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(71) Applicant: **Rethink SA**
57001 Thessaloniki (GR)

(72) Inventor: **Michelakis, Charalampos**
57001 Thessaloniki (GR)

(54) **Inkjet cartridge cleaning techniques**

(57) Aspects of this invention relate to processes and devices for cleaning a used inkjet cartridge during a re-manufacturing process. According to a first aspect a method is provided for cleaning an inkjet cartridge by inserting ultra-clean water in the inkjet cartridge chamber. In another aspect a device is disclosed for injecting ultra-clean water and creating a circulation path through the nozzles. The proposed device has means for injecting ultra-clean water through the upper part of an inkjet cartridge, through ventilation holes of the inkjet chamber. 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 configurations have been developed that attach to the print-head and exercise negative pressure (suction) to the inkjet chamber.

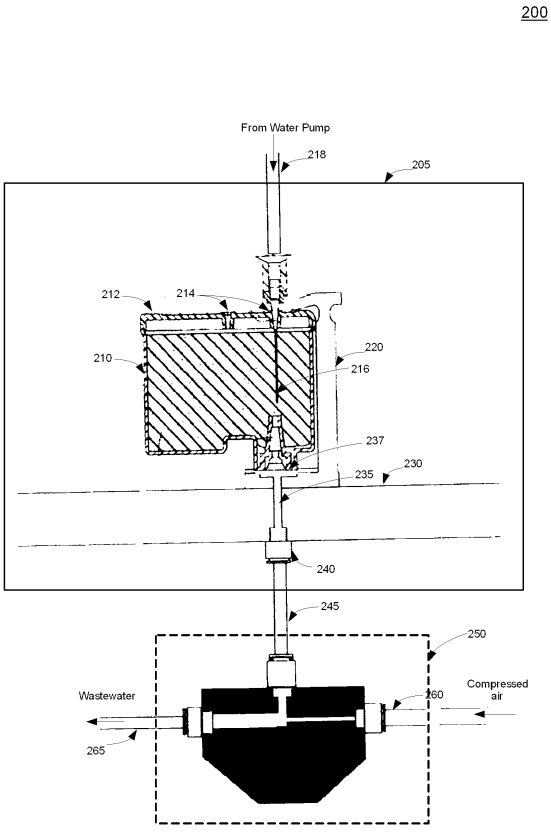

Fig. 4

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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 are inkjet print cartridges also called inkjet cartridges or ink cartridges.

[0003] There are many known techniques in the art for refilling or remanufacturing an inkjet cartridge. 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 value that is lower than five micro Siemens (5μS).

[0008] In another aspect a device is proposed for causing 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 ventilation holes of the inkjet chamber. 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 continues until clean water is coming out from both the upper part of the cartridge, overflowing the ventilation holes, and from the lower part, flowing in the suction piping.

[0011] In a further aspect, the pH value of the wastewater is measured and the cleaning process continues until the measured pH value is within a predefined range assuring that the inkjet cartridge has been sufficiently cleaned.

[0012] In a further aspect, the measured pH value is fed to a controller that controls operation of the cleaning device and terminates the cleaning process when the measured pH value is within a predefined range.

[0013] 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.

[0014] In a yet further aspect, an inkjet cartridge is inserted in a spinner after being cleaned with ultra-clean water. It is spinned at 800 rpm with the print-head looking outwards so that the water is force-ejected through centrifugal power.

[0015] This is followed by a drying cycle, where warm air is injected into the cartridge chamber(s).

[0016] The result of the above described techniques is a completely fresh cartridge ready for refilling.

Brief description of drawings

[0017] FIG. 1 is a lower perspective view of an inkjet cartridge.

[0018] FIG. 2 is a top plan view of the inkjet cartridge of FIG. 1.

[0019] FIG. 3 is a flow chart illustrating a method of cleaning an inkjet cartridge according to an exemplary embodiment.

[0020] FIG. 4 is a cross section view of a cartridge cleaning device according to another exemplary embodiment.

[0021] FIG. 5 is a block diagram of an inkjet cartridge cleaning system (ICCS) according to another exemplary embodiment.

Description of embodiments

[0022] 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.

[0023] 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. Ventilation 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.

[0024] 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 water pump is connected to the upper part of the inkjet cartridge, the inkjet cartridge being placed in a cartridge cleaning configuration, through openings, such as openings 48 and/or 49 of FIG. 1, and a draining apparatus, such as 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 use of the water 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 use of the draining apparatus. These dual-pumping steps, water from upper-part water pump and negative low pressure from lower part draining apparatus, create 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 so 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 between the print-head and the draining is selected transparent so as to allow visual inspection of the fraction of wastewater that flows through the nozzles into the draining apparatus, as described 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 water pump and the draining apparatus are removed from the inkjet cartridge cleaning configuration, as described 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 bypass some clogged holes. In step 160, the inkjet cartridge is spinned 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.

[0025] FIG. 4 is a cross section view of cartridge cleaning device 200 according to another exemplary embodiment. Cartridge cleaning device 200 includes cartridge cleaning configuration 205 and draining apparatus 250 connected with pipe 245. Cartridge cleaning configuration 205 includes cartridge clip 220 secured to the surface of hard board 230. Hard board 230 may be a wooden board although any hard penetratable material may be used. Once cartridge clip 220 is attached to hard board 230, bore 235 is opened with a piercing tool, such as a drill. Bore 235 is opened exactly where inkjet cartridge's print-head 237 is typically attached to cartridge clip 220 and is extended all the way through hard board 230. Any type of piercing tool that can open a bore, such as bore 235, may be used. Once bore 235 is opened, then inkjet cartridge 210 is attached to cartridge clip 220. Inkjet cartridge 210 includes cover 212 and openings 214. From at least one of the openings 214, needle 216, such as a syringe type needle, is inserted. Needle 216 is attached to one end of pipe 218. Pipe 218 is attached at the other end to a water pump (not shown). The water pump is attached to an ultra-clean water purification system that provides the water pump with ultra-clean water having a conductivity value that is less than 5 micro Siemens.

[0026] From the other side of hard board 230, connector 240 is attached to hard board 230, at the opposite opening of bore 235. Pipe 245 is attached to connector 240 at one end. Pipe 245 may be a transparent pipe allowing visual inspection of wastewater flowing through the pipe. At the other end of pipe 245, draining apparatus 250 is attached. Compressed air is inserted through pipe 260 and wastewater is drained through pipe 265.

[0027] Ultra clean water having a conductivity value that is lower than five micro Siemens (5μS), flows from the water pump to pipe 218. Then, through needle 216, ultra clean water floods inkjet cartridge 210. Wastewater is free to overflow inkjet cartridge 210 through openings 214. At the same time, draining apparatus 250 sucks wastewater. This creates a path that allows water to flow through the print-head. Pipe 245 may be used for wastewater visual inspection. Once the wastewater is sufficiently clean, then the cleaning process ends and inkjet cartridge 210 is removed from cartridge clip 220.

[0028] It should be noted that instead or additionally to the visual inspecting, a pH meter may be employed at some point either before the draining apparatus or after. A pH value of ultra-clean water is substantially different from that of water contaminated with ink. The pH meter 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 acceptable range the cleaning process is considered complete. In the case of differential reading, a pH reading of the ultra-clean water is compared to a pH reading of the wastewater at the output. When the difference is within a predefined acceptable range the cleaning process is considered complete.

[0029] FIG. 5 is a block diagram of inkjet cartridge

cleaning system (ICCS) 500 according to another exemplary embodiment. ICCS 500 includes cartridge cleaning device 510, similar to cartridge cleaning device 200 of FIG. 4. Cartridge cleaning device 510 includes cartridge cleaning configuration 515 and draining apparatus 520, corresponding to cartridge cleaning configuration 205 and draining apparatus 250 of FIG. 4, respectively. Cartridge cleaning device 510 is connected at one end to water pump 530. Water pump 530 is connected at one end to cartridge cleaning device 510 and at the other end to water purification system 540. Water purification system 540 receives water from the tap and provides ultra clean water to water pump 530. Water pump 530 and draining apparatus 520 are controlled by a controller, such as controller 560. Cartridge cleaning device 510 is connected at the other end to a pH meter, such as pH meter 550. pH meter 550 may be connected to controller 560 to provide pH values that correspond to the quality of the wastewater. Controller 560 receives pH values from pH meter and instructs water pump 530 and draining apparatus 520 to terminate operation when a pH value received is within a predefined desired range suggesting that the quality of the wastewater is such as to assume that the inkjet cartridge has been sufficiently cleaned.

[0030] The method of and device for cleaning inkjet cartridges has been described in relation to an inkjet cartridge having one chamber, which is typically a one colour cartridge. However, the same method and device 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.

[0031] One skilled in the art may appreciate that inkjet cartridge 10 is used as an example. Any other inkjet cartridge having substantially at least an inkjet chamber, a print-head with nozzles and a cover with ventilation openings may be cleaned with the proposed method.

Claims

1. A device for cleaning an inkjet cartridge having a print-head, comprising: (i) a cartridge cleaning configuration for securing an inkjet cartridge while leaving the print-head exposed; and (ii) a draining apparatus for sucking wastewater through the print-head.

2. The device of claim 1, further comprising a filling apparatus for filling the inkjet cartridge with ultra-clean water from at least one opening at the top of the inkjet cartridge.

3. The device of claim 2, where the cartridge cleaning configuration includes (i) a cartridge clip for securing the inkjet cartridge having a bore substantially where the print-head of the inkjet cartridge is in contact with the cartridge clip for leaving the print-head of the inkjet cartridge exposed; and (ii) a hard board, attached to the cartridge clip, having a bore substantially in line with the bore of the cartridge clip, where the draining apparatus is attached to the bore of the hard-board.

4. The device of claim 3, further comprising a transparent pipe connecting the draining apparatus to the bore to allow inspection of the wastewater.

5. The device of claims 2-4, where the filling apparatus includes at least one needle, of a syringe type, inserted to the at least one opening.

6. The device of claims 1-5, where the draining apparatus is a negative low pressure pump system.

7. The device of claim 6, where the needle is attached to a water pump.

8. The device of claim 7, where the water pump is attached to a water purification system providing the water pump with ultra-clean water, having a conductivity value that is less than 5 micro Siemens.

9. The device of claims 1-8, further comprising a pH meter, attached to the draining apparatus, to measure the pH value of the wastewater.

10. The device of claim 9, where the pH meter is connected to a controller to terminate operation of the filling and draining apparatuses, respectively, when the pH metering device measures a pH value within a predefined range.

11. A method of remanufacturing an inkjet cartridge comprising: (i) securing the cartridge to a cartridge cleaning configuration while leaving the print-head exposed, (ii) connecting a draining apparatus to the cartridge cleaning configuration substantially below where the print-head is exposed, (iii) filling the inkjet cartridge with ultra-clean water from at least an opening at the top of the inkjet cartridge while simultaneously sucking wastewater through the print-head with the draining apparatus, (iv) drying the inkjet cartridge; and (v) refilling the inkjet cartridge with ink.

12. The method of claim 11, further comprising inspecting the wastewater to determine when the cleaning process is complete.

13. The method of claim 12, where the inspecting includes visually inspecting the wastewater flowing through a transparent pipe.

14. The method of claims 12-13, where the inspecting includes measuring a pH value of the wastewater.

15. An inkjet cartridge remanufactured with the method of claims 11-14.

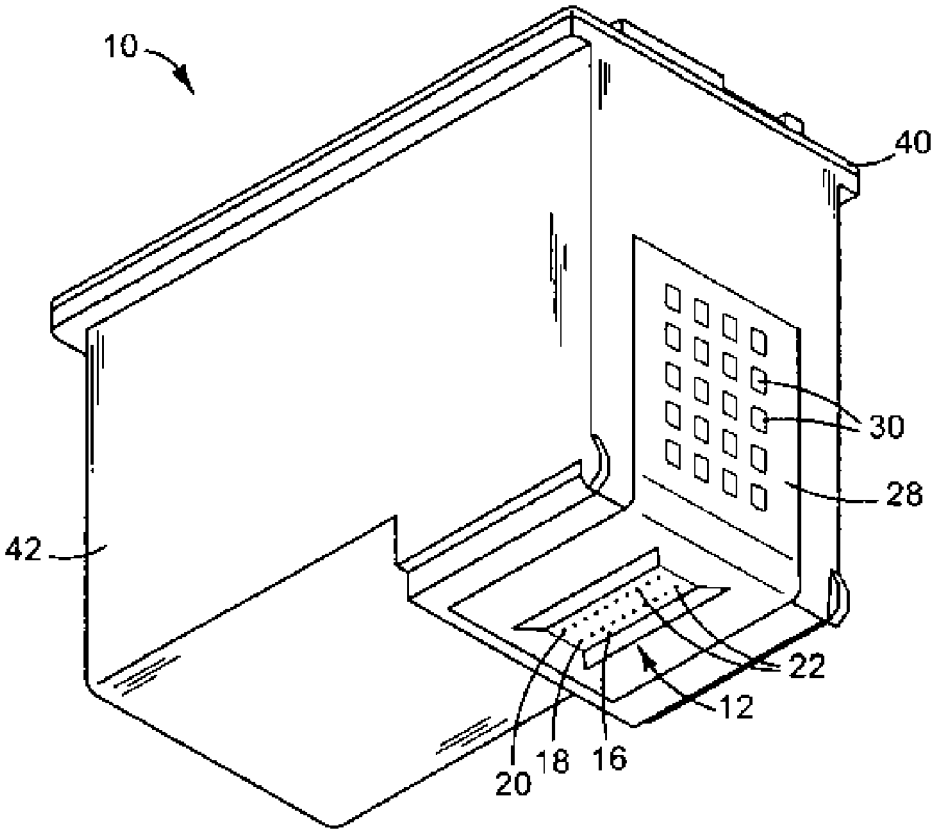

Fig. 1

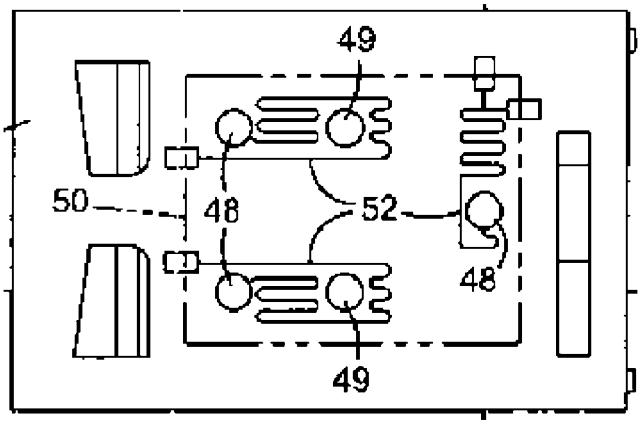

Fig. 2

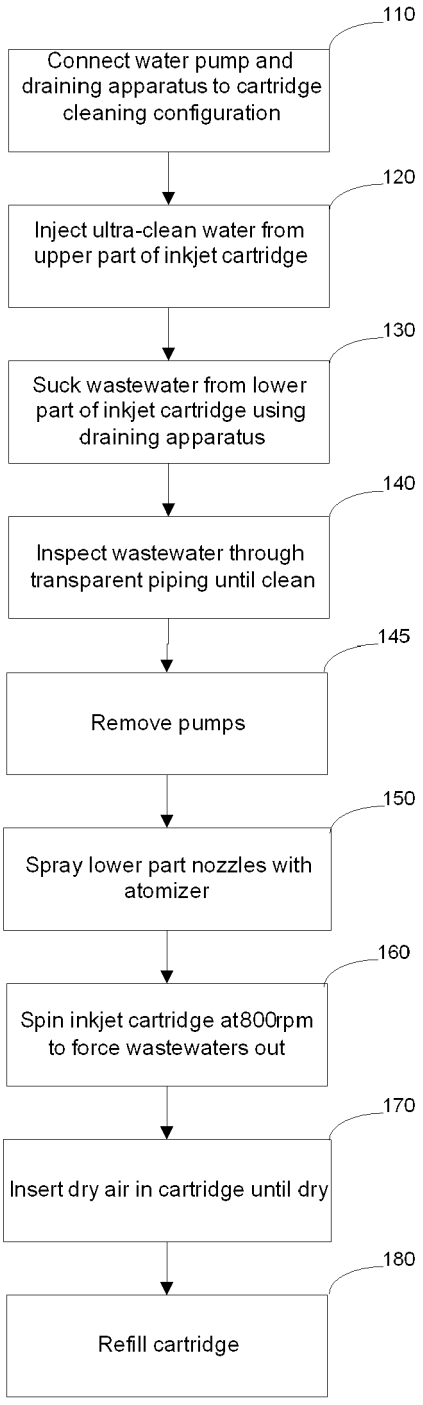
100
110
Connect water pump and draining apparatus to cartridge cleaning configuration
120
Inject ultra-clean water from upper part of inkjet cartridge
130
Suck wastewater from lower part of inkjet cartridge using draining apparatus
140
Inspect wastewater through transparent piping until clean
145
Remove pumps
150
Spray lower part nozzles with atomizer
160
Spin inkjet cartridge at800rpm to force wastewaters out
170
Insert dry air in cartridge until dry
180
Refill cartridge

Fig. 3

200

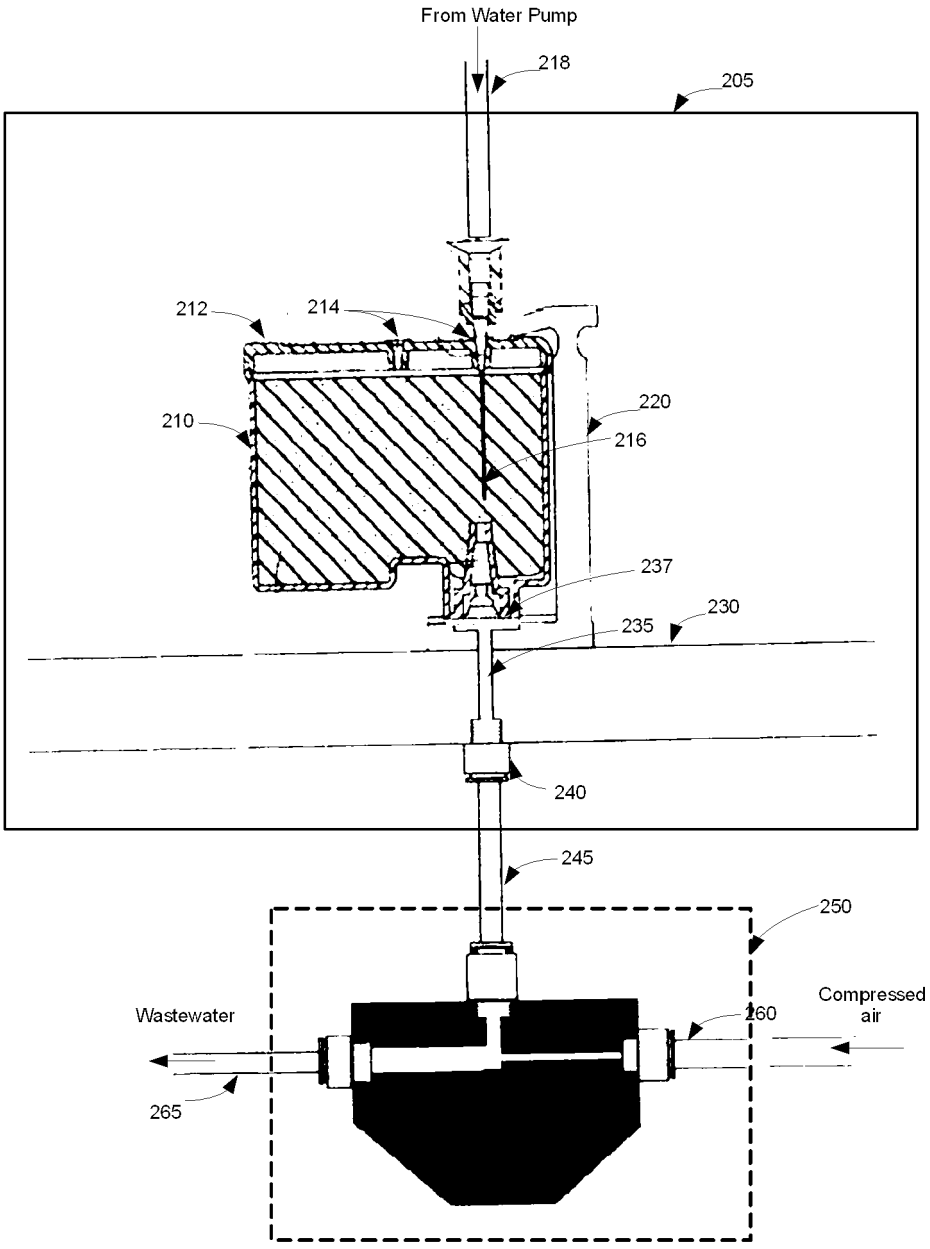
From Water Pump
218
205
212
214
210
220
216
237
230
235
240
245
250
Wastewater
Compressed air
260
265

Fig. 4

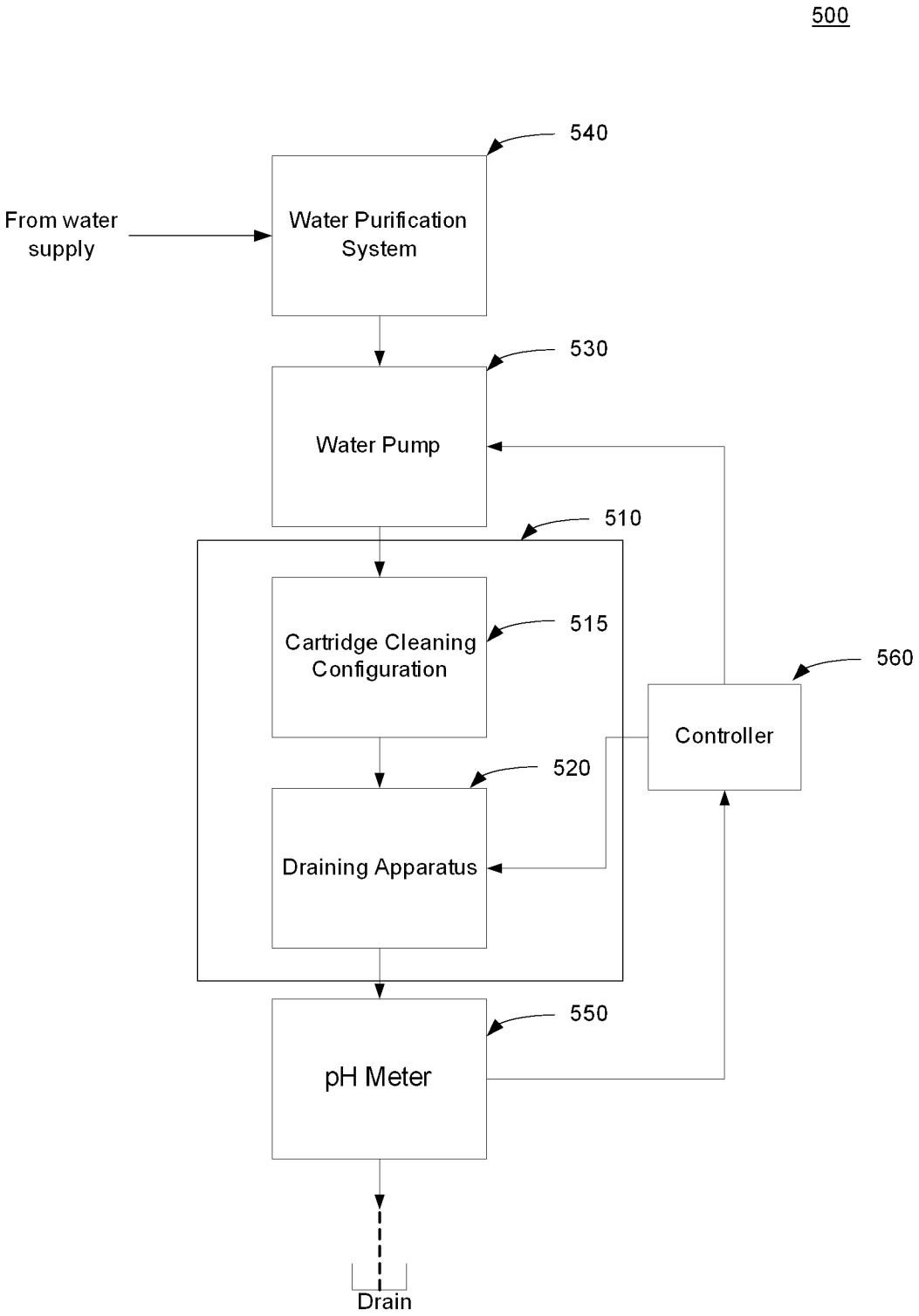
500
540
From water supply
Water Purification System
530
Water Pump
510
Cartridge Cleaning Configuration
515
560
Controller
520
Draining Apparatus
550
pH Meter
Drain

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 11 16 9383

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	28 October 2011	Adam, Emmanuel

CATEGORY OF CITED DOCUMENTS

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28-10-2011

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

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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