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(54) LIQUID DISPENSING RECORDING DEVICE

(57) According to one embodiment, a liquid dispensing recording device includes a liquid dispensing head, a liquid supply tank, a pump, a first tank, and a second tank. The liquid dispensing head dispenses a liquid. The liquid supply tank stores the liquid. The pump can regulate a flow of the liquid when the pump is stopped by setting an amount of the liquid to be supplied larger than a sum of an amount of the liquids passing through and dispensed from the liquid dispensing head. The first tank is connected downstream of the liquid supply tank and upstream of the pump, and has a liquid surface at a position lower than a nozzle surface of the liquid dispensing head. The second tank is connected downstream of the pump and upstream of the liquid dispensing head, and has a liquid surface at a position higher than the nozzle surface of the liquid dispensing head. If a liquid surface difference between the liquid surfaces of the first tank and the second tank is defined as h, the nozzle surface of the liquid dispensing head is located at or above a midpoint of the liquid surface difference h while the device is stopped.

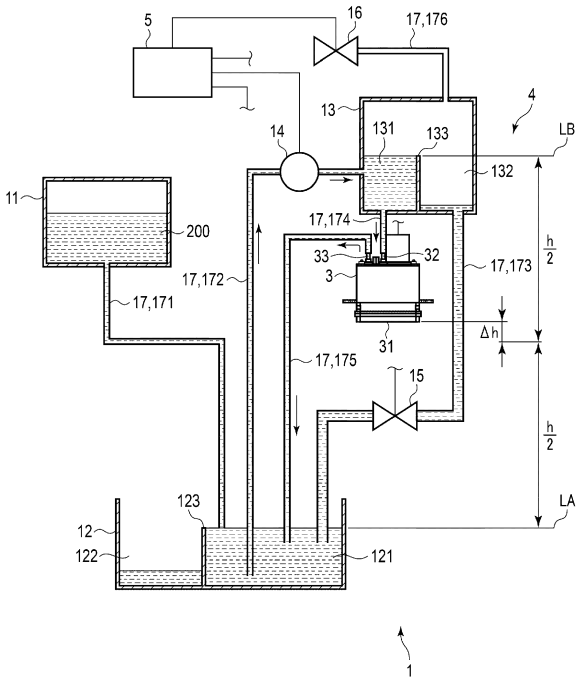

FIG.1

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Description

FIELD

[0001] Embodiments described herein relate generally to a liquid dispensing recording device.

BACKGROUND

[0002] In the related art, as a liquid dispensing recording device, there is an inkjet recording device including an inkjet head, which is a liquid dispensing head that dispenses ink as a liquid, and supplies the ink to the inkjet head by circulating the ink.

[0003] In an ink circulation method of the inkjet head, there is a technique of performing various kinds of control in order to perform stable circulation of ink, such as pressure detection by a pressure sensor, ink liquid surface detection, and flow rate variation of an ink circulation pump. However, if the ink circulation is stopped, the ink may not be held, the ink may flow downstream, and the ink may leak from the inkjet head. When the ink leaks from the inkjet head, it may be difficult to start the next ink circulation.

DISCLOSURE OF INVENTION

[0004] To this end, there is provided a liquid dispensing recording device comprising: a liquid dispensing head configured to dispense a liquid; a liquid supply tank configured to store the liquid; a pump configured to regulate a flow of the liquid when the pump is stopped by setting an amount of the liquid to be supplied larger than a sum of an amount of the liquid passing through the liquid dispensing head and an amount of the liquid dispensed from the liquid dispensing head; a first tank connected downstream of the liquid supply tank and upstream of the pump, and having a liquid surface at a position lower than a nozzle surface of the liquid dispensing head; a second tank connected downstream of the pump and upstream of the liquid dispensing head, and having a liquid surface at a position higher than the nozzle surface of the liquid dispensing head, wherein if a liquid surface difference between the liquid surface of the first tank and the liquid surface of the second tank is defined as h, the nozzle surface of the liquid dispensing head is located at or above a midpoint of the liquid surface difference h while the device is stopped.

[0005] Preferred embodiments are set out in dependent claims.

DESCRIPTION OF THE DRAWINGS

[0006] Figure 1 is an explanatory diagram schematically showing a configuration of a liquid dispensing recording device according to an embodiment.

DETAILED DESCRIPTION

[0007] In general, according to one embodiment, provided is a liquid dispensing recording device capable of maintaining a negative pressure on a nozzle surface of a liquid dispensing head when the device is stopped.

[0008] The liquid dispensing recording device according to an embodiment includes a liquid dispensing head, a liquid supply tank, a pump, a first tank, and a second tank. The liquid dispensing head dispenses a liquid. The liquid supply tank stores the liquid. The pump can regulate a flow of the liquid when the pump is stopped by setting an amount of the liquid to be supplied larger than a sum of an amount of the liquid passing through the liquid dispensing head and an amount of the liquid dispensed from the liquid dispensing head. The first tank is connected downstream of the liquid supply tank and upstream of the pump, and has a liquid surface at a position lower than a nozzle surface of the liquid dispensing head. The second tank is connected downstream of the pump and upstream of the liquid dispensing head, and has a liquid surface at a position higher than the nozzle surface of the liquid dispensing head. If a liquid surface difference between the liquid surface of the first tank and the liquid surface of the second tank is defined as h, the nozzle surface of the liquid dispensing head is located at or above a midpoint of the liquid surface difference h while the device is stopped.

[0009] Hereinafter, a configuration of a liquid dispensing recording device 1 according to an embodiment will be described with reference to Figure.

[0010] Figure is an explanatory diagram schematically showing the configuration of the liquid dispensing recording device 1 according to the embodiment. In Figure, a flow of a liquid 200 during driving is indicated by arrows.

[0011] As shown in Figure, the liquid dispensing recording device 1 includes a liquid dispensing head 3, a liquid circulation device 4, and a control device 5. The liquid dispensing recording device 1 may include a moving mechanism that moves the liquid dispensing head 3 and a conveying mechanism that conveys a recording medium that dispenses the liquid 200.

[0012] In an example of the embodiment, the liquid dispensing recording device 1 circulates ink as the liquid 200 and dispenses the ink from the liquid dispensing head 3 to a recording medium. Therefore, in the following description, it is assumed that the liquid dispensing recording device 1 is the inkjet recording device 1, the liquid dispensing head 3 is the inkjet head 3, the liquid circulation device 4 is the ink circulation device 4, and the liquid 200 is the ink 200.

[0013] A plurality of nozzles, which are holes, are formed in a nozzle surface 31 of the inkjet head 3. The inkjet head 3 is adjusted at a position in a height direction such that a meniscus is formed in the nozzles of the nozzle surface 31 and a negative pressure is maintained. The inkjet head 3 dispenses the ink 200 from the nozzles by driving an actuator.

[0014] The ink circulation device 4 includes an ink supply tank (a liquid supply tank) 11, a first tank 12, a second tank 13, a pump 14, a first opening and closing valve 15, and a second opening and closing valve 16. The ink circulation device 4 includes a plurality of tubes 17 that connect the ink supply tank 11, the first tank 12, the second tank 13, the pump 14, the first opening and closing valve 15, and the second opening and closing valve 16.

[0015] Here, the plurality of tubes 17 include a first tube 171 that connects the ink supply tank 11 to the first tank 12, a second tube 172 and a third tube 173 that connect the first tank 12 to the second tank 13, a fourth tube 174 that connects the second tank 13 to the inkjet head 3, a fifth tube 175 that connects the inkjet head 3 to the first tank 12, and a sixth tube (an atmosphere opening portion) 176 provided in the second tank 13 for opening to an atmosphere.

[0016] The ink supply tank 11 stores the ink 200. The ink supply tank 11 is disposed at a position higher than the first tank 12. The ink supply tank 11 supplies the ink 200 to the first tank 12 through the first tube 171. For example, the ink supply tank 11 is sealed.

[0017] The first tank 12 has a partition wall (a first tank partition wall) 123 having a predetermined height lower than a ceiling of the first tank 12, which partitions an interior of the first tank 12 into a plurality of chambers, for example, two chambers that are a first chamber 121 and a second chamber 122. The first chamber 121 stores the ink 200 supplied from the ink supply tank 11. That is, the first chamber 121 is connected downstream of the ink supply tank 11 in a flow direction of the ink 200 stored in the ink supply tank 11. The second chamber 122 stores the ink 200 that overflows the first chamber 121 from the partition wall 123. That is, a maximum liquid surface (a liquid surface LA) stored in the first chamber 121 of the first tank 12 has a height the same as that of an upper end of the partition wall 123. The first tank 12 is, for example, opened to the atmosphere.

[0018] The second tank 13 is disposed at a position higher than the first tank 12. The second tank 13 has a partition wall (a second tank partition wall) 133 having a predetermined height lower than a ceiling of the second tank 13, which partitions an interior of the second tank 13 into a plurality of chambers, for example, two chambers that are a first chamber 131 and a second chamber 132. The first chamber 131 stores the ink 200 supplied from the first tank 12. The second chamber 132 stores the ink 200 that overflows the first chamber 131 from the partition wall 133. That is, a maximum liquid surface (a liquid surface LB) stored in the first chamber 131 of the second tank 13 has a height the same as that of an upper end of the partition wall 133.

[0019] The first chamber 131 of the second tank 13 is connected to the first chamber 121 of the first tank 12 through the second tube 172. The second chamber 132 of the second tank 13 is connected to the first chamber 121 of the first tank 12 through the third tube 173. The first chamber 131 of the second tank 13 is connected upstream of the inkjet head 3 through the fourth tube 174.

[0020] The second tank 13 is sealed, and is formed to be able to be opened to the atmosphere via the sixth tube 176 as an atmosphere opening portion connected to an upper end of the second tank 13 and the second opening and closing valve 16.

[0021] The pump 14 is provided on the second tube 172 that connects the first chamber 121 of the first tank 12 to the first chamber 131 of the second tank 13. The pump 14 is connected downstream of the first chamber 121 of the first tank 12, and is connected upstream of the first chamber 131 of the second tank 13. The pump 14 supplies the ink 200 in the first chamber 121 of the first tank 12, which is an upstream tank provided upstream of the pump 14, to the first chamber 131 of the second tank 13, which is a downstream tank provided downstream of the pump 14, through the second tube 172 during driving. The pump 14 regulates a movement of the ink 200 when the pump is stopped.

[0022] The pump 14 is, for example, a tube pump (a peristaltic pump). The tube pump serving as the pump 14 has a function of supplying the ink 200 from upstream to downstream by being driven, and closing the second tube 172 by being stopped to regulate the flow of the ink 200.

[0023] The pump 14 is connected to the control device 5 and is driven based on a drive signal output from the control device 5. An amount of ink to be supplied downstream by the pump 14 when the pump 14 is driven is set to be larger than a sum of an amount of ink passing through the inkjet head 3 and an amount of ink dispensed from the inkjet head 3.

[0024] The first opening and closing valve 15 is electrically connected to the control device 5 and is driven based on an output signal from the control device 5. The first opening and closing valve 15 is a normally closed opening and closing valve that is normally closed and is opened when a signal is input from the control device 5. The first opening and closing valve 15 is provided on the third tube 173.

[0025] The second opening and closing valve 16 is electrically connected to the control device 5 and is driven based on an output signal from the control device 5. The second opening and closing valve 16 is a normally closed opening and closing valve that is normally closed and is opened when a signal is input from the control device 5. The second opening and closing valve 16 is provided on the sixth tube 176. The second opening and closing valve 16 opens and closes the sixth tube 176, which is an atmosphere opening portion of the second tank 13.

[0026] The first tube 171 connects the ink supply tank 11 to the first tank 12. For example, an upper end of the first tube 171 is connected to a lower side of the ink supply tank 11, for example, a lower surface of the ink supply tank 11. A lower end of the first tube 171 is connected to the first chamber 121 of the first tank 12. For example, the lower end of the first tube 171 is disposed at a height the same as that of the upper end of the partition wall

123 of the first tank 12. That is, the lower end of the first tube 171 is set at a height the same as that of the liquid surface LA which is the maximum liquid surface of the first chamber 121 of the first tank 12.

[0027] The second tube 172 connects the first tank 12 to the second tank 13. The second tube 172 connects the first chamber 121 of the first tank 12 to the first chamber 131 of the second tank 13. A lower end of the second tube 172 is disposed at a position lower than the liquid surface LA of the first chamber 121 of the first tank 12. An upper end of the second tube 172 is disposed at a position lower than the liquid surface LB of the first chamber 131 of the second tank 13. The upper end of the second tube 172 is connected to, for example, a position of a side wall of the first chamber 131 of the second tank 13, which is lower than the liquid surface LB.

[0028] The third tube 173 connects the second tank 13 to the first tank 12. The third tube 173 connects the second chamber 132 of the second tank 13 to the first chamber 121 of the first tank 12. An upper end of the third tube 173 is connected to a lower side of the second chamber 132 of the second tank 13, for example, a lower surface of the second chamber 132. A lower end of the third tube 173 is disposed at a position lower than the liquid surface LA of the first chamber 121 of the first tank 12. For example, an inner diameter (a tube diameter) of the third tube 173 is larger than inner diameters (tube diameters) of the first tube 171, the second tube 172, the fourth tube 174, and the fifth tube 175.

[0029] The fourth tube 174 connects the first chamber 131 of the second tank 13 to the inkjet head 3. An upper end of the fourth tube 174 is connected to the lower side of the first chamber 131 of the second tank 13, for example, the lower surface of the first chamber 131 of the second tank 13. A lower end of the fourth tube 174 is connected to a supply tube 32 of the inkjet head 3.

[0030] The fifth tube 175 connects the inkjet head 3 to the first chamber 121 of the first tank 12. An upper end of the fifth tube 175 is connected to a discharge tube 33 of the inkjet head 3. A lower end of the fifth tube 175 is disposed at a position lower than the liquid surface LA of the first chamber 121 of the first tank 12. The inner diameter of the fourth tube 174 and the inner diameter of the fifth tube 175 are, for example, the same. In the example of the embodiment, the first tube 171, the second tube 172, the fourth tube 174, and the fifth tube 175 are formed with the same diameter.

[0031] One end of the sixth tube 176 is connected to a portion above the partition wall 133 of the second tank 13, for example, an upper surface of the second tank 13. The other end of the sixth tube 176 is connected to the second opening and closing valve 16, and the second tank 13 is opened to the atmosphere by opening the second opening and closing valve 16.

[0032] The control device 5 is electrically connected to the inkjet head 3, the pump 14, the first opening and closing valve 15, and the second opening and closing valve 16. The control device 5 outputs drive signals to the inkjet head 3, the pump 14, the first opening and closing valve 15, and the second opening and closing valve 16.

[0033] For example, during driving, if the ink 200 can be dispensed from the inkjet head 3, the control device 5 outputs a drive signal to the pump 14 to drive the pump 14 and outputs a drive signal to the first opening and closing valve 15 and the second opening and closing valve 16 to open the first opening and closing valve 15 and the second opening and closing valve 16. During driving, the control device 5 outputs a drive signal to the actuator of the inkjet head 3 to drive the actuator, thereby dispensing the ink 200 from the nozzles of the nozzle surface 31.

[0034] For example, the control device 5 does not output signals to the pump 14, the first opening and closing valve 15, and the second opening and closing valve 16 when the inkjet head 3 is stopped from dispensing the ink 200. Accordingly, the pump 14 is stopped and the flow of the ink 200 in the pump 14 is regulated, and the normally closed first opening and closing valve 15 and second opening and closing valve 16 are closed and the flow of the ink 200 passing through the first opening and closing valve 15 and the second opening and closing valve 16 is regulated.

[0035] Next, a relationship between the nozzle surface 31 of the inkjet head 3 of the liquid dispensing recording device 1 and the liquid surface LA of the first chamber 121 of the first tank 12 and the liquid surface LB of the first chamber 131 of the second tank 13 fluidly connected to the inkjet head 3 will be described.

[0036] First, if a liquid surface difference in the height direction between the liquid surface LA of the first chamber 121 of the first tank 12 and the liquid surface LB of the first chamber 131 of the second tank 13 is defined as h, at least while the pump 14 is stopped, the nozzle surface 31 of the inkjet head 3 is located at a height position equal to or greater than a midpoint (h/2) of the liquid surface difference h and at a position lower than the second tank 13. The nozzle surface 31 of the inkjet head 3 is preferably disposed at a position higher than the midpoint of the liquid surface difference h at which a water head difference Δh occurs with respect to the midpoint of the liquid surface difference h.

[0037] A nozzle negative pressure of the inkjet head 3 can be calculated based on the liquid surface difference h, the water head difference Δh, and a pressure loss of the fourth tube 174 and a pressure loss of the fifth tube 175. In order to simplify the calculation of the nozzle negative pressure on the nozzle surface 31 of the inkjet head 3, the fourth tube 174 connected upstream of the inkjet head 3 to the fifth tube 175 connected downstream of the inkjet head 3 preferably have the same length and thickness. This is because pressures generated by the pressure losses of the fourth tube 174 and the fifth tube 175 are the same at IN and OUT of the inkjet head 3 and can be cancelled out.

[0038] A flow rate of the ink 200 can be obtained from

the pressure loss of the fourth tube 174, the pressure loss of the fifth tube 175, an internal pressure loss of the inkjet head 3, and the liquid surface difference h.

[0039] Next, an example of the flow of the ink 200 when the liquid dispensing recording device 1 is driven and stopped will be described.

[0040] First, the ink supply tank 11 supplies the ink 200 to the first chamber 121 of the first tank 12 both when the liquid dispensing recording device 1 is driven and stopped. In the embodiment, since the ink supply tank 11 is sealed, the ink 200 is supplied to the first chamber 121 through the first tube 171, and air is absorbed in through the first tube 171. Since the lower end of the first tube 171 is disposed at the same position as the upper end of the partition wall 123, if the liquid surface of the ink 200 in the first chamber 121 of the first tank 12 reaches the liquid surface LA which is the maximum liquid surface, the supply of the ink 200 from the ink supply tank 11 is stopped.

[0041] If the excess ink 200 over the liquid surface LA flows into the first chamber 121 of the first tank 12, the ink 200 in the first chamber 121 moves over the partition wall 123 to the second chamber 122. Accordingly, the liquid surface LA in the first chamber 121 of the first tank 12 is a normally constant liquid surface. For example, the excess ink 200 flows into the first chamber 121 of the first tank 12 due to a return flow of the ink 200 flowing from the second chamber 132 of the second tank 13 and/or the discharge tube 33 of the inkjet head 3 through the third tube 173 and/or the fifth tube 175 when the liquid dispensing recording device 1 is driven.

[0042] Next, when the inkjet recording device 1 is driven, the control device 5 drives the pump 14 and then opens the first opening and closing valve 15 and the second opening and closing valve 16. Therefore, the second tank 13 is opened to the atmosphere, and the ink is supplied from the first chamber 121 of the first tank 12 to the first chamber 131 of the second tank 13 by the pump 14. Therefore, the ink 200 passes through the second tube 172 from the first chamber 121 of the first tank 12 and moves to the first chamber 131 of the second tank 13, and passes through the fourth tube 174, the inkjet head 3, and the fifth tube 175 from the first chamber 131 of the second tank 13 and moves to the first chamber 121 of the first tank 12. Therefore, when the inkjet recording device 1 is driven, the ink 200 is circulated among the first chamber 121 of the first tank 12, the first chamber 131 of the second tank 13, and the inkjet head 3.

[0043] The amount of ink that the driven pump 14 supplies the ink 200 downstream is larger than the sum of the amount of ink passing through the inkjet head 3 and the amount of ink dispensed from the inkjet head 3. Therefore, the amount of the ink 200 supplied from the pump 14 to the first chamber 131 of the second tank 13 is larger than a circulation flow rate of the ink 200 passing through the inkjet head 3 from the first chamber 131 of the second tank 13 and returning to the first tank 12. However, the ink 200 that is supplied to the first chamber 131 of the second tank 13 and passed over the partition wall 133 (the liquid surface LB) moves from the first chamber 131 to the second chamber 132. Since the second opening and closing valve 16 is in an open state, the second tank 13 is opened to the atmosphere, and the first opening and closing valve 15 is in the open state. Therefore, the ink 200 moved to the second chamber 132 returns to the first chamber 121 of the first tank 12 through the third tube 173. Therefore, the liquid surface LB of the first chamber 131 of the second tank 13 is constant. By setting the inner diameter of the third tube 173 larger than the inner diameters of the second tube 172, the fourth tube 174, and the fifth tube 175, the liquid surface of the ink 200 in the second chamber 132 of the second tank 13 is prevented from elevating, and the ink 200 in the second chamber 132 can be prevented from passing over the partition wall 133.

[0044] Next, when the inkjet recording device 1 is stopped, the pump 14 has the function of regulating the flow of the ink 200 when the pump is stopped, and thus the ink 200 does not pass through the pump 14. When the inkjet recording device 1 is stopped, the normally closed first opening and closing valve 15 and second opening and closing valve 16 are closed. Accordingly, the second tank 13 is sealed, and then a flow path of the third tube 173 is closed. The inkjet head 3 is connected to the first chamber 121 of the first tank 12 through the fifth tube 175. Further, the nozzle surface 31 of the inkjet head 3 is located at a height position equal to or greater than the midpoint (h/2) of the liquid surface difference h. When the nozzle surface 31 of the inkjet head 3 is located at the position higher than the midpoint (h/2) of the liquid surface difference h, a pressure due to ink potential energy corresponding to the water head difference Δh from h/2, which is defined by the liquid surface LA of the first chamber 121 of the first tank 12 in which the lower end of the fourth tube 174 is disposed, is generated in the nozzles of the nozzle surface 31, and the ink in the nozzle of the nozzle surface 31 of the inkjet head 3 is in a negative pressure.

[0045] Therefore, the pressure of the ink 200 on the nozzle surface 31 (the nozzles) of the inkjet head 3 when the device is stopped is balanced with an atmospheric pressure or becomes a negative pressure with respect to the atmospheric pressure, and the ink 200 does not drop from the nozzle surface 31.

[0046] Further, since the flow of the ink 200 is stopped when the inkjet recording device 1 is stopped, the liquid surface LA in the first chamber 121 of the first tank 12 and the liquid surface LB in the first chamber 131 of the second tank 13 do not change. Therefore, if the first opening and closing valve 15 and the second opening and closing valve 16 are in the open state and the pump 14 is driven at the start of circulation of the ink 200, which is the next driving of the inkjet recording device 1, the circulation of the ink 200 is started while the negative pressure of the nozzles on the nozzle surface 31 of the inkjet head 3 is maintained.

[0047] According to the inkjet recording device 1 implemented as described above, the nozzle surface 31 of the inkjet head 3 is at a height equal to or greater than the midpoint (h/2) of the liquid surface difference h between the liquid surface LA of the first chamber 121 of the first tank 12 and the liquid surface LB of the first chamber 131 of the second tank 13. The first opening and closing valve 15 and the second opening and closing valve 16 are normally closed opening and closing valves, and the pump 14 has a function of preventing the ink 200 from flowing when the pump is stopped. With the configuration, if a power supply is not supplied to the control device 5 or if the control device 5 stops outputting a signal to the pump 14, the first opening and closing valve 15, and the second opening and closing valve 16, the inkjet recording device 1 can prevent the ink 200 in the second tank 13 and the inkjet head 3 from flowing to the first tank 12. The inkjet recording device 1 can also prevent the ink from dropping from the nozzles of the inkjet head 3. That is, the inkjet recording device 1 can prevent the ink 200 from dropping from the nozzles of the nozzle surface 31 of the inkjet head 3 by using the potential energy of the ink 200 when the device is stopped. In this way, the ink circulation device 4 of the inkjet recording device 1 can hold the liquid in the inkjet head 3 when the device is stopped.

[0048] Therefore, the negative pressure on the nozzle surface 31 of the inkjet head 3 can be maintained if the inkjet recording device 1 is stopped, and the circulation of the ink 200 can be started while the negative pressure on the nozzle surface 31 is maintained when the inkjet recording device 1 is driven next time. Therefore, the inkjet recording device 1 does not need to perform a control operation for ink supply during a period from the start of the next driving of the inkjet recording device 1 to the dispensing of the ink 200 from the inkjet head 3, and a time from the driving until the ink 200 can be dispensed can be shortened.

[0049] Since the inkjet recording device 1 is implemented to use the potential energy of the ink 200, a sensor or the like is not required for liquid surface management of the first chamber 121 of the first tank 12 and the first chamber 131 of the second tank 13, and thus the liquid surface management can be performed with a simple configuration. The liquid surface LA of the first chamber 121 of the first tank 12 and the liquid surface LB of the first chamber 131 of the second tank 13 are kept constant by the partition walls 123 and 133. Therefore, the inkjet recording device 1 can simplify the device configuration and control without requiring complicated control such as control requiring a program for the liquid surface management.

[0050] Since the second tank 13 downstream of the pump 14 is opened to the atmosphere by opening the second opening and closing valve 16 when the pump 14 is driven, pulsing does not occur in the ink 200 supplied to the inkjet head 3 due to sending of the ink 200 by the pump 14. Therefore, since the circulation of the ink 200 can be performed at a desired circulation flow rate of the ink 200, pressure fluctuation in the inkjet head 3 including the nozzle surface 31 is prevented. In the inkjet recording device 1, liquid droplets can be more stably dispensed from the inkjet head 3, and printing accuracy can be improved.

[0051] In the inkjet recording device 1, the ink supply tank 11 is sealed, and the lower end of the first tube connecting the ink supply tank 11 to the first chamber 121 of the first tank 12 is disposed at the upper end of the partition wall 123 (the height of the liquid surface LA). Accordingly, replenishment of the ink 200 from the ink supply tank 11 to the first chamber 121 of the first tank 12 which is an ink circulation system is also automatically performed. Therefore, the inkjet recording device 1 does not need to perform control for supplying the ink 200 from the ink supply tank 11 to the first chamber 121 of the first tank 12 until the ink supply tank 11 is empty.

[0052] According to the inkjet recording device 1 according to the embodiment described above, the device configuration and control can be simplified, and the negative pressure on the nozzle surface of the inkjet head 3 can be maintained when the device is stopped.

[0053] The embodiment is not limited to the example described above. For example, in the example described above, the pump 14 is a tube pump (a peristaltic pump). However, the pump 14 may be implemented to have a function of closing the second tube 172 by being stopped to regulate the flow of the ink 200. For example, the pump 14 may include a pump body that supplies the ink 200 from upstream to downstream, and a normally closed opening and closing valve that is opened if the pump body is driven and is closed if the pump body is stopped.

[0054] In the example described above, the first tank 12 recovers the liquid 200 exceeding the partition wall 123 from the first chamber 121 into the second chamber 122. However, the liquid dispensing recording device 1 is not limited to the configuration. That is, the liquid dispensing recording device 1 may include a device that draws the liquid 200 recovered in the second chamber 122 of the first tank 12 into the liquid supply tank 11. For example, a device that draws the liquid 200 in the second chamber 122 of the first tank 12 into the liquid supply tank 11 may be implemented to include, for example, a tube, a pump, and a filter.

[0055] In the example described above, the liquid dispensing recording device 1 circulates the ink 200 as a liquid in the ink circulation device 4 and dispenses the liquid from the inkjet head 3, and the liquid is not limited to the ink 200. That is, the liquid dispensing recording device 1 can be used for, for example, a 3D printer, an industrial manufacturing machine, and a medical application, and the liquid circulation device 4 can hold the liquid of the liquid dispensing head 3 in various liquids when the device is stopped.

[0056] According to at least one embodiment described above, a liquid dispensing recording device can be provided, which is capable of maintaining the negative

pressure on the nozzle surface of the liquid dispensing head when the device is stopped.

[0057] While a certain embodiment is described, the embodiment is presented as an example and is not intended to limit the scope of the exemplary embodiment. Such new embodiments can be implemented in other various forms, and various omissions, replacements, and changes can be made without departing from the spirit of the exemplary embodiment. The embodiments and the modification thereof are in the scope and the spirit of the exemplary embodiments and are also in the exemplary embodiments described in the scope of claims and an equivalent scope thereof.

Claims

1. A liquid dispensing recording device comprising:

a liquid dispensing head (3) configured to dispense a liquid;
a liquid supply tank (11) configured to store the liquid;
a pump (14) configured to regulate a flow of the liquid when the pump is stopped by setting an amount of the liquid to be supplied larger than a sum of an amount of the liquid passing through the liquid dispensing head and an amount of the liquid dispensed from the liquid dispensing head;
a first tank (12) connected downstream of the liquid supply tank and upstream of the pump, and having a liquid surface at a position lower than a nozzle surface of the liquid dispensing head;
a second tank (13) connected downstream of the pump and upstream of the liquid dispensing head, and having a liquid surface at a position higher than the nozzle surface of the liquid dispensing head, wherein
if a liquid surface difference between the liquid surface of the first tank and the liquid surface of the second tank is defined as h, the nozzle surface of the liquid dispensing head is located at or above a midpoint of the liquid surface difference h while the device is stopped.

2. The device according to claim 1, further comprising:

a tube (173) connecting the first tank to the second tank; and
a normally closed first opening and closing valve provided in the tube, wherein
the second tank includes a second tank partition wall partitioning an interior thereof into two chambers, one of the chambers (131) partitioned by the second tank partition wall is connected downstream of the pump and upstream of the liquid dispensing head, and the other chamber (132) partitioned by the second tank partition wall is connected to the tube.

3. The device according to claim 2, further comprising:

a normally closed second opening and closing valve, wherein
the second tank includes an atmosphere opening portion, and
the second opening and closing valve opens and closes the atmosphere opening portion.

4. The device according to claim 3, wherein
the first opening and closing valve and the second opening and closing valve are opened when the pump is driven.

5. The device according to any one of claims 1 to 4, further comprising:

a first tube(171) connecting the liquid supply tank to the first tank, wherein
the first tank includes a first tank partition wall partitioning an interior thereof into two chambers, and
a lower end of the first tube that connecting the liquid supply tank to the first tank is provided at a height position same as the first tank partition wall of one of the chambers partitioned by the first tank partition wall.

6. The device according to any one of claims 1 to 5, wherein the first tank is opened to the atmosphere.

7. The device according to any one of claims 1 to 6, further comprising:
a second tube (172) connecting the first tank to the second tank, the pump being provided on said second tube.

8. The device according to claim 7, wherein

a lower end of said second tube is disposed at a position lower than the first tank partition wall, and
an upper end of said second tube is disposed at a position lower than the second tank partition wall.

9. The device according to any one of claims 2 to 8, further comprising:
a third tube (173) connecting the second tank (13) to the first tank (12) wherein an upper end of the third tube (173) is connected to said other chamber (132) of the second tank (13).

10. The device according to any one of claims 1 to 9,

further comprising:
a fourth tube (174) connecting the second tank to the inkjet head.

11. The device according to claim 10, wherein the fourth tube (174) connects said one of the chambers (131) of the second tank (13) to the inkjet head (3).

12. The device according to any one of claims 1 to 11, further comprising:
a fifth tube (175) connecting the inkjet head to the first tank.

13. The device according to any one of claims 1 to 12, wherein:
the liquid supply tank is sealed.

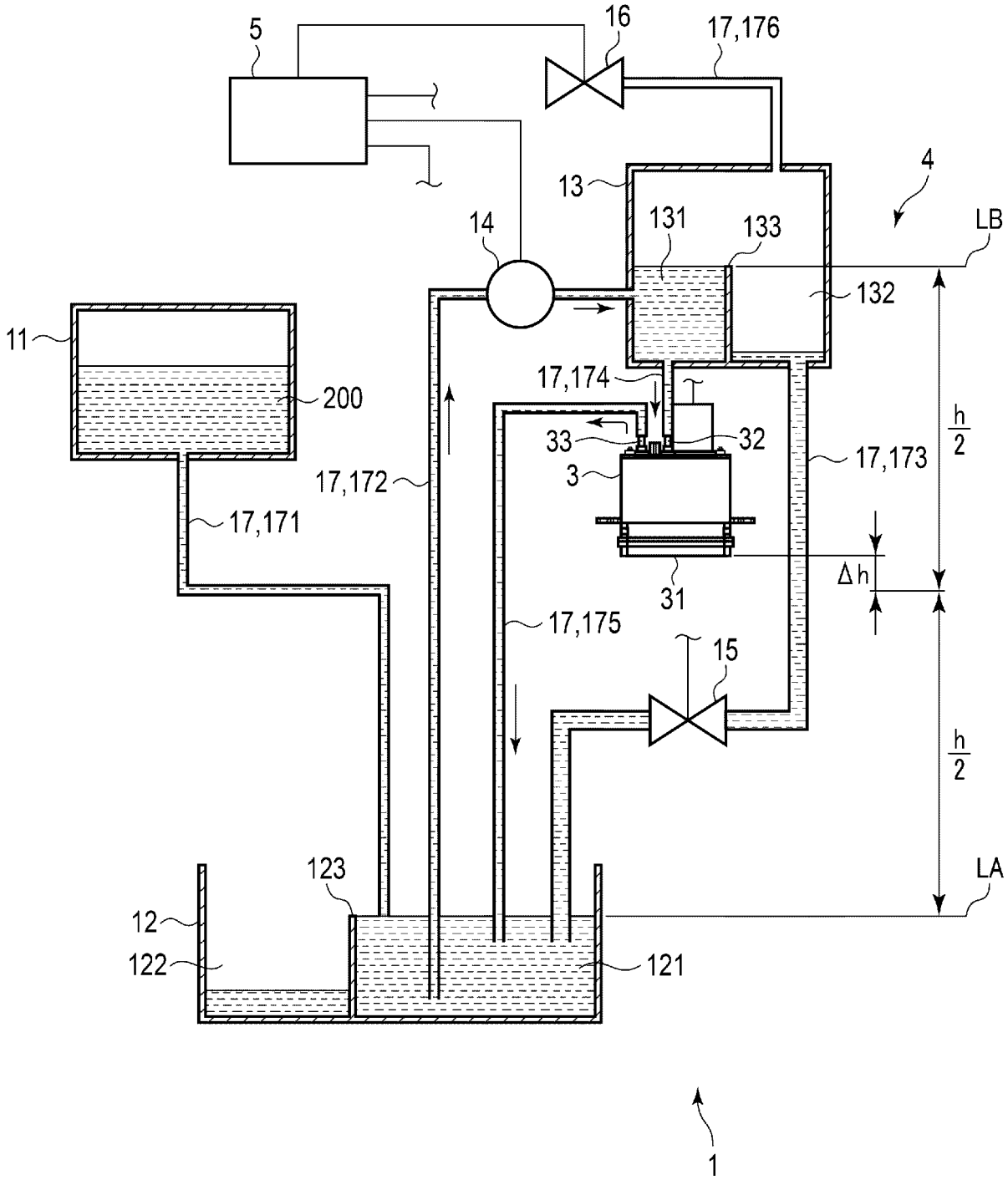
5
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FIG.1

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EUROPEAN SEARCH REPORT

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EP 23 20 7505

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 April 2024	Bitane, Rehab

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