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(54) **Inkjet cartridge cleaning techniques**

(57) Aspects of this invention relate to processes and devices for cleaning a used inkjet cartridge. According to a first aspect a method is provided for cleaning an inkjet cartridge by forcing flow of ultra-clean water in the inkjet cartridge chamber. In another aspect a device is proposed for forcing the circulation of ultra clean water in the inkjet chamber. The proposed device has means for injecting ultra clean water through the upper part of an inkjet cartridge, through inkjet chamber ventilation holes. The proposed device further comprises means for sucking wastewater through the lower part of the cartridge, through the print-head. For the latter to take place, special adaptors have been developed that attach to the print-head and exercise negative pressure (suction) to the inkjet chamber.

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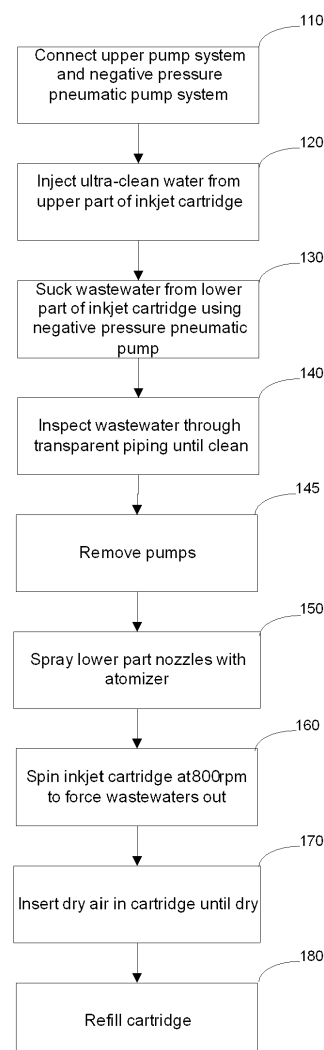


Fig. 3

Description

Technical Field

[0001] The present disclosure relates to computer peripherals and more specifically to cleaning techniques used during remanufacturing computer printing consumables.

Background Art

[0002] The demand for lower cost printing consumables has grown the need for reliable remanufactured or refilled used print cartridges. One category of print cartridges is inkjet print cartridges also called inkjet cartridges or ink cartridges.

[0003] There are many known techniques in the art for refilling or remanufacturing. In US7802859 a method of refilling a used ink cartridge is disclosed. A known problem related to inkjet cartridges is the clogging of the nozzles due to dried ink, air bubbles or dirt. In US5563636 a method of priming an inkjet cartridge is disclosed to deal with the specific problem.

[0004] However, although there are many techniques to refill a used inkjet cartridge or to prime a filled inkjet cartridge, it still remains an issue how to prepare a used inkjet cartridge for refilling. More specifically, cleaning a used inkjet cartridge to rid of residual dried ink in the chamber and the nozzles is critical to the success of refilling.

[0005] It would be desirable to introduce a technique for cleaning a used inkjet cartridge before refilling so as to become free of any residues in the ink chamber or in the printing nozzles.

Summary of invention

[0006] It is an object of this invention to propose a technique for cleaning a used inkjet cartridge before refilling so as to become free of any residues in the ink chamber or in the printing nozzles.

[0007] Aspects of this invention relate to processes and devices for cleaning a used inkjet cartridge. According to a first aspect a method is provided for cleaning an inkjet cartridge by forcing circulation of ultra-clean water in the inkjet cartridge chamber. The term "ultra clean water" is used in the present disclosure to describe water that has a conductivity that is lower than five micro Siemens (5 μ S).

[0008] In another aspect a device is proposed for forcing the circulation of ultra clean water in the inkjet chamber. The proposed device has means for injecting ultra clean water through the upper part of an inkjet cartridge, through inkjet chamber ventilation holes. The proposed device further comprises means for sucking wastewater through the lower part of the cartridge, through the print-head nozzles. For the latter to take place, special adaptors have been developed that attach to the print-head

and exercise negative pressure (suction) to the inkjet chamber.

[0009] In a further aspect of the invention, the water flowing through the lower part is visually inspected as it flows through means for inspecting, such as transparent piping.

[0010] Water circulation is continued until clean water is coming out from both the upper part of the cartridge, overflowing the upper chamber ventilation holes, and from the lower part, flowing in the suction piping.

[0011] In a further aspect, following the removal of the device attached to the cartridge print-head, atomised water, i.e. a mix of water and compressed air resulting in water droplets of very small dimensions, is sprayed on the print-head, further contributing to a print-head completely free of ink or any other residues.

[0012] In a yet further aspect, an inkjet cartridge is inserted in a spinner after being cleaned with ultra-clean water. It is spun at 800 rpm with the print-head looking outwards so that the water is force-ejected through centrifugal power.

[0013] This is followed by a drying cycle, where warm air is injected into the cartridge chamber(s).

[0014] The result of the above described process is a completely fresh cartridge ready for refilling.

Brief description of drawings

[0015] FIG. 1 is a lower perspective view of an inkjet cartridge.

[0016] FIG. 2 is a top plan view of the inkjet cartridge of FIG. 1.

[0017] FIG. 3 is a flow chart illustrating a method of cleaning an inkjet cartridge according to an exemplary embodiment.

Description of embodiments

[0018] FIG. 1 is a lower perspective view of inkjet cartridge 10. Inkjet cartridge 10 includes print-head 12 located at the bottom of cartridge 10 below an ink holding chamber (not shown). Print-head 12 includes a nozzle plate 16 with two arrays 18, 20 of ink ejection nozzles 22. In the embodiment shown, each array 18, 20 is a single row of nozzles 22. Flexible circuit 28 carries electrical traces from external contact pads 30 to firing resistors (not shown) positioned behind ink ejection nozzles 22.

[0019] FIG. 2 is a top plan view of inkjet cartridge 10 of FIG. 1. Openings 48 and 49 formed in cover 40 are covered by a label or other suitable adhesive sheet 50. Vent openings 48 are exposed to the atmosphere through circuitous tunnels 52. Each tunnel 52, commonly referred to as a labyrinth, is formed by a recess in the top of cover 40 that extends past the edge of label 50. Labyrinths, which are well known in the art of inkjet printing, are commonly used for venting ink cartridges to slow the rate of evaporation.

[0020] FIG. 3 is a flow chart illustrating method 100 of cleaning an inkjet cartridge according to an exemplary embodiment. In a first step 110, a high pressure pump system is connected to the upper part of the inkjet cartridge through openings, such as openings 48 and/or 49 of FIG. 1, and a negative low pressure pneumatic pump system is attached to the print-head at the lower part of the inkjet cartridge. In next step 120, ultra-clean water is injected from upper-part openings, such as openings 48 and/or 49 shown in FIG. 2, with the assistance of a high-pressure pump. In step 130, wastewater is sucked through nozzles, such as nozzles 22 of FIG. 1, at the lower part of the inkjet cartridge using negative pressure with the help of a negative low pressure pneumatic pump system. These dual-pressure steps, high-pressure from upper-part, negative low pressure from lower part, creates a circulation path for the water. At the same time, water is free to overflow the cartridge around the needles and through the openings. This is a desirable and expected result as the openings are wider than the width of the needles, the nozzles are very small and only a fraction of the water can flow through them and the negative low pressure is lower than the pressure of the water injected in the cartridge chamber. The piping of the negative low pressure pneumatic pump system is selected transparent so as to allow visual inspection of the fraction of wastewater that flows through the nozzles into the piping, as shown in step 140. Transparent flexibel plastic piping may be used for that purpose. When the visual inspection confirms that the wastewater is sufficiently clean, then both the high pressure pump system and the negative low pressure pneumatic pump system are removed from the inkjet cartridge, as shown in step 145. In a further step 150, atomized water is sprayed to the nozzles. The reason for the above is that some nozzles may remain clogged even after water has flown through the nozzles. When water is force-circulated through the print-head it follows the easiest way out and theoretically could by-pass some clogged holes. In step 160, the inkjet cartridge is spun at 800rpm to force wastewater out. In step 170, dry air is inserted in the cartridge until the cartridge is completely dry. In final step 180, the cartridge is refilled.

[0021] The high-pressure pump system may include at least a high-pressure pump and a set of syringe type needles, one for each opening. The negative low pressure pneumatic pump system may include at least a pump, a flexible transparent piping such as transparent flexibel plastic piping and a set of fittings, one for the pump and another for the print-head of the inkjet cartridge.

[0022] It should be noted that instead or on top of the visual inspecting, a pH reading may be applied at the output of the negative low pressure piping. pH reading of ultra-clean water is substantially different from that of water contaminated with ink. This pH reading may be stand alone or differential. In the first case a reference value is compared and when deviation from the reference

value is within a predefined range the cleaning process is considered complete. In the case of differential reading, a pH reading at the input is compared to a pH reading at the output. When the difference is within a predefined range the cleaning process is considered complete.

[0023] The method of cleaning used inkjet cartridges has been described in relation to a used inkjet cartridge having one chamber, which is typically a one colour cartridge. However, the same method can be used to clean a multi-colour, typically tri-colour, cartridge having a plurality of chambers, one for each colour. In this case the high-pressure pump system is connected to each chamber with at least one needle inserted in each chamber.

[0024] One skilled in the art may appreciate that inkjet cartridge 10 is used as an example. Any other inkjet cartridge having substantially an inkjet chamber, a print-head with nozzles and a cover with ventilation openings may be cleaned with the proposed method.

Claims

1. A method of remanufacturing an inkjet cartridge having at least an inkjet cartridge chamber with unwanted ink residues, comprising: (i) injecting ultra-clean water, having a conductivity with a value $C < 5\text{mS}$, through at least one upper opening of the inkjet cartridge until wastewater overflows through the at least one opening; and (iii) sucking wastewater through nozzles of a print-head at the lower part of the cartridge to create a flow path, wherein any ink residues in the inkjet cartridge chamber are removed due to the flow of the ultra-clean water.
2. The method of claim 1, further comprising inspecting the sucked wastewater until clean water comes through the lower part.
3. The method of claim 1, further comprising measuring the wastewater's pH value until it reaches a predefined range.
4. The method of claim 2, further comprising spraying atomised water to the nozzles of the print-head to remove any remaining ink clogs.
5. The method of claim 4, further comprising spinning the inkjet cartridge to force-eject the wastewater.
6. The method of claim 5, further comprising drying the inkjet cartridge.
7. The method of claim 6, further comprising refilling the dry inkjet cartridge with ink.
8. A device for remanufacturing an inkjet cartridge having at least an inkjet chamber with unwanted ink residues, comprising: (i) means for injecting ultra-clean

water, having a conductivity with a value $C < 5\text{mS}$, through at least one upper opening of the inkjet cartridge until wastewater overflows through the at least one opening; and (ii) means for sucking wastewater through nozzles of a print-head at the lower part of the cartridge to create a flow path, wherein any ink residues in the inkjet cartridge chamber are removed due to the flow of the ultra-clean water. 5

9. The device of claim 8, further comprising means for inspecting the sucked wastewater until clean water comes through the lower part. 10

10. The device of claim 8, further comprising means for measuring the wastewater's pH value until it reaches a predefined range. 15

11. The device of claim 9, further comprising means for spraying atomised water to the nozzles of the print-head to remove any ink clogs. 20

12. The device of claim 11, further comprising means for spinning the inkjet cartridge to force-eject the wastewater. 25

13. The device of claim 12, further comprising means for drying the inkjet cartridge.

14. The device of claim 13, further comprising means for refilling the dry inkjet cartridge with ink. 30

15. An inkjet cartridge remanufactured with the method of claims 1-7.

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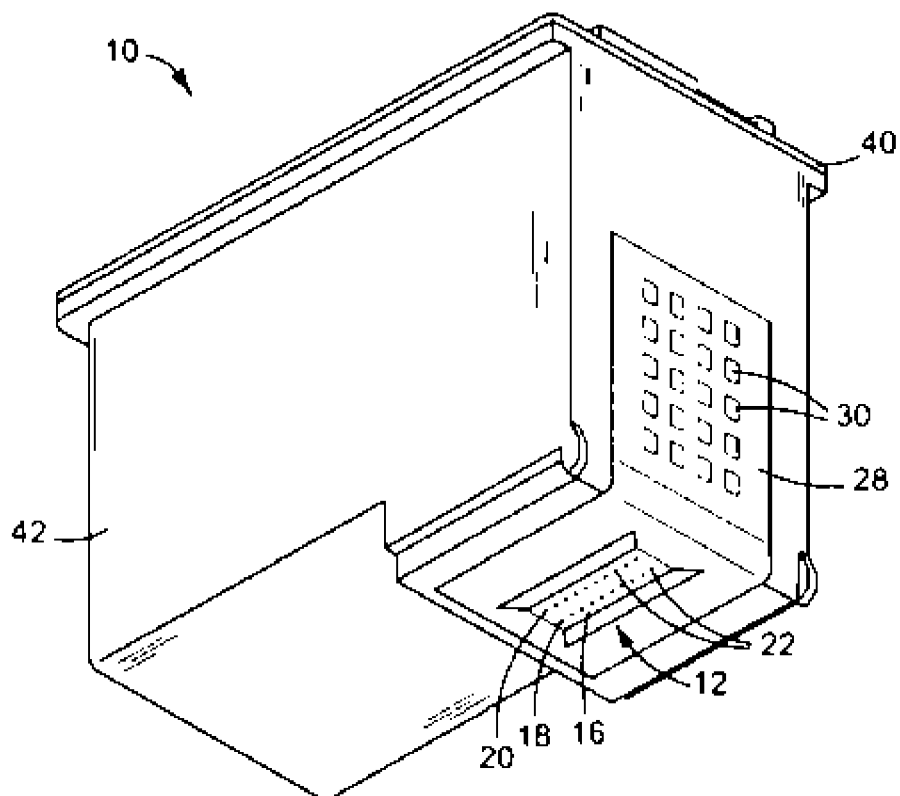


Fig. 1

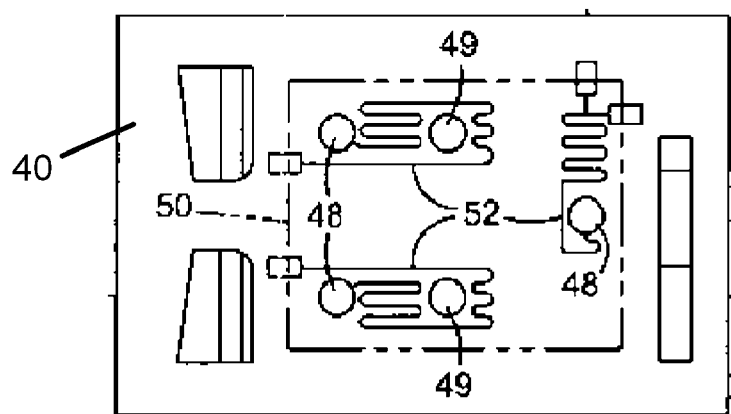


Fig. 2

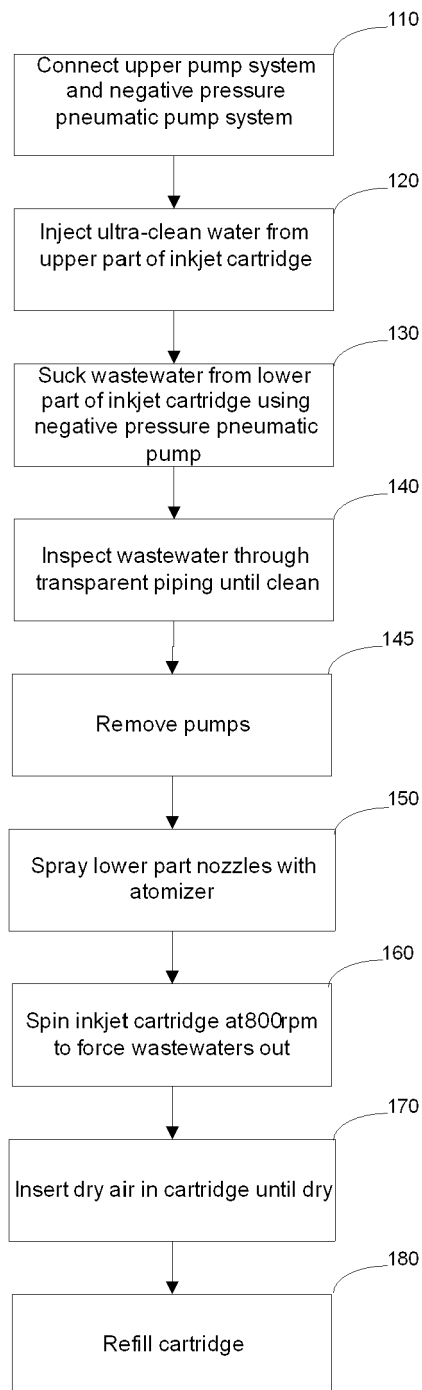


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 11 16 5194

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 013 446 A2 (SEIKO EPSON CORP [JP]) 28 June 2000 (2000-06-28) * paragraphs [0021], [0022]; claims 14, 15, 17, 23-25; figure 5 *	1-15	INV. B41J2/175
X	EP 1 867 454 A1 (CANON KK [JP]) 19 December 2007 (2007-12-19) * paragraphs [0098], [0100], [0145], [0173], [0179]; claims 1, 2, 21, 22; figures 4, 8 *	1-15	
X	US 2004/066429 A1 (WAZANA YOEL [US] ET AL) 8 April 2004 (2004-04-08) * paragraphs [0035], [0038]; figures 1-6 *	1,5,8,12	
X	US 5 933 175 A (STATHEM RALPH L [US] ET AL) 3 August 1999 (1999-08-03) * column 9, lines 38-50; figures 9, 10 *	1,8	
			TECHNICAL FIELDS SEARCHED (IPC)
			B41J
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		15 September 2011	Adam, Emmanuel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 16 5194

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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15-09-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1013446 A2	28-06-2000	AT 239618 T	15-05-2003
		DE 69907613 D1	12-06-2003
		DE 69907613 T2	25-05-2005
		HK 1029963 A1	24-12-2003
		JP 2000238283 A	05-09-2000
		US 6302534 B1	16-10-2001

EP 1867454 A1	19-12-2007	NONE	

US 2004066429 A1	08-04-2004	AU 2003273355 A1	04-05-2004
		EP 1569801 A2	07-09-2005
		WO 2004033209 A2	22-04-2004
		US 2004246316 A1	09-12-2004

US 5933175 A	03-08-1999	US 6139137 A	31-10-2000

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 7802859 A [0003]
- US 5563636 A [0003]