CALIBRATION OF OPT SENSOR THROUGH VACUUM FOR SUBSTRATE REGISTRATION IN ORDER TO APPLY DYNAMIC SWATH ADVANCE

HP INC
Calibration of OPT Sensor through Vacuum Servo for Substrate Registration
in order to apply Dynamic Swath Advance

Abstract: A calibration technique determines an optimal value of substrate vacuum that allows as swift movement of the substrate as possible while still maintaining sufficient control of substrate position to ensure accuracy of swath advance.
This disclosure relates to the field of printers.

A calibration technique is disclosed that determines the optimal amount of vacuum to be applied below a printing substrate that is high enough to obtain the right level of friction between the substrate and the OPT sensor to guarantee accuracy of the sensor measurements, but low enough to allow swift moving of the substrate in order to optimize throughput of the printer.

In Industrial printers in which printheads are disposed within a carriage which travels perpendicularly to the direction of the paper path, the substrate on which printing will be performed advances at regular intervals. The precision of these moves are not always as accurate as needed to achieve the desirable image quality. Dynamic Swath Advance precisely registers the position of the substrate at the end of each move, and compensates its position error by printing with a different part of the printhead. However, the precision of the printing process can only be as good as the registration process of the substrate. In order to achieve the right precision in the registration, a dedicated OPT sensor is used to avoid any slippage when moving the substrate.

Prior systems apply a fixed and relatively high value of vacuum. This value is sufficient to ensure the proper friction that guarantees the required OPT accuracy. However, applying this level of vacuum during movement of the substrate limits the speed of movement, and thus system throughput, and thus it is desirable to decrease the level of vacuum during movement. If the vacuum is reduced to too low a level, however, friction may be insufficient, resulting in slippage of the wheel of the OPT sensor and the substrate, causing position errors.

One of the difficulties is that the optimum vacuum level has several variability factors:

1. The type of substrate loaded on the printer.
2. The width of the substrate loaded.
3. The specifics and potential defects of each printer
4. The age of the printer

These different factors generate a different friction of the substrate upon the OPR sensor wheel and a different friction of the substrate upon the “platen” (the flat surface upon which the substrate moves during printing) for a given power applied to the vacuum fans. Hence the optimum level of vacuum (that is the optimum PWM to be applied to the vacuum fans) will be different across substrate type, substrate width, printers and time.

This is this issue of varying optimum point that we are addressing with the vacuum-servo based calibration.

According to the present disclosure, and as understood with reference to the Figure, a calibration technique determines an optimum vacuum value to be used during advance of the substrate 10 that accounts for the four different variability factors listed above:
Calibration is performed at various times: (1) when a substrate is loaded for the first time on a printer; (2) when executing the “add new media” procedure; (3) after a predetermined period of time since the last calibration; and (4) when media is loaded that has already been calibrated, but for a different width.

The calibration of the OPT sensor is based on a vacuum servo. A pressure sensor 20 in the vacuum chamber 30 allows the power of vacuum to be applied to obtain the optimal friction to be precisely defined.

The calibration process applies a ladder of growing vacuum (determined by the pressure sensor) to detect the point at which the OPT sensor has barely enough friction to work efficiently. Once this point has been detected, a second growing vacuum ladder is applied with steps ten times smaller in order to achieve better precision. Once this new point at which the OPT sensor starts/stop to work has been identified, then a specific margin in pressure is computed and the power of the vacuum necessary to obtain this pressure measurement becomes the calibrated pressure value to be applied during print jobs for this specific media of the specific width on the specific printer at the specific moment in time.

The decision of whether the friction is or isn't enough for proper OPT behavior is determined as follows:

1. Advance the media a small distance.
2. Measure the media advance through the drive roller (main media advance motor) encoder
3. Measure the media advance through the OPT sensor
4. Compare both measurements to decide whether they concord.

This disclosed calibration technique advantageously optimizes the OPT sensor measurement without affecting the throughput of the printer. It tackles all the sources of variability that could affect OPT precision and thus ensures the optimum IQ by allowing techniques that correct media advance defects in real-time, such as Dynamic Swath Advance, to be implemented. Furthermore, the technique wastes neither paper nor ink, and can be performed on the production line.

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