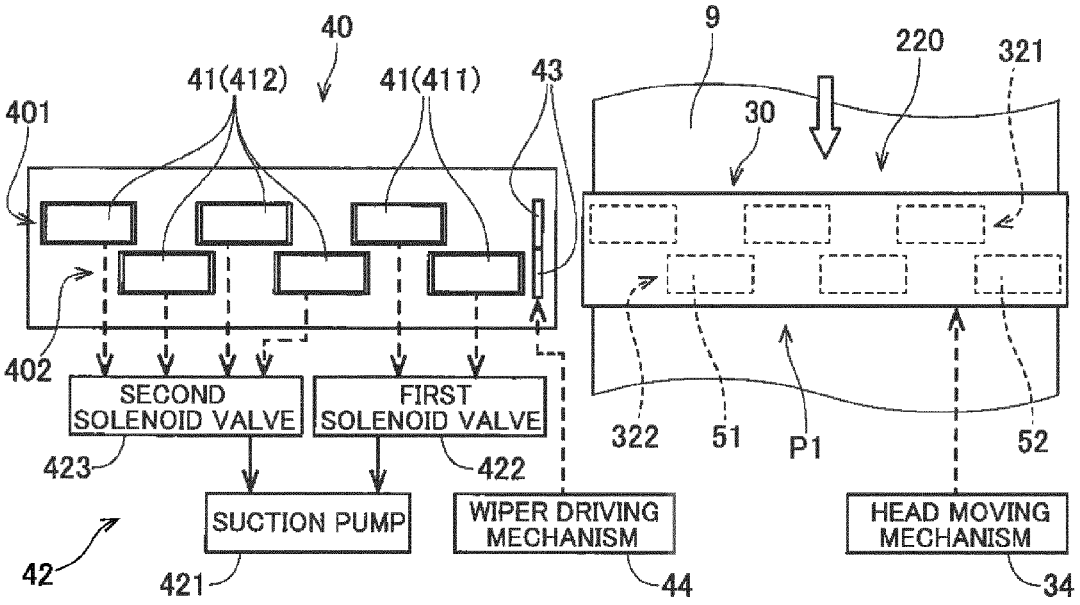


FIG.3B

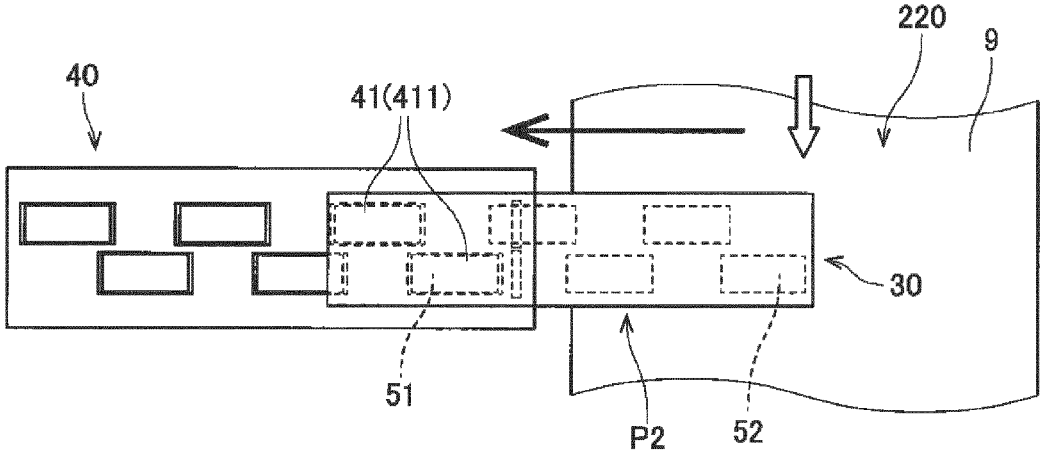


FIG.3C

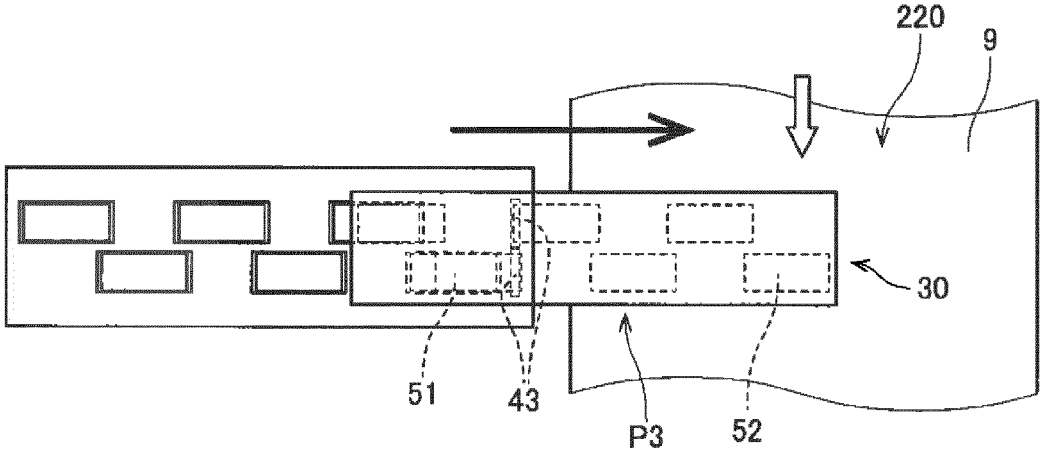


FIG.4A

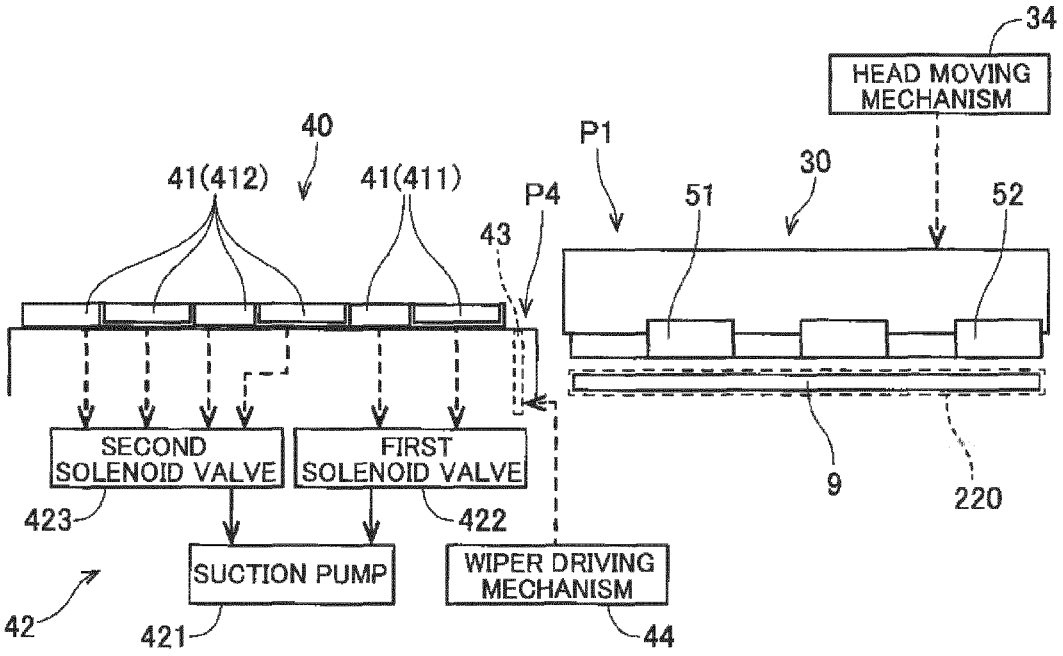


FIG.4B

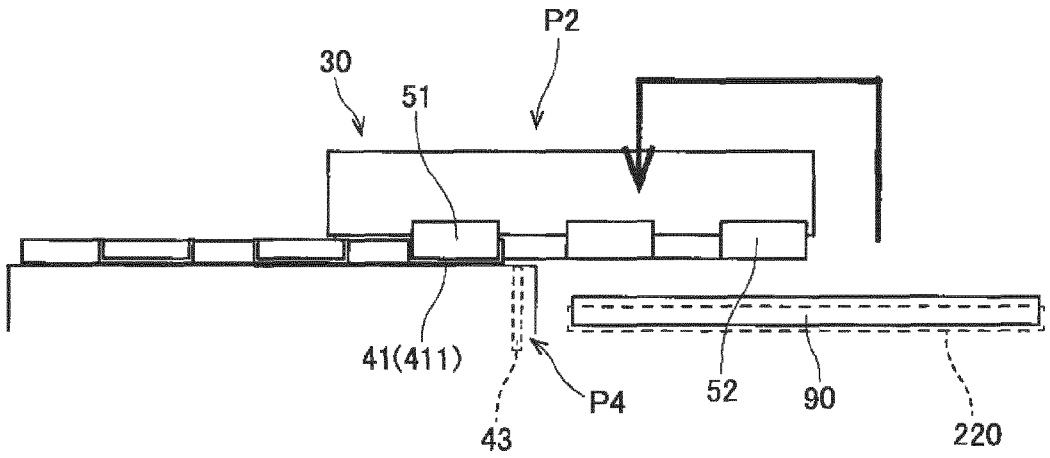


FIG.4C

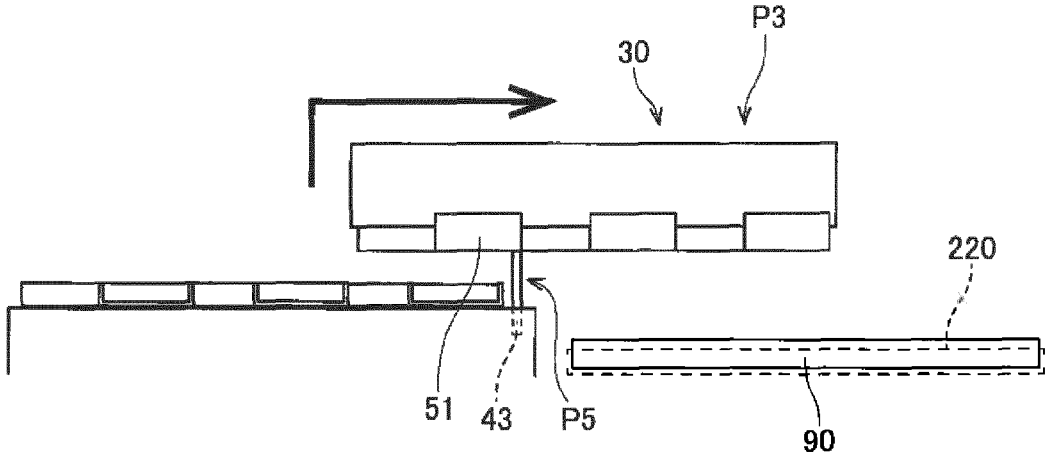


FIG.5

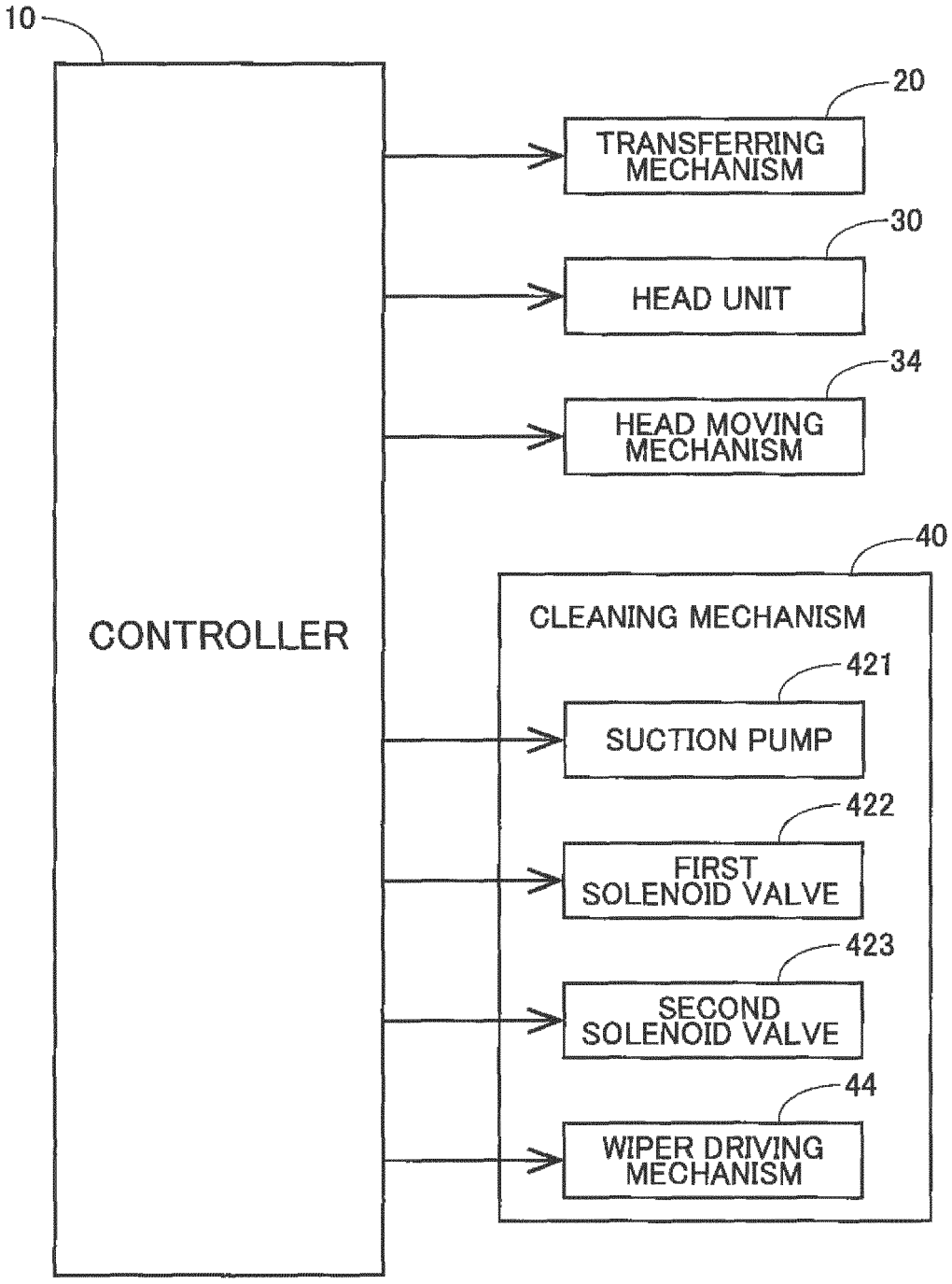
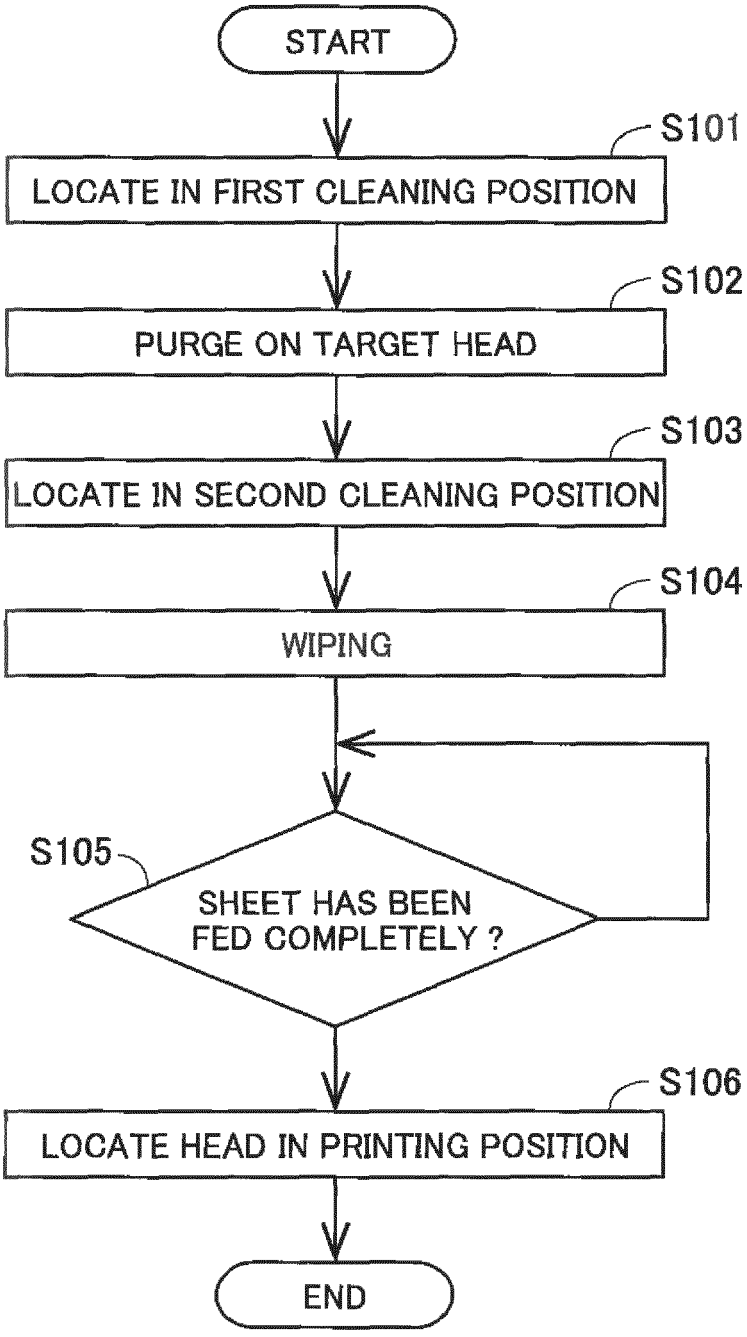

10
CONTROLLER
20
TRANSFERRING MECHANISM
30
HEAD UNIT
34
HEAD MOVING MECHANISM
40
CLEANING MECHANISM
421
SUCTION PUMP
422
FIRST SOLENOID VALVE
423
SECOND SOLENOID VALVE
44
WIPER DRIVING MECHANISM

FIG.6


START
S101
LOCATE IN FIRST CLEANING POSITION
S102
PURGE ON TARGET HEAD
S103
LOCATE IN SECOND CLEANING POSITION
S104
WIPING
S105
SHEET HAS BEEN FED COMPLETELY ?
S106
LOCATE HEAD IN PRINTING POSITION
END

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2008036865 A **[0002] [0003] [0004]**