August 26, 2019

HANDHELD INKJET CODER WITH 22 mm PRINT SWATH AND SEPARATE INK SUPPLY

HP INC

Handheld Inkjet Coder with 22mm Print Swath and Separate Ink Supply

Introduction

A global economy with an abundance of local transportation, channel and regulatory marking requirements is driving exciting growth in the coding and marking market. Herein disclosed and described is a compact or portable inkjet coder for product identification utilizing an inkjet printhead with a 22mm print swath and an ink supply tank.

Compact inkjet printer/coders are used to apply product identifiers and associated information like date codes and bar codes to products within commercial settings. A compact coder can be mounted to a packaging line or integrated with a handle and trigger into a hand-held system. The ease of having a hand-held system allows a person to quickly and accurately apply a printed code to materials without the necessity of having to bring a package or item to a printer and also being able to easily address less consistently structured objects.

There is an increasing variety of usage rates among coding and marking applications and customers, creating a need for printing systems that can enable both low-usage, high-mix and high-usage, low-mix applications. Traditionally these low-use and high-use applications are enabled with single-use printheads and bulk-printheads respectively.

Previously single-use printheads with integrated ink supplies were utilized but the small amount of ink made them less attractive for higher-volume printing. This disclosure discusses the use of a larger print swath thermal inkjet printhead that can be supplied from a separate ink tank within an easy-to-use hand-held frame. The unit acts as an integrated system for the ink supply tank, the printhead itself as well as actuators and a means of evaluating if the ink supply tank is out of ink.

This system will allow for a low-use bulk printing system and the use of a wider print swath also allows for the printing of high resolution 2D barcodes and other printed features.

In the present example uses, but is not limited to a printhead which has a 22mm printswath and an ink cartridge which holds 69ml of ink and can be changed out when it is empty without replacing the entire printhead. In other applications a single use printhead with integrated ink supply results in a much smaller print swath as well as a much more limited ink supply which could not be supplemented since the ink supply is built into the printhead.

Pairing a bulk inkjet printhead with a suitable compact external ink supply tank results in a form factor suitable for a hand-held coder, as shown in the figure below.

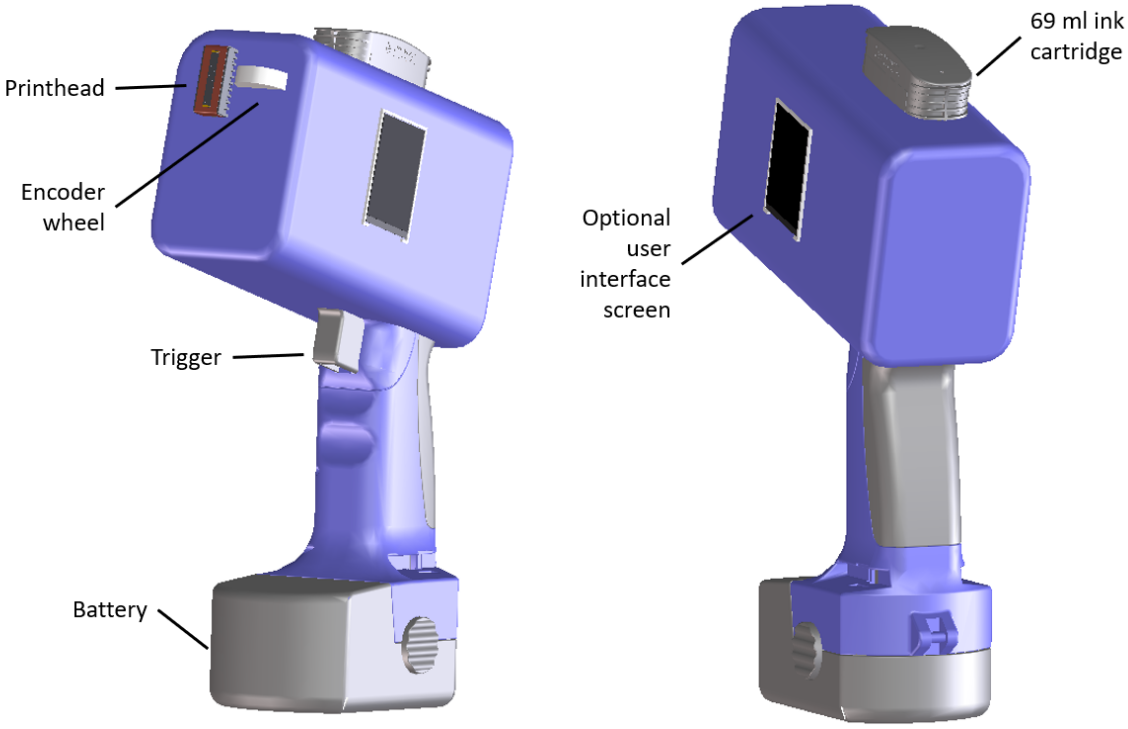

Figure 1. Handheld portable inkjet coder.

This architecture offers several advantages when compared to a common single-use printhead:

- Longer swath length
- Higher resolution
- Longer throw distance
- Longer time between interventions
- Lower cost per code, depending on pricing

General Architecture

A fixed compact coder and a hand-held coder require the same footprint and internal component layout. As shown in the following figure, a "frame" can be defined that applies to both use cases. When fitted with both a printhead and ink supply, the frame is a "loaded frame"; otherwise the frame is "empty".

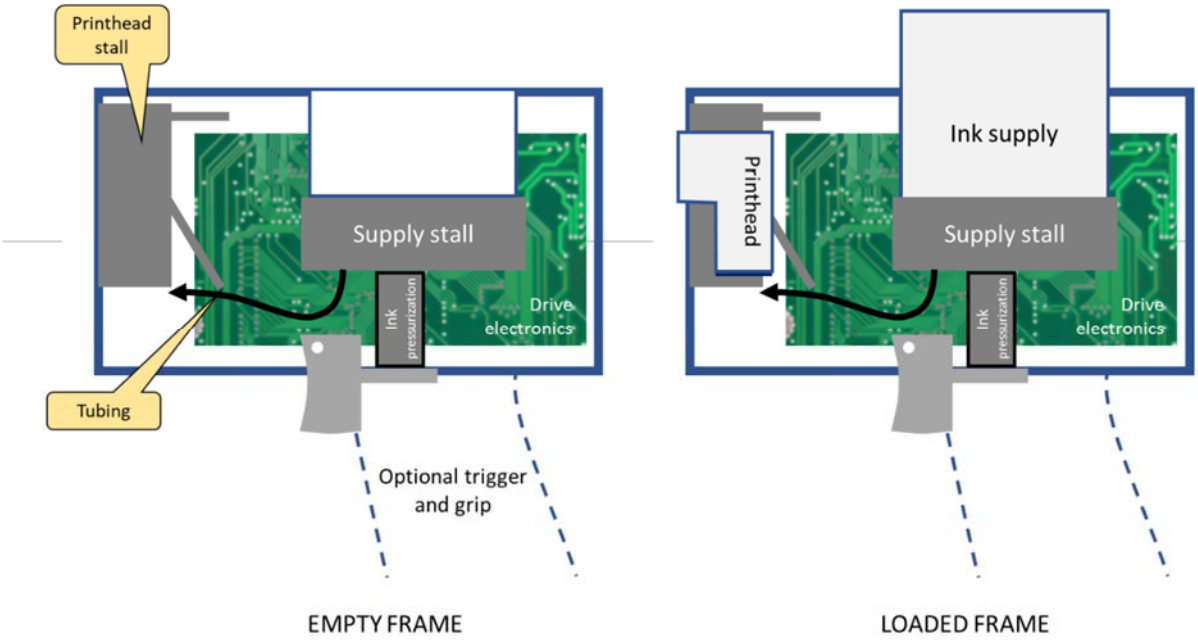

Figure 2. Component architecture of a compact coder

The frame includes these features:

- tubing or similar plumbing for transferring ink from the ink supply stall into the printhead
- a way to pressurize ink to ensure replenishment of the printhead
    - optionally, a way to detect out of ink (OOI) state of the ink supply
- drive electronics
- a way to replace an empty ink supply with a full one
- a way to replace a printhead with a new one
- a housing to mount internal components, protect them from dirt and damage, and provide either a mounting means for fixed applications or a grip for hand-held uses

The drive electronics prepare the printhead for printing, generate images to be printed and convert these into signals to be sent to the printhead, as well as monitor that the ink supply hasn't been emptied.

Optionally, the drive electronics also support a user interface, possibly including a built-in display and control buttons on the coder.

Note that the elements within the frame constitute a complete print cartridge. In other words, the elements of a single use print cartridge (drop ejection printhead, electrical interconnect, ink storage, ink delivery system and mechanical frame) map one-for-one against the frame's elements listed above.

Out of Ink (OOI) State

It is vital to detect when the ink cartridge is depleted and can no longer supply ink to the printhead. In this condition, the drop ejection nozzles cannot refill and print quality rapidly degrades. The figure below shows the key elements of the single use printhead ink cartridge above the mating features of a hand-held device

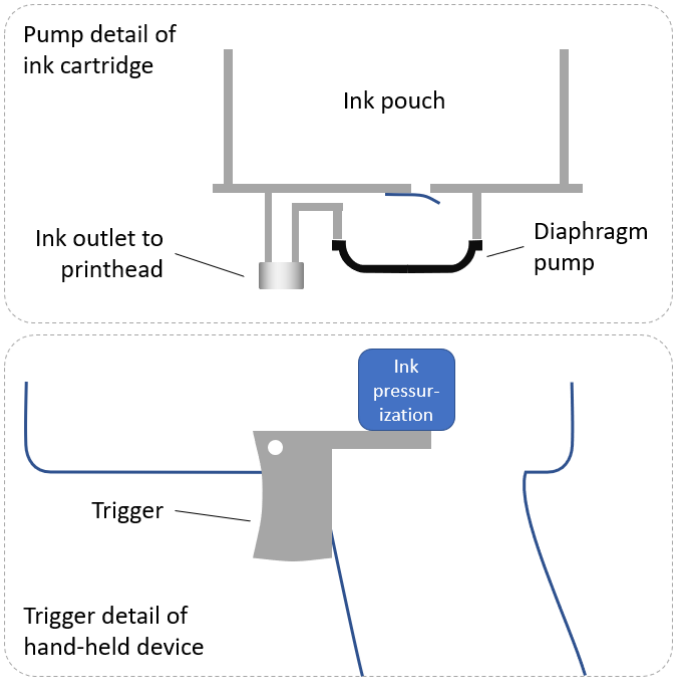

Figure 3. The key elements of the single use printhead ink cartridge above the mating features of a hand-held device

Figure 4 shows a mechanical linkage between the trigger of the hand-held device and the diaphragm pump of the ink cartridge.

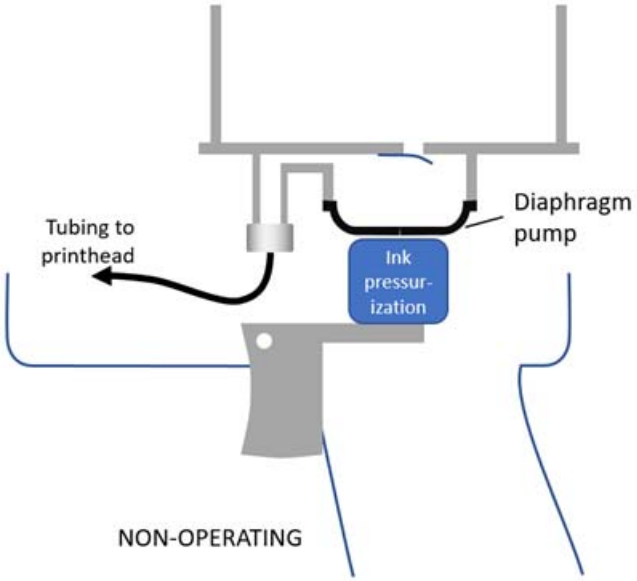

Figure 4. Mechanical linkage between the trigger of the hand-held device and the diaphragm pump of the ink cartridge

Figure 5 shows the actuator pushed up against the diaphragm pump by the action of the trigger. This closes the check valve at the top of the pump and pressurizes the ink within both the pump and the ink tubing leading to the printhead. The ink pressurization block slides up and down according to the motion of the trigger.

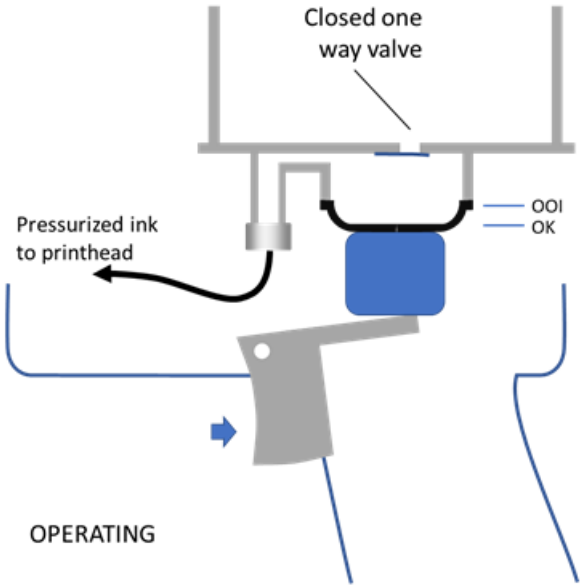

Figure 5. Actuator pushed up against the diaphragm pump by the trigger.

When the pressurization block descends, the elastomeric diaphragm pump returns to its as-molded shape, filling with ink from the ink pouch above it. Depressing the trigger can also arm the printhead's firing system.

Note also the two marks in the figure labeled "OK" and "OOI" (out of ink). These are for illustration only and need not be part of an actual coder product. These marks are drawn relative to where the pressurization block meets the diaphragm pump and show how far the block can deform the pump diaphragm when the ink pouch has ink or is empty, respectively.

In other words, when the ink pouch of the cartridge is empty, the diaphragm pump cannot refill and its elastomer diaphragm remains depressed several millimeters compared to when the cartridge is full. See Figure 6 below. These different positions can be easily detected, such as by a switch connected to the pump actuator.

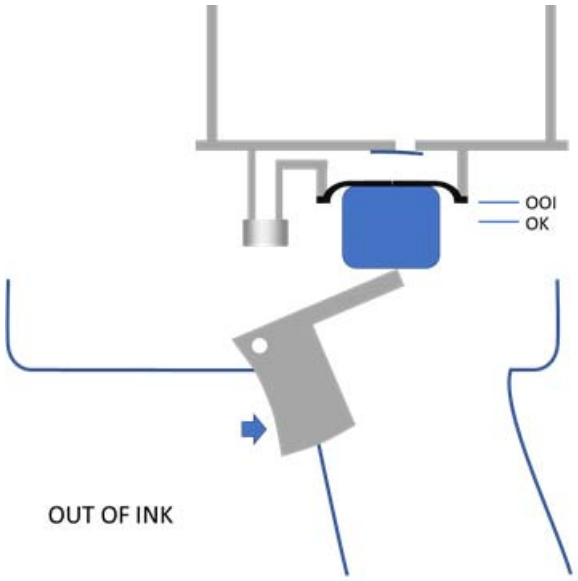

Figure 6. Out of Ink (OOI) state of the system.

In a fixed use coder, the pressurization of the diagram pump must be automated, as with an electric motor. The printhead can accommodate a wide range of ink pressures and flow rates. The ink delivery does not need to be closely regulated except for detecting out of ink.

CONCLUSION

While it is true that some of the larger continuous ink supply type printheads were designed with high-use bulk ink applications, this essay shows that the ease of use of single use cartridges can still be obtained through thoughtful integration of components. Furthermore, the choice of components allows

the resulting loaded frame to be tailored to the intended application, such as hand-held coders, through choices of print swath, size and weight of the frame, and delivered ink between ink replacement.

Depending on pricing, this approach can deliver significantly lower cost per unit ink volume than traditional single-use printhead systems, even accounting for the upfront investment in the frames and matching pockets.

Finally, these newer generations of thermal inkjet printheads can provide improved dot resolution, speed, and throw distance over earlier printheads. This paper describes a system architecture that combines all the above advantages into a configuration providing superior performance for hand-held coding applications.

Disclosed by Bruce Cowger and Mida Lorenz, HP Inc.