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(54) **Fluid flush system for ink jet printing system**

Fluidspülanlage für ein Tintenstrahldrucksystem

Système fluide de nettoyage pour système d'impression à jet d'encre

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Description

Technical Field

[0001] The present invention relates to the field of continuous ink jet printing and, more particularly, to flushing of one ink from a fluid system and replacement of that ink with an ink of a different color or chemistry.

Background Art

[0002] In continuous ink jet printing, a printer may have a variety of printing jobs, each requiring a different ink. Ink choice may be based on color, permanence or ease of operation. It is therefore desirable that the ink in a continuous ink jet printer be easily changed, rather than dedicating a separate printer to each type of ink.

[0003] As ink chemistry, in addition to color, may be incompatible between inks, it is desirable to flush the system with a colorless fluid of low surface tension to remove and dilute the old ink, before introducing the new ink.

[0004] Existing art requires the operator to perform such tasks as draining the old ink and flush fluid by inserting a tube into a fitting while holding a bucket as the tank drains, disposing of these buckets of waste, and connecting a special manifold in place of the printhead to properly route the fluid. The flush fluid is then circulated and disposed. No provision is made to remove ink trapped in tubing by sending it directly to waste. The flush instead works by successive dilutions of the residual ink.

[0005] It is seen, therefore, that it would be desirable to have an improved flush system for use with continuous ink jet printing systems.

Summary of the Invention

[0006] The present invention proposes flushing residual ink from a fluid system to facilitate an ink change.

[0007] In accordance with one aspect of the present invention, the flushing of ink from an ink jet fluid system is facilitated by a flush system module which attaches to the fluid system. The flush system rinses the printhead, ink tank, and all fluid lines exposed to ink with a flush fluid. The flush system module also removes the waste ink and flush fluid from the ink jet printer fluid system. Control of the flush system module is carried out by the ink jet printer control system capable of handling this function.

[0008] Other objects and advantages of the invention will be apparent from the following description, the accompanying drawing and the appended claims.

Brief Description of the Drawing

[0009]

Fig. 1 is a schematic diagram of a typical fluid system, including a printhead, of an ink jet printing system;

Fig. 2 is a schematic diagram of a flush fluid supply unit connected to the fluid system of Fig. 1;

Fig. 3 is a flowchart diagram illustrating attachment of the flush system module of the present invention; and

Fig. 4 is a flowchart diagram illustrating one flush sequence of the flush module, in accordance with the present invention.

10 Detailed Description of the Preferred Embodiments

[0010] Referring to Fig. 1, there is illustrated a typical fluid system 10 for an ink jet printer. Ink is pumped from an ink tank 12 to a drop generator 14, having an associated eyelid 13 and eyelid solenoid 15. Non-printing ink drops formed by the drop generator are caught by catcher means 16 and returned to the ink tank which is under vacuum, supplied by vacuum pump 42. An ink supply 36 and replenishment fluid supply 38 supply ink and/or replenishment fluid to the ink tank 12, as needed. The ink tank 12 includes a float for monitoring fluid levels. Additional lines 46, 48 and 50 connect the catch pan, the catcher, and the bar outlet, respectively, to the ink tank 12, across umbilical 52. The printhead portion of the system further comprises a pressure transducer 54, a bar outlet valve 55, a final filter 62, and an air filter 63 for filtering the system. The ink refill portion of the system includes additional filters 66 and 68 in line with valves 70 and 72, respectively. Additional components of the ink system comprise an ink pump 74 for pumping ink through the system, and an ink cell 78 for measuring ink concentration.

[0011] In accordance with the present invention, to change the ink in the printer system, it is necessary to flush all the ink out of the fluid lines 20 to and from the drop generator, the catcher, and the catch pan. It is also necessary to flush the bypass line 22 from the ink filter 24 and the ink refill line 26. Finally, the ink tank 12 must also be rinsed.

[0012] To facilitate this flushing, a flush system 28 is employed as shown in Fig. 2. The flush system comprises certain system changes to the existing printer fluid system and a separable flush system module, indicated by dotted line 76. The changes to the fluid system involve inserting and securing a spray tube 32 into an available service port 34 on the top of the fluid supply tank 12. One embodiment of the spray tube comprises a tube having a number of holes in the tube wall from which flush fluid can spray. Other devices which can rinse or spray flush fluid around the inside of the ink tank may also be employed. This spray tube device will be used to spray flush fluid on the inside of the ink supply tank to assist in flushing ink from the tank inside surfaces.

[0013] Existing fluid system control software is also upgraded by means of a floppy disk or some other suitable means. The upgraded software is programmed to include not only the control sequences normally employed by the fluid system for normal operation, but also for a ink

change flush sequence. In this new flush sequence, the printer controller is programmed not only to operate the pumps and the valves, etc. of the regular fluid system but also to operate the valves, pumps, etc. of the flush module.

[0014] Once these two permanent changes have been made to the fluid system: the installation of the spray tube device and upgrading the fluid system control software; the flush system module can be attached to the fluid system whenever needed for an ink change.

[0015] The attachment may be by any suitable means, such as by applying the steps in the flowchart 100 of Fig. 3. Initially, to attach the flush system module, the main ink filter 24 of the fluid system is removed, as indicated at block 102. Continuing with Fig. 3, and referring also to Figs. 1 and 2, the flush system lines 1b, 2b, and 3b are connected to the lines which normally connect to each of the filter ports 1a, 2a, and 3a, respectively. The ink refill and the replenishment fluid containers 36 and 38 are disconnected from the fluid system, at the ink/replenishment end of the system, as indicated at block 104, and flush system lines 4 and 5 in Fig. 2 are connected in their place, as indicated by block 106. Flush system line 6 in Fig. 2 is connected to the spray tube device, as shown at block 108. Then line 7 in Fig. 2 connects to an existing or supplied drain port, as shown by block 110, typically on the bottom of the fluid tank. At block 112, an electronic cable (not shown) is connected from the flush system to the fluid system controller or computer (not shown).

[0016] Continuing with Fig. 4 and referring also to Fig. 2, after the connections are made, the operator initiates a flush cycle from the keyboard or control panel of the ink jet print station. The ink jet controller then initiates the flush sequence. In a preferred embodiment of the present invention, the flush sequence follows the steps illustrated in flowchart 114 of Fig. 4. Initially, and simultaneously, the fluid supply tank 12 is emptied to waste 80 by means of the ink pump 74 and the flush fluid tank 30 is filled with flush fluid, as indicated at blocks 116 and 118, respectively. Flush fluid is drawn into the flush fluid tank by vacuum supplied through line 5, which was connected to the replenisher port on the back of the print station. The vacuum on the flush fluid tank is controlled by the replenishment valve 72. Once the flush fluid tank 30 is filled, as determined by a float switch in the tank, the replenishment valve is closed and the flush fluid tank is vent to atmosphere by vent valve 90. This stops the transfer of flush fluid from the flush fluid supply 98.

[0017] Once the fluid supply tank 12 is empty and the flush fluid tank 30 is full, flush fluid is pumped by pump 93 to the printhead, as indicated at block 120, via printhead valve 82. With the bar outlet valve 55 open, the drop generator and the bar outlet line are flushed. Closing the bar outlet valve forces the flush fluid out of the orifices of the drop generator to rinse off the charge plate and catcher 16, and the eyelid 13. With the catcher valve 64 open and the eyelid 13 closed, this fluid is drawn away by the catcher rinsing the catcher line. Closing the catcher

valve and opening the eyelid and the catch pan valve 60 causes the flush fluid to rinse the catch pan and the catch pan line.

[0018] Next, the printhead valve 82 is closed and the ink supply valve 70 of the print station is opened, at block 122, to allow flush fluid to flush the ink supply line. At block 124, the ink supply valve is shut and the tank valve 86 is opened. Simultaneously, at block 124, flush fluid is pumped through the filter bypass line 2b, fluid supply tank drain line 7 and the fluid supply tank spray tube 6. Fluid restrictors 58 in the bypass line and in the tank drain line ensure sufficient pressure is maintained for the spray tube to produce the desired spray of flush fluid inside the fluid tank. The spray tube device sprays flush fluid on the inside of the flush fluid supply tank rinsing ink off the inside surfaces of the tank.

[0019] During the previous stages of the flush cycle, all flush fluid is circulated to the fluid supply tank and is pumped to waste, and no flush fluid is re-circulated throughout the fluid system. The duration of the fluid supply tank spray cycle is such that the flush fluid tank empties just before the spray cycle ends. Subsequently, as shown at step 126, the vent valve remains open, the flush fluid pump continues to run and the printhead valve is opened. Air is then pumped through the bar inlet and bar outlet line by the flush system pump. This serves to evacuate the flush fluid from the drop generator and the bar inlet and outlet lines. The fluid system vacuum pump remains on, keeping the ink tank under vacuum to aid in drawing air through the drop generator. The ink tank vacuum also evacuates the catcher line and the catch pan lines. Next, at block 128, the printhead valve is closed and the air from the flush fluid supply pump is pumped/drawn through the ink supply line, thus evacuating flush fluid from it. And finally, at block 130, the flush fluid pump delivers air to evacuate the bypass line, fluid supply tank waste line and the tank spray line. Upon completion of this step, the system is completely flushed and evacuated. If required, this flush sequence may be repeated. This may be needed for example when changing to a highly incompatible ink or changing to a lightly colored ink such as yellow. Once the fluid system is sufficiently clean, the flush module can be disconnected. Another ink filter must be installed and the fluid system is ready to be filled with the new ink.

[0020] During the flush sequence, waste fluid is pumped into the waste tank 80. Subsequent to the flushing operation, after the flush module is disconnected from the printer fluid system, the flush fluid unit can be rolled to a convenient location and then emptied into an appropriate waste fluid receptacle via the waste pump 88. Typically, this is a manually controlled operation. Also during the flushing sequence, the fluid levels in the waste tank, flush fluid tank and the fluid supply tank are all monitored to prevent overflow.

[0021] In a preferred embodiment of the present invention, the flush fluid used is a clear fluid, so as not to leave residue or to tint light colored ink. It is also compatible

with the inks used in continuous ink jet systems. Additionally, the flush fluid may contain a surfactant to lower the surface tension to aid in wetting out filters and other components.

[0022] The invention has been described in detail with particular reference to certain preferred embodiments thereof, but it will be understood that modifications and variations can be effected within the scope of the invention as claimed.

Claims

1. A continuous ink jet printer system having a fluid system (10) including a drop generator (14), an ink tank (12), and a plurality of fluid lines (20) through which ink is transferred between the ink tank (12) and the drop generator (14); **characterized by** a plurality of ports (1a, 2a, 3a) connected to the fluid lines (20), and a flush system module (76) that includes:

a plurality of flush system lines (1b, 2b, 3b) connectable to the plurality of ports (1a, 2a, 3a) for flushing ink residue from the fluid system (10) by supplying a flush fluid to fluid lines (20) of the fluid system (10) which contain ink;
a waste tank (80) into which ink is removed from the fluid system; and
a flush fluid tank (30) from which the inside of the ink tank (12) is supplied with the flush fluid the flush fluid being removed from the fluid system and the fluid lines into the waste tank (80).

2. A continuous ink jet printer system as claimed in claim 1 further comprising a controller for controlling flushing of the fluid system (10).
3. A continuous ink jet printer system as claimed in claim 1 further comprising a controller for fluid system valves and pumps to ensure flow of flush fluid to the fluid system.
4. A continuous inkjet printer system as claimed in claim 1 further **characterized by** the flush system module (76) utilizing fluid system vacuum as a vacuum source.
5. A continuous ink jet printer system as claimed in claim 1 further **characterized by** a sprayer adapted to rinse the ink tank (12).
6. A method for flushing ink residue from a fluid system (10) of a continuous inkjet printer system having an ink tank (12), a drop generator, and a plurality of fluid lines (20) to supply ink to system components, **characterized by** the steps of:

attaching a flush system module (76) to the fluid

lines (20), the flush system module (76) comprising a waste tank (80), a flush fluid tank (30), and flush system lines (1b, 2b, 3b);
supplying flush fluid to the plurality of fluid lines (20) of the fluid system (10) which contain ink;
removing ink from the fluid system (10);
rinsing an inside of the ink tank (12) with the flush fluid; and
removing the flush fluid from the fluid system (10) and the fluid lines (20).

7. A method as claimed in claim 6 wherein the step of supplying flush fluid to fluid lines comprises the step of pumping the flush fluid.
8. A method as claimed in claim 6 wherein the step of removing flush fluid from the fluid lines further comprises the step of pumping air through the fluid lines.
9. A method as claimed in claim 6 wherein the step of rinsing an inside of the ink tank further comprises the step of spraying the flush fluid at inside surfaces of the ink tank.
10. A method as claimed in claim 6 wherein the step of supplying flush fluid further comprises the step of supplying a pressurized flush fluid.

Patentansprüche

1. Kontinuierlicher Tintenstrahldrucker, der ein Flüssigkeitssystem (10) umfasst, mit einer Tropfenerzeugungseinrichtung (14), einem Tintentank (12) und einer Vielzahl von Flüssigkeitsleitungen (20), durch die Tinte zwischen dem Tintentank (12) und der Tropfenerzeugungseinrichtung (14) übertragen wird,
gekennzeichnet durch
eine Vielzahl von Kanälen (1a, 2a, 3a), die mit den Flüssigkeitsleitungen (20) verbunden sind, und **durch** ein Spülsystem-Modul (76), welches umfasst:

eine Vielzahl von Spülungsleitungen (1b, 2b, 3b), die mit der Vielzahl von Kanälen (1a, 2a, 3a) verbunden sind, um Tintenreste aus dem Flüssigkeitssystem (10) wegzuspülen durch Zuführen einer Spülflüssigkeit in Flüssigkeitsleitungen (20) des Flüssigkeitssystems (10), die Tinte enthalten;
einen Abfallbehälter (80), in den Tinte aus dem Flüssigkeitssystem entleert wird; und
einen Spülflüssigkeitstank (30), von dem aus das Innere des Tintentanks (12) mit der Spülflüssigkeit versorgt wird, wobei die Spülflüssigkeit aus dem Flüssigkeitssystem und den Flüssigkeitsleitungen entfernt und in den Abfallbehälter (80) verbracht wird.

2. Kontinuierlich arbeitender Tintenstrahldrucker nach Anspruch 1, mit einer Steuereinrichtung zum Steuern der Spülung des Flüssigkeitssystems (10).
3. Kontinuierlich arbeitender Tintenstrahldrucker nach Anspruch 1, mit einer Steuereinrichtung für Ventile und Pumpen des Flüssigkeitssystems, um zu gewährleisten, dass Spülflüssigkeit in das Flüssigkeitssystem strömt.
4. Kontinuierlich arbeitender Tintenstrahldrucker nach Anspruch 1, **dadurch gekennzeichnet, dass** das Spülsystem-Modul (76) ein Flüssigkeitssystem-Vakuum als Vakuumquelle verwendet.
5. Kontinuierlicher Tintenstrahldrucker nach Anspruch 1, **gekennzeichnet durch** eine Sprüheinrichtung zum Ausspülen des Tintentanks (12).
6. Verfahren zum Wegspülen von Tintenresten aus einem Flüssigkeitssystem (10) eines kontinuierlich arbeitenden Tintenstrahldruckers mit einem Tintentank (12), einer Tropfenerzeugungseinrichtung und einer Vielzahl von Flüssigkeitsleitungen (20) zum Zuführen von Tinte zu Systemkomponenten, **gekennzeichnet durch** die Schritte:

Anbringen eines Spülsystem-Moduls (76) an den Flüssigkeitsleitungen (20), wobei das Spülsystem-Modul (76) einen Abfallbehälter (80), einen Spülflüssigkeitstank (30) und Spülungsleitungen (1b, 2b, 3b) aufweist;

Zuführen von Spülflüssigkeit zu der Vielzahl von Flüssigkeitsleitungen (20) des Flüssigkeitssystems (10), die Tinte enthalten;

Entfernen von Tinte aus dem Flüssigkeitssystem (10);

Ausspülen eines Innenraums des Tintentanks (12) mit der Spülflüssigkeit; und

Entfernen der Spülflüssigkeit aus dem Flüssigkeitssystem (10) und den Flüssigkeitsleitungen (20).
7. Verfahren nach Anspruch 6, worin der Schritt des Zuführens von Spülflüssigkeit zu den Flüssigkeitsleitungen den Schritt des Pumpens der Spülflüssigkeit umfasst.
8. Verfahren nach Anspruch 6, worin der Schritt des Entnehmens von Spülflüssigkeit aus den Flüssigkeitsleitungen den Schritt des Pumpens von Luft durch die Flüssigkeitsleitungen umfasst.
9. Verfahren nach Anspruch 6, worin der Schritt des Ausspülens eines Innenraums des Tintentanks weiterhin den Schritt des Aufsprühens der Spülflüssigkeit auf Innenflächen des Tintentanks umfasst.

10. Verfahren nach Anspruch 6, worin der Schritt des Zuführens von Spülflüssigkeit zudem den Schritt des Zuführens einer unter Druck stehenden Spülflüssigkeit aufweist.

Revendications

1. Système d'imprimante à jet d'encre en continu comportant un système pour fluide (10) comprenant un générateur de gouttes (14), un réservoir d'encre (12) et une pluralité de conduites pour fluide (20) à travers lesquelles l'encre est transférée entre le réservoir d'encre (12) et le générateur de gouttes (14), **caractérisé par** une pluralité d'orifices (1a, 2a, 3a) reliés aux conduites pour fluide (20), et un module de système de chasse (76) qui comprend :

une pluralité de conduites de système de chasse (1b, 2b, 3b) pouvant être reliées à la pluralité d'orifices (1a, 2a, 3a) en vue de chasser les résidus d'encre du système pour fluide (10) en fournissant un fluide de chasse aux conduites pour fluide (20) du système pour fluide (10) qui contiennent l'encre,

un réservoir de déchets (80) dans lequel l'encre est retirée du système pour fluide, et

un réservoir de fluide de chasse (30) à partir duquel l'intérieur du réservoir d'encre (12) reçoit le fluide de chasse, le fluide de chasse étant retiré du système pour fluide et des conduites pour fluide pour aller à l'intérieur du réservoir de déchets (80).

2. Système d'imprimante à jet d'encre en continu selon la revendication 1, comprenant en outre un contrôleur destiné à commander la chasse du système pour fluide (10).
3. Système d'imprimante à jet d'encre en continu selon la revendication 1, comprenant en outre un contrôleur des vannes et des pompes du système pour fluide afin d'assurer l'écoulement du fluide de chasse vers le système pour fluide.
4. Système d'imprimante à jet d'encre en continu selon la revendication 1, **caractérisé en outre en ce que** le module de système de chasse (76) utilise un élément d'aspiration du système pour fluide en tant que source de vide.
5. Système d'imprimante à jet d'encre en continu selon la revendication 1, **caractérisé en outre par** un pulvérisateur conçu pour rincer le réservoir d'encre (12).
6. Procédé destiné à chasser les résidus d'encre d'un système pour fluide (10) d'un système d'imprimante à jet d'encre en continu comportant un réservoir

d'encre (12), un générateur de gouttes et une pluralité de conduites pour fluide (20) afin de fournir de l'encre à des composants du système, **caractérisé par** les étapes consistant à :

- fixer un module de système de chasse (76) aux conduites pour fluide (20), le module de système de chasse (76) comprenant un réservoir de déchets (80), un réservoir de fluide de chasse (30) et des conduites pour système de chasse (1b, 2b, 3b),
fournir le fluide de chasse à la pluralité de conduites pour fluide (20) du système pour fluide (10) qui contiennent l'encre,
retirer l'encre du système pour fluide (10),
rincer l'intérieur du réservoir d'encre (12) avec le fluide de chasse, et
retirer le fluide de chasse du système pour fluide (10) et des conduites pour fluide (20).
7. Procédé selon la revendication 6, dans lequel l'étape consistant à fournir le fluide de chasse aux conduites pour fluide comprend l'étape consistant à pomper le fluide de chasse.
8. Procédé selon la revendication 6, dans lequel l'étape de retrait du fluide de chasse des conduites pour fluide comprend en outre l'étape consistant à pomper de l'air au travers des conduites pour fluide.
9. Procédé selon la revendication 6, dans lequel l'étape de rinçage de l'intérieur du réservoir d'encre comprend en outre l'étape de pulvérisation du fluide de chasse au niveau des surfaces intérieures du réservoir d'encre.
10. Procédé selon la revendication 6, dans lequel l'étape de fourniture du fluide de chasse comprend en outre l'étape de fourniture d'un fluide de chasse sous pression.

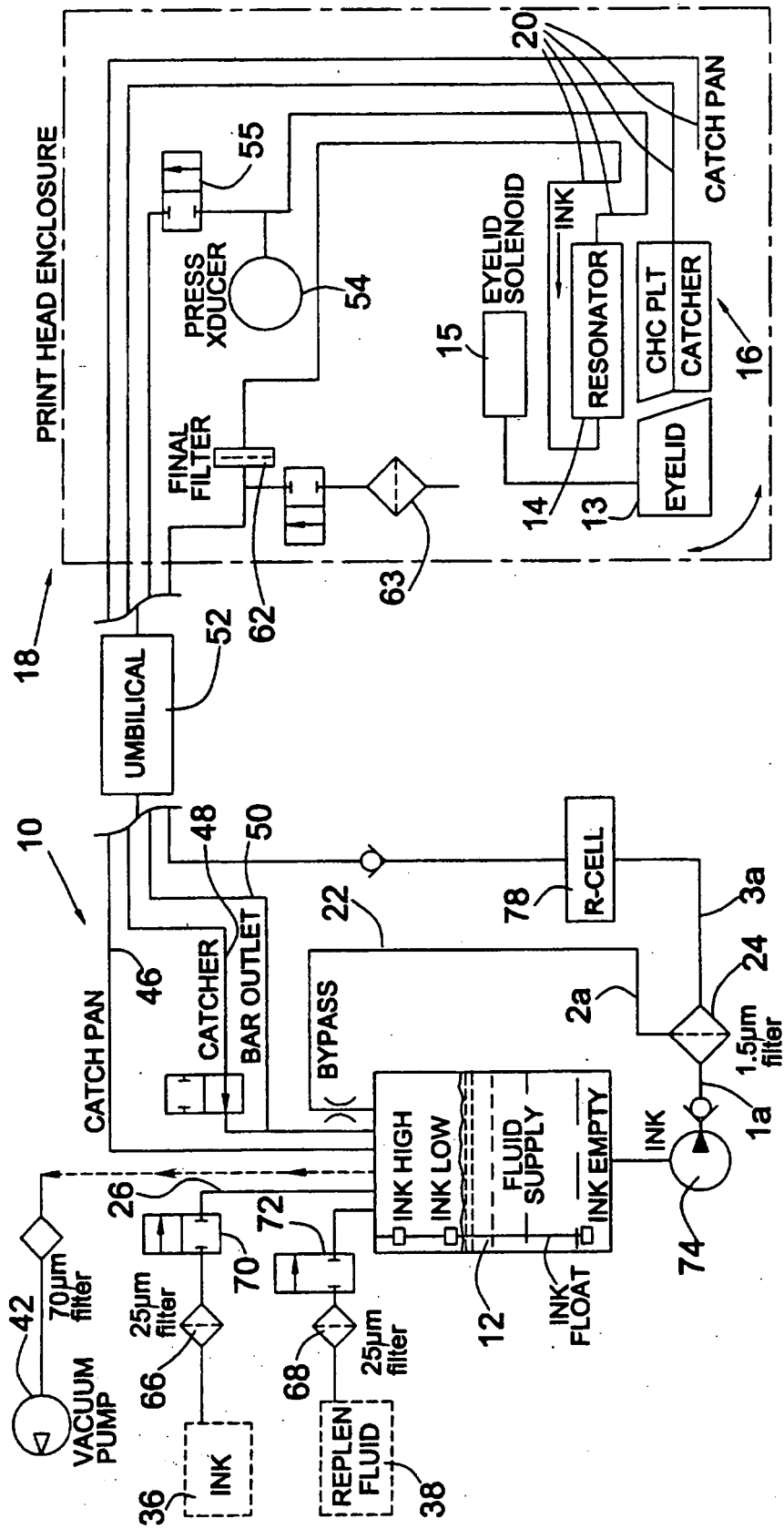


Fig.1

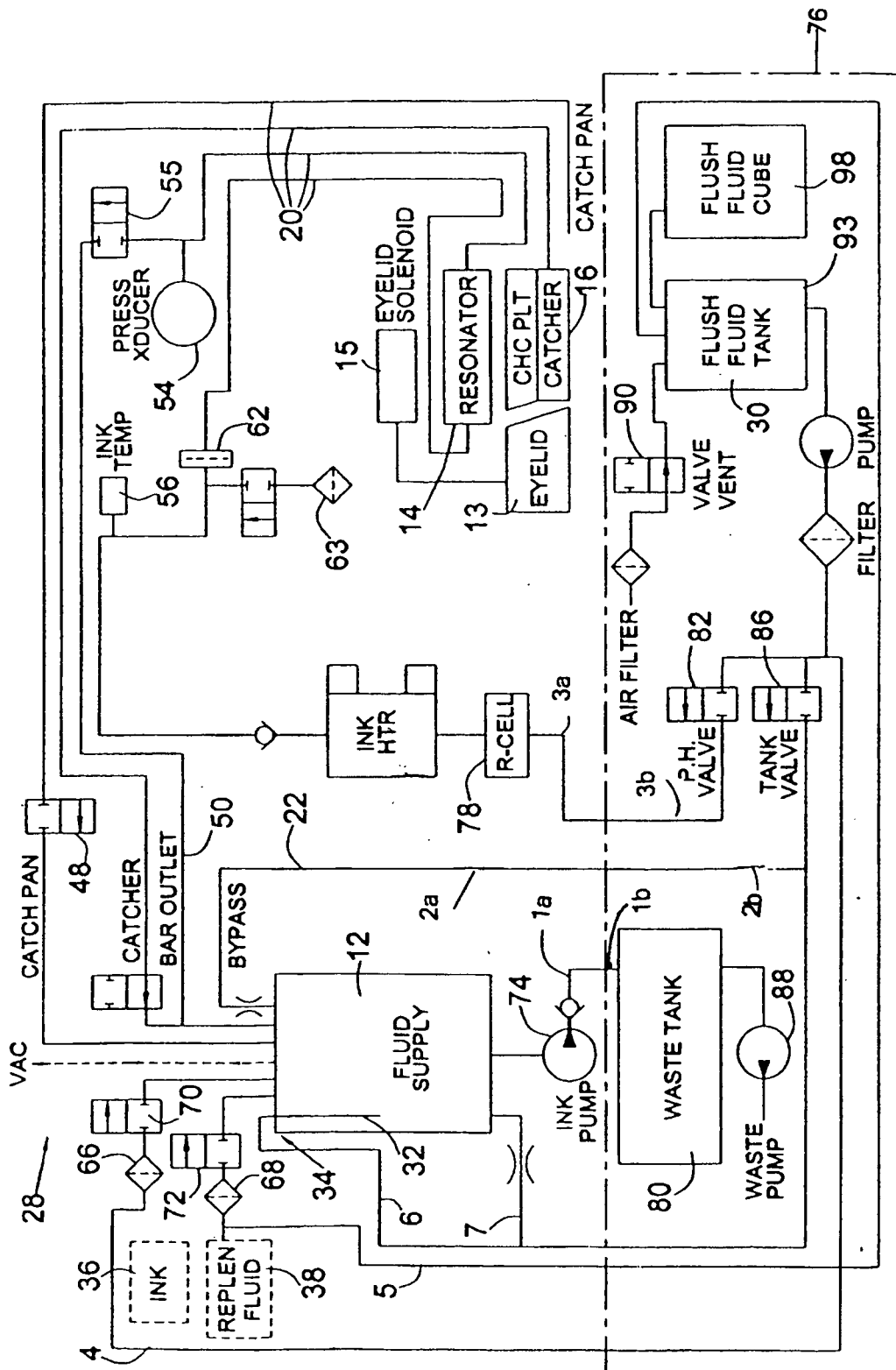


Fig.2

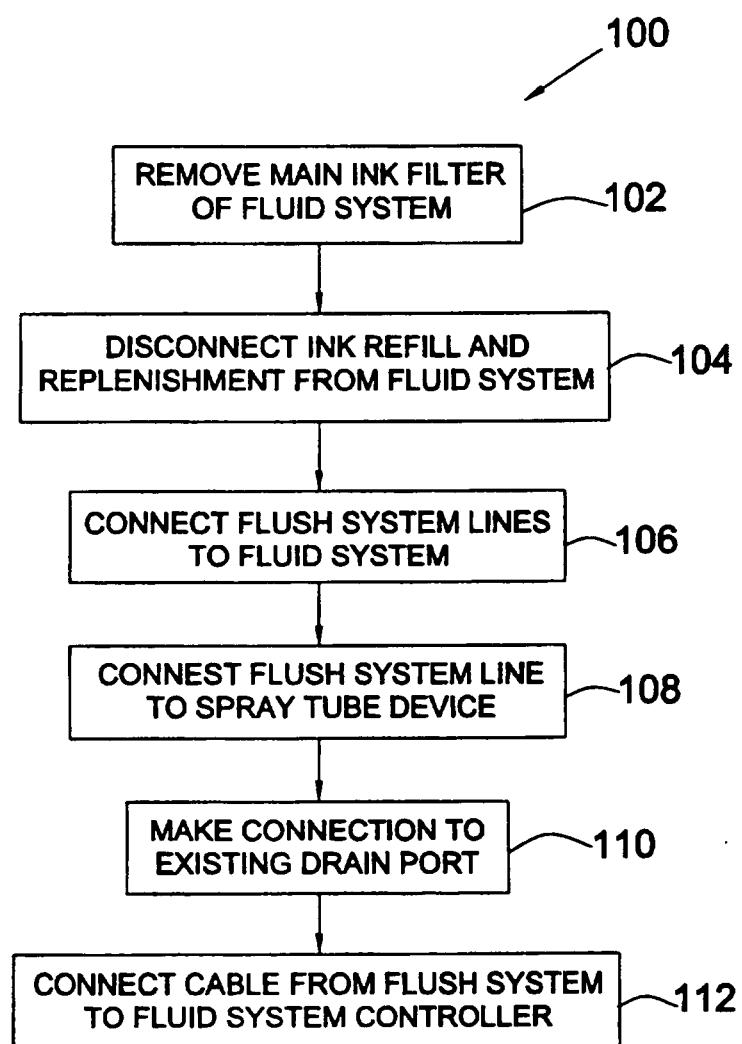


Fig.3

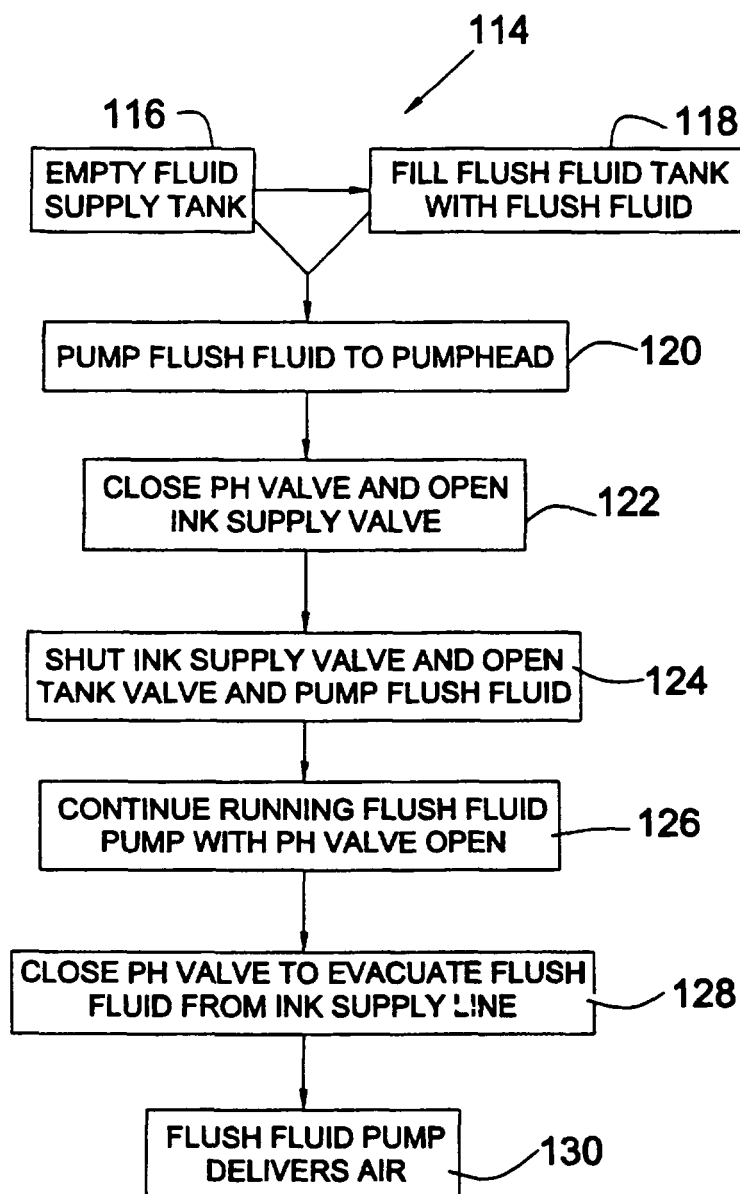


Fig.4