

(19)



(11)

EP 2 803 487 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
20.06.2018 Bulletin 2018/25

(51) Int Cl.:
B41J 2/175^(2006.01) B41J 2/18^(2006.01)
B41J 2/515^(2006.01)

(21) Application number: **13736152.3**

(86) International application number:
PCT/JP2013/050286

(22) Date of filing: **10.01.2013**

(87) International publication number:
WO 2013/105594 (18.07.2013 Gazette 2013/29)

(54) INKJET RECORDING APPARATUS

TINTENSTRAHLDRUCKVORRICHTUNG

DISPOSITIF D'IMPRESSION PAR JET D'ENCRE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

• **YAMAZAKI Kouichi**
Fukui-shi
Fukui 918-8560 (JP)

(30) Priority: **11.01.2012 JP 2012002785**

(74) Representative: **Denemeyer & Associates S.A.**
Postfach 70 04 25
81304 München (DE)

(43) Date of publication of application:
19.11.2014 Bulletin 2014/47

(56) References cited:
JP-A- 2006 247 899 JP-A- 2006 281 532
JP-A- 2007 075 753 JP-A- 2008 030 333
JP-A- 2009 051 046 JP-A- 2011 046 131
JP-A- 2011 046 131 JP-A- 2011 079 169

(73) Proprietor: **SEIREN CO., LTD.**
Fukui-shi
Fukui 918-8560 (JP)

(72) Inventors:
• **OKADA Kou**
Fukui-shi
Fukui 918-8560 (JP)

EP 2 803 487 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to an inkjet recording apparatus.

BACKGROUND ART

10 **[0002]** Inkjet recording apparatus have been known as the recording apparatus for recording images on various recording media. The inkjet recording apparatus has recording heads in which a plurality of nozzles is aligned in a discharge surface. The inkjet recording apparatus records an image on the recording medium by discharging ink from each nozzle. The ink to be discharged from the nozzle flows through a predetermined path and is supplied to the recording head.

15 **[0003]** Patent literature 1 discloses an image forming apparatus having a distribution tank. In the distribution tank, a common flow path for distributing ink to a plurality of heads is formed within a tank case. The top surface of the common flow path is formed in an inclined surface. An ink supply path from an ink supply port for supplying the ink to the common flow path is provided at one end of the common flow path. The ink supply path is formed in such a shape that rises upward obliquely toward the common flow path. The ink supply path communicates to the common flow path at an output port located in an upper position. The top surface of the common flow path is formed in the inclined surface. A bubble exhaust port is provided in the one end side of the common flow path (the upper side of the top surface), The bubble exhaust port is connected to an exhaust path. Patent literature 1 discloses that, when a bubble is mixed
20 in the ink flowing into the ink supply path, the bubble rises by its buoyancy and is exhausted to the bubble exhaust port due to the inclination of the ink supply path.

25 **[0004]** Patent literature 2 discloses an inkjet printing apparatus having an ink circulation path, an ink distributor, a plurality of inkjet heads, and degassing means. The distributor is provided in the circulation path. The plurality of inkjet heads is provided to the distributor. The degassing means is provided in the circulation path. The distributor has a distributor intake port into which the ink is supplied and a distributor exhaust port from which the ink is discharged. The inner upper surface of the distributor is tapered in a manner that its height increases from at the distributor intake port to at the distributor exhaust port. A valve is provided between the distributor and the inkjet heads. The ink discharged
30 from the distributor exhaust port is supplied into the degassing means. The degassing means is provided at the highest position among the circulation path, the distributor and the inkjet heads. The degassing means has a hollow fiber membranes through which the ink passes and decompression means.

35 **[0005]** Patent literature 3 discloses an inkjet recording apparatus for achieving a stable ink circulation while preventing a bubble from reaching a plurality of head modules. Further, JP 2006-247899A discloses an inkjet recording apparatus for recording an image on a recording medium comprising an ink tank, a plurality of recording heads, an ink flow path, a tubular distributor, wherein the ink flow path includes an inflow part, plurality of supply parts and a common flow path.

CITATION LIST

40 PATENT LITERATURES

[0006]

45 PATENT LITERATURE 1: Japanese Patent Application Laid-open No. 2011-46131
PATENT LITERATURE 2: Japanese Patent No. 4784129
PATENT LITERATURE 3: Japanese Patent Application Laid-open No. 2011-79169

SUMMARY OF INVENTION

50 PROBLEMS TO BE SOLVED BY THE INVENTION

55 **[0007]** There are line-type inkjet recording apparatus and serial-type inkjet recording apparatus in the inkjet recording apparatus. The line-type inkjet recording apparatus has a plurality of recording heads in which nozzles are aligned along the width direction of the recording medium. The plurality of recording heads is provided, fixed at a predetermined area to which the recording medium is conveyed. The conveyance direction of the recording medium is orthogonal to the width direction of the recording medium. The line-type inkjet recording apparatus is the recording apparatus that conveys the recording medium in the conveyance direction and records the image on the conveyed recording medium. The serial-type inkjet recording apparatus has a plurality of recording heads in which nozzles are aligned along the conveyance

direction of the recording medium. The plurality of recording heads moves in a reciprocating manner in the width direction of the recording medium (in the direction orthogonal to the conveyance direction). The serial type inkjet recording apparatus is the recording apparatus that records the image on the conveyed recording medium by repeating the reciprocation move of the recording heads and the conveyance of the recording medium.

5 **[0008]** The line-type inkjet recording apparatus and the serial-type inkjet recording apparatus have a distributor. The distributor is a mechanism for supplying the ink to respective recording heads. The distributor is provided on the way of ink flow paths connected to the ink tank. The plurality of recording heads is connected to the distributor via the ink flow paths. The distributor allows for distributing the ink flowing out of the ink tank and for supplying the ink to the respective recording heads, even when the number of the recording heads increases.

10 **[0009]** When a bubble is contained in the ink and the ink containing the bubble flows into the inside of the distributor, the ink containing the bubble is undesirably supplied to the recording heads, which may cause an inferior discharge of the ink. It is thus required to remove the bubble contained in the ink that has flowed into the inside of the distributor. In this regard, it is preferable that the distributor itself is formed in a simple shape. Complicated shape makes it difficult to process for obtaining that shape.

15 **[0010]** The purpose of the present invention is to provide an inkjet recording apparatus that is able to separate the bubble contained in the ink inside the distributor and preferably exhaust the separated bubble while making the distributor simple.

SOLUTIONS TO THE PROBLEMS

20 **[0011]** An inkjet recording apparatus of the present invention is defined in independent claim 1.

[0012] According to this inkjet recording apparatus, the ink that has flowed into the distributor flows from the lower part to the upper part in the vertical direction in the extending direction of the common flow path. In the distributor provided with inclination, the bubble contained in the ink to be supplied to the recording heads flows along the flow of the ink inside the common flow path and moves upward in the vertical direction by the buoyancy. Therefore, it suppresses that the previously-described bubble moves to the supply port side opened downward in the vertical direction than in the horizontal direction, so that the bubble can be preferably separated. The distributor is not required to have a special shape for the separation of the bubble, which allows for the simple distributor. The bubble that has moved upward in the vertical direction can be exhausted smoothly out of the outflow port. The ink with the bubble being separated can be supplied to the recording heads. The preferable discharge of the ink can be achieved and the preferable image recoding can be implemented. This allows for obtaining the inkjet recording apparatus that is able to separate the bubble contained in the ink inside the distributor and preferably exhaust the separated bubble while making the distributor simple.

30 **[0013]** In the inkjet recording apparatus, the followings are preferable: the inflow part may include a first joint part connected to the ink inflow path and formed with the inflow port, the outflow part may include a second joint part connected to the ink collection flow path and formed with the outflow port, the first joint part may be provided to the first side end such that a predetermined range of the common flow path side in the inflow port is inclined by as much as an inclination angle made by the extending direction of the common flow path with respect to the horizontal direction, and the second joint part may be provided to the second side end such that a predetermined range of the common flow path side in the outflow port is inclined by as much as the inclination angle. This allows the ink liquid-delivered via the ink inflow path to flow smoothly into the common flow path. Among the ink supplied into the common flow path, the ink which is not supplied to the recording heads but collected in the ink tank can be exhausted smoothly out of the common flow path and flow into the ink collection flow path. The preferable ink circulation can be achieved.

40 **[0014]** For the plurality of ink supply flow paths, lengths of respective flow paths through which the ink flows out of the supply port and is supplied to the recording head may be set to be the same. This allows the ink flowing out of each supply port to flow in the same manner for respective of the plurality of ink supply flow paths. When the ink is supplied to the plurality of recording heads via the different ink supply flow paths, the ink can be supplied to each recording head under the same state.

50 **[0015]** The inkjet recording apparatus may include: a plurality of supply side valves provided on the way of respective of the plurality of ink supply flow paths and configured to open and shut the respective of the ink supply flow paths; and a fixing part including a fixing surface to which the plurality of supply side valves is fixed, respectively. The fixing part may be provided to the inkjet recording apparatus such that the fixing surface is inclined by as much as an inclination angle made by the extending direction of the common flow path with respect to the horizontal direction. The plurality of supply side valves may be fixed to the fixing surface so that, in the distributor in the installation state, the supply side valve provided on the way of the ink supply flow path that is connected to the supply part provided at an upper position in the vertical direction is located upper in the vertical direction. According to this, the state where the ink is not supplied to respective recording heads can be achieved by shutting respective of the plurality of supply side valves. The plurality of supply side valves provided on the way of respective ink supply flow paths is provided in a manner that they are provided along the extending direction of the common flow path. Further, the alignment of the plurality of supply side

valves can be corresponded to the alignment of the supply parts connected to the supply side valves via the ink supply flow paths. Therefore, even when the supply side valves are provided on the way of the ink supply flow paths, respective of the plurality of ink supply flow paths can be set to have the same flow path length. In other words, for the plurality of ink supply flow paths, the same flow path length can be obtained between the supply ports and the supply side valves, and the same flow path length can be obtained between the supply side valves and the recording heads.

[0016] The inkjet recording apparatus may further include: a collection side valve provided on the way of the ink collection flow path and configured to open and shut the ink collection flow path. When an image is recorded on a recording medium in the inkjet recording apparatus, the liquid delivery unit may be driven, the collection side valve may be either opened or shut, and the plurality of supply side valves may be opened, respectively. When no image is recorded on a recording medium in the inkjet recording apparatus, the liquid delivery unit may be driven, the collection side valve may be opened, and the plurality of supply side valves may be shut, respectively. According to this, the ink can be preferably supplied to respective of the plurality of recording heads when the image is recorded on the recording medium in the inkjet recording apparatus. On the other hand, the ink can be collected in the ink tank and preferably circulated when no image is recorded on the recording medium in the inkjet recording apparatus. The ink is circulated when no image is recorded on the recording medium in the inkjet recording apparatus, which can suppress the precipitation of various components including the colorant contained in the ink.

[0017] When an image is recorded on a recording medium in the inkjet recording apparatus, the collection side valve may have an opening degree between open and shut depending on an amount of the ink that flows in respective of the plurality of ink supply flow paths to be supplied to respective of the plurality of recording heads. This allows for the adjustment of the amount of the ink supplied to respective recording heads.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is a plan view of an example of a schematic configuration of an inkjet recording apparatus.

FIG. 2 is a diagram illustrating an example of a recording unit including a plurality of recording heads, and in the diagram the recording unit is viewed from a discharge surface side of the recording heads formed with nozzles.

FIG. 3 is a diagram illustrating supply of ink to the recording heads and circulation of the ink.

FIG. 4 is a diagram illustrating an example of a schematic configuration of a distributor.

FIG. 5 is a cross-sectional diagram along the D-D line in FIG. 4.

FIG. 6 is a diagram illustrating another example of schematic configuration of the distributor.

FIG. 7 is a cross-sectional diagram along the E-F-G-H line in FIG. 6.

DESCRIPTION OF EMBODIMENTS

[0019] Embodiments to implement the present invention will be described. The present invention is not limited to the configuration described below, but can adopt various configurations in the same technical idea. For example, a part of the following configurations may be omitted, or replaced with other configurations and so on. Other configurations may be included.

< Inkjet recording apparatus >

[0020] An inkjet recording apparatus 1 will be described with reference to FIG. 1 and FIG. 2. The inkjet recording apparatus 1 is a line-type inkjet recording apparatus. The inkjet recording apparatus 1 is able to record full-color image on a recording medium 2. In the present embodiment, description will be provided by using an example of recording the full-color image by respective colors of yellow, magenta, cyan, and black. The inkjet recording apparatus 1 has a conveying unit 10, recording units 20Y, 20M, 20C, and 20K, a control box 30, ink tanks 40Y, 40M, 40C, and 40K, ink flow paths 50Y, 50M, 50C, and 50K, and distributors 60Y, 60M, 60C, and 60K,

[0021] The conveying unit 10 is configured with a conveying mechanism such as a conveyor. The conveying unit 10 conveys the recording medium 2 from the upstream side of the conveying unit 10 through the recording units 20Y, 20M, 20C, and 20K to the downstream side of the conveying unit 10. The conveying unit 10 has the same configuration as conveying units of inkjet recording apparatus that have already been implemented. Therefore, further description of the conveying unit 10 will be omitted.

[0022] The recording unit 20Y is a recording unit configured to record an image by a yellow ink. The recording unit 20M is a recording unit configured to record an image by a magenta ink. The recording unit 20C is a recording unit configured to record an image by a cyan ink. The recording unit 20K is a recording unit configured to record an image by a black ink. The recording unit 20Y includes a plurality of recording heads 22Y arranged as illustrated in FIG. 2. The

recording head 22Y has a plurality of nozzles 24Y formed therein that discharge the yellow ink. The recording unit 20M includes a plurality of recording heads 22M arranged as illustrated in FIG. 2. The recording head 22M has a plurality of nozzles 24M formed therein that discharge the magenta ink. The recording unit 20C includes a plurality of recording heads 22C arranged as illustrated in FIG. 2. The recording head 22C has a plurality of nozzles 24C formed therein that discharge the cyan ink. The recording unit 20K includes a plurality of recording heads 22K arranged as illustrated in FIG. 2. The recording head 22K has a plurality of nozzles 24K formed therein that discharge the black ink.

[0023] With respect to the arrangement and the total number of the respective recording heads 22Y, 22M, 22C, and 22K included respectively in each of the recording units 20Y, 20M, 20C, and 20K, it is illustrated in FIG. 2 that three per column by two columns results in six in total. However, this is a mere example. The arrangement and the total number of the recording heads 22Y, 22M, 22C, and 22K may be properly determined taking various conditions into consideration. With respect to the arrangement and the total number of the respective nozzles 24Y, 24M, 24C, and 24K formed respectively in each one of recording heads 22Y, 22M, 22C, and 22K, it is illustrated in FIG. 2 that three per column by two columns results in six in total. However, this is a mere example. The arrangement and the total number of the nozzles 24Y, 24M, 24C, and 24K may be properly determined taking various conditions into consideration.

[0024] The recording units 20Y, 20M, 20C, and 20K have the same configuration, and the recording heads 22Y, 22M, 22C, and 22K have the same configuration. In the present embodiment, when the recording units 20Y, 20M, 20C, and 20K are not distinguished to each other (when the ink colors are not distinguished) or when they are collectively represented, they are denoted as "recording unit(s) 20". Similarly, the recording heads 22Y, 22M, 22C, and 22K are denoted as "recording head(s) 22". The nozzles 24Y, 24M, 24C, and 24K are denoted as "nozzle(s) 24".

[0025] The recording unit 20 for each color is provided to the upper position of a conveyance surface 12. In the recording unit 20 for each color, the surface (the discharge surface) of the recording heads 22 formed with the nozzles 24 face a recording surface 3 of the recording medium 2 that is set on the conveyance surface 12 of the conveying unit 10 and conveyed. The recording units 20 for respective colors are aligned neighboring to each other in the conveyance direction of the recording medium 2 in the conveying unit 10. The recording units 20 for respective colors may be aligned in the different order than illustrated in FIG. 1 and FIG. 2. The alignment order of the recording units 20 for respective colors is properly determined taking various conditions into consideration. When the recording of the image is made by the inkjet recording apparatus 1, the ink of each color is discharged from the nozzles 24, which are formed in the recording heads 22 each included in the recording unit 20 for each color, toward the recording surface 3 of the recording medium 2, which is set on the conveyance surface 12 and conveyed. The ink of each color discharged from the nozzle 24 is dropped on the recording surface 3.

[0026] The control box 30 includes a control unit 32 and a connection interface (connection I/F) 34, for example. The control unit 32 controls the inkjet recording apparatus 1. The control unit 32 controls the processing for the inkjet recording process regarding the image recording and the like, for example. The control unit 32 includes a circuit board on which electronic parts are mounted, electrical wirings, and so on. At least a part of the components included in the control unit 32 may be provided to the upper part of the recording unit 20. The connection interface 34 is an interface configured to data-communicably connect the inkjet recording apparatus 1 (the control box 30) to an external device 36 such as a personal computer. For example, image data that corresponds to the image to be recorded is inputted to the inkjet recording apparatus 1 from the external device 36 via the connection interface 34. The control unit 32 controls the processing for the inkjet recording process according to the inputted image data.

[0027] The ink tanks 40Y, 40M, 40C, and 40K store the above-described ink of respective colors used for the image recording, respectively. The ink tank 40Y is an ink tank for storing the yellow ink. The ink tank 40M is an ink tank for storing the magenta ink. The ink tank 40C is an ink tank for storing the cyan ink. The ink tank 40K is an ink tank for storing the black ink. The ink tanks 40Y, 40M, 40C, and 40K have the same configuration. In the present embodiment, when the ink tanks 40Y, 40M, 40C, and 40K are not distinguished to each other (when the ink colors are not distinguished) or when they are collectively represented, they are denoted as "ink tank(s) 40".

[0028] The ink flow paths 50Y, 50M, 50C, and 50K are flow paths through each of which the ink of each color flows. The ink flow path 50Y is a flow path through which the yellow ink flows. The yellow ink that has flowed out of the ink tank 40Y flows through the ink flow path 50Y and is supplied to the plurality of recording heads 22Y included in the recording unit 20Y. The ink flow path 50M is a flow path through which the magenta ink flows. The magenta ink that has flowed out of the ink tank 40M flows through the ink flow path 50M and is supplied to the plurality of recording heads 22M included in the recording unit 20M. The ink flow path 50C is a flow path through which the cyan ink flows. The cyan ink that has flowed out of the ink tank 40C flows through the ink flow path 50C and is supplied to the plurality of recording heads 22C included in the recording unit 20C. The ink flow path 50K is a flow path through which the black ink flows. The black ink that has flowed out of the ink tank 40K flows through the ink flow path 50K and is supplied to the plurality of recording heads 22K included in the recording unit 20K. The ink flow paths 50Y, 50M, 50C, and 50K have the same configuration. In the present embodiment, when the ink flow paths 50Y, 50M, 50C, and 50K are not distinguished to each other (when the ink colors are not distinguished) or when they are collectively represented, they are denoted as "ink flow path(s) 50". Further description of the ink flow paths 50 will be provided later. In FIG. 1, the ink flow paths 50Y,

50M, 50C, and 50K are depicted in a simplified manner.

[0029] The distributors 60Y, 60M, 60C, and 60K are provided on the way of the ink flow paths 50Y, 50M, 50C, and 50K of the corresponding colors, respectively. The distributors 60Y, 60M, 60C, and 60K distribute the ink of respective colors to the recording heads 22Y, 22M, 22C, and 22K, respectively. The distributors 60Y, 60M, 60C, and 60K each has a tubular configuration having a space formed therein. The distributors 60Y, 60M, 60C, and 60K have the same configuration. In the present embodiment, when the distributors 60Y, 60M, 60C, and 60K are not distinguished to each other (when the ink colors are not distinguished) or when they are collectively represented, they are denoted as "distributor(s) 60". Further description of the distributors 60 will be provided later.

< Ink supply and ink circulation >

[0030] In the inkjet recording apparatus 1, by referring to FIG. 3 to FIG. 7 and the other figures, described will be the configuration in which the ink of each color each stored in the ink tank 40 for each color is supplied from the ink tank 40 to the plurality of recording heads 22 included in the recording unit 20 of the corresponding color. Further, by referring to FIG. 3 to FIG. 7 and the other figures, described will be the configuration in which the ink of each color each stored in the ink tank 40 for each color is circulated. The ink is supplied from the ink tank 40 to the recording heads 22 by the following configuration regardless of the ink color. Therefore, in the followings, the description will be provided without specifying the ink color.

[0031] The inkjet recording apparatus 1 has respective units as illustrated in FIG. 3. Each of these units is a mechanism for supplying the ink of a particular color from the ink tank 40 to the plurality of recording heads 22 included in the recording units 20 and circulating it. Specifically, the inkjet recording apparatus 1 has a pump 90, a collection side valve 92, a plurality of supply side valves 94, and a fixing part 96, in addition to the ink flow paths 50 and distributors 60 described above.

[0032] The ink flow path 50 includes an ink inflow path 52, an ink collection flow path 54, and a plurality of ink supply flow paths 56. Each of the ink inflow path 52, the ink collection flow path 54, and the ink supply flow paths 56 is made of a tube, a steel pipe, or the like. The ink inflow path 52 connects the ink tank 40 and the distributor 60. The ink inflow path 52 is a flow path for supplying the ink from the ink tank 40 to the distributor 60. The ink collection flow path 54 connects the distributor 60 and the ink tank 40. The ink collection flow path 54 is a flow path for collecting, in the ink tank 40, the ink that has been supplied to the distributor 60.

[0033] The ink supply flow paths 56 connect the distributor 60 and the plurality of recording heads 22, respectively. That is, the ink supply flow paths 56 are flow path for supplying, to respective of the plurality of recording heads 22, the ink which has been supplied to the distributor 60. In FIG. 3, the depiction of the plurality of recording heads 22 is omitted. Furthermore, in FIG. 3, for each of the plurality of ink supply flow paths 56, depicted is the part up to the half way toward the recording heads 22 side. The ink supply flow paths 56 are provided for the number corresponding to the number of the recording heads 22. For example, as illustrated in FIG. 2, the recording unit 20 for a particular color includes six recording heads 22. In this case, six ink supply flow paths 56 are provided correspondingly to the six recording heads 22. The plural number of the ink supply flow paths 56 may be provided to one recording head 22. For example, the number of the ink supply flow paths 56 to one recording head 22 may be two. In this case, twelve ink supply flow paths 56 are provided to six recording heads 22. The number of the ink supply flow paths 56 is properly determined taking various conditions into consideration. The plurality of ink supply flow paths 56 is set so that the same length is obtained for respective flow paths through which the ink flows out of supply ports 70 of supply parts 68 provided to the distributor 60 described later and is supplied to the recording heads 22.

[0034] The flow path diameter (the inner diameter) of each flow path of the ink inflow path 52, the ink collection flow path 54, and the ink supply flow paths 56 may be preferably set as follows. For example, the flow path diameter of the ink supply flow path 56 may be preferably set to be smaller than each flow path diameter of the ink inflow path 52 and the ink collection flow path 54. Each flow path diameter of the ink inflow path 52 and the ink collection flow path 54 may be preferably set to the same or close to each other.

[0035] As illustrated in FIG. 3, the distributor 60 includes an inflow part 61, an outflow part 64, a common flow path 67, a plurality of supply parts 68, and a tubular member 71. The inflow part 61 is provided to a first side end of the distributor 60 (a first side end of the tubular member 71). The inflow part 61 includes a first joint part 62. The first joint part 62 is fixed at the position corresponding to the first side end of the distributor 60 by, for example, being screwed into the tubular member 71. The ink inflow path 52 is connected to the inflow part 61. The connection of the inflow part 61 and the ink inflow path 52 is made by the ink inflow path 52 being connected to the first joint part 62. The first joint part 62 includes an inner flow path formed therein. This inner flow path functions as an inflow port of the ink that flows through the ink inflow path 52 and is supplied to the distributor 60 (hereafter, the inner flow path formed in the first joint part 62 is denoted as "inflow port 63"). That is, the ink supplied from the ink inflow path 52 passes through the inflow port 63 formed inside the first joint part 62 and is supplied to the inside (the common flow path 67) of the distributor 60.

[0036] The outflow part 64 is provided to a second side end of the distributor 60 (a second side end of the tubular

member 71). The outflow part 64 includes a second joint part 65. The second joint part 65 is fixed at the position corresponding to the second side end of the distributor 60 by, for example, being screwed into the tubular member 71. The ink collection flow path 54 is connected to the outflow part 64. The connection of the outflow part 64 and the ink collection flow path 54 is made by the ink collection flow path 54 being connected to the second joint part 65. The second joint part 65 includes an inner flow path formed therein. This inner flow path functions as an outflow port of the ink that flows through the inside (the common flow path 67) of the distributor 60 and flows out of the distributor 60 (hereafter, the inner flow path formed in the second joint part 65 is denoted as "outflow port 66"). That is, the ink flowing out of the inside of the distributor 60 passes through the outflow port 66 formed inside the second joint part 65 and is collected in the ink tank 40.

[0037] The common flow path 67 is formed inside the distributor 60, specifically, inside the tubular member 71. The common flow path 67 communicates with the inflow port 63 of the first joint part 62, the outflow port 66 of the second joint part 65, and each supply port 70 of the plurality of supply parts 68 described later. The ink that has passed through the inflow port 63 flows in the common flow path 67 and is supplied to the outflow port 66 and each of the plurality of supply ports 70. The common flow path 67 extends between the first side end and the second side end of the distributor 60. With respect to the shape of the common flow path 67, the sectional shape orthogonal to the extending direction of the common flow path 67 (hereafter, denoted as "extending direction") is constant along the extending direction. The sectional shape orthogonal to the extending direction is a circle as illustrated in FIG. 5 and FIG. 7, for example. In this case, the common flow path 67 is a tubular space with a constant inner diameter. The sectional shape orthogonal to the extending direction may be an ellipse or a polygon, for example, other than a circle.

[0038] The plurality of supply parts 68 is provided so as to be aligned in the extending direction at the side surface of the tubular distributor 60 formed by the side surface of the tubular member 71. The supply parts 68 are provided for the number corresponding to the number of the recording heads 22. This is the same as the case of the ink supply flow paths 56 described above. The description in this regard will be omitted. Each supply part 68 includes a third joint part 69. The third joint parts 69 are fixed at the side surface of the tubular distributor 60 by being screwed into the tubular member 71, respectively, for example. The plurality of supply parts 68 is fixed to be vertical to the side surface (the extending direction) of the distributor 60, for example. The ink supply flow paths 56 are connected to respective supply parts 68. The connection of the supply parts 68 and the ink supply flow paths 56 is made by the ink supply flow paths 56 being connected to the third joint parts 69. The third joint part 69 has an inner flow path formed therein. This inner flow path functions as the supply port (the supply port 70) for the ink that flows inside the distributor 60 (the common flow path 67) and flows out of the distributor 60. That is, the ink flowing out of the inside of the distributor 60 passes through the supply port 70 formed inside the third joint part 69 and is supplied to the recording head 22. The tubular member 71 is a straight tubular member. The first joint part 62 and the second joint part 65 are screwed into both ends of the tubular member 71, respectively, as described above. Further, the plurality of third joint parts 69 is screwed into the side surface of the tubular member 71. The inside of the tubular member 71 forms the common flow path 67.

[0039] In the side surface of the distributor 60, the plurality of supply parts 68 is aligned straight on a virtual line L4 in the extending direction as illustrated in FIG. 4, for example. As illustrated in FIG. 2, FIG. 4 corresponds to the case where the recording unit 20 for a particular color includes six recording heads 22, and thus illustrates six supply parts 68 (the same applies to FIG. 6). In addition, the plurality of supply parts 68 may be aligned in a staggered manner as illustrated in FIG. 6, for example. In this case, the plurality of supply parts 68 is divided into two groups with half the number thereof, and is aligned on two virtual lines L5 and L6 in the extending direction, respectively. The staggered alignment allows the supply parts 68 to be properly aligned at the side surface of the distributor 60 in case the larger number of the recording heads 22 are included in the recording unit 20 for a particular color, or in case the plural number of the ink supply flow paths 56 are connected to one recording head 22 or in other cases. The supply parts 68 aligned on the virtual line L5 and the supply parts 68 aligned on the virtual line L6 are provided inclined by an angle $\theta 8$ with respect to a reference line L7 so that the opening directions of the supply ports 70 are opposite, as illustrated in FIG. 7. In FIG. 4 and FIG. 6, the depiction of the inflow part 61 and the outflow part 64 at the first side end and the second side end of the distributor 60 is omitted.

[0040] As illustrated in FIG. 3, the distributor 60 is provided to the inkjet recording apparatus 1 in such an installation state that the extending direction inclines with respect to the horizontal direction. Under this installation state, the distributor 60 is set such that the second side end of the distributor 60 is located upper than the first side end in the vertical direction. Under this installation state, the distributor 60 is installed so that the opening direction of the supply port 70 is directed downward in the vertical direction than in the horizontal direction. The inclination angle $\theta 9$ made by the extending direction with respect to the horizontal direction is properly determined taking various conditions into consideration. The inventors conducted an experiment in view of preferably separating the bubble that is contained in the ink supplied to the recording head 22. From this experiment, the inventors have concluded that 45 degrees is one of the preferable angles for the inclination angle $\theta 9$.

[0041] As illustrated in FIG. 3, the first joint part 62 has a such structure that a predetermined range of the common flow path 67 side in the inflow port 63 (see the range labeled with the reference sign "631" in FIG. 3 and, hereafter,

denoted as "range 631") has a straight shape. The first joint part 62 is provided to the first side end of the distributor 60 so that the range 631 is in a state inclined by the inclination angle θ_9 with respect to the horizontal direction. The second joint part 65 has a such structure that a predetermined range of the common flow path 67 side in the outflow port 66 (see the range labeled with the reference sign "661" in FIG. 3 and, hereafter, denoted as "range 661") has a straight shape, as illustrated in FIG. 3. The second joint part 65 is provided to the second side end of the distributor 60 so that the range 661 is in a state inclined by the inclination angle θ_9 with respect to the horizontal direction.

[0042] The sectional area of the common flow path 67 (the area of the cross section of the above-described common flow path 67) is preferably set larger than the sectional area of the inflow port 63. The flow velocity of the ink that has passed through the inflow port 63 and flowed into the common flow path 67 can be reduced in the common flow path 67. The reduced flow velocity allows for improved efficiency in the separation of the bubble contained in the ink. The sectional area of the inflow port 63 is an area of the cross section orthogonal to the extending direction in the predetermined range 631 of the common flow path 67 side in the inflow port 63, for example. The opening area of one supply port 70 is preferably smaller than the sectional area of the common flow path 67. This can suppress that the bubble contained in the ink flowing in the common flow path 67 is mixed in the supply port 70.

[0043] The pump 90 functions as a liquid delivery unit for liquid-delivering the ink via the ink flow path 50 and the distributor 60. The pump 90 is provided on the way of the ink inflow path 52, as illustrated in FIG. 3. Upon the pump 90 being driven, the ink stored in the ink tank 40 flows out of the ink tank 40. The ink then flows through the ink inflow path 52, the distributor 60, and the ink supply flow path 56 and is supplied to the plurality of recording heads 22. Further, the ink that has flowed out of the ink tank 40 by the pump 90 being driven flows through the ink inflow path 52, the distributor 60, and the ink collection flow path 54 and is collected in the ink tank 40. In this case, the ink is circulated through the previously-described flow paths and the like.

[0044] The collection side valve 92 is provided on the way of the ink collection flow path 54. The collection side valve 92 is a valve for opening and shutting the ink collection flow path 54. The collection side valve 92 is made of an electromagnetic valve, for example. The plurality of the supply side valves 94 is provided on the way of respective of the plurality of ink supply flow paths 56. The number of the supply side valves 94 of the inkjet recording apparatus 1 corresponds to the number of the ink supply flow paths 56. The supply side valve 94 is a valve for opening and shutting the ink supply flow path 56 to which each supply side valve 94 is provided. The supply side valve 94 is made of an electromagnetic valve, for example.

[0045] The fixing part 96 is a component for fixing the plurality of supply side valves 94 thereto. The fixing part 96 is formed by processing the plate-like member, for example. The fixing part 96 is attached to stays 100 provided to a frame (not shown) of the inkjet recording apparatus 1 by a screwing and the like, for example. At this time, the fixing part 96 is in a state where a fixing surface 98 to which respective supply side valves 94 are fixed is inclined by the inclination angle θ_9 with respect to the horizontal direction. That is, the fixing part 96 is provided to the inkjet recording apparatus 1 so that the fixing surface 98 is in a state arranged along the side surface of the distributor 60.

[0046] The plurality of supply side valves 94 is aligned and fixed to the fixing surface 98 so as to be in an alignment state (an arrangement state) that corresponds to the alignment (the arrangement) of the plurality of supply parts 68 connected via the ink supply flow paths 56. Therefore, the plurality of supply side valves 94 is fixed to the fixing surface 98 so that, in the distributor 60 in the above-described installation state, the supply side valve 94 provided on the way of the ink supply flow path 56 that is connected to the supply part 68 provided at an upper position in the vertical direction is located upper in the vertical direction. When the plurality of supply parts 68 is aligned as illustrated in FIG. 4 and FIG. 5, the plurality of supply side valves 94 are aligned straight correspondingly to the plurality of supply parts 68 aligned straight on the virtual line L4. When the plurality of supply parts 68 is aligned as illustrated in FIG. 6 and FIG. 7, the plurality of supply side valves 94 is aligned in a staggered manner correspondingly to the plurality of supply parts 68 aligned in a staggered manner based on the virtual lines L5 and L6. The plurality of supply side valves 94 is the valves common to each other. Thus, even under the state where the supply side valves 94 are provided on the way of respective ink supply flow paths 56, the lengths of the flow paths through which the ink flows out of the supply port 70 and is supplied to the recording heads 22 (the lengths of the ink supply flow paths 56) are the same. In the fixing part 96, the fixing surface 98 may be formed stepwise along the inclination angle θ_9 . This case also allows for the same flow path length of the ink supply flow paths 56, as described previously.

[0047] The opening and shutting of the collection side valve 92 and the supply side valves 94 and the opening degrees when opened are controlled by the control unit 32 included in the control box 30. Described will be the opening and shutting of the collection side valve 92 and the supply side valves 94 for the case where the ink is supplied to the recording heads 22 and for the case where the ink is circulated without being supplied to the recording heads 22. When the image is recorded on the recording medium 2 in the inkjet recording apparatus 1, the pump 90 is in a driving state. The collection side valve 92 is either opened or shut. The plurality of supply side valves 94 is opened, respectively. At this time, respective of the plurality of supply side valves 94 are opened at predetermined opening degrees. The opening and shutting of the collection side valve 92 is controlled depending on the total supply amount to the recording heads 22. For example, when the amount of the ink discharged from the nozzles 24 increases and, as a result, much ink is supplied

to respective recording heads 22, the collection side valve 92 is in a shut state or in a slightly opened state. On the other hand, when the amount of the ink discharged from the nozzles 24 decreases and, as a result, less ink is supplied to respective recording heads 22, the collection side valve 92 is in a fully opened state or close to a fully opened state, for example. The opening degrees for all the supply side valves 94 may be the same. Alternatively, the opening degrees of respective supply side valves 94 may be adjusted to be different degrees for respective supply side valves 94.

[0048] When no image is recorded on the recording medium 2 in the inkjet recording apparatus 1, the pump 90 is in a driving state. The collection side valve 92 is opened. The plurality of supply side valves 94 is shut, respectively. The opening and shutting of the collection side valve 92 and the supply side valves 94 and the opening degrees when opened may be controlled by color. For example, when a monochrome image is recorded on the recording medium 2, the collection side valve 92 and the supply side valve 94 for the supply and circulation of the black ink only is to be controlled. The collection side valve 92 and the supply side valves 94 for the supply and circulation for the colors other than black are controlled similarly to the case where no image is recorded in the inkjet recording apparatus 1. Also when a color image is recorded on the recording medium 2, the opening and shutting of the collection side valve 92 and the supply side valves 94 and the opening degrees when opened may be controlled by color.

< Advantages by the present embodiment >

[0049] The present embodiment allows for the following advantages.

[0050]

(1) The distributor 60 is provided to the inkjet recording apparatus 1 so as to be in the state (the installation state) as illustrated in FIG. 3. This installation state is the state where the second side end of the distributor 60 is located upper than the first side end in the vertical direction, the extending direction is inclined with respect to the horizontal direction, and the opening direction of the supply port 70 is directed downward in the vertical direction than in the horizontal direction. The ink that has flowed in the distributor 60 flows in the common flow path 67 from the lower part to the upper part thereof in the vertical direction along the extending direction. The bubble that is contained in the ink to be supplied to the recording heads 22 flows along the flow of the ink inside the common flow path 67 and moves upward in the vertical direction by the buoyancy. This suppresses that the bubble moves to the supply port 70 side opened downward in the vertical direction than in the horizontal direction, so that the bubble can be preferably separated. The distributor is not required to have a special shape for the separation of the bubble, which allows for the simple distributor 60. The bubble that has moved upward in the vertical direction can be exhausted smoothly from the outflow port 66.

(2) The range 631 of the inflow port 63 and the range 661 of the outflow port 66 that communicate with the common flow path 67 are inclined by the inclination angle θ_9 which is the same angle as the extending direction of the common flow path 67, with respect to the horizontal direction. This allows the ink liquid-delivered via the ink inflow path 52 to smoothly flow into the common flow path 67. The ink which has flowed into the common flow path 67 and is collected in the ink tank 40 without being supplied to the recording heads 22 can be smoothly exhausted from the common flow path 67 and flow into the ink collection flow path 54. This allows for the preferable circulation of the ink.

(3) The plurality of ink supply flow paths 56 respectively has the same length of the flow paths through which the ink flows out of the supply port 70 of the supply part 68 provided to the side surface of the distributor 60 and is supplied to the recording heads 22. This allows the ink flowing out of respective supply ports 70 to flow in the same manner for respective of the plurality of ink supply flow paths 56. When the ink is supplied to the plurality of recording heads 22 via different ink supply flow paths 56, the ink can be supplied to respective recording heads 22 in the same state.

The supply side valves 94 are provided on the way of respective of the plurality of ink supply flow paths 56. The plurality of supply side valves 94 is fixed in the following manner to the fixing part 96 of which the fixing surface 98 is inclined by the inclination angle θ_9 with respect to the horizontal direction. That is, the plurality of supply side valves 94 is fixed in the alignment state (the arrangement state) corresponding to the alignment (the arrangement) of the plurality of supply parts 68 connected via the ink supply flow paths 56. Thus, even when the supply side valves 94 are provided on the way of the ink supply flow paths 56, respective of the plurality of ink supply flow paths 56 can be set to have the same flow path length. In other words, for respective of the plurality of ink supply flow paths 56, the same flow path length can be obtained between the supply port 70 and the supply side valve 94, and the same flow path length can be obtained between the supply side valve 94 and the recording heads 22.

(4) When an image is recorded on the recording medium 2 in the inkjet recording apparatus 1, the pump 90 is driven, the collection side valve 92 is either opened or shut, and the plurality of supply side valves 94 is opened, respectively. The collection side valve 92 has an opening degree between open and shut depending on an amount of the ink that flows in respective of the plurality of ink supply flow paths 56 to be supplied to respective of the plurality of recording heads 22. Therefore, when the image is recorded on the recording medium 2 in the inkjet recording apparatus 1,

the ink can be preferably supplied to respective of the plurality of recording heads 22. The ink amount supplied to the plurality of recording heads 22 can be adjusted, respectively. When no image is recorded on the recording medium 2 in the inkjet recording apparatus 1, the pump 90 is driven, the collection side valve 92 is opened, and the plurality of supply side valves 94 is shut, respectively. Therefore, when no image is recorded on the recording medium 2 in the inkjet recording apparatus 1, the ink can be collected in the ink tank 40 and preferably circulated. When no image is recorded on the recording medium 2 in the inkjet recording apparatus 1, the circulation of the ink can suppress the precipitation of respective components including the colorant contained in the ink.

< Modified examples >

[0051] The present embodiment can be modified as follows.

[0052]

(1) In the above description, a line-type inkjet recording apparatus has been described as the example of the inkjet recording apparatus 1. However, the inkjet recording apparatus may be a serial-type inkjet recording apparatus. The above-described advantages can be obtained also in the serial-type inkjet recording apparatus which employs the same configuration as respective parts as described above.

(2) In the above description, yellow, magenta, cyan, and black have been described as the example for the colors of the ink used in the image recording. However, the ink of different colors than these colors may be used. For example, in addition to the four colors or in place of any one of these colors, light cyan, light magenta, and light yellow which are the light color system of each color of cyan, magenta, and yellow, and/or clear may be used. In this case, the inkjet recording apparatus 1 has the same respective components as described above corresponding to the ink of the added or replaced colors. This also allows for the advantages as described above.

(3) In the above description, the inkjet recording apparatus 1 in which one distributor 60 is provided to one recording unit 20 has been described. However, a plurality of distributors 60 may be provided to one recording unit 20. For example, as illustrated in FIG. 2, it is assumed that the recording unit 20 for a particular color includes six recording heads 22. In this case, provided may be two distributors 60 each including supply parts 68 the number of which corresponds to three recording heads 22. Also, provided may be three distributors 60 each including supply parts 68 the number of which corresponds to two recording heads 22. The plurality of distributors 60 is provided to the inkjet recording apparatus 1 such that respective distributors 60 are in a state aligned in a predetermined direction and in the above-described installation state.

The ink inflow path 52 includes, at a predetermined position, branch flow paths that are divided into the number corresponding to the number of the distributors 60. Respective branch flow paths of the ink inflow paths 52 are connected to the inflow parts 61 provided to respective of the plurality of distributors 60. The ink collection flow path 54 includes branch flow paths that are divided into the number corresponding to the number of the distributors 60. Respective branch flow paths of the ink collection flow paths 54 are connected to the outflow parts 64 provided to respective of the plurality of distributors 60. The branch flow paths of the ink collection flow paths 54 connected to respective outflow parts 64 are joined into one flow path at a predetermined position. The ink inflow paths 52 and/or the ink collection flow paths 54 the number of which corresponds to the number of the distributors 60 may be provided. In this case, the plurality of distributors 60 and the ink tanks 40 are connected by the ink inflow paths 52 the number of which corresponds to the number of the distributors 60 and/or the ink collection flow paths 54 the number of which corresponds to the number of the distributors 60. When the ink inflow paths 52 are provided for the number corresponding to the number of the distributors 60, the pump 90 or the following liquid delivery unit is provided at a position on the way of respective ink inflow paths 52. This also allows for the above-described advantages.

(4) In the above description, the pump 90 has been described as the example of the liquid delivery unit for liquid-delivering the ink via the ink flow path 50 and the distributor 60. The liquid delivery of the ink may be implemented by a pressure transfer system. In this case, the liquid delivery unit in the inkjet recording apparatus 1 includes a pressure tank and the like in addition to the pump 90. In the liquid delivery unit in the pressure transfer system, the pump 90 may be a smaller pump compared to in the case of the above-described configuration. The pressure tank is provided at a position on the way of the ink inflow path 52 that is the distributor 60 side of the pump 90. Upon the pump 90 being driven, the ink flows out of the ink tank 40. The ink that has flowed out flows through the inflow path 52 and flows into the pressure tank. The pressure tank is the tank for pressurizing the ink flowing in the ink flow path 50. The pressurization of the ink in the pressure tank is done by the pressurization mechanism connected to the pressure tank. The pressurization mechanism pressurizes the ink stored in the pressure tank by sending a compressed air to the inside of the pressure tank to cause the inner pressure of the pressure tank to be higher than the atmospheric pressure. Such liquid delivery unit of the pressure transfer system is driven by that the compressed air is supplied to the pressure tank with a predetermined amount of the ink being stored in the pressure tank. The ink

that has been stored and pressurized in the pressure tank flows out of the pressure tank and again flows in the ink inflow path 52 and the like, as described above. This also allows for the advantages as described above.

DESCRIPTION OF REFERENCE SIGNS

5

[0053]

	1	Inkjet recording apparatus
	2	Recording medium
10	3	Recording surface
	10	Conveying unit
	12	Conveyance surface
	20, 20Y, 20M, 20C, 20K	Recording unit
	22, 22Y, 22M, 22C, 22K	Recording head
15	24, 24Y, 24M, 24C, 24K	Nozzle
	30	Control box
	32	Control unit
	34	Connection interface
	36	External device
20	40, 40Y, 40M, 40C, 40K	Ink tank
	50, 50Y, 50M, 50C, 50K	Ink flow path
	52	Ink inflow path
	54	Ink collection flow path
	56	Ink supply flow path
25	60	Distributor
	61	Inflow part
	62	First joint part
	63	Inflow port
	64	Outflow part
30	65	Second joint part
	66	Outflow port
	67	Common flow path
	68	Supply part
	69	Third joint part
35	70	Supply port
	71	Tubular member
	90	Pump
	92	Collection side valve
	94	Supply side valve
40	96	Fixing part
	98	Fixing surface
	100	Stay
	631,661	Range

45

Claims

1. An inkjet recording apparatus (1) for recording an image on a recording medium, the inkjet recording apparatus comprising:

50

an ink tank (40, 40Y, 40M, 40C, 40K) configured to store ink of a particular color;
a plurality of recording heads (22, 22Y, 22M, 22C, 22K) in which nozzles configured to discharge the ink are formed;

55

an ink flow path (50, 50Y, 50M, 50C, 50K) through which the ink flows;
a tubular distributor (60) provided on the way of the ink flow path (50, 50Y, 50M, 50C, 50K) and configured to distribute, to respective of the plurality of recording heads (22, 22Y, 22M, 22C, 22K), the ink that flows through the ink flow path (50, 50Y, 50M, 50C, 50K) and is supplied from the ink tank (40, 40Y, 40M, 40C, 40K); and
a liquid delivery unit configured to liquid-deliver, via the ink flow path (50, 50Y, 50M, 50C, 50K) and the distributor

(60), the ink supplied to the plurality of recording heads (22, 22Y, 22M, 22C, 22K) from the ink tank (40, 40Y, 40M, 40C, 40K) and collected in the ink tank (40, 40Y, 40M, 40C, 40K), wherein the ink flow path (50, 50Y, 50M, 50C, 50K) includes:

5 an ink inflow path (52) for connecting the ink tank (40, 40Y, 40M, 40C, 40K) and the distributor (60) and supplying the ink to the distributor (60) from the ink tank;
 an ink collection flow path (54) for connecting the distributor and the ink tank (40, 40Y, 40M, 40C, 40K) and collecting, in the ink tank (40, 40Y, 40M, 40C, 40K), the ink supplied to the distributor (60); and
 10 a plurality of ink supply flow paths (56) for connecting the distributor (60) and respective of the plurality of recording heads (22, 22Y, 22M, 22C, 22K) and supplying the ink supplied to the distributor (60) to respective of the plurality of recording heads (22, 22Y, 22M, 22C, 22K), wherein the distributor (60) includes:

an inflow part (61) including an inflow port (63) to which the ink inflow path (52) is connected and into which the ink flows;
 15 an outflow part (64) including an outflow port (66) to which the ink collection flow path (54) is connected and out of which the ink flows;
 a plurality of supply parts (68) each including supply ports (70) to which respective of the plurality of ink supply flow paths (56) is connected, and out of which the ink flows; and
 a common flow path (67) formed inside the distributor (60), communicating with the inflow port (63),
 20 the outflow port (64), and the plurality of supply ports (70), and configured to cause the ink flowing out of the inflow port (63) to flow therein and supply the ink to the outflow port (64) and the plurality of supply ports (70), respectively,
 wherein the inflow part (61) is provided to a first side end of the tubular distributor (60),
 wherein the outflow part (64) is provided to a second side end of the tubular distributor (60),
 25 wherein the common flow path (67) extends between the first side end and the second side end,
 wherein respective of the plurality of supply parts (68) are provided so as to be aligned at a side surface of the tubular distributor (60) in an extending direction of the common flow path (67), and
 wherein the distributor (60) is provided to the inkjet recording apparatus (1) in such an installation state that the second side end is located upper than the first side end in a vertical direction, the extending
 30 direction of the common flow path (67) is inclined with respect to a horizontal direction, and an opening direction of the supply port (70) is directed downward in the vertical direction than in the horizontal direction, **characterized in that**
 the apparatus (1) further comprises a plurality of supply side valves (94) provided on the way of respective of the plurality of ink supply flow paths (56) and configured to open and shut the respective
 35 of the ink supply flow paths (56), and a collection side valve (92) provided on the way of the ink collection flow path (54) and configured to open and shut the ink collection flow path (54).

2. The inkjet recording apparatus according to claim 1,
 40 wherein the inflow part (61) includes a first joint part (62) connected to the ink inflow path (52) and formed with the inflow port (63),
 wherein the outflow part (64) includes a second joint part (65) connected to the ink collection flow path (54) and formed with the outflow port (66),
 wherein the first joint part (62) is provided to the first side end such that a predetermined range of the common flow path side in the inflow port (63) is inclined by as much as an inclination angle made by the extending direction of
 45 the common flow path (67) with respect to the horizontal direction, and
 wherein the second joint part (65) is provided to the second side end such that a predetermined range of the common flow path side in the outflow port (66) is inclined by as much as the inclination angle.

3. The inkjet recording apparatus (1) according to claim 1 or 2, wherein, for the plurality of ink supply flow paths (56),
 50 lengths of respective flow paths through which the ink flows out of the supply port (70) and is supplied to the recording head (22, 22Y, 22M, 22C, 22K) are set to be the same.

4. The inkjet recording apparatus (1) according to claim 1 further comprising:

55 a fixing part (96) including a fixing surface to which the plurality of supply side valves (94) is fixed, respectively, wherein the fixing part (96) is provided to the inkjet recording apparatus (1) such that the fixing surface is inclined by as much as an inclination angle made by the extending direction of the common flow path (67) with respect to the horizontal direction, and

wherein the plurality of supply side valves (94) is fixed to the fixing surface so that, in the distributor (60) in the installation state, the supply side valve (94) provided on the way of the ink supply flow path (56) that is connected to the supply part (68) provided at an upper position in the vertical direction is located upper in the vertical direction.

- 5 5. The inkjet recording apparatus (1) according to claim 4
 wherein, when an image is recorded on a recording medium in the inkjet recording apparatus (1),
 the liquid delivery unit is driven,
 the collection side valve (92) is either opened or shut, and
 the plurality of supply side valves (94) is opened, respectively,
 10 wherein, when no image is recorded on a recording medium in the inkjet recording apparatus (1),
 the liquid delivery unit is driven,
 the collection side valve (92) is opened, and
 the plurality of supply side valves (94) is shut, respectively.
- 15 6. The inkjet recording apparatus (1) according to claim 5, wherein, when an image is recorded on a recording medium
 in the inkjet recording apparatus (1), the collection side valve (92) has an opening degree between open and shut
 depending on an amount of the ink that flows in respective of the plurality of ink supply flow paths (56) to be supplied
 to respective of the plurality of recording heads (22, 22Y, 22M, 22C, 22K).

20

Patentansprüche

1. Tintenstrahlaufzeichnungsvorrichtung (1) zum Aufzeichnen eines Bildes auf einem Aufzeichnungsmedium,
 wobei die Tintenstrahlaufzeichnungsvorrichtung umfasst:
- 25 einen Tintenbehälter (40, 40Y, 40M, 40C, 40K), der so gestaltet ist, dass Tinte einer bestimmten Farbe gespeichert wird;
 eine Vielzahl von Aufzeichnungsköpfen (22, 22Y, 22M, 22C, 22K), in denen Düsen gebildet sind, die so gestaltet
 sind, dass die Tinte abgegeben wird;
 30 einen Tintenströmungsweg (50, 50Y, 50M, 50C, 50K), durch den die Tinte strömt;
 einen röhrenförmigen Verteiler (60), der auf dem Weg des Tintenströmungswegs (50, 50Y, 50M, 50C, 50K)
 bereitgestellt und so gestaltet ist, um die Tinte, die durch den Tintenströmungsweg (50, 50Y, 50M, 50C, 50K)
 strömt und vom Tintenbehälter (40, 40Y, 40M, 40C, 40K) zugeführt wird, zu dem jeweiligen der Vielzahl von
 Aufzeichnungsköpfen (22, 22Y, 22M, 22C, 22K) zu verteilen; und
 35 eine Flüssigkeitsabgabeeinheit, die so so gestaltet ist, dass sie über den Tintenströmungsweg (50, 50Y, 50M,
 50C, 50K) und den Verteiler (60) die Tinte flüssig abgibt, die der Vielzahl von Aufzeichnungsköpfen (22, 22Y,
 22M, 22C, 22K) aus dem Tintenbehälter (40, 40Y, 40M, 40C, 40K) zugeführt und im Tintenbehälter (40, 40Y,
 40M, 40C, 40K) gesammelt wird,
 wobei der Tintenströmungsweg (50, 50Y, 50M, 50C, 50K) umfasst:
- 40 einen Tinteneinströmweg (52) zum Verbinden des Tintenbehälters (40, 40Y, 40M, 40C, 40K)
 und den Verteiler (60) und das Zuführen der Tinte zum Verteiler (60) aus dem Tintenbehälter;
 einen Tintensammelströmungsweg (54) zum Verbinden des Verteilers und des Tintenbehälters
 (40, 40Y, 40M, 40C, 40K) und Sammeln der dem Verteiler (60) zugeführten Tinte im Tintenbehälter (40,
 40Y, 40M, 40C, 40K); und
 45 eine Vielzahl von Tintenversorgungsströmungswegen (56) zum Verbinden des Verteilers (60) und des
 jeweiligen der Vielzahl von Aufzeichnungsköpfen (22, 22Y, 22M, 22C, 22K) und zum Zuführen der dem
 Verteiler (60) zugeführten Tinte zu jeweils einem der Vielzahl von Aufzeichnungsköpfen (22, 22Y, 22M,
 22C, 22K), wobei
 50 der Verteiler (60) umfasst:
- einen Einströmteil (61) umfassend eine Einströmöffnung (63), mit der der Tinteneinströmweg (52)
 verbunden ist und in die die Tinte einströmt;
 einen Ausströmteil (64) umfassend eine Ausströmöffnung (66), mit der der Tintensammelströmungs-
 weg (54) verbunden ist und aus der die Tinte ausströmt;
 55 eine Vielzahl von Versorgungsteilen (68), umfassend jeweils Versorgungsöffnungen (70), mit denen
 jeweilige der Vielzahl von Tintenversorgungsströmungswegen (56) verbunden sind und aus denen die
 Tinte ausströmt; und

einen gemeinsamen Strömungsweg (67), der innerhalb des Verteilers (60) gebildet ist und mit der Einströmöffnung (63), der Ausströmöffnung (64) und der Vielzahl von Versorgungsöffnungen (70) in Verbindung steht und gestaltet ist, um das Ausströmen der Tinte aus der Einströmöffnung (63) zu bewirken und darin zu strömen und die Tinte der Ausströmöffnung (64) bzw. der Vielzahl von Versorgungsöffnungen (70) zuzuführen,
 wobei der Einströmteil (61) an einem ersten Seitenende des röhrenförmigen Verteilers (60) bereitgestellt ist,
 wobei der Ausströmteil (64) an einem zweiten Seitenende des rohrförmigen Verteilers (60) bereitgestellt ist,
 wobei sich der gemeinsame Strömungsweg (67) zwischen dem ersten Seitenende und dem zweiten Seitenende erstreckt,
 wobei jeder der Vielzahl von Versorgungsteilen (68) so bereitgestellt ist, dass er an einer Seitenfläche des röhrenförmigen Verteilers (60) in einer Erstreckungsrichtung des gemeinsamen Strömungswegs (67) ausgerichtet ist, und
 wobei der Verteiler (60) an der Tintenstrahlaufzeichnungsvorrichtung (1) in einem solchen Installationszustand bereitgestellt ist, dass das zweite Seitenende höher als das erste Seitenende in einer vertikalen Richtung angeordnet ist, wobei die Erstreckungsrichtung des gemeinsamen Strömungswegs (67) in Bezug auf eine horizontale Richtung geneigt ist und eine Öffnungsrichtung der Versorgungsöffnung (70) in vertikaler Richtung nach unten gerichtet und dann in horizontaler Richtung gerichtet ist,
dadurch gekennzeichnet, dass die Vorrichtung (1) ferner eine Vielzahl von versorgungsseitigen Ventilen (94) umfasst, die auf dem jeweiligen Weg der Vielzahl von Tintenversorgungsströmungswegen (56) bereitgestellt sind und zum Öffnen und Schließen der jeweiligen Tintenversorgungsströmungswegen (56) gestaltet sind, und ein sammelseitiges Ventil (92), das auf dem Weg des Tintensammelströmungswegs (54) bereitgestellt und zum Öffnen und Schließen des Tintensammelströmungswegs (54) gestaltet ist.

2. Tintenstrahlaufzeichnungsvorrichtung nach Anspruch 1,
 wobei der Einströmteil (61) einen ersten Verbindungsteil (62) umfasst, der mit dem Tinteneinströmweg (52) verbunden und mit der Einströmöffnung (63) gebildet ist,
 wobei der Ausströmteil (64) einen zweiten Verbindungsteil (65) umfasst, der mit dem Tintensammelströmungsweg (54) verbunden und mit der Ausströmöffnung (66) gebildet ist,
 wobei der erste Verbindungsteil (62) an dem ersten Seitenende derart bereitgestellt ist, dass ein vorgegebener Bereich der Seite des gemeinsamen Strömungswegs in der Einströmöffnung (63) um einen Neigungswinkel geneigt ist, der durch die Erstreckungsrichtung des gemeinsamen Strömungswegs (67) in Bezug auf die horizontale Richtung hergestellt wird, und
 wobei der zweite Verbindungsteil (65) an dem zweiten Seitenende derart bereitgestellt ist, dass ein vorgegebener Bereich der Seite des gemeinsamen Strömungswegs in der Ausströmöffnung (66) um den Neigungswinkel geneigt ist.
3. Tintenstrahlaufzeichnungsvorrichtung (1) nach Anspruch 1 oder 2, wobei bei der Vielzahl von Tintenversorgungsströmungswegen (56) Längen von jeweiligen Strömungswegen, durch die die Tinte aus der Versorgungsöffnung (70) strömt und dem Aufzeichnungskopf (22, 22Y, 22M, 22C, 22K) zugeführt wird, so eingestellt sind, dass sie gleich sind.
4. Tintenstrahlaufzeichnungsvorrichtung (1) nach Anspruch 1, ferner umfassend:
 einen Befestigungsteil (96) umfassend eine Befestigungsfläche, an der die Vielzahl von versorgungsseitigen Ventilen (94) jeweils befestigt sind,
 wobei der Befestigungsteil (96) an der Tintenstrahlaufzeichnungsvorrichtung (1) derart bereitgestellt ist, dass die Befestigungsfläche um einen Neigungswinkel geneigt ist, der durch die Erstreckungsrichtung des gemeinsamen Strömungswegs (67) in Bezug auf die horizontale Richtung hergestellt wird, und
 wobei die Vielzahl von versorgungsseitigen Ventilen (94) an der Befestigungsfläche befestigt ist, so dass im Verteiler (60) im Installationszustand das auf dem Weg des Tintenversorgungsströmungswegs (56) bereitgestellte versorgungsseitige Ventil (94), das mit dem Versorgungsteil (68) verbunden ist, der an einer oberen Position in der vertikalen Richtung bereitgestellt ist, in der vertikalen Richtung oben angeordnet ist.
5. Tintenstrahlaufzeichnungsvorrichtung (1) nach Anspruch 4,
 wobei, wenn ein Bild auf einem Aufzeichnungsmedium in der Tintenstrahlaufzeichnungsvorrichtung (1) aufgezeichnet wird,

die Flüssigkeitsabgabeeinheit angetrieben wird,
das sammelseitige Ventil (92) entweder geöffnet oder geschlossen ist, und
die Vielzahl von versorgungsseitigen Ventilen (94) jeweils geöffnet ist,
wobei, wenn kein Bild auf einem Aufzeichnungsmedium in der Tintenstrahl aufzeichnungsvorrichtung (1) aufge-
zeichnet wird,
die Flüssigkeitsabgabeeinheit angetrieben wird,
das sammelseitige Ventil (92) geöffnet ist, und
die Vielzahl von versorgungsseitigen Ventilen (94) jeweils geschlossen ist.

6. Tintenstrahl aufzeichnungsvorrichtung (1) nach Anspruch 5, wobei, wenn ein Bild auf einem Aufzeichnungsmedium in der Tintenstrahl aufzeichnungsvorrichtung (1) aufgezeichnet wird, das sammelseitige Ventil (92) einen Öffnungsgrad zwischen offen und geschlossen aufweist, der von einer Menge der Tinte abhängt, die in jeweiligen der Vielzahl von Tintenversorgungsströmungswegen (56) strömt, die jeweiligen der Vielzahl von Aufzeichnungsköpfen (22, 22Y, 22M, 22C, 22K) zugeführt werden soll.

Revendications

1. Dispositif d'impression par jet d'encre (1) permettant l'impression d'une image sur un support d'impression, le dispositif d'impression par jet d'encre comprenant :

un réservoir d'encre (40, 40Y, 40M, 40C, 40K) conçu pour stocker de l'encre d'une couleur particulière ;
une pluralité de têtes d'impression (22, 22Y, 22M, 22C, 22K) dans laquelle des buses conçues pour décharger l'encre sont formées ;

un trajet d'écoulement d'encre (50, 50Y, 50M, 50C, 50K) à travers lequel l'encre s'écoule ;
un distributeur tubulaire (60) disposé sur le parcours du trajet d'écoulement d'encre (50, 50Y, 50M, 50C, 50K) et conçu pour distribuer, respectivement à la pluralité de têtes d'impression (22, 22Y, 22M, 22C, 22K), l'encre qui s'écoule à travers le trajet d'écoulement d'encre (50, 50Y, 50M, 50C, 50K) et est alimenté à partir du réservoir d'encre (40, 40Y, 40M, 40C, 40K) ; et

une unité de distribution de liquide conçue pour distribuer un liquide, par l'intermédiaire du trajet d'écoulement d'encre (50, 50Y, 50M, 50C, 50K) et du distributeur (60), l'encre étant alimentée vers la pluralité de têtes d'impression (22, 22Y, 22M, 22C, 22K) à partir du réservoir d'encre (40, 40Y, 40M, 40C, 40K) et collectée dans le réservoir d'encre (40, 40Y, 40M, 40C, 40K),

ledit trajet d'écoulement d'encre (50, 50Y, 50M, 50C, 50K) comportant :

un trajet d'écoulement d'encre (52) pour relier le réservoir d'encre (40, 40Y, 40M, 40C, 40K) et le distributeur (60) et alimenter l'encre vers le distributeur (60) à partir du réservoir d'encre ;
un trajet d'écoulement de collecte d'encre (54) pour relier le distributeur et le réservoir d'encre (40, 40Y, 40M, 40C, 40K) et collecter, dans le réservoir d'encre (40, 40Y, 40M, 40C, 40K), l'encre administrée au distributeur (60) ; et

une pluralité de trajets d'écoulement d'alimentation d'encre (56) pour relier le distributeur (60) et respectivement la pluralité de têtes d'impression (22, 22Y, 22M, 22C, 22K) et alimenter l'encre alimentée vers le distributeur (60) respectivement vers la pluralité de têtes d'impression (22, 22Y, 22M, 22C, 22K), ledit distributeur (60) comportant :

une partie d'écoulement d'entrée (61) comportant un orifice d'écoulement d'entrée (63) auquel le trajet d'écoulement d'entrée d'encre (52) est relié et dans lequel l'encre s'écoule ;

une partie d'écoulement de sortie (64) comportant un orifice d'écoulement de sortie (66) auquel le trajet d'écoulement de collecte d'encre (54) est relié et hors duquel l'encre s'écoule ;

une pluralité de parties d'alimentation (68) comportant chacune des orifices d'alimentation (70) auxquels respectivement la pluralité de trajets d'écoulement d'alimentation d'encre (56) est reliée et hors desquels l'encre s'écoule ; et

un trajet d'écoulement commun (67) formé à l'intérieur du distributeur (60), communiquant avec l'orifice d'écoulement d'entrée (63), l'orifice d'écoulement de sortie (64) et la pluralité d'orifices d'alimentation (70) et conçu pour provoquer l'écoulement de l'encre hors de l'orifice d'écoulement d'entrée (63) pour s'écouler en lui et alimenter l'encre vers l'orifice d'écoulement de sortie (64) et la pluralité d'orifices d'alimentation (70), respectivement,

ladite partie d'écoulement d'entrée (61) étant disposée sur une première extrémité latérale du distri-

buteur tubulaire (60),
 ladite partie d'écoulement de sortie (64) étant disposée sur une seconde extrémité latérale du distributeur tubulaire (60),
 ledit trajet d'écoulement commun (67) s'étendant entre la première extrémité latérale et la seconde extrémité latérale,
 respectivement la pluralité de parties d'alimentation (68) étant disposées de façon à être alignées au niveau d'une surface latérale du distributeur tubulaire (60) suivant une direction d'extension du trajet d'écoulement commun (67) et
 ledit distributeur (60) étant disposé sur le dispositif d'impression par jet d'encre (1) dans un état d'installation tel que la seconde extrémité latérale se trouve au-dessus de la première extrémité latérale dans une direction verticale, la direction d'extension du trajet d'écoulement commun (67) étant inclinée par rapport à une direction horizontale et une direction d'ouverture de l'orifice d'alimentation (70) étant dirigée vers le bas dans la direction verticale plutôt que dans la direction horizontale, **caractérisé en ce que** le dispositif (1) comprend en outre une pluralité de vannes latérales d'alimentation (94) disposées sur le parcours respectivement de la pluralité de trajets d'écoulement d'alimentation d'encre (56) et conçues pour ouvrir et fermer respectivement les trajets d'écoulement d'alimentation d'encre (56) et une vanne latérale de collecte (92) disposée sur le parcours du trajet d'écoulement de collecte d'encre (54) et conçue pour ouvrir et fermer le trajet d'écoulement de collecte d'encre (54).

2. Dispositif d'impression par jet d'encre selon la revendication 1,
 ladite partie d'écoulement d'entrée (61) comportant une première partie de jonction (62) reliée au trajet d'écoulement d'entrée d'encre (52) et formée avec l'orifice d'écoulement d'entrée (63),
 ladite partie d'écoulement de sortie (64) comportant une seconde partie de jonction (65) reliée au trajet d'écoulement de collecte d'encre (54) et formée avec l'orifice d'écoulement de sortie (66),
 ladite première partie de jonction (62) étant disposée sur la première extrémité latérale de sorte qu'une plage prédéfinie du côté trajet d'écoulement commun dans l'orifice d'écoulement d'entrée (63) soit inclinée selon un angle allant jusqu'à un angle d'inclinaison formé par la direction d'extension du trajet d'écoulement commun (67) par rapport à la direction horizontale et
 ladite seconde partie de jonction (65) étant disposée sur la seconde extrémité latérale de sorte qu'une plage prédéfinie du côté trajet d'écoulement commun dans l'orifice d'écoulement de sortie (66) soit inclinée selon un angle allant jusqu'à l'angle d'inclinaison.

3. Dispositif d'impression par jet d'encre (1) selon la revendication 1 ou 2, pour la pluralité des trajets d'écoulement d'alimentation d'encre (56), les longueurs des trajets d'écoulement respectifs à travers lesquels l'encre s'écoule hors de l'orifice d'alimentation (70) et est alimentée vers la tête d'impression (22, 22Y, 22M, 22C, 22K) étant ajustées pour être identiques.

4. Dispositif d'impression par jet d'encre (1) selon la revendication 1, comprenant en outre :

une partie de fixation (96) comportant une surface de fixation à laquelle la pluralité de vannes latérales d'alimentation (94) est fixée, respectivement,
 ladite partie de fixation (96) étant disposée sur le dispositif d'impression par jet d'encre (1) de sorte que la surface de fixation soit inclinée selon un angle allant jusqu'à un angle d'inclinaison formé par la direction d'extension du trajet d'écoulement commun (67) par rapport à la direction horizontale et
 ladite pluralité de vannes latérales d'alimentation (94) étant fixées à la surface de fixation de sorte que, dans le distributeur (60) à l'état d'installation, la vanne latérale d'alimentation (94) disposée sur le parcours du trajet d'écoulement d'alimentation d'encre (56) qui est reliée à la partie d'alimentation (68) disposée au niveau d'une position supérieure dans la direction verticale se trouve au-dessus dans la direction verticale.

5. Dispositif d'impression par jet d'encre (1) selon la revendication 4,
 lorsqu'une image est imprimée sur un support d'impression dans le dispositif d'impression par jet d'encre (1), ladite unité de distribution de liquide étant actionnée,
 la vanne latérale de collecte (92) étant soit ouverte soit fermée et
 ladite pluralité de vannes latérales d'alimentation (94) étant ouverte, respectivement,
 lorsqu'aucune image n'est imprimée sur un support d'impression dans le dispositif d'impression par jet d'encre (1), ladite unité de distribution de liquide étant actionnée,
 ladite vanne latérale de collecte (92) étant ouverte et
 ladite pluralité de vannes latérales d'alimentation (94) étant fermée, respectivement.

EP 2 803 487 B1

6. Dispositif d'impression par jet d'encre (1) selon la revendication 5, lorsqu'une image est imprimée sur un support d'impression dans le dispositif d'impression par jet d'encre (1), ladite vanne latérale de collecte (92) ayant un degré d'ouverture entre l'ouverture et la fermeture en fonction de la quantité de l'encre qui s'écoule respectivement dans la pluralité de trajets d'écoulement d'alimentation d'encre (56) à alimenter vers respectivement la pluralité de têtes d'impression (22, 22Y, 22M, 22C, 22K).

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

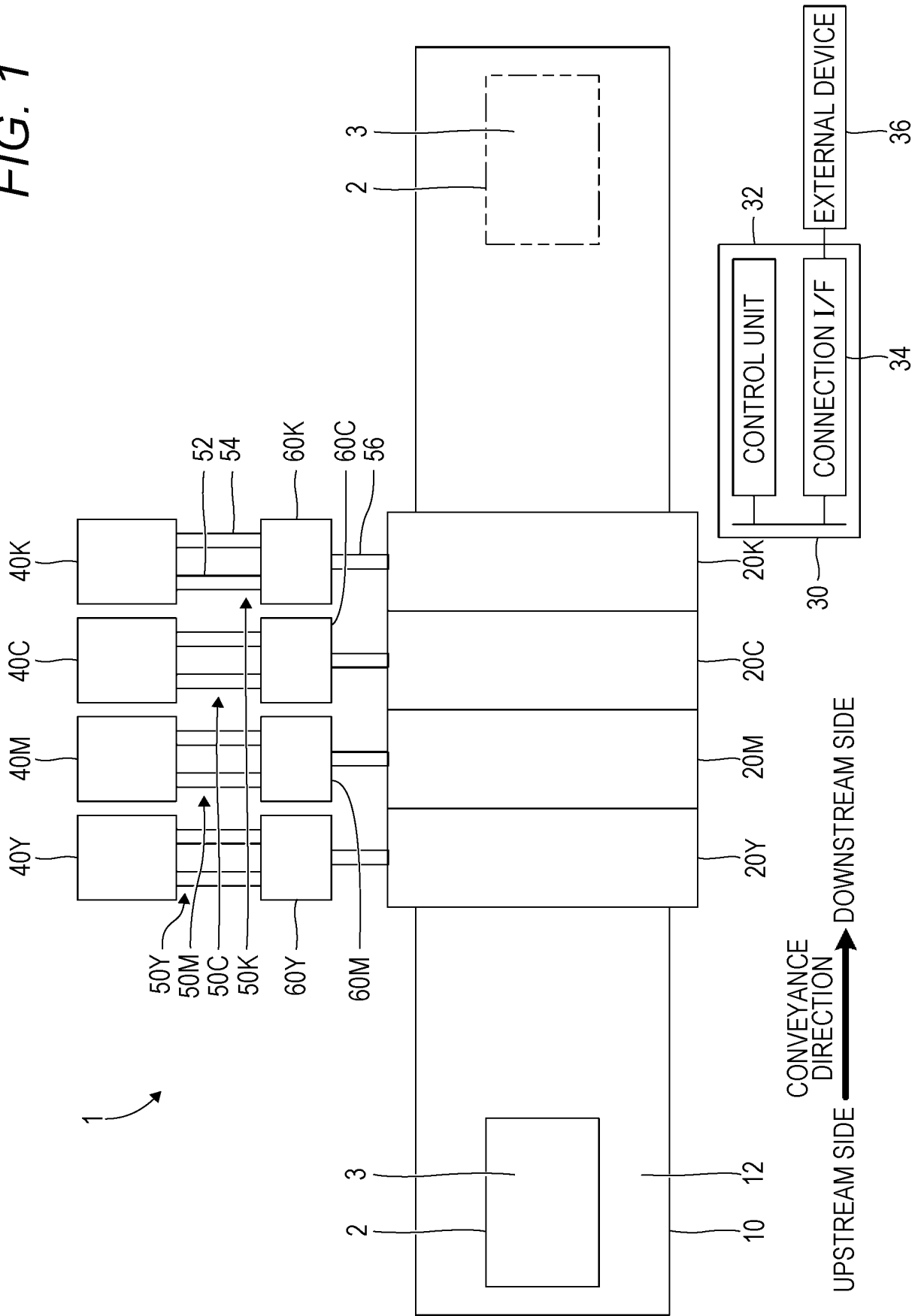


FIG. 2

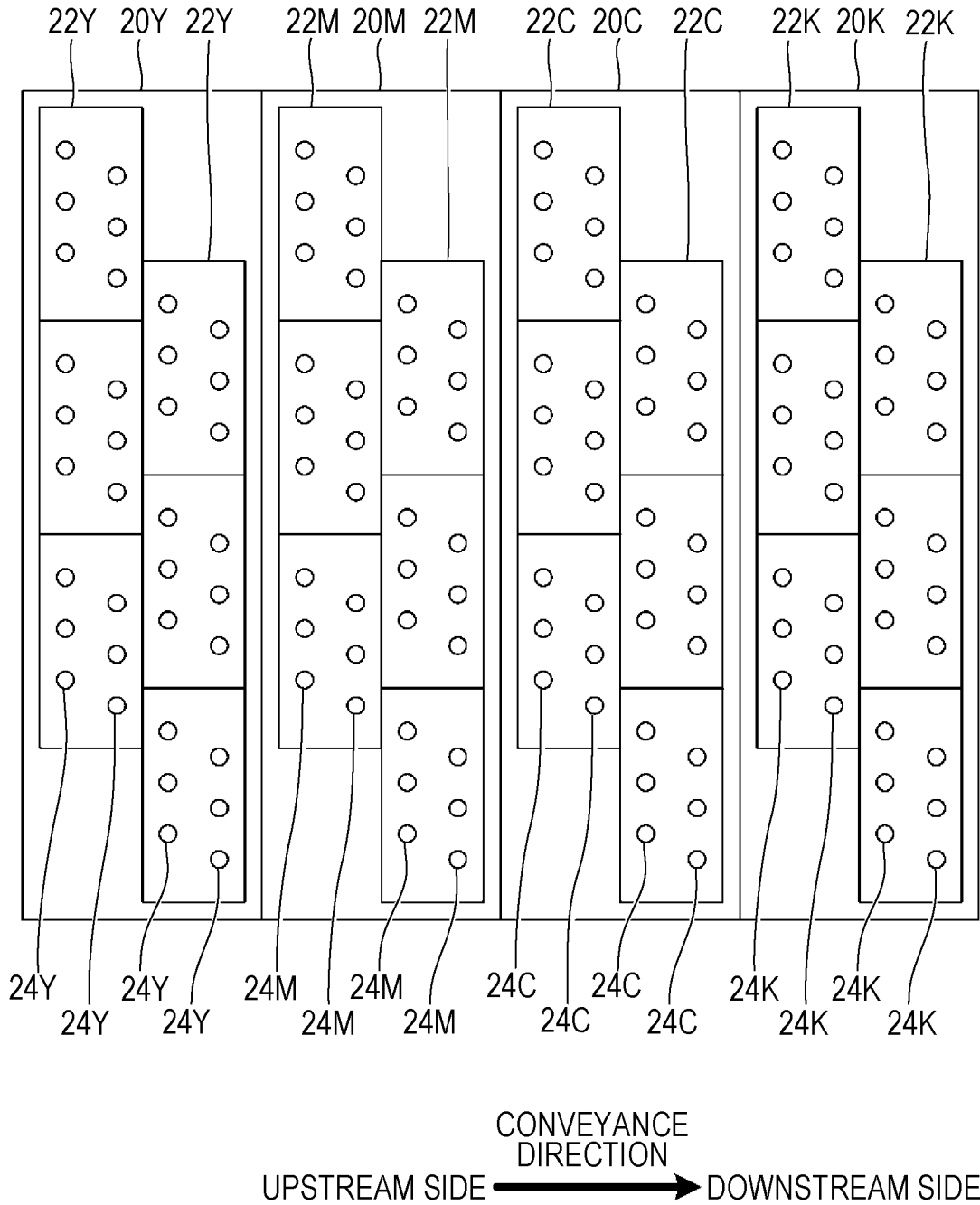


FIG. 3

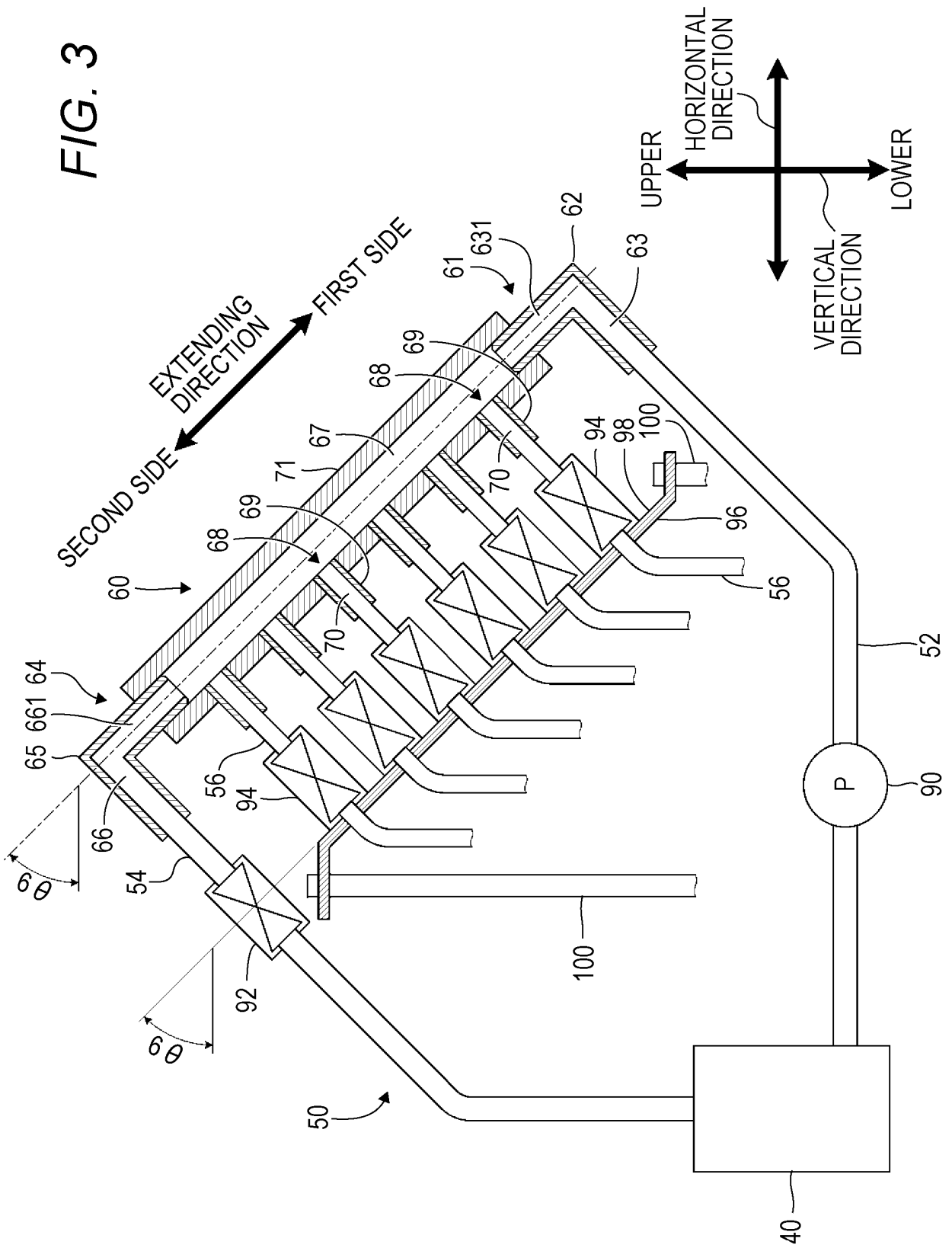


FIG. 4

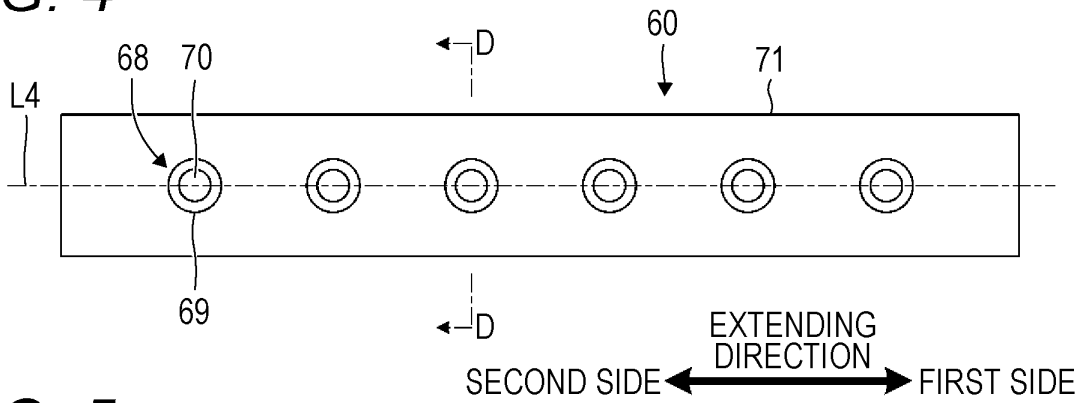


FIG. 5

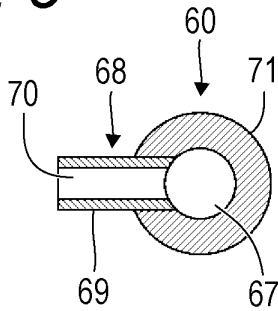


FIG. 6

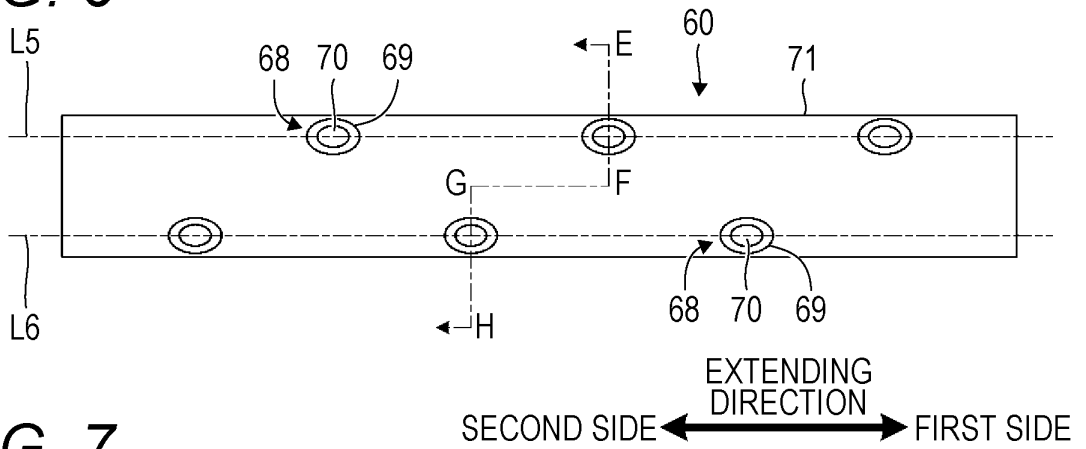
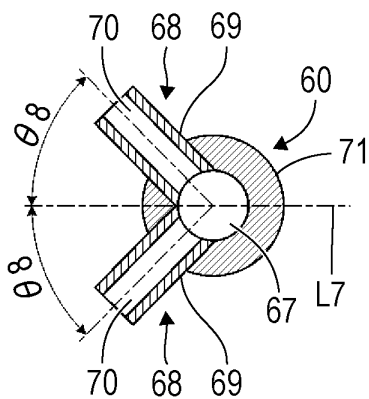


FIG. 7



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2006247899 A [0005]
- JP 2011046131 A [0006]
- JP 4784129 B [0006]
- JP 2011079169 A [0006]