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INK DROOLING DETECTION BASED ON A PRESSURE DROP

HP INC

Ink Drooling detection based on a Pressure drop

Abstract

During printing, the print-zone reaches a temperature up to 45ºC. Eventually, the printhead and the ink inside the printhead will reach the steady state temperature of the print-zone. This causes air bubbles in the printhead to expand due to the increase in temperature. If the printhead cools down with a depressurized IDS (Ink Delivery System), the change in volume of the air would be replaced by air entering through the nozzles, causing air ingestion problems. This is the reason why IDS need to be kept pressurized after printing during the cool down period.

In normal operation a printhead does not drool thanks to the internal backpressure of the printhead. This is possible because inside the printhead there are 2 bags, one per chamber, connected to the atmosphere and slightly compressed by 2 levers joined by a spring, this compression is what determines the backpressure. One of these levers end also works as a regulator valve for the printhead ink inlet, opening or closing the *volcano*. To keep the backpressure, it is important that the volcano is well sealed in closed position.

If the *volcano* is not closing properly the fluidic path between the IDS and the printhead chamber is connected, therefore the printhead backpressure is lost, since the printhead inside pressure will be now subjected to the IDS pressure. Under these conditions drooling through the nozzles of the printhead will occur whenever IDS pressure is high enough.

Invention

The invention describes a process to detect ink drooling through the printhead (or leakage on the IDS) during Idle time, based on the air pressure drop of the APS (Air Pressure System). This is possible because when there is ink flowing out of the Intermediate Tank (IT), the air pressure of the APS decreases. The IT is essentially a bag filled with ink (connected to the IDS) inside a plastic container pressurized with air. Then, when the ink volume in the bag is reduced there is more space inside the container for the air to expand, this air expansion translates into air pressure reduction, that can be read through the air pressure sensor connected to the IT.

Furthermore, the ink drooling can be detected also based on an ink pressure drop. An ink pressure sensor reads the pressure of the ink. If the ink is flowing out of the IT, the hydrostatic pressure is reduced. The pressure reduction can be read through the ink pressure sensor located on the IDS.

When a drooling through the printhead is detected, the IDS will be depressurized in order to avoid the ink drooling and a System Error will be displayed to inform the customer that there is an issue with a certain printhead.
Additionally, in printers with an IDS capable of performing ink recirculation, which typically includes multiple cartridges to recirculate the ink between these cartridges, when the ink drooling is detected, the IT is emptied to one of the cartridge in order to stop the ink drooling as the IT does not have ink inside.

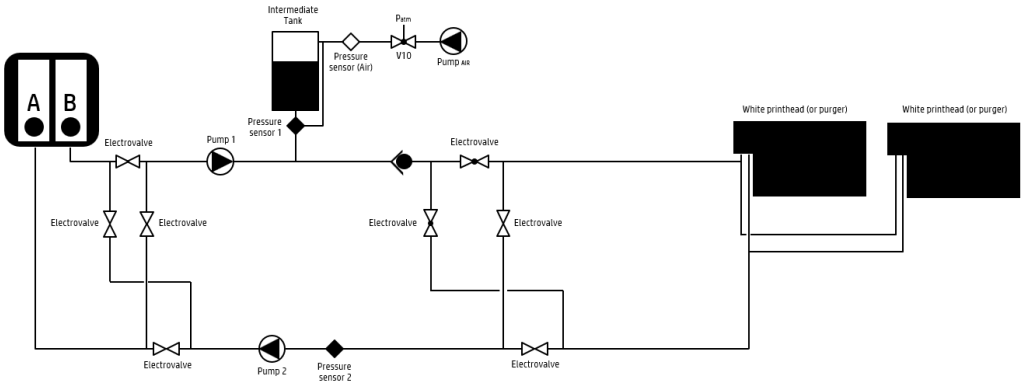

Figure 1. Schematics of an Ink Recirculation Delivery System with an Intermediate

The following example shows the ink drooling detection based on the pressure drop.

Printer in Idle conditions with APS pressurized in normal operation:
The air pressure in Idle conditions is maintained almost constant. The small decrement of the air pressure is related to the leakage through the relieve valve.

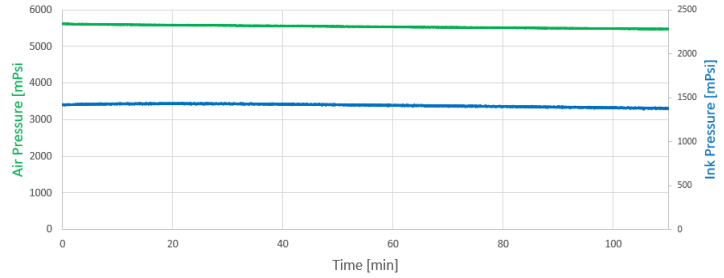

Figure 2. No ink drooling

Printer in Idle conditions with APS pressurized showing ink drooling:
Due to the ink drooling, the air pressure drastically decreases over time. After 45min, the air pressure decreases 1082mPsi. Also, the ink pressure decreases 339mPsi.
Note: as the air working pressure is set between a certain threshold, when the air pressure reaches the bottom threshold, the air pump is turned on pressurizing the air again.

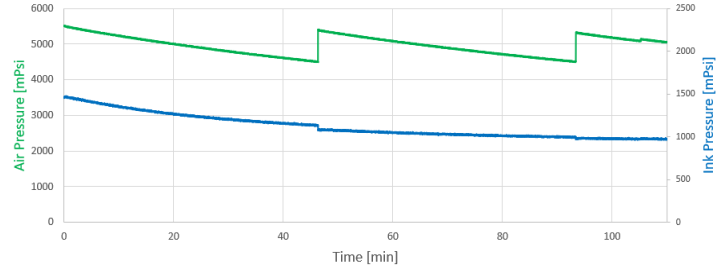

Figure 3. Ink drooling detected based on Pressure drop

The advantages of the invention are:

- Customer experience: detecting and preventing the ink drooling will prevent creating customer dissatisfaction. A printhead drool is a catastrophic failure mode, besides damaging HW parts, it will require a difficult cleaning process from the customer and depending on the surface where the ink is spilled a permanent damage on customers workplace, since some of HP inks are extremely durable.

- Robustness: a diagnostic to detect that there is a potential risk of ink drooling increases the overall robustness of the printer.

- Repair cost: detecting the ink drooling and acting to reduce it, could avoid damaging hardware parts (motor, encoder, electronic parts..) which will imply a service visit and the cost of the replaced parts, as well as not having the printer functional until the reparation is done.

- Reduce ink waste: by depressurizing the APS when a drooling situation is detected, reduces the ink waste due to the drooling

- Cost: It reuses the current hardware of the printer and no additional electronic element (EE board, cables, …) or mechanical parts are required.

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