April 02, 2019

DRYING SYSTEM TEMPERATURE CONTROL FOR A LARGE FORMAT TEXTILE PRINTER

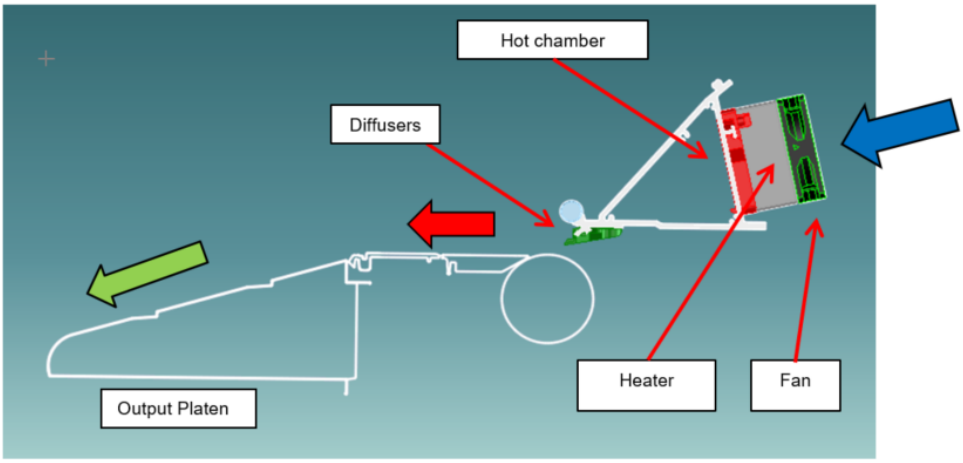
HP INC

Title

Drying system temperature control for a large format textile printer

Abstract

In the digital large format textile business, the drying system is one of the most important subsystems in the printer. The objectives of this system are dry the media enough so that there is no transfer between the rolled media and the following one, and to provide a hot air (airflow and temperature) in the print zone to reduce bleed and coalescence. And one of the most critical parameters in the dryers is the control of the temperature uniformity along the scan axis in the print zone. A fine control of the temperature uniformity increases the media versatility by enabling lower temperatures in the print zone while drying and increase the during capability level. Also improves bleed and coalescence and other image quality artifacts. In several printers, the drying system is based on convection with a hot chamber flowing hot air through several diffusers to the print zone. As can be seen in the picture:



In those drying systems, in most of the cases, the temperature uniformity can be achieved by separating the chamber in several modules. Each module controlled independently. This article shows another method: using a unique hot chamber but implementing a distributor on front of each pair fan/heater with the temperature sensor located behind the distributor. In this implementation, the fans/heaters, with the distributors, provide a very good temperature uniformity along the whole chamber. And, with the

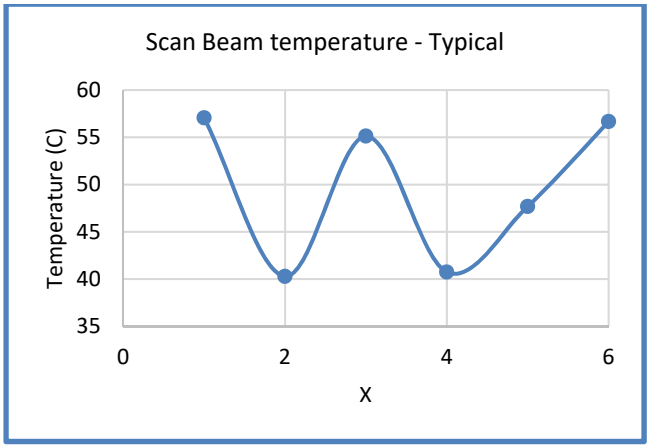
temperature sensors behind the distributors, the variability of the measures can be controlled much better.

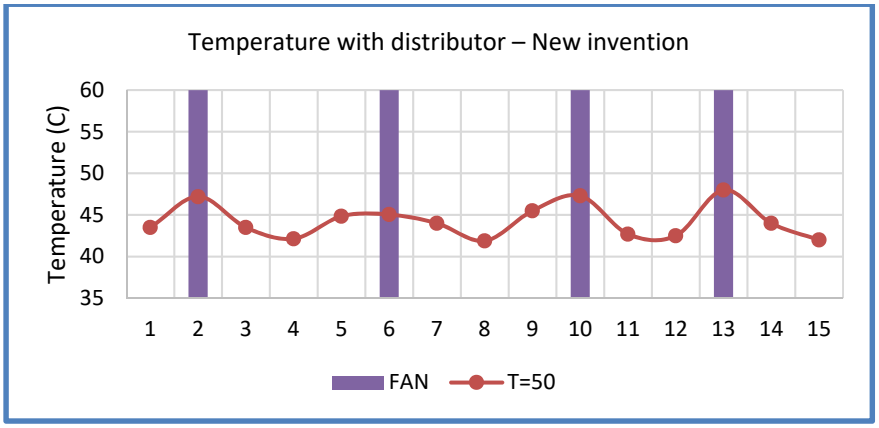
Problems solved by the invention

The main problem solved by this invention is the improvement of the temperature uniformity in both the hot chamber and the print zone along the scan axis.

In the dryer convection systems (that are using several local fan/heaters assemblies along the chamber) it is difficult to ensure the uniform temperature and pressure. But if the variability of the temperature can be controlled and reduced then the overall temperature can be reduced (allowing wider media ranges) or the drying capability can be improved.

With the new invention, the temperature variability can be reduced from +/- 10°C (typical) to +/- 4°C (new invention), at 50°C temperature chamber, as can be seen in the following pictures.





Prior solutions and their disadvantages

Prior solutions and their disadvantages to improve the temperature uniformity in the convective dryers, in the hot chambers, are:

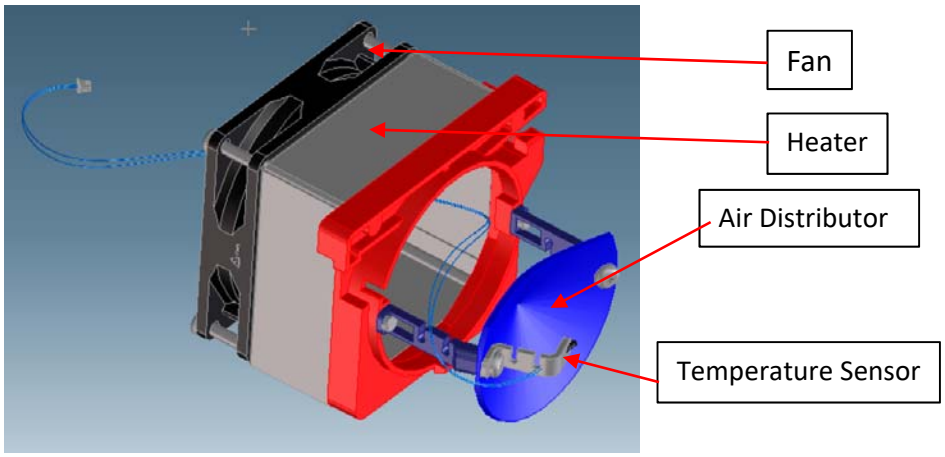
- Use a unique hot chamber along the scan axis:
  There is a unique chamber and several fan/heaters assemblies along the scan axis and the temperature sensors can be implemented or not.
  These are the main disadvantages of this configuration:
  - Large variability of temperature along the hot chamber and the print zone
  - When there is no temperature sensor in the chamber, the air temperature cannot be controlled. In some printers, the heater is only used to warm-up the printer when the external temperatures are low

- Use several hot multi-chambers along the scan axis:
  There are several chambers (depending on the printer width) with a fan/heater/temperature sensor in each chamber. Each module can control de air temperature with temperature sensor.
  The main disadvantage of this configuration is the cost implied and the overall complexity. Each module required each hardware supports and PCA controls.

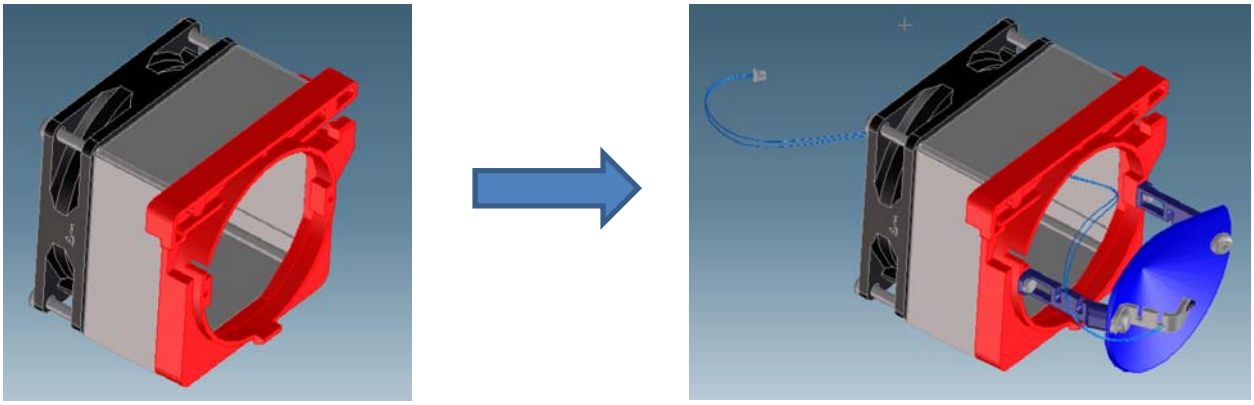
- Increase the number of fans/heaters in a unique chamber along the scan axis:
  Another option can be used to improve the temperature uniformity can be increase the numbers of fans/heaters assemblies along the scan axis. The more fan/heaters assemblies, better temperature uniformity can be got.
  The main disadvantage of this configuration is the cost of the components (fan/heater/temperature sensors).

Description of the invention

The invention refers to a new assembly fan + heater + air distributor + temperature sensor implemented in the hot chamber of the Drying System:



Compared with typical dryer we have added the air distributor and the temperature sensor:



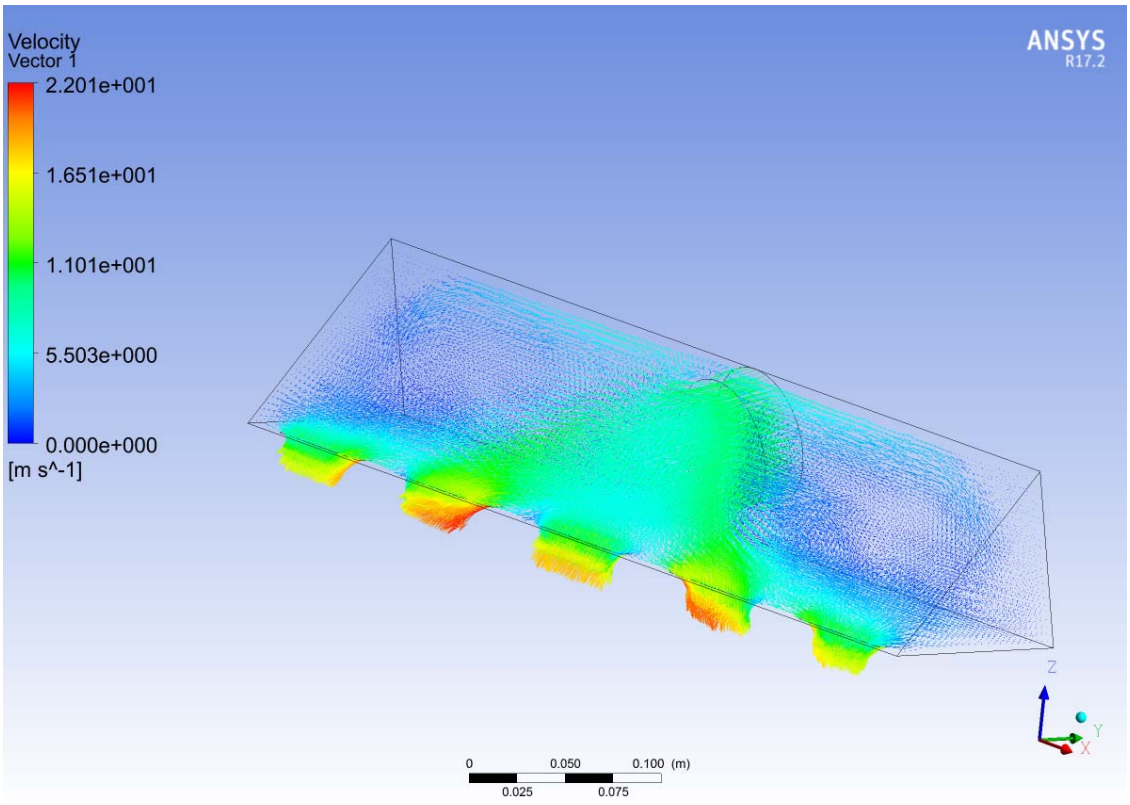
TYPICAL SYSTEM

NEW INVENTION

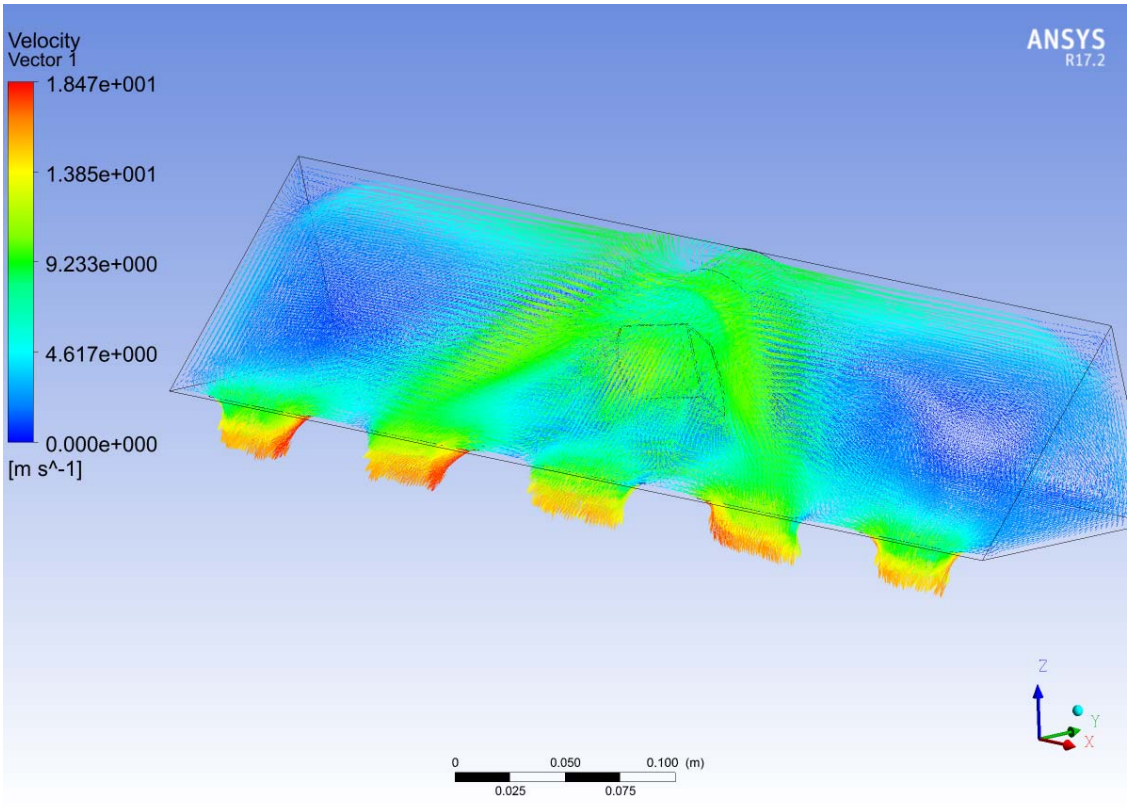
The air distributer spreads the fan airflow in front of the fan/heater, to ensure that there are not dead points between fans.

This is as Ansys airflow simulation of the distributor (each model consists of a segment of the hot chamber, one fan and five diffusers). It is only airflow velocity model (not temperature):

WITHOUT DISTRIBUTOR:

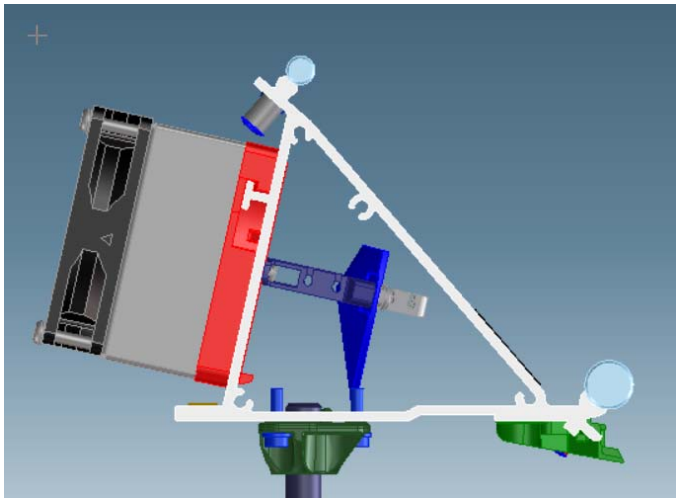


WITH DISTRIBUTOR (this is one of the geometries investigated):

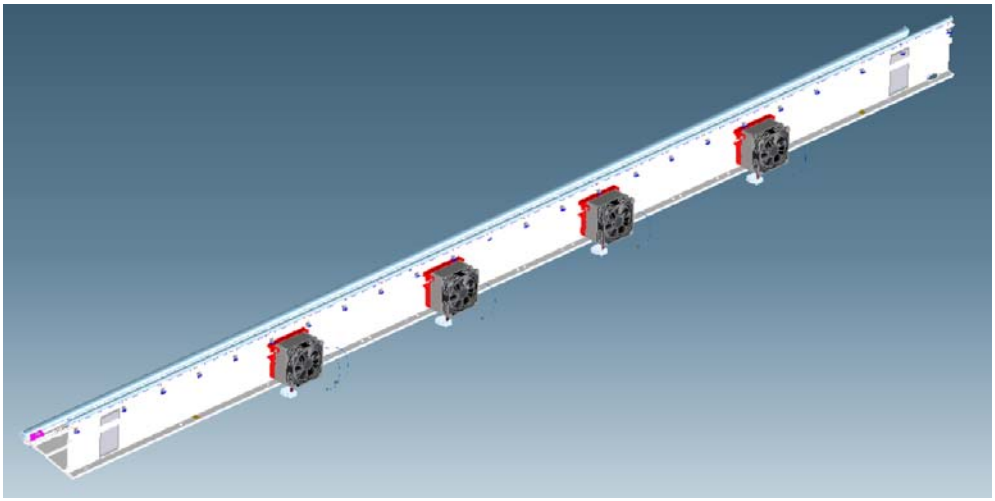


And the temperature sensor provides the control of the temperature of the chamber and allows the closed loop servo. This temperature sensor has been located beneath to isolate the airflows variability from the fans.

This is the cross section of the fan/heater/distributor/sensor assembly in the hot chamber:



And these are the four assemblies implemented in a 64” width printer:



Advantages of the solution over what has been done before

- As stated before, this solution offers a much better temperature uniformity along the scan axis hot chamber and reducing the cost and the complexity of the drying system.
- Another important advantage is that, since the temperature sensor is not located in the hot airflow, the measurement variability is much accurate.
- And another important advantage of the solution is that the whole assembly (fan + heater + air distributor + temperature sensor) serviceability is very good. All the components of the Drying System can be replaced very easily by service or even trained customers.

Disclosed by Antonio Monclús, HP Inc.