Waterless Offset Printing in Future Newspaper Applications

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Abstract: Within the recent years the development of printing machines for waterless offset printing has focused on new inking and printing units. The machines designed target technical and economical issues as well. New designs take into consideration the stability of all relevant surface temperatures, thus leading to a more stable and predictable process. In addition with other newly developed subsystems the waterless newspaper project will offer the possibility to push the printing process even further towards an industrial process. The general concept will be discussed and first results will be presented.

Introduction

This article will sketch the considerations that led to the design of a new class of printing machines. One of these, a newspaper printing machine, named Cortina, will be shown early this year at DRUPA 2000 in Düsseldorf, Germany.

Design overview

The design goal of this machine was to establish a compact 8-high tower that reduces the needed volume and the number of working levels. The incorporated anilox short train keyless inking system reduces paper waste, enables a real short

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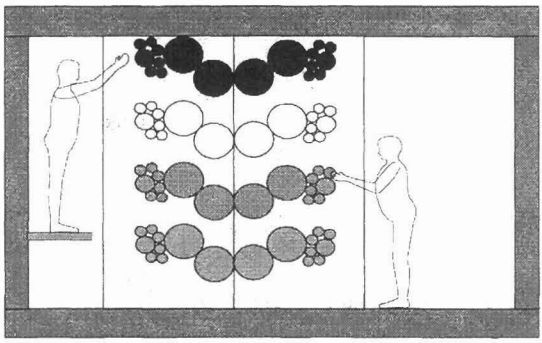
come to color and needs no ink zones. Double circumference plate and blanket cylinders are used to enable straight and collected production, covering different production requirements. Another target is to achieve a more stable process that leads to predictable and constant quality.



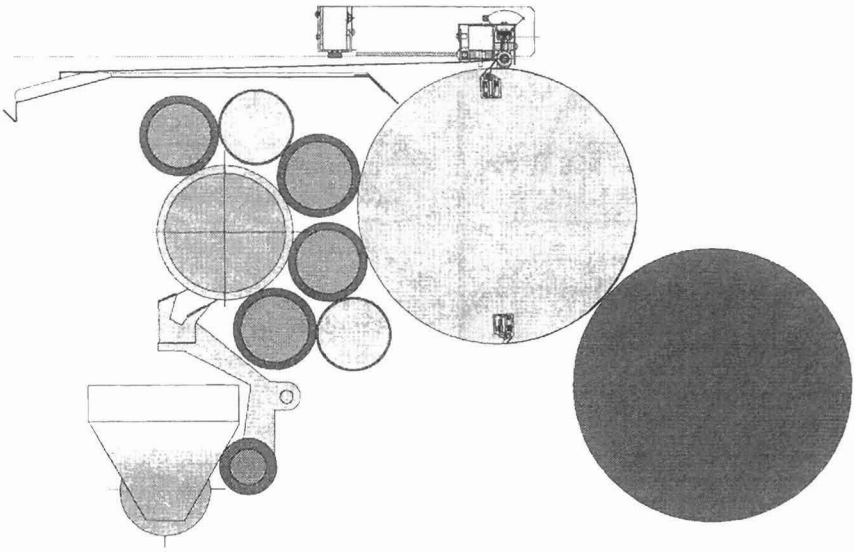
Choosing the printing process to be waterless reduces the number of physico-chemical interactions (ink-water-balance, emulsification). Due to the omission the dampening system the whole process can be seen of mechanical (constancy pressure) or thermodynamical nature (constancy of temperature). Remaining physico-chemical processes are predetermined due to the engineering process beforehand to control the ink – plate interaction. The development of the process thus has to focus on two critical issues, first to find the optimum plate and /or ink system and second to guarantee that the machine will reproduce the results during it's lifetime.
Thus closed loop temperature and nip pressure control (inking system) are incorporated.
Further due to the use of a short ink train, the comparatively low temperature and the thin layer of ink used in the ink train misting is low.

Mechanical Considerations

To assure a defined quality in print and the desired ease of use several means were taken into considerations that will be discussed now:

- Form roller diameter (misting, toning)
  The form roller diameter has to be chosen taking contradictory properties into consideration. Generally misting increases when reducing the diameter of the form roller. On the other hand decreasing the diameter reduces the risk of toning. Refraining from a 1:1 form roller there is a chance of slight ghosting. This can be strongly reduced using inks with good flow properties.
- semiautomatic plate loading

The chosen loading mechanism is the ideal compromise as it gives rise to

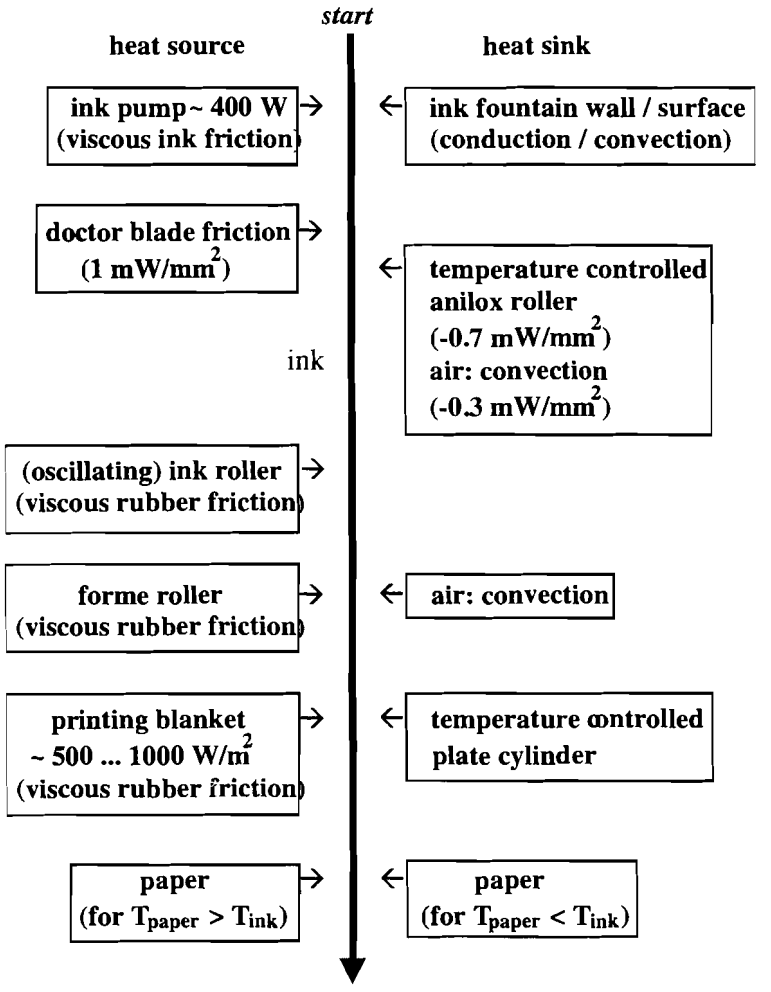


saving time without increasing cost of investment.

- sliding tower
  Due to the very compact design of the press conventional solutions no longer hold. The sliding tower mechanism is a proven technique used in banknote presses. Nonetheless the forces have to be absorbed without changes in nip zone pressure.
- Direct drive technology
  The direct drive technology (24 drives; plate cylinder, blanket cylinder, anilox roller times eight) enable the press to run all the axes independently. Thus semiautomatic plate loading can be done at the utmost speed. Furthermore a pre inking mechanism can be installed, that first runs the inking unit and after stabilising preinks the plate. Finally the press can be started. Engaging plate and blanket cylinder now, lets the press run at densities very close to the determined ones.
- Automatic nip pressure engagement
  The automatic nip pressure engagement is a tool that helps to keep the press at best operating conditions. As the pressure form roller – plate cylinder is low, a small deviation of the settings and/or the diameter (swelling, shrinking) and/or the hardness can have a major impact on toning properties.
- Doctor blade
  The design of the doctor chamber has to assure to fill the cell homogeneously over the width. Long series of test led to preferred settings and materials. Depending on the ink used a lifetime of several 100,000

revolutions seems to be achievable, delivering a constant ink film to the roller and finally to the plate.

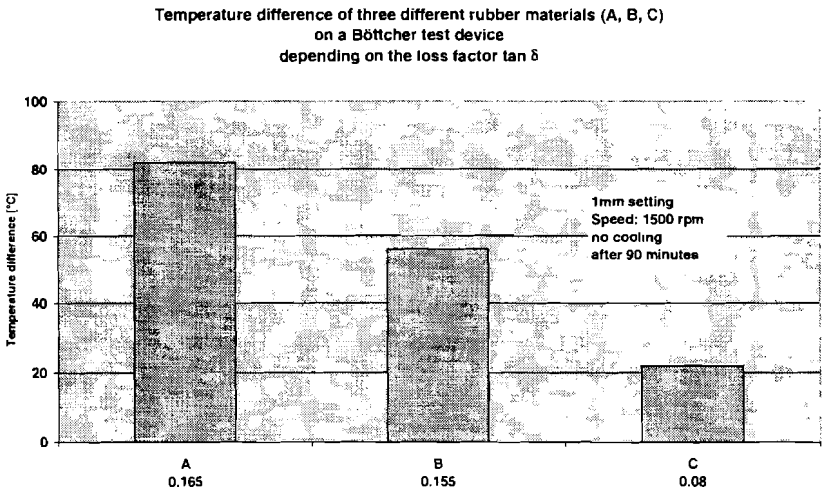
Thermic Trajectory of ink



- Ceramic Anilox roller
  The use of laser engraved Anilox rollers specially designed for the use in newspaper printing ensures more than 100 million impressions

Thermodynamic Considerations

To achieve a stable waterless printing process the constancy of the surface temperature is essential. Therefore liquid coolants are used in the press, no airblast cooling, beside convection is used. The successful temperature control depends on the understanding of the thermodynamic properties of the parts included. It is essential to understand heat sources and sinks, and even more important the time dependent behaviour due to the interaction with heat capacities fed through different conductive media. Since none of the sinks and sources are constant with respect to the velocity of the press care has to be taken to choose the right temperature control system. In this approach temperature is measured on the surface using IR sensors. These sensors have the capability to correct the measurement according to room temperature. This yields to more accurate and even more important to more consistent values.
As sketched in the scheme it is the idea to guide the ink from the ink tray (pump) and a comparatively „high" temperature of 35 ±5 °C to the paper (20 – 25°C) without exceeding the limits. The Anilox roller is usually temperatured at 30 ± 5°C; the target temperature is kept within ± 1°C.



As heat sources can be identified: the ink pump, the doctor blade friction, the viscous friction (form roller – anilox roller, form roller – plate cylinder and form roller oscillating roller) and viscous friction due the oscillation movement. All of

these sources with the exception of the form roller – plate cylinder interaction are absorbed by the Anilox roller temperature control. As friction is dependent on the pressure forces correct nip pressure settings prove to be crucial.

The rubber material may heavily contribute to the temperatures achieved as shown in the graph (Weinert, 1999). Here three different viscous materials were run under the same conditions on a testing device (true rolling, steel - rubber). Depending on the loss factor temperatures differences from close to 20°C up to 80°C were observed after a run of 90 minutes.

Ink Development

The ink development has to focus on two major aspects, the ink build up (plate) and paper build up (blanket). It seems that toning and solid density can be addressed more easy.
But also it has to be taken into consideration, that other behaviours are correct:

- The ink has to flow in the ink tray and must not create to much loss when being pumped. (This feature is not only related to viscosity and not fully understood.)
- Set off / rub off is similar to products printed in wet offset.

To merge all of these features doesn't seem impossible. But it requires considerable time and iterations.

Plate Development

During the past two years two plate systems (Toray, analog and Presstek, PearlDry) were used. Recently two more approached (KPG, Quantum NAW and Toray, Emerald). All of these show a very similar behaviour. Compared to the influence of ink development plates seem to be of second order importance in regard of toning and ink density. Future developments have to prove that life time and especially price match the requirements of the newspaper market.

References:

Weinert, J.
1999 „Chemische und physikalische Wirkungszusammenhänge bei gummierten Walzen im Zeitungsdruck", 1. Böttcher Fachsymposium Zeitungsdruck, (June 17-18, 1999)