EUROPEAN PATENT SPECIFICATION

(54) Ink jet recording apparatus including pump, method for controlling the ink-jet recording apparatus and method for controlling the pump

Tintenstrahlaufzeichnungsgerät mit Pumpe, Verfahren zur Steuerung eines Tintenstrahlaufzeichnungsgerätes und Verfahren zur Steuerung der Pumpe

Appareil d'enregistrement à jet d'encre avec pompe, méthode de commande d'un appareil d'enregistrement à jet d'encre et méthode de commande de la pompe

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an ink-jet recording apparatus comprising a pump that sucks liquid therein and discharges the liquid thereout, to a method for controlling the ink-jet recording apparatus, and to a method for controlling the pump.

2. Description of Related Art

[0002] An ink-jet recording apparatus such as ink-jet printers comprises an ink-jet head formed with a large number of nozzles through which ink is ejected. The ink-jet head is connected, through a tube or the like, with an ink cartridge that serves as an ink supply source. During a printing operation, the ink-jet head sucks ink from the ink cartridge by making use of a capillary effect within the nozzles and a difference between the ink cartridge and the nozzles in pressure acting thereon. Then, the ink is ejected through the nozzles, so that an image is recorded onto a record medium such as papers. An example of this type of ink supplying system is described in EP 818 317 A2.

[0003] However, air bubbles sometimes arise in the tube while, e.g., renewing the ink cartridge. When these air bubbles stay within the tube, suction of ink from the ink cartridge into the head becomes troublesome, which may adversely affect a recording onto a record medium.

[0004] As a means for solving the aforementioned problem, known is a technique in which a pump having two tubes passing there through is disposed between a head and an ink cartridge and the pump performs a purge operation using one of the two tubes (see Japanese Patent Publication No. 7-80304). The purge operation allows ink containing air bubbles to be discharged, through the nozzles, out of the tube or out of an ink passage of the head.

[0005] In this technique, the pump includes a housing in which a cylindrical cavity is formed, and a rotor rotatably mounted within the cavity. Three rollers are rotatably journaled to the rotor. These three rollers are disposed apart by the same angle from one another in a circumferential direction. A diameter of the rotor is smaller than a diameter of the cylindrical cavity in the housing, thus forming a space between the rotor and an inner wall of the housing. The two tubes are disposed through upper and lower portions of this space. The upper tube, which connects the head with the ink cartridge, constitutes an ink supply path. The lower tube, which connects a waste ink tank with a purge cap for covering a nozzle face of the head, constitutes an ink discharge path. The lower tube contributes to the purge operation.

[0006] Various types of pump are described in US 2 353 965, GB 2 158 517A, WO 98/03794A and US 4,133,617A. However, these pumps are not suitable for use in static positions for the introduction and dismount of ink cartridges in an ink-jet recording apparatus.

[0007] In the above-described technique, however, when ink is forcibly supplied to the head during the purge operation or the like, the rollers of the rotor repeatedly applies alternating pressurization and depressurization onto the upper tube that constitutes the ink supply path. This causes damage on the tube, which means a failure of the pump, and therefore raises a problem that ink cannot smoothly be supplied to the ink-jet head.

[0008] An object of the present invention is to provide an ink-jet recording apparatus comprising a pump that is unlikely to cause a failure, a method for controlling the ink-jet recording apparatus capable of preventing a failure of the pump, and a method for controlling the pump capable of preventing a failure.

[0009] According to a first aspect of the present invention, there is provided an ink-jet recording apparatus comprising:

- a pump that includes a housing, a rotor, a partition, a first passage, and a second passage; wherein:
  - the housing defines a cavity formed therein and also has an inlet port through which ink is sucked into the cavity and an outlet port through which ink is discharged out of the cavity;
  - the rotor is rotatable within the cavity;
  - the partition is supported on the rotor such that both ends thereof can be in contact with an inner surface of the housing, the partition being rotatable within the cavity together with the rotor;
  - the inner surface of the housing and the rotor forming the first passage within the cavity the first passage extending from the inlet port to the outlet port on one side of the rotor;
  - the inner surface of the housing and the rotor forming the second passage within the cavity, the second passage being longer than the first passage and extending from the inlet port to the outlet port via another side of the rotor opposite to the first passage; the ink-jet recording apparatus further comprising:
    - an ink-jet head to which ink is arranged to be supplied from the pump; and
    - a detector arranged to detect whether or not the partition is disposed within such a range that a flow resistance in the first passage can be higher than a flow resistance in the second passage.

[0010] According to a second aspect of the present invention, there is provided an ink-jet recording apparatus comprising:

- a pump that includes a housing, a rotor, a partition,
According to a third aspect of the present invention, there is provided an ink-jet recording apparatus comprising:

- a pump that includes a housing, a rotor, a partition, a first passage, and a second passage; wherein:
  - the housing defines a cavity formed therein and also has an inlet port through which ink is sucked into the cavity and an outlet port through which ink is discharged out of the cavity;
  - the rotor is rotatable within the cavity;
  - the partition is supported on the rotor such that both ends thereof can be in contact with an inner surface of the housing, the partition being rotatable within the cavity together with the rotor;
  - the inner surface of the housing and the rotor forming the first passage within the cavity the first passage extending from the inlet port to the outlet port on one side of the rotor;
  - the housing defines a cavity formed therein and also has an inlet port through which ink is sucked into the cavity and an outlet port through which ink is discharged out of the cavity;
  - the rotor is rotatable within the cavity;
  - the partition is supported on the rotor such that both ends thereof can be in contact with an inner surface of the housing, the partition being rotatable within the cavity together with the rotor;
  - the inner surface of the housing and the rotor forming the first passage within the cavity the first passage extending from the inlet port to the outlet port on one side of the rotor; the ink-jet recording apparatus further comprising:
    - an ink-jet head to which ink is arranged to be supplied from the pump; and
    - a detector arranged to detect whether or not the partition is disposed within such a range that a ratio of a flow resistance in the second passage to a flow resistance in the first passage is lower than the ratio obtained when the ink-jet head is performing a recording.

According to a fourth aspect of the present invention, there is provided an ink-jet recording apparatus comprising:

- a pump that includes a housing, a rotor, a partition, a first passage, and a second passage; wherein:
  - the housing defines a cavity formed therein and also has an inlet port through which ink is sucked into the cavity and an outlet port through which ink is discharged out of the cavity;
  - the rotor is rotatable within the cavity;
  - the partition is supported on the rotor such that both ends thereof can be in contact with an inner surface of the housing, the partition being rotatable within the cavity together with the rotor;
  - the inner surface of the housing and the rotor forming the first passage within the cavity the first passage extending from the inlet port to the outlet port on one side of the rotor; the ink-jet recording apparatus further comprising:
    - an ink-jet head to which ink is arranged to be supplied from the pump; and
    - a detector arranged to detect whether or not the partition is disposed within such a range that a flow resistance in the first passage is higher than the flow resistance obtained when the ink-jet head is performing a recording.

According to a fifth aspect of the present invention, there is provided a method for controlling an ink-jet recording apparatus comprising:

- a pump that includes a housing, a rotor, a partition, a first passage, and a second passage; wherein:
  - the housing defines a cavity formed therein and also has an inlet port through which ink is sucked into the cavity and an outlet port through which ink is discharged out of the cavity;
  - the rotor is rotatable within the cavity;
  - the partition is supported on the rotor such that both ends thereof can be in contact with an inner surface of the housing, the partition being rotatable within the cavity together with the rotor;
  - the inner surface of the housing and the rotor forming the first passage within the cavity the first passage extending from the inlet port to the outlet port on one side of the rotor; the ink-jet recording apparatus further comprising:
    - an ink-jet head to which ink is arranged to be supplied from the pump; and
    - a detector arranged to detect whether or not the partition is disposed within such a range that the sum of flow resistances in the first and second passages is higher than the sum of flow resistances obtained when the ink-jet head is performing a recording.
ink is discharged out of the cavity;
the rotor is rotatable within the cavity;
the partition is supported on the rotor such that both ends thereof can be in contact with an inner surface of the housing, the partition being rotatable within the cavity together with the rotor;
the inner surface of the housing and the rotor forming the first passage within the cavity the first passage extending from the inlet port to the outlet port on one side of the rotor;
the inner surface of the housing and the rotor forming the second passage within the cavity, the second passage being longer than the first passage and extending from the inlet port to the outlet port via another side of the rotor opposite to the first passage; the ink-jet recording apparatus further comprising:

an ink-jet head to which ink is arranged to be supplied from the pump; and
the method comprising steps of:

disposing the partition within such a range that a flow resistance in the first passage can be higher than a flow resistance in the second passage; and
starting an initial ink introduction into the cavity.

[0014] According to a sixth aspect of the present invention, there is provided a method for controlling an ink-jet recording apparatus comprising:

a pump that includes a housing, a rotor, a partition, a first passage, and a second passage; wherein:

the housing defines a cavity formed therein and also has an inlet port through which ink is sucked into the cavity and an outlet port through which ink is discharged out of the cavity;
the rotor is rotatable within the cavity;
the partition is supported on the rotor such that both ends thereof can be in contact with an inner surface of the housing, the partition being rotatable within the cavity together with the rotor;
the inner surface of the housing and the rotor forming the first passage within the cavity the first passage extending from the inlet port to the outlet port on one side of the rotor;
the inner surface of the housing and the rotor forming the second passage within the cavity, the second passage being longer than the first passage and extending from the inlet port to the outlet port via another side of the rotor opposite to the first passage; the ink-jet recording apparatus further comprising:

an ink-jet head to which ink is arranged to be supplied from the pump; and
the method comprising steps of:

disposing the partition within such a range that a ratio of a flow resistance in the second passage to a flow resistance in the first passage is lower than the ratio obtained when the ink-jet head is performing a recording; and
starting an initial ink introduction into the cavity.

[0015] According to a seventh aspect of the present invention, there is provided a method for controlling an ink-jet recording apparatus comprising:

a pump that includes a housing, a rotor, a partition, a first passage, and a second passage; wherein:

the housing defines a cavity formed therein and also has an inlet port through which ink is sucked into the cavity and an outlet port through which ink is discharged out of the cavity;
the rotor is rotatable within the cavity;
the partition is supported on the rotor such that both ends thereof can be in contact with an inner surface of the housing, the partition being rotatable within the cavity together with the rotor;
the inner surface of the housing and the rotor forming the first passage within the cavity the first passage extending from the inlet port to the outlet port on one side of the rotor;
the inner surface of the housing and the rotor forming the second passage within the cavity, the second passage being longer than the first passage and extending from the inlet port to the outlet port via another side of the rotor opposite to the first passage; the ink-jet recording apparatus further comprising:

an ink-jet head to which ink is arranged to be supplied from the pump; and
the method comprising steps of:

disposing the partition within such a range that a ratio of a flow resistance in the first passage to a flow resistance in the second passage is lower than the ratio obtained when the ink-jet head is performing a recording; and
starting an initial ink introduction into the cavity.

[0016] According to an eighth aspect of the present invention, there is provided a method for controlling an ink-jet recording apparatus comprising:

a pump that includes a housing, a rotor, a partition, a first passage, and a second passage; wherein:

the housing defines a cavity formed therein and also has an inlet port through which ink is sucked into the cavity and an outlet port through which ink is discharged out of the cavity;
the rotor is rotatable within the cavity;
the partition is supported on the rotor such that both ends thereof can be in contact with an inner surface of the housing, the partition being rotatable within the cavity together with the rotor;
the inner surface of the housing and the rotor forming the first passage within the cavity the first passage extending from the inlet port to the outlet port on one side of the rotor;
the inner surface of the housing and the rotor forming the second passage within the cavity, the second passage being longer than the first passage and extending from the inlet port to the outlet port via another side of the rotor opposite to the first passage; the ink-jet recording apparatus further comprising:

an ink-jet head to which ink is arranged to be supplied from the pump; and
the method comprising steps of:

disposing the partition within such a range that a ratio of a flow resistance in the second passage to a flow resistance in the first passage is lower than the ratio obtained when the ink-jet head is performing a recording; and
starting an initial ink introduction into the cavity.
the housing defines a cavity formed therein and also has an inlet port through which ink is sucked into the cavity and an outlet port through which ink is discharged out of the cavity; the rotor is rotatable within the cavity; the partition is supported on the rotor such that both ends thereof can be in contact with an inner surface of the housing, the partition being rotatable within the cavity together with the rotor; the inner surface of the housing and the rotor forming the first passage within the cavity; the first passage extending from the inlet port to the outlet port on one side of the rotor; the inner surface of the housing and the rotor forming the second passage within the cavity; the second passage being longer than the first passage and extending from the inlet port to the outlet port via another side of the rotor opposite to the first passage; the ink-jet recording apparatus further comprising:

- an ink-jet head to which ink is arranged to be supplied from the pump; and
- the method comprising steps of:
  - disposing the partition within such a range that the sum of flow resistances in the first and second passages is higher than the sum of flow resistances obtained when the ink-jet head is performing a recording; and
  - dismounting from the pump an ink supply member that supplies ink to the pump.

[0017] The apparatuses or methods according to the aforementioned first to eighth aspects do not adopt such a system that, as in the prior art, a tube disposed within a pump is subjected to repeated pressurization and depressurization. Therefore, the pump has a relatively simple construction, and at the same time the pump is unlikely to incur a failure that would otherwise be caused by, e.g., damage on a tube. Thus, the ink-jet head can be prevented from seeing a defective ink supply that would be caused by a failure of the pump.

[0018] In the apparatuses or methods according to the aforementioned first, third and fifth to seventh aspects, based on a result of detection by the detector, the partition is disposed within the above-described ranges prior to dismounting from the pump the ink supply member that supplies ink to the pump, and then the ink supply member is dismounted from the pump with the partition being kept within the above-described ranges. As a result, pressure within the cavity can substantially be kept constant during a dismounting of the ink supply member. This can prevent breakage of meniscuses.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Other and further objects, features and advantages of the invention will appear more fully from the following description taken in connection with the accompanying drawings in which:

- FIG. 1 illustrates a general construction of an ink-jet printer according to an embodiment of the present invention;
- FIG. 2 schematically illustrates a system for supplying ink to an ink-jet head illustrated in Fig. 1;
- FIG. 3 is a partial sectional view of a pump and an ink cartridge illustrated in FIG. 2;
- FIG. 4 is a sectional view of the pump taken along the line IV-IV of FIG. 2;
- FIG. 5 is a block diagram showing an electrical structure in the ink-jet printer illustrated in FIG. 1;
- FIGS. 6A, 6B, and 6C are partial sectional views showing a process of mounting the ink cartridge to a receiver;
- FIGS. 7A, 7B, and 7C are partial sectional views showing a process of dismounting the ink cartridge from the receiver;
- FIGS. 8A, 8B, and 8C are sectional views showing stepwise states of the pump during a purge operation;
- FIG. 9A is a sectional view showing a state of the pump at the time of initial ink introduction;
- FIG. 9B is a sectional view showing a state of the pump during a printing operation;
- FIG. 9C is a sectional view showing a state of the pump at the time of dismounting the ink cartridge from the receiver;
- FIGS. 10A and 10B are sectional views showing a first modification of the pump which is applicable to the ink-jet printer according to the present invention; and
- FIGS. 11A and 11B are sectional views showing a second modification of the pump, which is applicable to the ink-jet printer according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] In the following, some preferred embodiments of the present invention will be described in conjunction with the accompanying drawings.
First, referring to FIG. 1, a description will be given to a general construction of an ink-jet printer according to an embodiment of the present invention. An ink-jet printer 101 of this embodiment is a color printer having four ink-jet heads 1. The printer 101 includes a paper feed unit 111 (as shown lefthand in FIG. 1) and a paper discharge unit 112 (as shown righthand in FIG. 1). Within the printer 1, formed, is a paper conveyance path running from the paper feed unit 111 to the paper discharge unit 112.

A pair of paper feed rollers 105a and 105b are disposed immediately downstream from the paper feed unit 111, so that the rollers 105a and 105b can pinch a paper as a record medium which is in this condition conveyed from left to right in FIG. 1. In a middle of the paper conveyance path and below the four heads 1, a conveyance unit 113 is provided in confrontation with the four heads 1. The conveyance unit 113 has two rollers 106 and 107, and a looped conveyor belt 108 that is wound on the rollers 6 and 7 to be stretched between them.

The conveyor belt 108 has a two-layered structure made up of a silicone rubber and a polyester-base body impregnated with urethane. The silicone rubber is adopted to form an outer face, i.e., a conveyor face of the conveyor belt 108. A paper fed through the pair of paper feed rollers 105a and 105b is pressed on the conveyor face of the conveyor belt 108 to thereby be held onto the conveyor face by adhesive power, and in this condition conveyed downstream, i.e., rightward in FIG. 1 in association with clockwise rotation (rotation in a direction of the arrow 104) of one roller 106.

Pressing members 109a and 109b are provided at a position where a paper is fed onto the conveyor belt 108 and a position where a paper is discharged from the conveyor belt 108, respectively. The pressing members 109a and 109b serve to press a paper onto the conveyor face of the conveyor belt 108 in order to prevent a separation of the paper from the conveyor face. Thereby, the paper can surely be held on the conveyor face to be conveyed on.

A peeling plate 110 is provided immediately downstream (rightward in FIG. 1) from the conveyor belt 108. The peeling plate 110 peels off a paper, which is held on the conveyor face of the conveyor belt 108 by adhesive power, from the conveyor face so that the paper can be transferred toward the paper discharge unit 112.

The four ink-jet heads 1 are arranged in parallel along a paper conveyance direction, and each ink-jet head 1 has, at its lower end, a head main body 1a. Each head main body 1a has a rectangular shape when sectioned along a plane that is parallel to the conveyor face. The head main bodies 1a are arranged close to one another with a longitudinal axis of each head main body 1a extending perpendicularly to the paper conveyance direction, i.e., perpendicularly to the drawing sheet of FIG. 1. That is, the printer 101 is of line type. Bottom faces of the respective four head main bodies 1a confront the paper conveyance path, and a large number of small-diameter nozzles (not illustrated) are arranged on the bottom faces of the four head main bodies 1a. Ejected from the bottom faces of the four head main bodies 1a are magenta ink, yellow ink, cyan ink, and black ink, respectively.

Between the conveyor face of the conveyor belt 108 and the bottom faces of the head main bodies 1a, a narrow clearance, though which the paper conveyance path is formed. With this construction, while a paper, which is being conveyed by the conveyor belt 108, passes immediately under the four head main bodies 1a in order, the respective color inks are ejected through the corresponding nozzles toward an upper face, i.e., a print face of the paper to thereby form a desired color image on the paper.

In a space enclosed by the conveyor belt 108, a nearly rectangular parallelepiped guide 121 is disposed to be opposed to the ink-jet heads 1. The guide 121 is in contact with an inner face of an upper-located part of the conveyor belt 108 to thereby support the upper-located part from an inside. The guide 121 and the conveyor belt 108 have substantially the same width.

The ink-jet printer 101 further comprises a maintenance unit 117 that performs maintenance on the ink-jet heads 1. The maintenance unit 117 includes four purge caps 116 that are adapted to cover the bottom faces of the respective head main bodies 1a.

While the ink-jet printer 101 is performing a printing operation, the maintenance unit 117 is in a "withdrawal position" which means a position immediately below the paper feed unit 111 as shown in FIG. 1. When a predetermined condition is satisfied after completion of the printing operation, the maintenance unit 117 moves in a horizontal direction into a "maintenance position" which means a position immediately below the four head main bodies 1a, that is, a position where the conveyance unit 113 exists in FIG. 1. Examples of the aforesaid predetermined condition include a condition that the printer 101 remains without any printing operation for a predetermined time period, a condition that the printer 101 is powered off, and the like. When the maintenance unit 117 is in the maintenance position, the purge caps 116 of the maintenance unit 117 cover the bottom faces of the corresponding head main bodies 1a in order to avoid drying of the nozzles.

The conveyance unit 113 is supported on an elevator mechanism including a chassis 120, and movable in a vertical direction by means of the elevator mechanism. The chassis 120, which is a component of the elevator mechanism, is put on a cylindrical member 115 disposed thereunder. The cylindrical member 115 is rotatable around a shaft 114 that is deviated from a center of the cylindrical member 115. Thus, in association with rotation of the shaft 114, an uppermost level of the cylindrical member 115 varies, and accordingly the chassis 120 and the conveyance unit 113 move up and down.

Before the maintenance unit 117 starts moving from the "withdrawal position" into the "maintenance po-
As illustrated in FIG. 3, a switch 4 of push-button type is provided in a face of the receiver 3 confronting a front face of the ink cartridge 20. Upon a contact with the front face of the ink cartridge 20, the switch 4 sends a mounting-completion signal to a CPU (i.e., Central Processing Unit) 61 of a controller 60 (see FIG. 5). The mounting-completion signal means a signal informing that an ink cartridge 20 is completely received in a receiver 3.

The receiver 3 further includes, in its lower right side in FIG. 3, a stopper 5, an L-shaped arm 6 having a right-angled portion 6a, and a solenoid valve 7. One end of the L-shaped arm 6 is connected with the stopper 5, and the other end thereof is connected with the solenoid valve 7. The stopper 5 is insertable into an opening 21b that is formed in a casing 21 of the ink cartridge as will be described later. The arm 6 has an elongated slot 8 formed through its one end portion near the solenoid valve 7. Within the elongated slot 8, attached is one end of a slide-movable portion 7a of the solenoid valve 7. The right-angled portion 6a of the arm 6 is supported on a main frame of the printer 101 so that the arm 6 may rotate therearound.

When the slide-movable portion 7a of the solenoid valve 7, which is in a state shown in FIG. 3, slides toward an inside of the solenoid valve 7 (i.e., slides rightward in FIG. 3), the arm 6 rotates around the right-angled portion 6a in a counterclockwise direction in FIG. 3, so that the stopper 5 is pulled out of the opening 21b and at the same time the one end of the slide-movable portion 7a moves along the elongated slot 8. In order to renew the ink cartridge 20, the stopper 5 is pulled out of the opening 21b in this manner to thereby allow the ink cartridge 20 to be detached from and attached to the receiver 3. Then, after completion of mounting of the ink cartridge 20, the stopper 5 is inserted into the opening 21b. Therefore, the ink cartridge 20 can be duly locked against improper dismounting from the receiver 3.

As illustrated in FIG. 2, each ink cartridge 20 and each corresponding ink-jet head 1 are connected with each other through a pump 30 and a long cylindrical tube 13. The tube 13 is made of an elastomer and has a sufficient flexibility. On an upper face of each head main body 1a, provided is a tube-shaped member 14 that protrudes from the vicinity of one longitudinal end of the upper face. One end of the tube 13 is fitted into the tube-shaped member 14, and the other end thereof is connected with the pump 30. Ink is introduced from the ink cartridge 20, through the pump 30, the tube 13, and the tube-shaped member 14, into an ink passage formed within the head main body 1a, and the ink is then ejected through the nozzles.

As illustrated in FIGS. 2 and 3, the ink cartridge 20 includes a casing 21 made of a synthetic resin, and an ink bag 22 disposed within the casing 21.

Referring to FIG. 3, a handle 21a is provided on a rear face of the casing 21. The opening 21b into which the stopper 5 can be inserted is formed through a bottom wall of the casing 21 in its thickness direction.

The ink bag 22 is made of a pouch film that has been obtained by thermocompression-bonding a plurality of flexible films. The ink bag 22 contains deaerated ink. The pouch film has a layered structure made up of, from inside to outside, an innermost polypropylene layer, a polyester layer as a base material, an aluminum-foil layer having a gas barrier function, and a nylon layer for improving strength. A cap 23 made of a silicone rubber or a butyl rubber seals an opening of the ink bag 22.

A cylindrical hollow needle 25 made of a metal protrudes from the pump 30, and is pierced through the cap 23. In order to renew the ink cartridge 20, the hollow needle 25 is pulled away from the cap 23 so that the ink cartridge 20 can be separated from the pump 30.

The pump 30 includes a housing 31 in which a substantially cylindrical cavity 32 is formed. The housing 31 has a cylindrical shape with its axis extending in a direction perpendicular to the drawing sheets of FIGS. 2 and 3, that is, extending in a lateral direction of the drawing sheet of FIG. 4. The housing 31 has, on its peripheral wall, an inlet port 31a (shown on a left side in FIG. 3) through which ink is sucked into the cavity 32, and an outlet port 31b (shown on an upper side in FIG. 3) through which ink is discharged out of the cavity 32. Both the inlet port 31a and the outlet port 31b are defined by walls that protrude from the peripheral wall of the housing 31.

A base end of the hollow needle 25 is fitted into the inlet port 31a. A front end of the hollow needle 25 has an obliquely cut, sharpened shape, and is pierced through the cap 23 of the ink cartridge 20. Ink contained in the ink bag 22 of the ink cartridge 20 flows through the hollow needle 25, and then introduced from the inlet port 31a into the cavity 32 of the pump 30.
is positioned substantially in the middle of a length of the housing 31 in its axial direction (i.e., in the horizontal direction in FIG. 4). A length of the recess 34 in the aforementioned axial direction is approximately one third of a length of the peripheral wall of the housing 31 in the same axial direction.

[0047] The housing 31 includes therein a rotor 40. An opening 33 for a shaft 40b of the rotor 40 passing therethrough is provided in one endwall of the housing 31 whose plane is perpendicular to the axial direction. The rotor 40 includes a rotator 40a rotatable within the cavity 32, and a shaft 40b that transmits rotation force to the rotator 40a.

[0048] The rotator 40a has a substantially cylindrical shape whose peripheral surface is partially flattened to thereby form a cut-off portion 42. The rotator 40a is rotatable around an axis that extends in the direction perpendicular to the drawing sheets of FIGS. 2 and 3, that is, extends in the lateral direction of the drawing sheet of FIG. 4. A thickness of the rotator 40a in the axial direction is substantially equal to a distance between opposite endwalls of the housing 31. Thus, endwalls of the rotator 40a, whose planes are perpendicular to the axial direction, are in contact with the housing 31 (see FIG. 4). The shaft 40b has a substantially cylindrical shape with its diameter smaller than that of the rotator 40a. The shaft 40b protrudes, in the axial direction, from a center of one endwall of the rotator 40a whose plane is perpendicular to the axial direction. The shaft 40b is eccentric to an axial center of the housing 31. During rotation of the rotator 40a, the peripheral surface of the rotator 40a except the cut-off portion 42 is partially contactable with the inner surface of the housing.

[0049] The rotator 40a also has a slit 41 that extends in a diametrical direction without overlapping the cut-off portion 42. The slit 41 is formed throughout an entire thickness of the rotator 40a. In the slit 41, disposed are a partition 50, and two slide members 51a and 51b that sandwich the partition 50 therebetween. The partition 50 and the slide members 51a and 51b are supported on the rotator 40a such that their end portions in the diametrical direction can confront the inner surface of the housing 31. In this condition, the partition 50 and the slide members 51a and 51b are, together with the rotator 40a, rotatable within the cavity 32.

[0050] There is a very narrow clearance between each slide member 51a or 51b and a face of the rotator 40a defining the slit 41. The partition 50 and the slide members 51a and 51b are put in layers as illustrated in FIG. 3, and, in this condition, are slidable in the slit in the diametrical direction of the rotator 40a. In addition, the partition 50 and the slide members 51a, 51b are made from different materials as will be detailed later. As a result, the slide members 51a and 51b obtain a smaller sliding friction coefficient against an inner surface of the slit 41 than that of the partition 50. Thus, the partition 50 and the slide members 51a and 51b are, while kept in the layered state, slidable smoothly within the slit 41.

[0051] Each of the partition 50 and the slide members 51a and 51b is a plate-like member having a rectangular shape in a plan view whose length in the diametrical direction of the rotator 40 is larger than that of the rotator 40. However, the partition 50 and the slide members 51a, 51b are different from each other in their length in the diametrical direction, thickness, materials, and the like. A length of the partition 50 in the diametrical direction, which is longer than that of the slide members 51a and 51b, is substantially equal to a diameter of the cavity 32. In addition, the partition 50 is thicker than the slide members 51a and 51b. The partition 50 is made of an elastic material such as EPDM (i.e., ethylene-propylene-diene terpolymer) based synthetic rubbers, whereas the slide member 51a and 51b are made of a POM (i.e., polyoxymethylene) resin or the like.

[0052] The length of the slide members 51a and 51b in the diametrical direction is smaller than that of the partition 50. Therefore, when the slide members 51a and 51b rotate with the rotator 40a, their both ends in the diametrical direction are not brought into contact with the inner surface of the housing 31.

[0053] Without the slide members 51a and 51b, a portion of the partition 50 protruding from the rotator 40a would be bent so much due to its friction against the inner surface of the housing 31 during rotation of the rotator 40a, and therefore excessive rotational torque would often be caused. In this embodiment, however, such a bending and excessive rotational torque can be prevented because the portion of the partition 50 protruding from the rotator 40a is sandwiched between the slide members 51a and 51b.

[0054] The rotor 40 rotates in association with rotation of a gear 43 that is disposed to be always kept in contact with a part of a peripheral surface of the shaft 40b as illustrated in FIG. 4. Two protrusions 44 and 45 are formed on a surface of the gear 43 opposite to a surface thereof facing the housing 31. The two protrusions 44 and 45 are provided side by side to form a line along a diameter of the gear 43, and are displaced along with rotation of the gear 43.

[0055] Two proximity sensors 47 and 48 are respectively disposed at a position confronting the protrusion 45 (illustrated with a solid line in FIG. 4) as located when the rotor 40 is in a later-described “print position” and at a position confronting the protrusion 44 (illustrated with a dotted line in FIG. 4) as located when the rotor 40 is in a later-described “introduction position”. The proximity sensors 47 and 48 include detectors 47a and 48a, respectively. When the protrusions 44 and 45 are brought into confrontation with the corresponding detectors 48a and 47a, the sensors 47 and 48 detect them. A rotational state of the rotor 40, which includes a position of the partition 50, can be determined based on results of detections by the proximity sensors 47 and 48.

[0056] The pump 30 further includes a filter container 35 that is connected to the housing 31 through the outlet port 31b. Inside the filter container 35, formed is a cavity
that is most expanded outward around its center in a vertical direction. The filter container 35 opens out at upside and downside thereof. A lower opening of the filter container 35 corresponds to the outlet port 31b, and the other side of the tube 13 is fitted into an upper opening thereof. Thus, a vertical ink passage extending from the outlet port 31b to the tube 13 is formed inside the filter container 35.

[0057] A mesh filter 36 is disposed substantially at the center of the cavity within the filter container 35. The mesh filter 36 can filtrate ink on the way to be supplied from the ink cartridge 20 into the ink-jet head 1. Even if, for example, rubber chips, etc., are produced by insertion/uninsertion of the hollow needle 35 into/from the cap 23, such rubber chips can be captured by the filter 36 and thus removed from ink. The provision of the filter container 35 enables simplification of the ink cartridge 20, because it is not necessary to provide an extra filter within the ink cartridge 20.

[0058] The filter 36 is laid in a horizontal manner. Accordingly, even if air bubbles are produced in the cavity 32 at the time of introducing ink into the empty cavity 32 of the pump 30 (i.e., at the time of initial ink introduction) or the like, the air bubbles can easily be discharged through the filter 36 because the air bubbles receive a relatively large force that travels upward in the vertical direction. Such a relatively large force is produced by a combination of buoyancy of the air bubbles and liquid-feeding force of the pump 30. This can prevent stay of a large amount of air bubbles on an upstream side of the filter 36 (i.e., under the filter 36 in FIG. 3), and therefore can prevent an interruption of ink supply to the ink-jet head 1.

[0059] In addition, the outlet port 31b is formed in an upper face of the housing 31. Therefore, even if air bubbles arise within the cavity 32, the air bubbles follow the buoyancy to move upward in the vertical direction and then are smoothly discharged through the filter 36.

[0060] Next, referring to FIG. 5, an electrical structure in the ink-jet printer 101 will be described.

[0061] A controller 60 in the ink-jet printer 101 includes a CPU 61, an interface 62, an ROM 63, an RAM 64, an input port 65, and an output port 66. Upon a print instruction signal that has been inputted through the interface 62, the CPU 61 operates in accordance with a control program stored in the ROM 63. In this manner, a printing operation including feeding a paper, conveying a paper, discharging a paper, and ejecting ink, etc., are controlled.

[0062] The CPU 61 performs, if necessary, various processings using the RAM 64. The CPU 61 also receives printing data from the outside (e.g., from a personal computer) via the interface 62, then, if necessary, prepares print image data using image data or the like that are stored in the ROM 63, and then stores the print image data in the RAM 64.

[0063] The CPU 61 drives, via the output port 66 and a motor driver 131, a paper feed motor 141 that is connected with the paper feed rollers 105a and 105b (see FIG. 1). The CPU 61 also drives, via the output port 66 and a motor driver 132, a conveyer motor 142 that is connected with the roller 106. In addition, the CPU 61 drives each of the four ink-jet heads 1 via a head drive circuit 130, thereby printing an image based on print image data.

[0064] Next, referring to FIGS. 6A, 6B and 6C, a description will be given to a process of mounting the ink cartridge 20 to the receiver 3.

[0065] FIG. 6A shows a state where the ink cartridge 20 is not yet mounted to the receiver 3. At this time, no ink is contained in the cavity 32 of the pump 30.

[0066] When the printer 101 is powered up, the CPU 61 (see FIG. 5) determines that "ink should be initially introduced into the cavity 32 of the pump 30", and then drives a rotor drive motor 143 via the output port 66 and a motor driver 133, thereby rotating the gear 43 illustrated in FIG. 4. Thus, the rotor 40 starts rotating in the counterclockwise direction in FIG. 6A.

[0067] After the CPU 61 determines that "ink should be initially introduced into the cavity 32 of the pump 30", the proximity sensor 48 starts its detection operation. The rotor 40 comes in an introduction position as shown in FIG. 6B, and, coincidently with this, the proximity sensor 48 detects the protrusion 44 (see FIG. 4) and then sends a detection signal to the CPU 61 via the input port 65. The CPU 61, which has received the detection signal, stops the rotor drive motor 143 via the output port 66 and the motor driver 133, and then the gear 43 is stopped accordingly.

[0068] The CPU 61 thus stops the rotor drive motor 143, and at the same time drives the solenoid valve 7 via the output port 66 and a solenoid valve driver 134 so that the slide-movable portion 7a can slide toward the inside of the solenoid valve 7 (i.e., slide rightward in FIG. 6B). As a result, the arm 6 rotates around the right-angled portion 6a in the counterclockwise direction in FIG. 6B, and the stopper 5 is pulled out of the receiver 3. Thus, the ink cartridge can be mounted to the receiver 3. In this state, a user grips the handle 21a, and moves the ink cartridge 20 rightward in FIG. 6B to thereby mount the ink cartridge 20 to the receiver 3.

[0069] Coincidently with completion of mounting the ink cartridge 20 to the receiver 3, the front face of the ink cartridge 20 comes into contact with the switch 4, which then sends a mounting-completion signal to the CPU 61 via the input port 65. The CPU 61, which has received the mounting-completion signal, drives the solenoid valve 7 via the output port 66 and the solenoid valve driver 134, so that the slide-movable portion 7a can slide outward from the solenoid valve 7 (i.e., slide leftward in FIG. 6B). Consequently, the arm 6 rotates around the right-angled portion 6a in a clockwise direction in FIG. 6B, and the stopper 5 is inserted into the opening 21. Thereby, the ink cartridge 20 can be duly locked against improper dismounting from the receiver 3 (see FIG. 6C).

[0070] Thereafter, a pressing mechanism (not illustrated) provided in the ink cartridge 20 presses the ink bag
22, so that ink contained in the ink bag 22 flows through the hollow needle 25 and then introduced from the inlet port 31a into the cavity 32 of the pump 30. How the ink flows within the cavity 32 at this time will be detailed later.

[0071] How long a time period the rotor drive motor 143 is stopped during the initial ink introduction is determined in the following manner.

[0072] Each ink cartridge 20 has a chip (not illustrated) that stores therein ink information, and each receiver 3 has a reader 12 (see FIG. 5). When the ink cartridge 20 is completely mounted to the receiver 3, the reader 12 reads the ink information stored in the chip and sends that information to the CPU 61 via the input port 65.

[0073] The printer 101 includes a temperature sensor 10 (see FIG. 5) that measures an ambient temperature in the printer 101. The temperature sensor 10 sends a temperature information to the CPU 61 via the input port 65.

[0074] Based on the ink information and the temperature information respectively sent from the reader 12 and the temperature sensor 10, the CPU 61 retrieves data from the ROM 63 or RAM 64, to thereby determine how long a time period the rotor drive motor 143 should be stopped.

[0075] For example, when the ink cartridge 20 contains ink having a high viscosity, it takes a relatively long time to fill the cavity 32 with the ink. If the rotor 40 rotates before the cavity 32 is filled with the ink, the ink incurs air bubbles because the ink is mixed with air that has already existed in the cavity 32 prior to the ink introduction. In this embodiment, therefore, a viscosity of ink is identified based on the ink information and the temperature information, and a suitable time period for ink introduction is calculated in accordance with the viscosity of ink, then determining how long a time period the rotor drive motor 143 should be stopped.

[0076] After completion of the initial ink introduction into the cavity 32, a print start signal is sent to the CPU 61. The CPU 61, which has received the print start signal, drives the rotor drive motor 143 to rotate the rotor 40. Then, the rotor 40 comes into a print position as shown in FIG. 7A, and, coincidently with this, the proximity sensors 47 and 48 start their detection operations. The CPU 61 determines a rotational state of the rotor 40 on the basis of results of detection by the proximity sensors 47 and 48. The rotor 40 comes in a dismount position as shown in FIG. 7B, and, coincidently with this, the CPU 61 stops the rotor drive motor 143, and then the gear 43 is stopped accordingly.

[0081] The CPU 61 thus stops the rotor drive motor 143, and at the same time drives the solenoid valve 7 via the solenoid valve driver 134 so that the slide-movable portion 7a can slide toward the inside of the solenoid valve 7 (i.e., slide rightward in FIG. 7B). As a result, the arm 6 rotates around the right-angled portion 6a in the counterclockwise direction in FIG. 7B, and the stopper 5 is pulled out of the opening 21b. Thus, the ink cartridge becomes dismountable from the receiver 3. In this state, a user grips the handle 21a, and moves the ink cartridge 20 leftward in FIG. 7B to thereby dismount the ink cartridge 20 from the receiver 3.

[0082] When the front face of the ink cartridge 20 becomes apart from the switch 4, the switch 4 sends a signal to the CPU 61 via the input port 65. The CPU 61, which has received the signal, drives the solenoid valve 7 via the output port 66 and the solenoid valve driver 134, so that the slide-movable portion 7a can slide outward from the solenoid valve 7 to insert the stopper 5 into the receiver 3 (see FIG. 7C).

[0083] Even when ink remains within the ink cartridge 20, the ink cartridge 20 can be renewed by pushing a stopper releasing button 16 (see FIG. 5) that is provided in the printer 101. The CPU 61 receives a signal from the stopper releasing button 16 via the input port 65, and then performs the same operations as when it receives the signal from the ink amount detector 15. As a result, the ink cartridge 20 becomes dismountable from the receiver 3.

[0084] Next, referring to FIGS. 8A, 8B, and 8C, a description will be given to a process of dismounting the ink cartridge 20 from the receiver 3.
in the purge caps 116 (see FIG. 1), and stored in a waste ink tank (not illustrated) that is connected with the purge caps 116.

When the CPU 61 determines that "a purge operation should be performed", the CPU 61 drives the rotor drive motor 143 so that the rotor 40, which is in a state as shown in FIG. 8A, can rotate at a predetermined speed in the counterclockwise direction in FIG. 8A. As a result, since ink is forcibly supplied from the ink cartridge 20 to the head 1, ink staying within the tube 13 and within the ink passage of the head main body 1a is discharged through the nozzles.

Rotation of the rotor 40 changes positions of the cut-off portion 42 and the partition 50 relative positions to the housing 31, and flow resistance of ink within the cavity 32 is variously changed accordingly. When the peripheral surface of the rotator 40a and the inner surface of the housing 31, which have been spaced from each other by the cut-off portion 42 as illustrated in FIG. 8A, are brought into contact with each other as illustrated in FIG. 8B, a higher flow resistance is applied to ink that flows from the inlet port 31a through an upper-left side of the rotator 40a in FIG. 8B to the outlet port 31b. During a shift from a state of FIG. 8B to a state of FIG. 8C, a region 32x in which the inlet port 31a exists is gradually increased and negative pressure arises within the region 32x, so that ink is sucked from the ink cartridge 20 through the inlet port 31a. During a shift from the state of FIG. 8B to the state of FIG. 8C, a region 32y in which the outlet port 31b exists is gradually decreased. Accordingly, ink contained in this region 32y is forcibly supplied to the head 1 through the outlet port 31b.

FIG. 8B and FIG. 8C differ in position of the set of partition 50 and slide members 51a and 51b relative to the rotor 40. This is because, during the shift from the state of FIG. 8B to the state of FIG. 8C, pushing force applied by the inner surface of the housing 31 to one end of the partition 50 (as located on an upper-right side in FIG. 8B) gradually becomes larger than pushing force applied by the inner surface of the housing 31 to the other end of the partition 50 (as located on a lower side in FIG. 8B), and consequently the partition 50 slides together with the slide members 51a and 51b. Like this, in association with the rotation of the rotor 40, the partition 50 and the slide members 51a and 51b accordingly slide within the slit 41.

The partition 50 made of an elastic material as described above is, during its rotation with the rotor 40, expanded or contracted in the diametrical direction of the rotator 40a while having opposite ends thereof being always kept in contact with the inner surface of the housing 31 except the recess 34.

Next, referring to FIG. 9A, a description will be given to how ink flows within the cavity 32 of the pump 30 at the initial ink introduction into the cavity 32 of the pump 30. Prior to starting an initial ink introduction, the rotor 40 is moved into the introduction position as shown in FIGS. 6B and 6C. During the initial ink introduction, the rotor 40 is kept in the introduction position. At this time, the partition 50 partitions the cavity 32 into a region 32c in which the inlet port 31a exists and a region 32d in which the outlet port 31b exists. The cut-off portion 42 is located in the region 32d in which the outlet port 31b exists, and the peripheral surface of the rotator 40a is in contact with the inner surface of the housing 31. One end of the partition 50 is disposed in this contact area, and the other end thereof confronts the recess 34.

Passages extending from the inlet port 31a to the outlet port 31b are formed within the cavity 32. These passages include a first passage 30a and a second passage 30b. The first passage 30a runs on an upper-left side of the rotator 40a in FIG. 9A. The second passage 30b runs on a side of the rotator 40a opposite to the first passage 30a. The second passage 30b is longer than the first passage 30a.

When the rotor 40 is in the introduction position, a flow resistance in the first passage 30a is very high because the peripheral surface of the rotator 40a and one end of the partition 50 are in contact with the inner surface of the housing 31. In the second passage 30b, on the other hand, ink can flow relatively smoothly from the region 32c via the recess 34 into the region 32d, because the other end of the partition 50 confronts the recess 34. At this time, therefore, the flow resistance in the first passage 30a is higher than the flow resistance in the second passage 30b.

Ink having introduced from the inlet port 30a fills the region 32c, and then flows preferentially through the longer, second passage 30b due to the aforementioned difference in flow resistance, thereby filling the region 32d. Accordingly, air that has existed within the cavity 32 before the ink introduction is pushed by ink flowing through the second passage 30b and smoothly moved toward the outlet port 31b, to be discharged through the outlet port 31b.

Next, referring to FIG. 9B, a description will be given to how ink flows within the cavity 32 of the pump 30 during a printing operation. While the ink-jet heads 1a are performing a printing operation, the rotor 40 is kept in the print position as shown in FIGS. 3, 6A, and 7A. At this time, the partition 50 partitions the cavity 32 into a region 32a in which the inlet port 31a and the outlet port 31b exist and a region 32b in which neither the inlet port 31a nor the outlet port 31b exists. The cut-off portion 42 is located in the region 32a in which the inlet port 31a and the outlet port 31b exist, and the rotator 40a is in no contact with the housing 31. Both ends of the partition 50 are, instead of confronting the recess 34, in contact with the inner face of the housing 31.

When the rotor 40 is in the print position, a flow resistance in the first passage 30a is very low because a relatively large space appears above the cut-off portion 42. In the second passage 30b, on the other hand, both ends of the partition 50 are in contact with the inner surface of the housing 31. Thus, a flow resistance in the second passage 30b is higher than that in the first pas-
During the printing operation, ink having introduced from the inlet port 30a flows preferentially through the shorter, first passage 30a to reach the outlet port 30b due to a difference in flow resistance. As a result, for ink ejections from the ink-jet head 1, required ink is naturally supplied from the ink cartridge 20 via the pump 30 to the ink-jet head 1. Thus, ink can smoothly be supplied to the ink-jet head 1.

Next, referring to FIG. 9C, a description will be given to how ink flows within the cavity 32 of the pump 30 at the time of dismounting the ink cartridge 20 from the receiver 3. Prior to dismounting the ink cartridge 20, the rotor 40 is moved into the dismount position as shown in FIGS. 7B and 7C. During a dismounting operation, the rotor 40 is kept in the dismount position. When the rotor 40, which is in the introduction position as shown in FIG. 9A, is slightly rotated in the counterclockwise direction, the rotor 40 comes in the dismount position. At this time, the partition 50 partitions the cavity 32 into a region 32e in which the inlet port 31a exists and a region 32f in which the outlet port 31b exists, which is the same as in the above-described case where the rotor 40 is in the introduction position. As in the case where the rotor 40 is in the introduction position, further, the cut-off portion 42 is located in the region 32f in which the outlet port 31b exists, and the peripheral surface of the rotator 40a is in contact with the inner surface of the housing 31. One end of the partition 50 is disposed in this contact area. However, differently from the case where the rotor 40 is in the introduction position, the other end of the partition 50 does not confront the recess 34 but is slightly shifted therefrom in an upper-right direction, and in this position the other end of the partition 50 is in contact with the inner surface of the housing 31.

When the rotor 40 is in the dismount position, a flow resistance in the first passage 30a is very high because the peripheral surface of the rotator 40a and one end of the partition 50 are in contact with the inner surface of the housing 31, which is the same as in the case where the rotor 40 is in the introduction position. On the other hand, a flow resistance in the second passage 30b is higher than that in the case where the rotor 40 is in the introduction position (see FIG. 9A). This is because the other end of the partition 50 does not confront the recess 34 but is in contact with the inner surface of the housing 31. Consequently, the sum of the flow resistances in the first and second passages 30a and 30b is much higher than that in the case where the rotor 40 is in the print position (see FIG. 9B).

In comparison between the flow resistance in the first passage 30a and the flow resistance in the second passage 30b which are obtained when the rotor 40 is in the dismount position, the flow resistance in the first passage 30a is higher than the flow resistance in the second passage 30b. This is because not only the partition 50 but also the rotator 40a are in contact with the housing 31 in the first passage 30a, whereas only the partition 50 is in contact with the housing 31 in the second passage 30b.

When the rotor 40 is in the respective three positions as described above, the flow resistances in the first and second passages 30a and 30b satisfy the following formulas:

\[ R_{1} > R_{2} \quad (1a); \]
\[ R_{10} < R_{20} \quad (2); \]
\[ R_{100} > R_{200} \quad (1b); \]
\[ R_{2}/R_{1} < R_{20}/R_{10} \quad (3a); \]
\[ R_{200}/R_{100} < R_{20}/R_{10} \quad (3b); \]
\[ R_{10} < R_{1} \quad (4a); \]
\[ R_{10} < R_{100} \quad (4b); \]
\[ R_{100}+R_{200} > R_{10}+R_{20} \quad (5), \]

where \( R_{1}, R_{10}, \) and \( R_{100} \) represent a flow resistance in the first passage 30a and \( R_{2}, R_{20}, \) and \( R_{200} \) represent a flow resistance in the second passage 30b, when the rotor 40 is in the introduction position as in FIG. 9A, in the print position as in the FIG. 9B, and in the dismount position as in the FIG. 9C, respectively.

As has been described above, the ink-jet printer 101 of this embodiment does not adopt such a system that a tube disposed within a pump is subjected to repeated pressurization and depressurization. Therefore, the pump 30 has a relatively simple construction, and at the same time the pump 30 is unlikely to incur a failure that would otherwise be caused by, e.g., damage on a tube. Thus, the ink-jet head 1 can be prevented from seeing a defective ink supply that would be caused by a failure of the pump 30.

In addition, based on the results of detections by the proximity sensors 47 and 48, the partition 50 is
disposed within a predetermined range prior to starting the initial ink introduction into the cavity 32, and then ink is introduced into the cavity 32 with the partition 50 being kept within the aforesaid predetermined range. Thereby, air bubbles are unlikely to arise within the cavity 32. In this embodiment, the rotor 40 that supports the partition 50 is kept in the introduction position (see FIG. 9A) during the initial ink introduction. When the rotor 40 is in the introduction position, the flow resistance R1 in the first passage 30a is higher than the flow resistance R2 in the second passage 30b (R1 > R2). If the flow resistance R1 in the first passage 30a was lower than the flow resistance R2 in the second passage 30b (R1 < R2), ink could not flow well into the longer second passage 30b, thus failing to move air toward the outlet port 31b. As a result, the air would be mixed into the ink, and air bubbles might arise within the cavity 32. In this embodiment, however, air is pushed by ink and smoothly moved toward the outlet port 31b. Therefore, air bubbles are unlikely to arise within the cavity 32.

In this embodiment, the flow resistances in the first and second passages 30a and 30b satisfy not only the formula "R1 > R2 (1a)" but also the formulas "R2/R1 < R20/R10 (3a)" and "R10 < R1 (4a)". When the rotor 40 supports the partition 50 is positioned so as to satisfy at least one of the three formulas (1a), (3a), and (4a), air bubbles can be prevented from arising within the cavity 32 at the time of the initial ink introduction.

Further, based on the results of detections by the proximity sensors 47 and 48, the partition 50 is disposed within a predetermined range prior to dismounting the ink cartridge 20 from the pump 30 and more specifically from the receiver 3, and then the ink cartridge 20 is dismounted from the pump 30 with the partition 50 being kept within the aforesaid predetermined range. This can prevent breakage of meniscuses. In this embodiment, the rotor 40 that supports the partition 50 is kept in the dismount position (see FIG. 9C) during the dismounting operation for the ink cartridge 20. When the rotor 40 is in the dismount position, pressure within the cavity 32 can substantially be kept constant, because the sum of the flow resistances in the first and second passages 30a and 30b is higher than that in the case where the rotor 40 is in the print position (see FIG. 9B). During the dismounting operation, therefore, no air is introduced through the inlet port 31a, thus balancing pressure in the ink supply path between the ink cartridge 20 and the head 1. This can prevent breakage of meniscuses. Breakage of meniscus may cause ink leakage from the nozzles, which can however be relieved in this embodiment.

After the proximity sensor 48 detects that the rotor 40 is disposed in the introduction position, the stopper 5 is pulled out of the receiver 3 to allow the ink cartridge 20 to be mounted to the receiver 3. That is, the ink cartridge 20 cannot be mounted to the receiver 3 until the rotor 40 is disposed within the predetermined range. This can prevent ink introduction into the cavity 32 from occurring before the rotor 40 is disposed within the predetermined range.

In addition, until the rotor 40 is disposed in the dismount position, the stopper 5 is not pulled out of the opening 21b and therefore the ink cartridge 20 is not allowed to be dismounted from the pump 30. If the ink cartridge 20 was dismounted from the pump 30 before the rotor 40 is disposed in the dismount position, pressure in the ink supply path would fall unbalanced and meniscuses would be broken, which however can be prevented surely in this embodiment.

This embodiment can realize the above-described effects with a simple structure, by employing the stopper 5 that is movable into and out of the receiver 3 in association with results of detection by the sensors 47 and 48. As a result, the sensors 47 and 48 can realize efficient detection operations.

When the rotor 40 is in the introduction position and in the dismount position, the flow resistance in the first passage 30a is very high because the rotator 40a of the rotor 40 as well as one end of the partition 50 are in contact with the inner surface of the housing 31 along the first passage 30a. However, this is not the case in the dismount position, the flow resistance in the first passage 30a may be regulated by means of, for example, only one end of the partition 50 being in contact with the inner surface of the housing 31 along the first passage 30a. In other words, the flow resistance in the first passage 30a may be regulated by means of, without using the rotator 40a, the partition 50 alone. This can further simplify the structure.

The recess 34 is formed in the inner surface of the housing 31 along the second passage 30b. Therefore, when the rotor 40 is in the introduction position and in the dismount position, the flow resistance in the second passage 30b is effectively low.

It is preferable that, after the initial ink introduction into the cavity 32, the rotor 40 is vibrated while kept in the aforesaid predetermined range. For example, in the state of FIG. 9A that is set as a base state, the rotor 40 is rotated with ± 5 degrees in the forward and backward directions at a speed of approximately 1/50 to 1/100 of a speed at which the rotor 40 rotates during a purge operation. In this case, the other end of the partition 50 takes a position confronting the recess 34 and a position contacting the inner surface of the housing 31, and therefore the other end of the partition 50 slides on a part of the surface of the housing 31 near the recess 34. Thus, the flow resistance in the second passage 30b is more lowered. However, the flow resistance in the first passage 30a does not vary so much. Accordingly, a difference in flow resistance between the first passage 30a and the second passage 30b becomes larger, thus further enhancing the effect that air bubbles are unlikely to arise within the cavity 32.

Then, referring to FIGS. 10A and 10B, a de-
A pump 230 according to this modification has substantially the same structure as that of the above-described pump 30, but differs therefrom in that a sealer 231 is provided on the peripheral surface of the rotator 40a of the rotor 40, and in that two recesses 232 are formed in the inner surface of the housing 31.

When the rotor 40 is in an introduction position as shown in FIG. 10A, the partition 50 partitions the cavity 32 in a different manner from in the above-described pump 30 (see FIG. 9A). That is, the partition 50 partitions the cavity 32 into a region 32a in which the inlet port 31a and the outlet port 31b exist and a region 32b in which neither the inlet port 31a nor the outlet port 31b exists. Both ends of the partition 50 are disposed in the second passage 30b and confront the respective recesses 232. The cut-off portion 42 is located in the region 32b in which neither the inlet port 31a nor the outlet port 31b exists. The peripheral surface of the rotator 40a is in contact with the inner surface of the housing 31 along the first passage 30a. The sealer 231 is disposed in this contact area.

At this time, a flow resistance in the first passage 30a is very high, because the peripheral surface of the rotator 40a is in contact with the inner surface of the housing 31 and, moreover, the sealer 231 is disposed in this contact area. In the second passage 30b, on the other hand, ink can flow relatively smoothly to the outlet port 31b via the recesses 232, because both ends of the partition 50 confront the respective recesses 232. At this time, therefore, the flow resistance in the first passage 30a is higher than the flow resistance in the second passage 30b.

When the rotor 40 is in a print position as shown in FIG. 10B, the partition 50 partitions the cavity 32 in the same manner as in the above-described pump 30 (see FIG. 9B). That is, the partition 50 partitions the cavity 32 into a region 32a in which the inlet port 31a and the outlet port 31b exist and a region 32b in which neither the inlet port 31a nor the outlet port 31b exists. The cut-off portion 42 is located in the region 32a in which the inlet port 31a and the outlet port 31b exist, and the rotator 40a is in no contact with the housing 31. As a result, the flow resistance in the first passage 30a is very low, so that ink can smoothly be supplied to the ink-jet head 1.

When the rotor 40 is in the print position, in the above-described pump 30 (see FIG. 9B), both ends of the partition 50 are in contact with the inner surface of the housing 31, whereas, in this modification both ends of the partition 50 confront the respective recesses 232. At this time, accordingly, the flow resistance in the second passage 30b in this modification is lower than that in the above-described pump 30, so that ink flows in the second passage 30b as well as the first passage 30a.

A dismount position of the rotor 40 in this modification corresponds to the introduction position of the rotor 40 in the above-described embodiment (see FIG. 9A). In the first passage 30a, the peripheral surface of the rotator 40a and one end of the partition 50 are in contact with the inner surface of the housing 31. In the second passage 30b, since the location of the recess is different from that in the above-described embodiment, the other ends of the partition 50 is in contact with the inner surface of the housing 31. In this state, the flow resistance in the first passage 30a and the flow resistance in the second passage 30b are substantially equal to those obtained when the rotor 40 is in the dismount position in the above-described embodiment. Thus, the sum of the flow resistances in the first and second passages 30a and 30b is much higher than that in the case where the rotor 40 is in the print position (see FIG. 10B).

A pump 330 according to this modification has substantially the same structure as that of the pump 230 of the first modification (see FIGS. 10A and 10B), but differs therefrom only in that the rotor 40 has no cut-off portion 42.

When the rotor 40 is in an introduction position as shown in FIG. 11A, the partition 50 partitions the cavity 32 in the same manner as in the first modification (see FIG. 10A). That is, the partition 50 partitions the cavity 32 into a region 32a in which the inlet port 31a and the outlet port 31b exist and a region 32b in which neither the inlet port 31a nor the outlet port 31b exists. Both ends of the partition 50 are disposed in the second passage 30b and confront the respective recesses 232. The peripheral surface of the rotator 40a is in contact with the inner surface of the housing 31 along the first passage 30a. The sealer 231 is disposed in this contact area.

At this time, similarly to the first modification, a flow resistance in the first passage 30a is very high. On the other hand, a flow resistance in the second passage 30b is, because the recess 232 is provided, lower than the flow resistance in the first passage 30a.

When the rotor 40 is in a print position as shown in FIG. 11B, the partition 50 partitions the cavity 32 in the same manner as in the first embodiment (see FIG. 10B). That is, the partition 50 partitions the cavity 32 into a region 32a in which the inlet port 31a and the outlet port 31b exist and a region 32b in which neither the inlet port 31a nor the outlet port 31b exists. Both ends of the partition 50 are disposed in the second passage 30b and confront the respective recesses 232. The peripheral surface of the rotator 40a is in contact with the inner surface of the housing 31 along the first passage 30a. The sealer 231 is disposed in this contact area.
The flow resistance in the first and second passages 30a and 30b satisfy at least any one of the above three formulas (1a), (3a), and (4a).

The flow resistance in the second passage 30b is relatively low. Therefore, ink flows in the second passage 30b as well as the first passage 30a.

A dismount position of the rotor 40 in this modification corresponds to the introduction position of the rotor 40 in the above-described embodiment (see FIG. 9A), as in the first modification. In this case, accordingly, the flow resistance in the first passage 30a and the flow resistance in the second passage 30b are substantially equal to those obtained when the rotor 40 is in the dismount position in the above-described embodiment. Thus, the sum of the flow resistances in the first and second passages 30a and 30b is much higher than that in the case where the rotor 40 is in the print position (see FIG. 10B).

In the above-described first and second modifications as well, when the rotor 40 is in the respective three positions as described above, the flow resistances in the first and second passage 30a and 30b satisfy the aforementioned formulas (1a), (1b), (2), (3a), (3b), (4a), (4b), and (5), with the same effects as described above.

In the first and second modifications, when the rotor 40 is in the introduction position, both ends of the partition 50 are disposed in the second passage 30b and, in addition, the rotator 40a is in contact with the inner surface of the housing 31 along the first passage 30a. Like this, the flow resistances in the first and second passages 30a and 30b can surely be regulated using both of the partition 50 and the rotator 40a.

In the first and second modifications, moreover, the recesses 232 are formed in the inner surface of the housing 31 along the second passage 30b such that the recesses 232 can confront the respective ends of the partition 50 when the rotor 40 is in the introduction position. Thereby, the flow resistance in the second passage 30b is effectively slow.

Further, the sealer 231 provided on the peripheral surface of the rotor 40 is brought into contact with the inner surface of the housing 31, thereby allowing the flow resistance in the first passage 30a to become very high when the rotor 40 is in the introduction position.

The partition 50 and the rotor 40 may be disposed at various positions, insofar as, during the initial ink introduction, the flow resistances in the first and second passages 30a and 30b satisfy at least any one of the above three formulas (1a), (3a), and (4a).

The flow resistance in the first and second passages 30a and 30b can be regulated by means of various elements instead of the cut-off portion 42 and the sealer 231 provided in the rotator 40a and the recess 34 or 232 formed on the housing 31.

It is also possible to replace the cut-off portion 42 formed in the rotator 40a with a through-hole and to dispose the rotor 40 in such a manner that the through-hole may constitute a part of the first passage 30a during a printing operation. In this case as well, the flow resistance in the first passage 30a becomes very low during the printing operation.

The stopper 5, the arm 6, and the solenoid valve 7 can be omitted.

A means for detecting a rotational state of the rotor 40, which includes a position of the partition 50, is not limited to the proximity sensors 47 and 48, but may be other sensors such as an angle sensor which realize detections in various manners.

It is also possible to provide a pressure sensor in the ink supply path between the ink cartridge 20 and the head 1 and, prior to reaching such pressure as to break meniscuses, to dispose the rotor 40 and the partition 50 within the predetermined range. This can more surely prevent breakage of meniscuses during an operation for dismounting the ink cartridge 20.

An application of the present invention is not limited to line-type ink-jet printers. The present invention is also applicable to, for example, serial-type ink-jet printers, ink-jet type facsimile machines or copying machines.

While this invention has been described in conjunction with the specific embodiments outlined above, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, the preferred embodiments of the invention as set forth above are intended to be illustrative, not limiting. Various changes may be made without departing from the scope of the invention as defined in the claims.

Claims

1. An ink-jet recording apparatus comprising:

   a pump (30) that includes a housing (31), a rotor (40), a partition (50), a first passage (32a), and a second passage (32b); wherein:

   the housing (31) defines a cavity (32) formed therein and also has an inlet port (31a) through which ink is sucked into the cavity (32) and an outlet port (31b) through which ink is discharged out of the cavity (32);

   the rotor (40) is rotatable within the cavity (32);

   the partition (50) is supported on the rotor (40) such that both ends thereof can be in contact with an inner surface of the housing
(31), the partition (50) being rotatable within the cavity (32) together with the rotor (40); the inner surface of the housing (31) and the rotor (40) forming the first passage (32a) within the cavity (32), the first passage extending from the inlet port (31a) to the outlet port (31b) on one side of the rotor (40); the inner surface of the housing (31) and the rotor (40) forming the second passage (32b) within the cavity (32), the second passage being longer than the first passage, (32a) and extending from the inlet port (31a) to the outlet port (31b) via another side of the rotor (40) opposite to the first passage; the ink-jet recording apparatus further comprising:

an ink-jet head (1) to which ink is arranged to be supplied from the pump (30); and
a detector (44, 45, 47, 48) arranged to detect whether or not the partition (50) is disposed within such a range that a flow resistance $R_1$ (R100) in the first passage (32a) can be higher than a flow resistance $R_2$ (R200) in the second passage (32b).

2. An ink-jet recording apparatus (101) comprising:

a pump (30) that includes a housing (31), a rotor (40), a partition (50), a first passage (32a), and a second passage (32b); wherein:

the housing (31) defines a cavity (32) formed therein and also has an inlet port (31a) through which ink is sucked into the cavity (32) and an outlet port (31b) through which ink is discharged out of the cavity (32);
the rotor (40) is rotatable within the cavity (32);
the partition (50) is supported on the rotor (40) such that both ends thereof can be in contact with an inner surface of the housing (31), the partition (50) being rotatable within the cavity (32) together with the rotor (40);
the inner surface of the housing (31) and the rotor (40) forming the first passage (32a) within the cavity (32) the first passage extending from the inlet port (31a) to the outlet port (31b) on one side of the rotor (40);
the inner surface of the housing (31) and the rotor (40) forming the second passage (32b) within the cavity (32), the second passage being longer than the first passage (32a) and extending from the inlet port (31a) to the outlet port (31b) via another side of the rotor (40) opposite to the first passage;
the ink-jet recording apparatus further comprising:

an ink-jet head (1) to which ink is arranged to be supplied from the pump (30); and
a detector (44, 45, 47, 48) arranged to detect whether or not the partition (50) is disposed within such a range that a flow resistance $R_2$ (R200) in the second passage (32b) is lower than the ratio $R_2$ (R200) obtained when the ink-jet head is performing a recording.

3. An ink-jet recording apparatus (101) comprising:

a pump (30) that includes a housing (31), a rotor (40), a partition (50), a first passage (32a), and a second passage (32b); wherein:

the housing (31) defines a cavity (32) formed therein and also has an inlet port (31a) through which ink is sucked into the cavity (32) and an outlet port (31b) through which ink is discharged out of the cavity (32);
the rotor (40) is rotatable within the cavity (32);
the partition (50) is supported on the rotor (40) such that both ends thereof can be in contact with an inner surface of the housing (31), the partition (50) being rotatable within the cavity (32) together with the rotor (40);
the inner surface of the housing (31) and the rotor (40) forming the first passage (32a) within the cavity (32) the first passage extending from the inlet port (31a) to the outlet port (31b) on one side of the rotor (40);
the inner surface of the housing (31) and the rotor (40) forming the second passage (32b) within the cavity (32), the second passage being longer than the first passage (32a) and extending from the inlet port (31a) to the outlet port (31b) via another side of the rotor (40) opposite to the first passage;
the ink-jet recording apparatus further comprising:

an ink-jet head (1) to which ink is arranged to be supplied from the pump (30); and
a detector (44, 45, 47, 48) arranged to detect whether or not the partition (50) is disposed within such a range that a flow resistance $R_1$ (R100) in the first
passage (32a) is higher than the flow resistance (R10) obtained when the ink-jet head is performing a recording.

4. The ink-jet recording apparatus (101) according to claim 1, 2 or 3, further comprising a first permiter that, after the detector (44,45,47,48) detects that the partition (50) is disposed within the range, is arranged to permit an initial ink introduction into the cavity (32).

5. The ink-jet recording apparatus (101) according to claim 4, wherein the first permiter includes a regulator capable of, in association with a result of detection by the detector (44,45,47,48), selectively taking a first position in which it allows an ink supply member to supply ink to the pump (30); and a second position in which it prevents the ink supply member from supplying ink.

6. The ink-jet recording apparatus according to claim 4 or 5, further comprising a determiner that is arranged to determine whether or not an initial ink introduction into the cavity (32) should be performed, wherein the detector (44,45,47,48) is arranged to start its detection operation after the determiner determines that an initial ink introduction into the cavity should be performed.

7. The ink-jet recording apparatus according to any one of claims 1 to 6, wherein, when one end of the partition (50) is in contact with the inner surface of the housing (31) along the first passage (32a), the detector (44,45,47,48) is arranged to detect that the partition (50) is disposed within the range.

8. The ink-jet recording apparatus (101) according to any one of claims 1 to 7, wherein a recess (34) is formed in such a portion of the inner surface of the housing (31) along the second passage (32b) as to be, when one end of the partition (50) is in contact with the inner surface of the housing along the first passage (32a), confronting the other end of the partition (50), such that ink can flow relatively smoothly from a first region (32c) of the second passage (32b) to a second region (32d) on the other side of the partition (50) via the recess (34).

9. The ink-jet recording apparatus (101) according to any one of claims 1 to 8, wherein, when both ends of the partition (50) are disposed in the second passage (32b); the detector (44,45,47,48) is arranged to detect that the partition (50) is disposed within the range.

10. The ink-jet recording apparatus (101) according to claim 9, wherein:

- a peripheral surface of the rotor (40) is arranged to, along with rotation of the rotor (40), make intermittent contact with the inner surface of the housing (31) along the first passage (32a); and when both ends of the partition (50) are disposed in the second passage (32b), the peripheral surface of the rotor (40) is arranged to make contact with the inner surface of the housing along the first passage (32a).

11. The ink-jet recording apparatus (101) according to claim 9 or 10, wherein the rotor (40) is provided, on its peripheral surface, with a sealer that obstructs, the first passage (32a) when both ends of the partition (50) are disposed in the second passage (32b).

12. The ink-jet recording apparatus (101) according to claim 9, 10 or 11 wherein a recess (34) is formed in such a portion of the inner surface of the housing (31) along the second passage (32b) as to, when both ends of the partition (50) are disposed in the second passage (32b), confront at least either of both ends of the partition (50), such that ink may flow around the partition via the recess.

13. An ink-jet recording apparatus comprising:

- a pump (30) that includes a housing (31), a rotor (40), a partition (50), a first passage (32a), and a second passage (32b); wherein:
  - the housing (31) defines a cavity (32) formed therein and also has an inlet port (31a) through which ink is sucked into the cavity (32) and an outlet port (31b) through which ink is discharged out of the cavity (32);
  - the rotor (40) is rotatable within the cavity (32);
  - the partition (50) is supported on the rotor (40) such that both ends thereof can be in contact with an inner surface of the housing (31), the partition (50) being rotatable within the cavity (32) together with the rotor (40); the inner surface of the housing (31) and the rotor (40) forming the first passage (32a) within the cavity (32) the first passage extending from the inlet port (31a) to the outlet port (31b) on one side of the rotor (40);
  - the inner surface of the housing (31) and the rotor (40) forming the second passage (32b) within the cavity (32), the second passage being longer than the first passage (32a) and extending from the inlet port (31a) to the outlet port (31b) via another side of the rotor (40) opposite to the first passage; the ink-jet recording apparatus further comprising:
an ink-jet head (1) to which ink is arranged to be supplied from the pump (30); and
a detector (44,45,47,48) arranged to detect whether or not the partition (50) is disposed within such a range that the sum of flow resistances (R100,R200) in the first and second passages (32a, 32b) is higher than the sum of flow resistances (R10,R20) obtained when the ink-jet head is performing a recording.

14. The ink-jet recording apparatus (101) according to claim 13, further comprising a permitter that, after the detector (44,45,47,48) detects that the partition (50) is disposed within the range, is arranged to permit an ink supply member which supplies ink to the pump (30) to be dismounted from the pump (30).

15. The ink-jet recording apparatus according to claim 14, wherein the permitter includes a regulator capable of, in association with a result of detection by the detector (44,45,47,48), selectively taking a first position in which it allows movement of the ink supply member and a second position in which it prevents movement of the ink supply member.

16. The ink-jet recording apparatus according to claim 14 or 15, further comprising a determiner for determining whether or not the ink supply member should be dismounted from the pump (30), wherein the detector (44,45,47,48) is arranged to start its detection operation after the determiner determines that the ink supply member should be dismounted from the pump (30).

17. A method for controlling an ink-jet recording apparatus (101) comprising:

a pump (30) that includes a housing (31), a rotor (40), a partition (50), a first passage (32a), and a second passage (32b); wherein:

the housing (31) defines a cavity (32) formed therein and also has an inlet port (31a) through which ink is sucked into the cavity (32) and an outlet port (31b) through which ink is discharged out of the cavity (32);
the rotor (40) is rotatable within the cavity (32);
the partition (50) is supported on the rotor (40) such that both ends thereof can be in contact with an inner surface of the housing (31), the partition (50) being rotatable within the cavity (32) together with the rotor (40);
the inner surface of the housing (31) and the rotor (40) forming the first passage (32a) within the cavity (32) the first passage extending from the inlet port (31a) to the outlet port (31b) on one side of the rotor (40); the inner surface of the housing (31) and the rotor (40) forming the second passage (32b) within the cavity (32), the second passage being longer than the first passage (32a) and extending from the inlet port (31a) to the outlet port (31b) via another side of the rotor (40) opposite to the first passage;
the ink-jet recording apparatus further comprising:

an ink-jet head (1) to which ink is arranged to be supplied from the pump (30); and

the method comprising steps of:

disposing the partition (50) within such a range that a flow resistance (R1) in the first passage (32a) is higher than a flow resistance (R2) in the second passage (32b); and
starting an initial ink introduction into the cavity (32).

18. A method for controlling an ink-jet recording apparatus (101) comprising:

a pump (30) that includes a housing (31), a rotor (40), a partition (50), a first passage (32a), and a second passage (32b); wherein:

the housing (31) defines a cavity (32) formed therein and also has an inlet port (31a) through which ink is sucked into the cavity (32) and an outlet port (31b) through which ink is discharged out of the cavity (32); the rotor (40) is rotatable within the cavity (32); the partition (50) is supported on the rotor (40) such that both ends thereof can be in contact with an inner surface of the housing (31), the partition (50) being rotatable within the cavity (32) together with the rotor (40); the inner surface of the housing (31) and the rotor (40) forming the first passage (32a) within the cavity (32) the first passage extending from the inlet port (31a) to the outlet port (31b) on one side of the rotor (40); the inner surface of the housing (31) and the rotor (40) forming the second passage (32b) within the cavity (32), the second passage being longer than the first passage (32a) and extending from the inlet port (31a) to the outlet port (31b) via another side of
19. A method for controlling an ink-jet recording apparatus (101) comprising:

a pump (30) that includes a housing (31), a rotor (40), a partition (50), a first passage (32a), and a second passage (32b); wherein:

the housing (31) defines a cavity (32) formed therein and also has an inlet port (31a) through which ink is sucked into the cavity (32) and an outlet port (31b) through which ink is discharged out of the cavity (32);
the rotor (40) is rotatable within the cavity (32);
the partition (50) is supported on the rotor (40) such that both ends thereof can be in contact with an inner surface of the housing (31), the partition (50) being rotatable within the cavity (32) together with the rotor (40);
the inner surface of the housing (31) and the rotor (40) forming the first passage (32a) within the cavity (32) the first passage extending from the inlet port (31a) to the outlet port (31b) on one side of the rotor (40);
the inner surface of the housing (31) and the rotor (40) forming the second passage (32b) within the cavity (32), the second passage being longer than the first passage (32a) and extending from the inlet port (31a) to the outlet port (31b) via another side of the rotor (40) opposite to the first passage;
the ink-jet recording apparatus further comprising:

an ink-jet head (1) to which ink is arranged to be supplied from the pump (30); and

the method comprising steps of:

disposing the partition (50) within such a range that a ratio of a flow resistance (R2) in the second passage (32b) to a flow resistance (R1) in the first passage (32a) is lower than the ratio (R20:R10) obtained when the ink-jet head is performing a recording; and
starting an initial ink introduction into the cavity (32).

20. The method according to claim 17, 18 or 19, further comprising a step of, after starting the initial ink introduction, vibrating the partition (50).

21. The method according to claim 17, 18 or 19, wherein the step of starting the initial ink introduction includes permitting an ink supply member to supply ink to the pump.

22. A method for controlling an ink-jet recording apparatus (101) comprising:

a pump (30) that includes a housing (31), a rotor (40), a partition (50), a first passage (32a), and a second passage (32b);

wherein:

the housing (31) defines a cavity (32) formed therein and also has an inlet port (31a) through which ink is sucked into the cavity (32) and an outlet port (31b) through which ink is discharged out of the cavity (32);
the rotor (40) is rotatable within the cavity (32);
the partition (50) is supported on the rotor (40) such that both ends thereof can be in contact with an inner surface of the housing (31), the partition (50) being rotatable within the cavity (32) together with the rotor (40);
the inner surface of the housing (31) and the rotor (40) forming the first passage (32a) within the cavity (32) the first passage extending from the inlet port (31a) to the outlet port (31b) on one side of the rotor (40);
the inner surface of the housing (31) and the rotor (40) forming the second passage (32b) within the cavity (32), the second passage being longer than the first passage (32a) and extending from the inlet port (31a) to the outlet port (31b) via another side of the rotor (40) opposite to the first passage;
the ink-jet recording apparatus further comprising:

an ink-jet head (1) to which ink is arranged to be supplied from the pump (30); and

the method comprising steps of:
disposing the partition (50) within such a range that the sum of flow resistances (R100, R200) in the first and second passages (32a, 32b) is higher than the sum of flow resistances (R10, R20) obtained when the ink-jet head is performing a recording; and dismounting from the pump (30) an ink supply member that supplies ink to the pump.

23. The method according to claim 22, wherein the dismounting step includes permitting movement of the ink supply member.

2. Tintenstrahlaufzeichnungsgerät (101) mit:

einer Pumpe (30), die ein Gehäuse (31) enthält, einem Rotor (40), einer Trennung (50), einem ersten Durchgang (32a) und einem zweiten Durchgang (32b); worin das Gehäuse (31) einen darin gebildeten Hohlraum (32) definiert und auch eine Einlassöffnung (31a), durch die Tinte in den Hohlraum (32) gesaugt wird, und eine Auslassöffnung (31b), durch die Tinte aus dem Hohlraum (32) ausgegeben wird, aufweist;
der Rotor (40) drehbar in dem Hohlraum (32) ist;die Trennung (50) auf dem Rotor (40) derart gelagert ist, dass beide Enden davon in Kontakt mit einer inneren Oberfläche des Gehäuses (31) stehen können, wobei die Trennung (50) zusammen mit dem Rotor (40) drehbar innerhalb des Hohlraumes (32) ist;
die innere Oberfläche des Gehäuses (31) und der Rotor (40) den ersten Durchgang (32a) innerhalb des Hohlraumes (32) bilden, wobei der erste Durchgang von der Einlassöffnung (31a) zu der Auslassöffnung (31b) auf einer Seite des Rotors erstreckt,
die innere Oberfläche des Gehäuses (31) und der Rotor (40) den zweiten Durchgang (32b) innerhalb des Hohlraumes (32) bilden, wobei der zweite Durchgang länger als der erste Durchgang (32a) ist und sich von der Einlassöffnung (31a) zu der Auslassöffnung (31b) über eine andere Seite des Rotors (40) entgegengesetzt zu dem ersten Durchgang erstreckt;

wobei das Tintenstrahlaufzeichnungsgerät weiter aufweist:

einen Tintenstrahlkopf (1), an dem Tinte angeordnet ist, die von der Pumpe (30) zu liefern ist; und einen Detektor (44, 45, 47, 48), der zum Erfassen angeordnet ist, ob oder nicht die Trennung innerhalb eines solchen Bereiches vorgesehen ist, dass ein Flusswiderstand (R1; R100) in dem ersten Durchgang (32a) höher sein kann als ein Flusswiderstand (R2; R200) in dem zweiten Durchgang (32b).
3. Tintenstrahlaufzeichnungsgerät (101) mit:

einer Pumpe (30), die ein Gehäuse (31) enthält, 
einem Rotor (40), einer Trennung (50), einem ersten Durchgang (32a) und einem zweiten 
Durchgang (32b);

worin das Gehäuse (31) einen darin gebildeten Hohlraum (32) definiert und auch eine Einlassöffnung (31a), 
durch die Tinte in den Hohlraum (32) gesaugt wird, und eine Auslassöffnung (31b), durch die Tinte aus 
dem Hohlraum (32) ausgegeben wird, aufweist; 
der Rotor (40) drehbar innerhalb des Hohlraumes (32) ist; 
die Trennung (50) auf dem Rotor (40) derart gelagert 
ist, dass beide Enden davon mit einer inneren Ober-
fläche des Gehäuses (31) in Kontakt stehen können, 
wobei die Trennung (50) zusammen mit dem Rotor 
(40) drehbar innerhalb des Hohlraumes (32) ist; 
die innere Oberfläche des Gehäuses (31) und der Rotor (40) den ersten Durchgang (32a) innerhalb 
des Hohlraumes (32) bilden, wobei sich der erste 
Durchgang von der Einlassöffnung (31a) zu der Aus-
lassöffnung (31b) auf einer Seite des Rotors (40) 
erstreckt; 
die innere Oberfläche des Gehäuses (31) und der 
Rotor (40) den zweiten Durchgang (32b) innerhalb 
des Hohlraumes (32) bilden, wobei der zweite 
Durchgang länger als der erste Durchgang (32a) ist 
und sich von der Einlassöffnung (31a) zu der Aus-
lassöffnung (31b) über eine andere Seite des Rotors 
(40) entgegengesetzt zu dem ersten Durchgang er-
erstreckt; 
wobei das Tintenstrahlaufzeichnungsgerät weiter 
aufweist:

einen Tintenstrahlkopf (1), an dem Tinte ange-
ordnet ist, die von der Pumpe (30) zu liefern ist; und 
einen Detektor (44, 45, 47, 48), der zum Erfas-
sen angeordnet ist, ob oder nicht die Trennung (50) innerhalb eines solchen Bereiches vorge-
sehen ist, dass ein Flusswiderstand (R1; R100) 
in dem ersten Durchgang (32a) höher als der 
Flusswiderstand (R10) ist, der erhalten wird, 
wober der Tintenstrahlkopf ein Aufzeichnen aus-
führt.

4. Tintenstrahlaufzeichnungsgerät (101) nach An-
spruch 1, 2 oder 3, weiter mit einem ersten Erlauber, 
der, nachdem der Detektor (44, 45, 47, 48) erfasst, 
dass die Trennung (50) innerhalb des Bereiches vor-
gesehen ist, angeordnet ist zum Erlauben einer an-
fänglichen Tinteneinführung in den Hohlraum (32).

5. Tintenstrahlaufzeichnungsgerät (101) nach An-
spruch 4, bei dem der erste Erlauber einen Regulator

enthält, der in Verknüpfung mit einem Resultat der 
Erfassung durch den Detektor (44, 45, 47, 48) se-
lektiv eine erste Position, in der er einem Tintenlie-
ferteil erlaubt, Tinte zu der Pumpe (30) zu liefern; 
und eine zweite Position, in der er dem Tintenliefer-
teil verhindert, Tinte zu liefern, annehmen kann.

6. Tintenstrahlaufzeichnungsgerät nach Anspruch 4 
or 5, weiter mit einem Bestimmer, der zum Be-
stimmen angeordnet ist, ob oder nicht eine anfäng-
liche Tinteneinführung in den Hohlraum (32) ausge-
führt werden soll, 
worin der Detektor (44, 45, 47, 48) angeordnet ist 
zum Starten seiner Erfassungstätigkeit, nachdem 
der Bestimmer bestimmt, dass eine anfängliche Tin-
teneinführung in den Hohlraum ausgeführt werden soll.

7. Tintenstrahlaufzeichnungsgerät nach einem der An-
sprüche 1 bis 6, bei dem, wenn ein Ende der Tren-
nung (50) in Kontakt mit der inneren Oberfläche des 
Gehäuses (31) entlang des ersten Durchganges 
(32a) steht, der Detektor (44, 45, 47, 48) angeordnet 
ist zum Erfassen, dass die Trennung (50) in dem 
Bereich vorgesehen ist.

8. Tintenstrahlaufzeichnungsgerät (101) nach einem der Ansprüche 1 bis 7, bei dem eine Ausnehmung 
(34) in solch einem Abschnitt der inneren Oberfläche des 
Gehäuses (31) entlang des zweiten Durchganges 
(32b) gebildet ist, dass, wenn ein Ende der Trennung (50) in Kontakt mit der inneren Oberfläche des 
Gehäuses entlang des ersten Durchganges (32a) steht, 
sein der andere Ende der Trennung (50) 
gegenüber ist, so dass Tinte relativ glatt von einem 
ersten Bereich (32c) des zweiten Durchganges 
(32b) zu einem zweiten Bereich (32b) auf der ande-
ren Seite der Trennung (50) durch die Ausnehmung 
(34) fließen kann.

9. Tintenstrahlaufzeichnungsgerät (101) nach einem der Ansprüche 1 bis 8, bei dem, wenn beide Enden 
der Trennung (50) in dem zweiten Durchgang (32b) 
vorgesehen sind, der Detektor (44, 45, 47, 48) zum 
Erfassen angeordnet ist, dass die Trennung (50) inner-
halb des Bereiches vorgesehen ist.

10. Tintenstrahlaufzeichnungsgerät (101) nach An-
spruch 9, bei dem:

eine Randoberfläche des Rotors (40) angeord-
nert ist, um zusammen mit der Drehung des Ro-
tors (40) unterbrochenen Kontakt mit der inne-
ren Oberfläche des Gehäuses (41) entlang des 
ersten Durchganges (32a) herzustellen; und 
wenne beide Enden der Trennung (50) in dem 
zweiten Durchgang (32b) vorgesehen sind, die 
Randoberfläche des Rotors (40) angeordnet ist,
um Kontakt mit der inneren Oberfläche des Gehäuses entlang des ersten Durchganges (32a) herzustellen.

11. Tintenstrahlaufzeichnungsgerät (101) nach Anspruch 9 oder 10, bei dem der Rotor (40) auf seiner Randoberfläche mit einem Abdichter versehen ist, der den ersten Durchgang (32a) blockiert, wenn beide Enden der Trennung (50) in dem zweiten Durchgang (32b) vorgesehen sind.

12. Tintenstrahlaufzeichnungsgerät (101) nach Anspruch 9, 10 oder 11, bei dem eine Ausnehmung (34) in solch einem Abschnitt der inneren Oberfläche des Gehäuses (31) entlang des zweiten Durchganges (32b) gebildet ist, dass sie, wenn beide Enden der Trennung (50) in dem zweiten Durchgang (32b) vorgesehen sind, mindestens einem der beiden Enden (50) gegenübersteht, so dass Tinte um die Trennung durch die Ausnehmung fließen kann.

13. Tintenstrahlaufzeichnungsgerät mit:

einer Pumpe (30), die ein Gehäuse (31) enthält, einem Rotor (40), einer Trennung (50), einem ersten Durchgang (32a) und einem zweiten Durchgang (32b);

worin das Gehäuse (31) einen darin gebildeten Hohlraum (32) definiert und auch eine Einlassöffnung (31a), durch die Tinte in den Hohlraum (32) gesaugt wird, und eine Auslassöffnung (31b), durch die Tinte aus dem Hohlraum (32) ausgegeben wird, aufweist; der Rotor (40) drehbar innerhalb des Hohlraumes (32) ist; die Trennung (50) auf dem Rotor (40) derart gelagert ist, dass beide Enden davon in Kontakt mit einer inneren Oberfläche des Gehäuses (31) stehen können, wobei die Trennung (50) zusammen mit dem Rotor (40) drehbar innerhalb des Hohlraumes (32) ist; die innere Oberfläche des Gehäuses (31) und der Rotor (40) den ersten Durchgang (32a) innerhalb des Hohlraumes (32) bilden, wobei sich der erste Durchgang von der Einlassöffnung (31a) zu der Auslassöffnung (31b) auf einer Seite des Rotors (40) erstreckt; die innere Oberfläche des Gehäuses (31) und der Rotor (40) den zweiten Durchgang (32b) innerhalb des Hohlraumes (32) bilden, wobei der zweite Durchgang länger als der erste Durchgang (32a) ist und sich von der Einlassöffnung (31a) zu der Auslassöffnung (31b) über eine andere Seite des Rotors (40) entgegengesetzt zu dem ersten Durchgang erstreckt; wobei das Tintenstrahlaufzeichnungsgerät weiter aufweist;

14. Tintenstrahlaufzeichnungsgerät (101) nach Anspruch 13, weiter mit einem Erlauber, der, nachdem der Detektor (44, 45, 47, 48) erfasst hat, dass die Trennung (50) innerhalb des Bereiches vorgesehen ist, angeordnet ist zum Erlauben eines Tintenlieferteiles, das Tinte zu der Pumpe (30) liefert, von der Pumpe (30) abgebaut zu werden.


16. Tintenstrahlaufzeichnungsgerät nach Anspruch 14 oder 15, weiter mit einem Bestimmer zum Bestimmen, ob oder nicht das Tintenlieferteil von der Pumpe (30) abzubauen ist, worin der Detektor (44, 45, 47, 48) angeordnet ist zum starten seiner Erfassungstätigkeit, nachdem der Bestimmer bestimmt hat, dass das Tintenlieferteil von der Pumpe (30) abgebaut werden soll.

17. Verfahren zum Steuern eines Tintenstrahlaufzeichnungsgeräts (101) mit:

einer Pumpe (30), die ein Gehäuse (31) enthält, einem Rotor (40), einer Trennung (50), einem ersten Durchgang (32a) und einem zweiten Durchgang (32b);

worin das Gehäuse (31) einen darin gebildeten Hohlraum (32) definiert und auch eine Einlassöffnung (31a), durch die Tinte in den Hohlraum (32) gesaugt wird, und eine Auslassöffnung (31b), durch die Tinte aus dem Hohlraum (32) ausgegeben wird, nach dem der Detektor (44, 45, 47, 48) angeordnet ist zum starten seiner Erfassungstätigkeit, nachdem der Bestimmer bestimmt hat, dass das Tintenlieferteil von der Pumpe (30) abgebaut werden soll.
ist;
die innere Oberfläche des Gehäuses (31) und der Rotor (40) den ersten Durchgang (32a) innerhalb des Hohlraumes (32) bilden, wobei sich der erste Durchgang von der Einlassöffnung (31a) zu der Auslassöffnung (31b) auf einer Seite des Rotors (40) erstreckt;
die innere Oberfläche des Gehäuses (31) und der Rotor (40) den zweiten Durchgang (32b) innerhalb des Hohlraumes (32) bilden, wobei der zweite Durchgang länger als der erste Durchgang (32a) ist und sich von der Einlassöffnung (31a) zu der Auslassöffnung (31b) über eine andere Seite des Rotors (40) entgegengesetzt zu dem ersten Durchgang erstreckt;
wobei das Tintenstrahlaufzeichnungsgerät weiter aufweist:
einen Tintenstrahlkopf (1), an dem Tinte angeordnet ist, die von der Pumpe (30) zu liefern ist; und
wobei das Verfahren die Schritte aufweist:
Vorsehen der Trennung (50) innerhalb solch eines Bereiches, dass ein Verhältnis eines Flusswiderstandes (R2) in dem ersten Durchgang (32a) höher als ein Flusswiderstand (R2) in dem zweiten Durchgang (32b) ist; und
Starten einer anfänglichen Tinteneinführung in den Hohlraum (32).

18. Verfahren zum Steuern eines Tintenstrahlaufzeichnungsgerätes (101) mit:
einer Pumpe (30), die ein Gehäuse (31) enthält, einem Rotor (40), einer Trennung (50), einem ersten Durchgang (32a) und einem zweiten Durchgang (32b);
worin
das Gehäuse (31) einen darin gebildeten Hohlraum (32) definiert und auch eine Einlassöffnung (31a), durch die Tinte in den Hohlraum (32) gesaugt wird, und eine Auslassöffnung (31b), durch die Tinte aus dem Hohlraum (32) ausgegeben wird, aufweist;
der Rotor (40) drehbar in dem Hohlraum (32) ist; die Trennung (50) auf dem Rotor (40) derart gelagert ist, dass beide Enden davon in Kontakt mit einer inneren Oberfläche des Gehäuses (31) stehen können, wobei die Trennung (50) zusammen mit dem Rotor (40) drehbar in dem Hohlraum (32) ist; die innere Oberfläche des Gehäuses (31) und der Rotor (40) den ersten Durchgang (32a) innerhalb des Hohlraumes (32) bilden, wobei sich der erste Durchgang von der Einlassöffnung (31a) zu der Auslassöffnung (31b) auf einer Seite des Rotors (40) erstreckt;
Durchgang länger als der erste Durchgang (32a) ist und sich von der Einlassöffnung (31a) zu der Auslassöffnung (31b) über eine andere Seite des Rotors (40) entgegengesetzt zu dem ersten Durchgang erstreckt; wobei das Tintenstrahlaufzeichnungsgerät weiter aufweist:

- einen Tintenstrahlkopf (1), an dem Tinte angeordnet ist, die von der Pumpe (30) zu liefern ist; und

wobei das Verfahren die Schritte aufweist:

Vorsehen der Trennung (50) innerhalb solch eines Bereiches, dass ein Flusswiderstand (R1) in dem ersten Durchgang (32a) höher als der Flusswiderstand (R10) ist, der erhalten wird, wenn der Tintenstrahlkopf ein Aufzeichnen ausführt; und

Starten einer anfänglichen Tinteneinführung in den Hohlraum (32).

20. Verfahren nach Anspruch 17, 18 oder 19, weiter mit einem Schritt des, nach Starten der anfänglichen Tinteneinführung, Vibrieren der Trennung (50).


22. Verfahren zum Steuern eines Tintenstrahlaufzeichnungsgerätes (101) mit:

- einer Pumpe (30), die ein Gehäuse (31) enthält, einem Rotor (40), einer Trennung (50), einem ersten Durchgang (32a) und einem zweiten Durchgang (32b);

worin das Gehäuse einen darin gebildeten Hohlraum (32) definiert und auch eine Einlassöffnung (31a), durch die Tinte in den Hohlraum (32) gesaugt wird, und eine Auslassöffnung (31b), durch die Tinte aus dem Hohlraum (32) ausgegeben wird, aufweist;

- der Rotor (40) drehbar innerhalb des Hohlraumes (32) ist;

- die Trennung (50) auf dem Rotor (40) derart gelagert ist, dass beide Enden davon in Kontakt mit einer inneren Oberfläche des Gehäuses (31) stehen können, wobei die Trennung (50) zusammen mit dem Rotor (40) drehbar innerhalb des Hohlraumes (32) ist;

- die innere Oberfläche des Gehäuses (31) und der Rotor (40) den ersten Durchgang (32a) innerhalb des Hohlraumes (32) bilden, wobei sich der erste Durchgang von der Einlassöffnung (31a) zu der Auslassöffnung (31b) auf einer Seite des Rotors (40) erstreckt;

- die innere Oberfläche des Gehäuses (31) und der Rotor (40) den zweiten Durchgang (32b) innerhalb des Hohlraumes (32) bilden, wobei der zweite Durchgang länger als der erste Durchgang (32a) ist und sich von der Einlassöffnung (31a) zu der Auslassöffnung (31b) über eine andere Seite des Rotors (40) entgegengesetzt zu dem ersten Durchgang erstreckt; wobei das Tintenstrahlaufzeichnungsgerät weiter aufweist:

- einen Tintenstrahlkopf (1), an dem Tinte angeordnet ist, die von der Pumpe (30) zu liefern ist; und

wobei das Verfahren die Schritte aufweist:

- Vorsehen der Trennung (50) innerhalb solch eines Bereiches, dass die Summe der Flusswiderstände (R100, R200) in dem ersten und dem zweiten Durchgang (32a, 32b) höher als die Summe der Flusswiderstände (R10, R20) ist, die erhalten wird, wenn der Tintenstrahlkopf ein Aufzeichnen ausführt; und

- Abbauen eines Tintenlieferteiles von der Pumpe (30), das Tinte zu der Pumpe liefert.


**Revendications**

1. Appareil d'enregistrement à jet d'encre comprenant :

- une pompe (30) qui comprend un logement (31), un rotor (40), une cloison (50), un premier passage (32a) et un second passage (32b) ; dans lequel :

- le logement (31) définit une cavité (32) formée dedans et comporte également un port d’entrée (31a) par lequel l’encre est aspirée dans la cavité (32) et un port de sortie (31b) par lequel l’encre est évacuée hors de la cavité (32) ;

- le rotor (40) peut tourner à l’intérieur de la cavité (32) ;

- la cloison (50) est supportée sur le rotor (40) de façon que ses deux extrémités puissent être en contact avec une surface interne du logement (31), la cloison (50) pouvant tourner à l’intérieur de la cavité (32) conjointement au rotor (40) ;

- la surface interne du logement (31) et le rotor (40) formant le premier passage (32a) à
l’intérieur de la cavité (32), le premier passage s’étendant du port d’entrée (31a) au port de sortie (31b) sur un côté du rotor (40) ; la surface interne du logement (31) et le rotor (40) formant le second passage (32b) à l’intérieur de la cavité (32), le second passage étant plus long que le premier passage (32a) et s’étendant du port d’entrée (31a) au port de sortie (31b) via un autre côté du rotor (40) à l’opposé du premier passage ; l’appareil d’enregistrement à jet d’encre comprenant en outre :

une tête à jet d’encre (1) à laquelle l’encre doit être fournie depuis la pompe (30) ; et
un détecteur (44, 45, 47, 48) disposé de façon à détecter si oui ou non la cloison est disposée dans une plage telle qu’une résistance à l’écoulement (R1 ; R100) dans le premier passage (32a) peut être supérieure à une résistance à l’écoulement (R2 ; R200) dans le second passage (32b).

2. Appareil d’enregistrement à jet d’encre (101) comprenant :

une pompe (30) qui comprend un logement (31), un rotor (40), une cloison (50), un premier passage (32a) et un second passage (32b) ; dans lequel :

le logement (31) définit une cavité (32) formée dedans et comporte également un port d’entrée (31a) par lequel l’encre est aspirée dans la cavité (32) et un port de sortie (31b) par lequel l’encre est évacuée hors de la cavité (32) ;
le rotor (40) peut tourner à l’intérieur de la cavité (32) ;
là cloison (50) est supportée sur le rotor (40) de façon que ses deux extrémités puissent être en contact avec une surface interne du logement (31), la cloison (50) pouvant tourner à l’intérieur de la cavité (32) conjointement au rotor (40) ;
là surface interne du logement (31) et le rotor (40) formant le premier passage (32a) à l’intérieur de la cavité (32), le premier passage s’étendant du port d’entrée (31a) au port de sortie (31b) sur un côté du rotor (40) ; la surface interne du logement (31) et le rotor (40) formant le second passage (32b) à l’intérieur de la cavité (32), le second passage étant plus long que le premier passage (32a) et s’étendant du port d’entrée (31a) au port de sortie (31b) via un autre côté du rotor (40) à l’opposé du premier passage ; l’appareil d’enregistrement à jet d’encre comprenant en outre :

une tête à jet d’encre (1) à laquelle l’encre doit être fournie depuis la pompe (30) ; et
un détecteur (44, 45, 47, 48) disposé de façon à détecter si oui ou non la cloison est disposée dans une plage telle qu’un rapport d’une résistance à l’écoulement (R2 ; R200) dans le second passage (32b) sur une résistance à l’écoulement (R1 ; R100) dans le premier passage (32a) est inférieur au rapport (R20 ; R10) obtenu lorsque la tête à jet d’encre effectue un enregistrement.

3. Appareil d’enregistrement à jet d’encre (101) comprenant :

une pompe (30) qui comprend un logement (31), un rotor (40), une cloison (50), un premier passage (32a) et un second passage (32b) ; dans lequel :

le logement (31) définit une cavité (32) formée dedans et comporte également un port d’entrée (31a) par lequel l’encre est aspirée dans la cavité (32) et un port de sortie (31b) par lequel l’encre est évacuée hors de la cavité (32) ;
le rotor (40) peut tourner à l’intérieur de la cavité (32) ;
là cloison (50) est supportée sur le rotor (40) de façon que ses deux extrémités puissent être en contact avec une surface interne du logement (31), la cloison (50) pouvant tourner à l’intérieur de la cavité (32) conjointement au rotor (40) ;
là surface interne du logement (31) et le rotor (40) formant le premier passage (32a) à l’intérieur de la cavité (32), le premier passage s’étendant du port d’entrée (31a) au port de sortie (31b) sur un côté du rotor (40) ; la surface interne du logement (31) et le rotor (40) formant le second passage (32b) à l’intérieur de la cavité (32), le second passage étant plus long que le premier passage (32a) et s’étendant du port d’entrée (31a) au port de sortie (31b) via un autre côté du rotor (40) à l’opposé du premier passage ; l’appareil d’enregistrement à jet d’encre comprenant en outre :
(30) ; et
un détecteur (44, 45, 47, 48) disposé de façon à déterminer si oui ou non la cloison (50) est disposée dans une plage telle qu’une résistance à l’écoulement (R1 ; R100) dans le premier passage (32a) est supérieure à la résistance à l’écoulement (R10) obtenue lorsque la tête à jet d’encre effectue un enregistrement.

4. Appareil d’enregistrement à jet d’encre (101) selon la revendication 1, 2 ou 3, comprenant en outre un premier dispositif d’autorisation qui, après que le détecteur (44, 45, 47, 48) a détecté que la cloison (50) est disposée dans la plage, est agencé de façon à autoriser une introduction d’encre initiale dans la cavité (32).

5. Appareil d’enregistrement à jet d’encre (101) selon la revendication 4, dans lequel le premier dispositif d’autorisation comprend un régulateur capable, en association avec un résultat de détection du détecteur (44, 45, 47, 48), de prendre de façon sélective une première position dans laquelle il permet à un élément d’alimentation en encre de fournir de l’encre à la pompe (30) ; et une seconde position dans laquelle il empêche l’élément d’alimentation en encre de fournir de l’encre.

6. Appareil d’enregistrement à jet d’encre selon la revendication 4 ou 5, comprenant en outre un dispositif de détermination qui est agencé pour déterminer si oui ou non une introduction d’encre initiale dans la cavité (32) doit être effectuée, dans lequel le détecteur (44, 45, 47, 48) est agencé pour commencer son opération de détection après que le dispositif de détermination a déterminé qu’une introduction d’encre initiale dans la cavité devait être effectuée.

7. Appareil d’enregistrement à jet d’encre selon l’une quelconque des revendications 1 à 6, dans lequel, lorsqu’une extrémité de la cloison (50) est en contact avec la surface interne du logement (31), le long du premier passage (32a), le détecteur (44, 45, 47, 48) est agencé pour déterminer que la cloison (50) est disposée à l’intérieur de la plage.

8. Appareil d’enregistrement à jet d’encre (101) selon l’une quelconque des revendications 1 à 7, dans lequel un renforcement (34) est formé dans une partie de la surface interne du logement (31) le long du second passage (32b), de façon à ce que, lorsqu’une extrémité de la cloison (50) est en contact avec la surface interne du logement le long du premier passage (32a), il soit contre l’autre extrémité de la cloison (50), de façon que l’encre puisse s’écouler relativement doucement depuis une première région (32c) du second passage (32b) jusqu’à une seconde région (32d) sur l’autre côté de la cloison (50) via le renforcement (34).

9. Appareil d’enregistrement à jet d’encre (101) selon l’une quelconque des revendications 1 à 8, dans lequel, lorsque les deux extrémités de la cloison (50) sont disposées dans le second passage (32b), le détecteur (44, 45, 47, 48) est agencé pour déterminer que la cloison (50) est disposée à l’intérieur de la plage.

10. Appareil d’enregistrement à jet d’encre (101) selon la revendication 9, dans lequel :

une surface périphérique du rotor (40) est agencée pour, conjointement à la rotation du rotor (40), entrer en contact intermittent avec la surface interne du logement (31) le long du premier passage (32a) ; et lorsque les deux extrémités de la cloison (50) sont disposées dans le second passage (32b), la surface périphérique du rotor (40) est agencée pour entrer en contact avec la surface interne du logement le long du premier passage (32a).

11. Appareil d’enregistrement à jet d’encre (101) selon la revendication 9 ou 10, dans lequel le rotor (40) est muni sur sa surface périphérique d’un scellant qui obstrue le premier passage (32a) lorsque les deux extrémités de la cloison (50) sont disposées dans le second passage (32b).

12. Appareil d’enregistrement à jet d’encre (101) selon la revendication 9, 10 ou 11, dans lequel un renforcement (34) est formé dans une partie de la surface interne du logement (31) le long du second passage (32b) de façon à ce que, lorsque les deux extrémités de la cloison (50) sont disposées dans le second passage (32b), il se trouve contre au moins l’une des deux extrémités de la cloison (50), de façon que l’encre puisse s’écouler autour de la cloison via le renforcement.

13. Appareil d’enregistrement à jet d’encre comprenant :

une pompe (30) qui comprend un logement (31), un rotor (40), une cloison (50), un premier passage (32a) et un second passage (32b) ; dans lequel :

le logement (31) définit une cavité (32) formée dedans et comporte également un port d’entrée (31a) par lequel l’encre est aspirée dans la cavité (32) et un port de sortie (31b) par lequel
l’encre est évacuée hors de la cavité (32) ; le rotor (40) peut tourner à l’intérieur de la cavité (32) ; la cloison (50) est supportée sur le rotor (40) de façon que ses deux extrémités puissent être en contact avec une surface interne du logement (31), la cloison (50) pouvant tourner à l’intérieur de la cavité (32) conjointement au rotor (40) ; la surface interne du logement (31) et le rotor (40) formant le premier passage (32a) à l’intérieur de la cavité (32), le premier passage s’étendant du port d’entrée (31a) au port de sortie (31b) sur un côté du rotor (40) ; la surface interne du logement (31) et le rotor (40) formant le second passage (32b) à l’intérieur de la cavité (32), le second passage étant plus long que le premier passage (32a) et s’étendant du port d’entrée (31a) au port de sortie (31b) via un autre côté du rotor (40) à l’opposé du premier passage ; l’appareil d’enregistrement à jet d’encre comprenant en outre :

une tête à jet d’encre (1) à laquelle l’encre doit être fournie depuis la pompe (30) ; et
un détecteur (44, 45, 47, 48) disposé de façon à détecter si oui ou non la cloison (50) est disposée dans une plage telle que la somme des résistances à l’écoulement (R100, R200) dans les premier et second passages (32a, 32b) est supérieure à la somme des résistances à l’écoulement (R10, R20) obtenue lorsque la tête à jet d’encre effectue un enregistrement.

14. Appareil d’enregistrement à jet d’encre (101) selon la revendication 13, comprenant en outre un dispositif d’autorisation qui, après que le détecteur (44, 45, 47, 48) a détecté que la cloison (50) est disposée dans la plage, est agencé de façon à autoriser qu’un élément d’alimentation en encre qui fournit de l’encre à la pompe (30) soit démonté de la pompe (30).

15. Appareil d’enregistrement à jet d’encre selon la revendication 14, dans lequel le dispositif d’autorisation comprend un régulateur capable, en association avec un résultat de détection du détecteur (44, 45, 47, 48), de prendre de façon sélective une première position dans laquelle il permet un déplacement de l’élément d’alimentation en encre et une seconde position dans laquelle il empêche le déplacement de l’élément d’alimentation en encre.

16. Appareil d’enregistrement à jet d’encre selon la revendication 14 ou 15, comprenant en outre un dispositif de détermination destiné à déterminer si oui ou non l’élément d’alimentation en encre doit être démonté de la pompe (30), dans lequel le détecteur (44, 45, 47, 48) est agencé pour commencer son opération de détection après que le dispositif de détermination a déterminé que l’élément d’alimentation en encre devait être démonté de la pompe (30).

17. Procédé de commande d’un appareil d’enregistrement à jet d’encre (101) comprenant :

une pompe (30) qui comprend un logement (31), un rotor (40), une cloison (50), un premier passage (32a) et un second passage (32b) ; dans lequel :

le logement (31) définit une cavité (32) formée dedans et comporte également un port d’entrée (31a) par lequel l’encre est aspirée dans la cavité (32) et un port de sortie (31b) par lequel l’encre est évacuée hors de la cavité (32) ;
le rotor (40) peut tourner à l’intérieur de la cavité (32) ;
la cloison (50) est supportée sur le rotor (40) de façon que ses deux extrémités puissent être en contact avec une surface interne du logement (31), la cloison (50) pouvant tourner à l’intérieur de la cavité (32) conjointement au rotor (40) ;
la surface interne du logement (31) et le rotor (40) formant le premier passage (32a) à l’intérieur de la cavité (32), le premier passage s’étendant du port d’entrée (31a) au port de sortie (31b) sur un côté du rotor (40) ;
la surface interne du logement (31) et le rotor (40) formant le second passage (32b) à l’intérieur de la cavité (32), le second passage étant plus long que le premier passage (32a) et s’étendant du port d’entrée (31a) au port de sortie (31b) via un autre côté du rotor (40) à l’opposé du premier passage ; l’appareil d’enregistrement à jet d’encre comprenant en outre :

une tête à jet d’encre (1) à laquelle l’encre doit être fournie depuis la pompe (30) ;

le procédé comprenant les étapes consister à :

disposer la cloison (50) dans une plage telle qu’une résistance à l’écoulement (R1) dans le premier passage (32a) soit supérieure à une résistance à l’écoulement (R2) dans le second passage (32b) ;
commencer une introduction d’encre initiale dans la cavité (32).

18. Procédé de commande d’un appareil d’enregistrement à jet d’encre (101) comprenant :

une pompe (30) qui comprend un logement (31), un rotor (40), une cloison (50), un premier passage (32a) et un second passage (32b) ; dans lequel :

le logement (31) définit une cavité (32) formée dedans et comporte également un port d’entrée (31a) par lequel l’encre est aspirée dans la cavité (32) et un port de sortie (31b) par lequel l’encre est évacuée hors de la cavité (32) ;

le rotor (40) peut tourner à l’intérieur de la cavité (32) ;

la cloison (50) est supportée sur le rotor (40) de façon que ses deux extrémités puissent être en contact avec une surface interne du logement (31), la cloison (50) pouvant tourner à l’intérieur de la cavité (32) conjointement au rotor (40) ;

la surface interne du logement (31) et le rotor (40) formant le premier passage (32a) à l’intérieur de la cavité (32), le premier passage s’étendant du port d’entrée (31a) au port de sortie (31b) sur un côté du rotor (40) ;

la surface interne du logement (31) et le rotor (40) formant le second passage (32b) à l’intérieur de la cavité (32), le second passage étant plus long que le premier passage (32a) et s’étendant du port d’entrée (31a) au port de sortie (31b) via un autre côté du rotor (40) à l’opposé du premier passage ;

l’appareil d’enregistrement à jet d’encre comprenant en outre :

une tête à jet d’encre (1) à laquelle l’encre doit être fournie depuis la pompe (30) ; et

le procédé comprenant les étapes consistant à :

disposer la cloison (50) dans une plage telle qu’un rapport d’une résistance à l’écoulement (R2) dans le second passage (32b) sur une résistance à l’écoulement (R1) dans le premier passage (32a) soit inférieur au rapport (R20:R10) obtenu lorsque la tête à jet d’encre effectue un enregistrement ; et commencer une introduction d’encre initiale dans la cavité (32).

19. Procédé de commande d’un appareil d’enregistrement à jet d’encre (101) comprenant :

une pompe (30) qui comprend un logement (31), un rotor (40), une cloison (50), un premier passage (32a) et un second passage (32b) ; dans lequel :

le logement (31) définit une cavité (32) formée dedans et comporte également un port d’entrée (31a) par lequel l’encre est aspirée dans la cavité (32) et un port de sortie (31b) par lequel l’encre est évacuée hors de la cavité (32) ;

le rotor (40) peut tourner à l’intérieur de la cavité (32) ;

la cloison (50) est supportée sur le rotor (40) de façon que ses deux extrémités puissent être en contact avec une surface interne du logement (31), la cloison (50) pouvant tourner à l’intérieur de la cavité (32) conjointement au rotor (40) ;

la surface interne du logement (31) et le rotor (40) formant le premier passage (32a) à l’intérieur de la cavité (32), le premier passage s’étendant du port d’entrée (31a) au port de sortie (31b) sur un côté du rotor (40) ;

la surface interne du logement (31) et le rotor (40) formant le second passage (32b) à l’intérieur de la cavité (32), le second passage étant plus long que le premier passage (32a) et s’étendant du port d’entrée (31a) au port de sortie (31b) via un autre côté du rotor (40) à l’opposé du premier passage ;

l’appareil d’enregistrement à jet d’encre comprenant en outre :

une tête à jet d’encre (1) à laquelle l’encre doit être fournie depuis la pompe (30) ; et

le procédé comprenant les étapes consistant à :

disposer la cloison (50) dans une plage telle qu’une résistance à l’écoulement (R1) dans le premier passage (32a) soit supérieure à la résistance à l’écoulement (R10) obtenue lorsque la tête à jet d’encre effectue un enregistrement ; et commencer une introduction d’encre initiale dans la cavité (32).

20. Procédé selon la revendication 17, 18 ou 19, comprenant en outre une étape consistant, après le démarrage de l’introduction d’encre initiale, à faire vibrer la cloison (50).

22. Procédé de commande d’un appareil d’enregistrement à jet d’encre (101) comprenant :

une pompe (30) qui comprend un logement (31), un rotor (40), une cloison (50), un premier passage (32a) et un second passage (32b) ; dans lequel :

le logement (31) définit une cavité (32) formée dedans et comporte également un port d’entrée (31a) par lequel l’encre est aspirée dans la cavité (32) et un port de sortie (31b) par lequel l’encre est évacuée hors de la cavité (32) ;
le rotor (40) peut tourner à l’intérieur de la cavité (32) ;
la cloison (50) est supportée sur le rotor (40) de façon que ses deux extrémités puissent être en contact avec une surface interne du logement (31), la cloison (50) pouvant tourner à l’intérieur de la cavité (32) conjointement au rotor (40) ;
la surface interne du logement (31) et le rotor (40) formant le premier passage (32a) à l’intérieur de la cavité (32), le premier passage s’étendant du port d’entrée (31a) au port de sortie (31b) sur un côté du rotor (40) ;
la surface interne du logement (31) et le rotor (40) formant le second passage (32b) à l’intérieur de la cavité (32), le second passage étant plus long que le premier passage (32a) et s’étendant du port d’entrée (31a) au port de sortie (31b) via un autre côté du rotor (40) à l’opposé du premier passage ;
l’appareil d’enregistrement à jet d’encre comprenant en outre :

une tête à jet d’encre (1) à laquelle l’encre doit être fournie depuis la pompe (30) ; et
le procédé comprenant les étapes consistant à :

disposer la cloison (50) dans une plage telle que la somme des résistances à l’écoulement (R100, R200) dans les premier et second passages (32a, 32b) soit supérieure à la somme des résistances à l’écoulement (R10, R20) obtenue lorsque la tête à jet d’encre effectue un enregistrement ; et
démonter de la pompe (30) un élé-
