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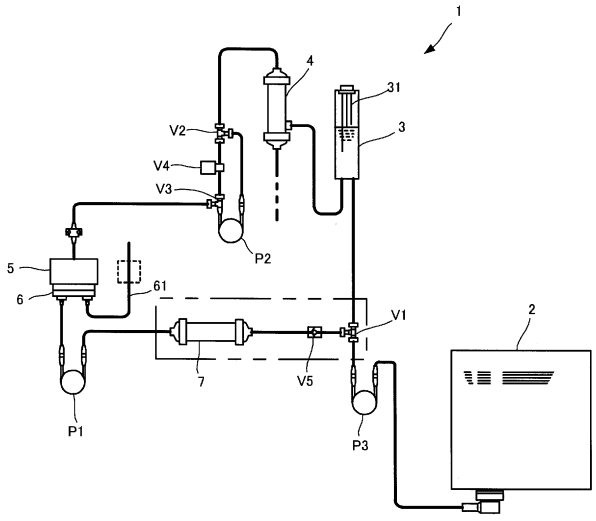
(54) INKJET PRINTING DEVICE

(57) An object of the present invention is to provide an inkjet printing device capable of effectively using unused ink ejected by means of a blank ejection operation, etc. The present invention provides an inkjet printing device 1 for performing printing by ejecting ink onto a print object, the printing device 1 including a first ink tank 2 for storing ink, a second ink tank 3 for storing the ink supplied from the first ink tank 2, a print head 5 provided with nozzles for ejecting the ink supplied from the second ink tank 3 onto a print object, a deaerating means 4 for removing air bubbles from the ink, the deaerating means being disposed between the second ink tank 3 and the print head 5, and a recycle flow path for returning unused ink ejected from the nozzles of the print head 5 back to the second ink tank 3.

Fig.1



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Description

Technical Field

[0001] The present invention relates to an inkjet printing device.

Background Art

[0002] Hitherto, an inkjet printing device for performing printing by ejecting ink onto a print object, such as fabric, has been proposed. In this inkjet printing device, ink is ejected from the nozzles of the print head. When ink remains in the nozzles and dries, the viscosity of the ink remaining in the nozzles increases, possibly causing clogging in the nozzles. In order to remove ink having an increased viscosity from the nozzles of the print head, a so-called blank ejection operation, in which the ink in the nozzles is forcibly removed with a suction pump or the like, is regularly performed (e.g., Patent Document 1).

Citation List

Patent Document

[0003]

Patent Document 1: JP7-246710A

Summary of Invention

Technical Problem

[0004] The ink ejected by means of the above-mentioned blank ejection operation, etc., is discarded without being used; such unused ink is needlessly wasted. In view of this problem, an object of the present invention is to provide an inkjet printing device capable of effectively using unused ink ejected by means of a blank ejection operation, etc.

Solution to Problem

[0005] The inkjet printing device according to the present invention performs printing by ejecting ink onto a print object. The printing device according to the present invention includes a first ink tank for storing ink, a second ink tank for storing the ink supplied from the first ink tank, a print head provided with nozzles for ejecting the ink supplied from the second ink tank onto a print object, a deaerating means for removing air bubbles from the ink, the deaerating means being disposed between the second ink tank and the print head, and a recycle flow path for returning unused ink ejected from the nozzles of the print head back to the second ink tank.

[0006] The above-described inkjet printing device is provided with a recycle flow path for returning, back to the second ink tank, unused ink ejected by means of a blank ejection operation or the like from the nozzles of the print head. The blank ejection operation is performed for preventing the nozzles from clogging. The unused ink ejected by means of the blank ejection operation or the like can thereby be effectively used. The ink recycled in the above manner sometimes includes air bubbles, etc.; however, because a deaerating means is disposed between the second ink tank and the print head of the present invention, ink with no air bubbles can be supplied to the print head. Further, because a deaerating means is disposed between the second ink tank and the print head, the second ink tank may be an open tank such that the ink is in contact with the air.

[0007] The above-described inkjet printing device can have a variety of configurations. For example, the pressure loss of ink in the deaerating means is preferably 0.1 kPa or less. The resistance from the second ink tank to the print head is thereby reduced, achieving smooth ink supply by means of the hydraulic head system. For the same reason as above, the deaerating means is preferably an external perfusion type.

[0008] The first ink tank, the second ink tank, and the deaerating means may be connected in line in this order. Due to this configuration, the first ink tank may also be an open tank.

[0009] It is preferable that an ink booster pump be further provided for supplying pressurized ink to the nozzles of the print head. This ink booster pump forcibly discharges ink from the nozzles of the print head, reliably preventing the nozzles from clogging.

[0010] It is also preferable to provide a suction pump for suctioning the ink from the nozzles of the print head, in order to forcibly discharge the ink from the nozzles of the print head.

Advantageous Effects of Invention

[0011] The inkjet printing device according to the present invention can effectively use unused ink ejected by means of blank ejection operation or the like.

Brief Description of Drawings

[0012]

Figure 1 schematically illustrates one embodiment of the inkjet printing device of the present invention. Figure 2 is a partial sectional view of one embodiment of the deaerating module of the present invention.

Description of Embodiments

[0013] Embodiments of the inkjet printing device of the present invention are described below with reference to the drawings.

[0014] As illustrated in Fig. 1, in an inkjet printing device 1, ink stored in a first ink tank 2 is supplied to a second

ink tank 3 to be temporarily stored in the second ink tank 3. After the ink in the second ink tank 3 is deaerated with a deaerating module 4, the ink is supplied to a print head 5. The print head 5 then ejects the ink onto a print object to perform printing. The inkjet printing device 1 further includes a suction pad 6, a suction pump P1, and an ink booster pump P2, which serve as clogging prevention means for preventing the nozzles of the print head 5 from clogging. A filter unit 7 is also provided for removing dust, etc., from unused ink ejected by means of a blank ejection operation from the print head 5 by using the clogging prevention means.

[0015] The first ink tank 2 is an open tank for storing ink to be supplied to the second ink tank 3. When the ink in the first ink tank 2 is consumed, the tank 2 is replaced with a new first ink tank 2. Alternatively, it is also possible to refill the first ink tank 2 with ink. Although the first ink tank 2 is an open tank, it may be a closed tank, which does not allow the ink to be in contact with the air. The capacity of the first ink tank 2 is not limited, and is generally about 5 to 10 L.

[0016] The second ink tank 3 is connected to the first ink tank 2 via an ink feed pump P3 and a three-way valve V1. The second ink tank 3 is an open ink tank for temporarily storing ink supplied from the first ink tank 2 and ink ejected by means of a blank ejection operation. The second ink tank 3 supplies the ink to the print head 5 by means of the hydraulic head system. The second ink tank 3 is provided with a liquid surface detection sensor 31 for detecting the liquid surface of the ink to control the hydraulic head. When the liquid surface detection sensor 31 detects that the liquid surface of the ink stored in the second ink tank 3 is lowered to below the set value while printing is performed, the ink feed pump P3 is operated to supply ink from the first ink tank 2 to the second ink tank 3. Although the second ink tank 3 is an open tank, it may also be a closed tank. The capacity of the second ink tank 3 is smaller than that of the first ink tank 2, and is generally about 70 to 100 mL.

[0017] The deaerating module 4 is located between the second ink tank 3 and the print head 5. The deaerating module 4 is a unit for removing air bubbles from the ink fed from the second ink tank 3 to the print head 5. More specifically, as shown in Fig. 2, the deaerating module 4 is an external perfusion type, and a plurality of hollow strings 42 are housed in a hollow tube-like body 41. To reduce the pressure inside each hollow string 42, at least one of the upper or lower end of each hollow string 42 is connected to a vacuum pump P4. In the deaerating module 4, the ink fed to the tube-like body 41 flows outside the hollow strings 42 so as to be deaerated. Specifically, the ink fed from the second ink tank 3 to the tube-like body 41 through a supply port 43 is sent to the center of the tube-like body 41; while being directed radially outwardly, the ink is brought into contact with the outer surface of each hollow string 42, and air bubbles in the ink are thereby absorbed into the inside of each hollow string 42. The deaerated ink is then fed to the print head 5 from the tube-like body 41 via the outlet 44. The pressure loss of the ink in the deaerating module 4 is preferably 0.1 kPa or less. The vacuum pump P4 corresponds to a pressure-reducing means of the present invention.

[0018] The print head 5 ejects the ink supplied from the second ink tank 3 via the deaerating module 4 onto a print object. A known print head having a plurality of nozzles can be used. Between the print head 5 and deaerating module 4, two three-way valves V2 and V3, a pinch valve V4 provided between the three-way valves V2 and V3, and an ink booster pump P2 are disposed. The ink booster pump P2 is connected, via the three-way valves V2 and V3, to the flow path connecting to the deaerating module 4 and the print head 5. When printing is performed, the pinch valve V4 is in an open state, and the ink from the second ink tank 3 is supplied to the print head 5 via the three-way valves V2 and V3, and the pinch valve V4, without passing through the ink booster pump P2. In contrast, in the event that the pressurized ink is supplied to the nozzles of the print head 5 to prevent the nozzles of the print head 5 from clogging, the pinch valve V4 is set to a closed state. Thereby, the ink from the second ink tank 3 is sent to the ink booster pump P2, via the three-way valves V2 and V3, which allows high-pressure ink to be supplied to the nozzles of the print head 5 to forcibly discharge the ink from the nozzles, preventing the nozzles from clogging. The ink from the ink booster pump P2 is discharged to the suction pad 6 described later.

[0019] As a means for eliminating clogging of the nozzles of the print head 5, the suction pad 6 and the suction pump P1 are provided. The suction pad 6 is provided so as to hermitically seal the nozzle portion of the print head 5. When the suction pump P1 is operated while the nozzle portion of the print head 5 is hermetically sealed with the suction pad 6, the ink in the nozzles of the print head 5 is forcibly suctioned to be discharged to the suction pad 6. The suction pad 6 is removed from the print head 5 when printing is performed. Because the suction pad 6 covers the nozzles of the print head 5, it also functions as a cap, preventing the ink within the nozzles from drying. The suction pad 6 is attached to an ink-discharging tube 61. When an opening and closing means (not shown), such as an opening and closing valve, provided with the ink-discharging tube 61 is set to a closed state, the ink within the nozzles of the print head 5 is suctioned as described above. When the opening and closing means is set to an open state, only the ink within the suction pad 6 is suctioned, while the ink within the nozzles of the print head 5 is not suctioned. The flow path from the suction pad 6 to the second ink tank 3 corresponds to the recycle flow path of the present invention.

[0020] The ink discharged to the suction pad 6 is returned to the second ink tank 3 via a filter unit 7, a check valve V5, and the three-way valve V1. As the ink passes through the filter unit 7, dust, etc., is removed from the ink. The check valve V5 is provided to prevent the ink from flowing in reverse. The check valve V5 prevents the

ink fed from the first ink tank 2 to the second ink tank 3 from flowing into the filter unit 7. When returning the ink discharged to the suction pad 6 back to the second ink tank 3, the ink feed pump P3 is stopped.

[0021] The embodiments of the present invention are described above. However, the present invention is not limited thereto, and various modifications can be made without departing from the spirit of the present invention. For example, in the above embodiments, two clogging prevention means, i.e., a suction means consisting of a suction pad 6 and a suction pump P1, and a booster means consisting of an ink booster pump P2, are used as clogging prevention means of the nozzles of the print head 5; however, it is possible for only one of the means to be used.

Explanation of Reference Numerals

[0022]

1. Inkjet Printing Device
2. First Ink Tank
3. Second Ink Tank
4. Deaerating Module (Deaerating Means)
5. Print Head

P1: Suction Pump
P2: Ink Booster Pump

Claims

1. An inkjet printing device for performing printing by ejecting ink onto a print object, the device comprising:

a first ink tank for storing ink;
a second ink tank for storing the ink supplied from the first ink tank;
a print head provided with nozzles for ejecting the ink supplied from the second ink tank onto a print object;
a deaerating means for removing air bubbles from the ink, the deaerating means being disposed between the second ink tank and the print head; and
a recycle flow path for returning unused ink ejected from the nozzles of the print head back to the second ink tank.

2. The inkjet printing device according to claim 1, wherein the deaerating means comprises:

a tube-like body for receiving, inside the body, ink from the second ink tank;
a plurarity of hollow strings provided inside the tube-like body; and
a pressure-reducing means for reducing the pressure inside each hollow string.

3. The inkjet printing device according to claim 1 or 2, wherein a pressure loss of the ink in the deaerating means is 0.1 kPa or less.

4. The inkjet printing device according to any one of claims 1 to 3, wherein the first ink tank, the second ink tank, and the deaerating means are connected in line in this order.

5. The inkjet printing device according to any one of claims 1 to 4, wherein either one of the first or second ink tank is an open tank.

6. The inkjet printing device according to any one of claims 1 to 5, further comprising an ink booster pump for supplying pressurized ink to the nozzles of the print head.

7. The inkjet printing device according to any one of claims 1 to 6, further comprising a suction pump for suctioning ink from the nozzles of the print head.

Fig.1

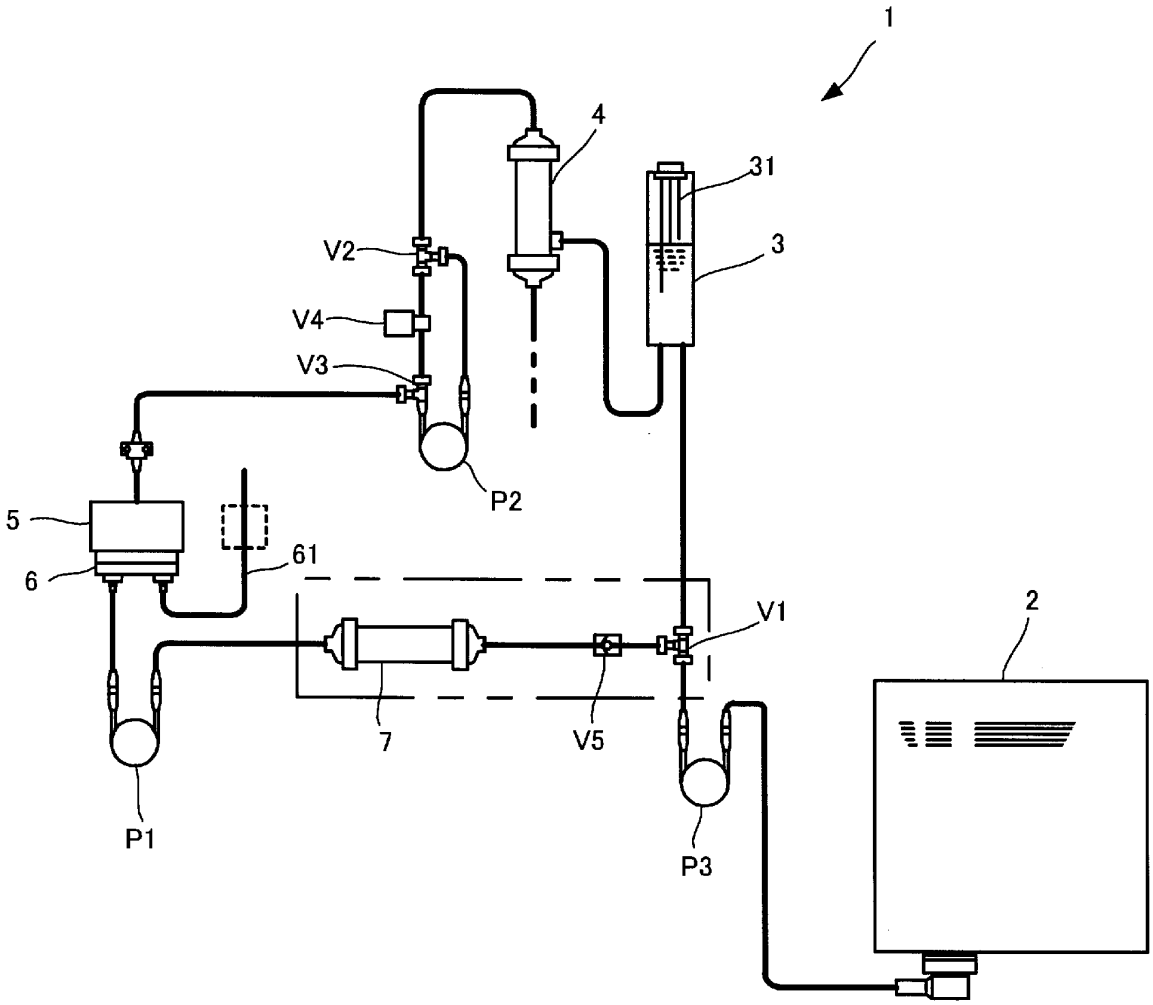
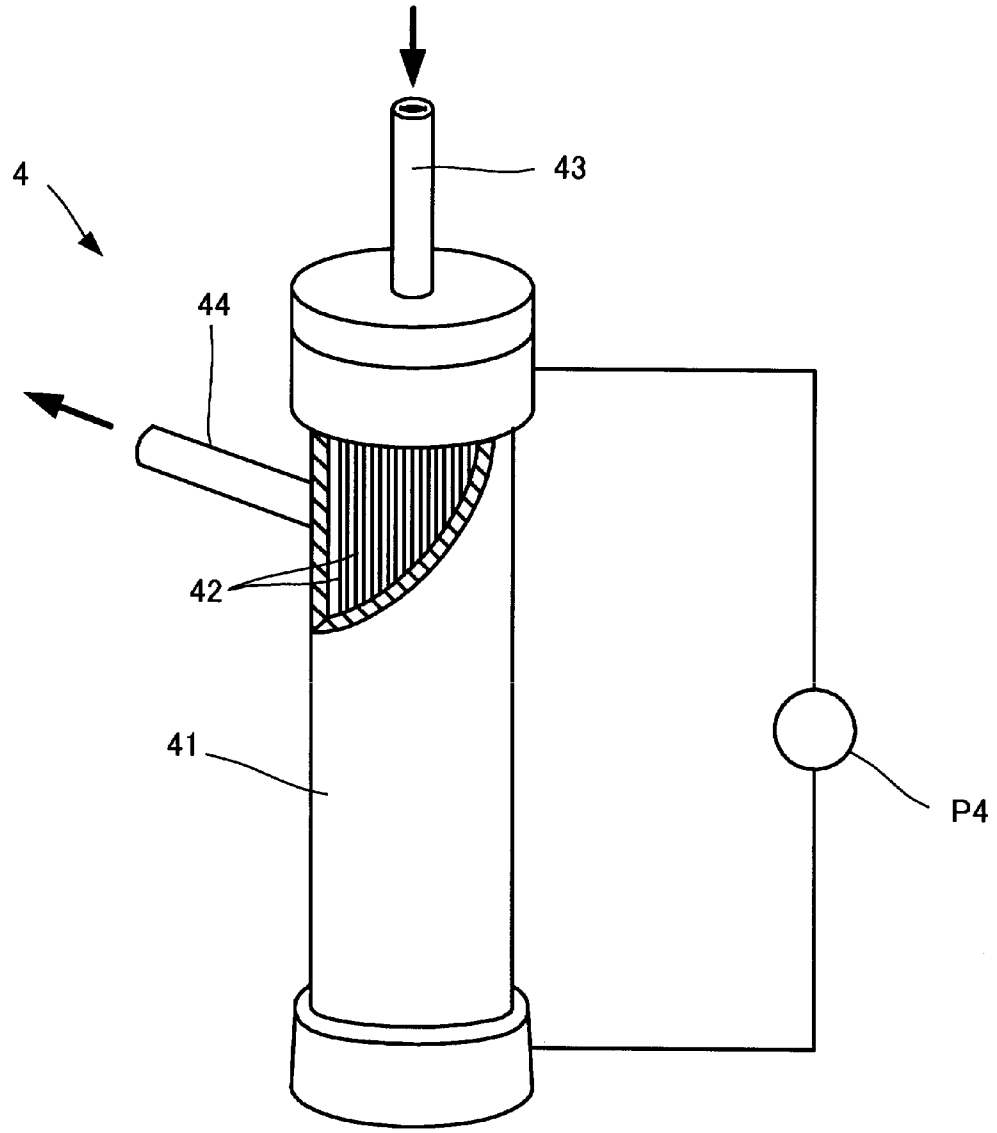


Fig.2



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/078675

A. CLASSIFICATION OF SUBJECT MATTER
B41J2/175(2006.01)i, *B41J2/18*(2006.01)i, *B41J2/185*(2006.01)i, *D06P5/00*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B41J2/175, B41J2/18, B41J2/185, D06P5/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2012
Kokai Jitsuyo Shinan Koho	1971-2012	Toroku Jitsuyo Shinan Koho	1994-2012

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2001-328283 A (Canon Aptex Inc.), 27 November 2001 (27.11.2001), paragraphs [0027] to [0030]; fig. 1 (Family: none)	1-7
Y	JP 2008-49582 A (SII Printek Inc.), 06 March 2008 (06.03.2008), paragraphs [0019] to [0024]; fig. 1 (Family: none)	1,2,4-7
Y	JP 2008-114170 A (Mitsubishi Rayon Engineering Co., Ltd.), 22 May 2008 (22.05.2008), paragraphs [0011], [0023]; fig. 2 (Family: none)	3-7

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search 04 January, 2012 (04.01.12)	Date of mailing of the international search report 17 January, 2012 (17.01.12)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 7246710 A **[0003]**