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Flexographic printing

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1. Printing method

When we read the industry news we are warned again and again that the prospects of the printing industry are weak. Offset printing is doomed, and digital printing has a future. This or something along these lines is the message conveyed to us. A printing method which has consistently shown an exciting and eventful development during recent years is flexographic printing. While it was formerly discounted due to coarse screen rulings and the squashed edge effect, flexography could continuously improve its quality and thus significantly expand its position in packaging and decorative printing by gaining additional market shares. Now numerous duels with gravure printing or offset printing are being fought and also won in these fields of application. That`s reason enough to explain this printing method in some detail and to have a look at the state-of-the-art.

Flexography is one of the direct letterpress printing methods. Analogous to conventional letterpress printing, ink is transferred onto the substrate by means of raised printing elements (reliefs). In contrast to the letterpress printing forme, the flexographic printing forme is, however, soft and elastic. The advantage is that clearly less contact pressure is required and that the printing forme can adapt itself even to rough or uneven substrates like, e.g., corrugated board or tissue and nevertheless ensure consistently even ink transfer. On the other hand, these properties of the printing forme have adverse effects in the light image areas (highlights). Here, the finely structured relief may quickly be deformed, resulting in strong tonal value increases and unsharp printing behaviour. The printing forme materials used are elastomers or photopolymers. In combination with better printing inks, the latter have opened up the way to fine screen rulings and multicolour flexographic printing for the very first time near the end of the 1970ies.

The compact design of the flexo printing unit brings about a short ink transfer path similar to that in gravure printing. This becomes obvious above all in the fast response of the inking unit. While in offset printing some, respectively, sheets or metres of the web are needed for proper ink settings, changes in the settings in flexographic printing can be seen on the substrate after just a few revolutions of the printing plate already. This is a very favourable property which also has positive effects on the production run stability as regards inking.

Another advantage of the short inking unit is that cleaning of the pan and anilox rollers is comparatively fast. With a chambered doctor blade system, cleaning of the anilox roller is even possible via the chambered doctor blade. For this purpose, ink

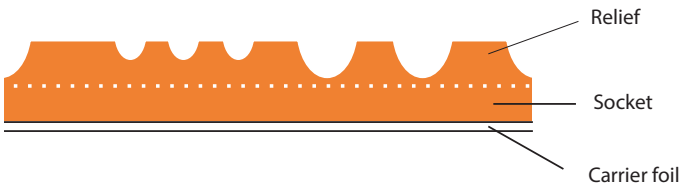

Figure 1: Structure of a single-layer photopolymer plate

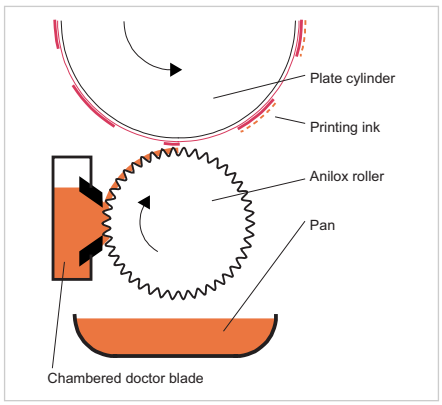

Figure 2: Chambered doctor blade principle

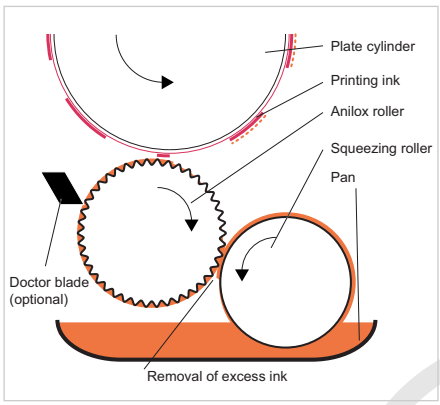

Figure 3: Squeezing principle

transport from the container is interrupted and a cleaning agent is pumped through the chambered doctor blades. The cells of the anilox roller are thoroughly rinsed in order to achieve optimum cleaning. Stubborn dirt due to dried ink residues may necessitate additional cleaning. In this case, many different cleaning methods are used. The applications range from chemical wet cleaning to mechanical methods using dry ice and/or plastic particles as well as ultrasonic cleaning. Intensive cleaning of the anilox roller is normally carried out outside the printing press. Treatment in the printing press is only done where extensive assembly operations are involved for the removal of the anilox roller. Basically it can be said that cleaning of the anilox roller requires special attention. Dirty cells have a significant effect on ink transfer. Regular maintenance and care are a basic requirement of high-quality flexographic printing.

In combination with the anilox roller, the rather simple principle of letterpress printing enables fast and efficient inking of the printing elements. The anilox roller is a roller with a ceramic coating or a hard chrome-plated roller with an even cell structure on the surface. Together with the frequently used doctor blade system (chambered doctor blade principle) or the simpler pan roller system (squeezing principle), these cells ensure ink metering as required and produce an even ink film on the printing forme and later-on the substrate.

The printing inks used are, with the exception of UV printing inks, low-viscous and are water-based or produced with organic solvents. Where conventional inks are used, drying is mainly by evaporation or, where absorbent substrates are used, by absorption of the solvent portion contained therein. Like in other fields of application, the setting of UV printing inks is by cross linking of the monomer and prepolymer structures after radiation with UV light.

Inking in flexographic printing can be described as being very even. The ink quantities applied vary depending on the pick-up volume of the anilox roller used. As a result, there is a direct interdependence between the printable screen lining, the selected anilox roller and the substrate. While in a printing unit using the squeeze principle ink application can be adjusted to a small extent by changing the gap between the anilox roller and the pan roller, a printing unit using the chambered doctor blade principle always necessitates an exchange of the anilox roller. This additional set-up operation is, however, worth the trouble because it ensures consistent ink application throughout print production and high reproduction precision in follow-up jobs. Essential re-quirements are, however, good maintenance of the anilox rollers used, well-planned ink management and well-documented production specifications.

Besides the construction principle of the inking unit, a distinction between flexo printing presses is also made with regard to the basic design. Depending on the field of application and the print product, basically three types are prevalent now. The central cylinder design, the unit design and the compact design. **Central cylinder printing machines** are mainly used for printing on elastic and slightly stretchable printing substrates like plastic films or for preprinting cover sheets for corrugated board. **The unit design** is used for narrow web label printing machines, stable composite materials (e. g. beverage cartons) and as sheetfed printing machines for printing on corrugated and solid board. **The compact design,** on the other hand, is, e.g. used for napkin printing machines or in paper sack production. The above-mentioned examples make it quite clear that flexo printing machines are highly specialised production systems which are often operated in combination with print finishing aggregates. There simply isn`t the one and only flexo printing machine, but each and every machine is tailored to the field of application, is a total technical solution. The large number of substrates that can be used opens up numerous fields of application for flexo printing. One domain is, no doubt, packaging printing. The wide spectrum of applications ranges from labels to plastic bags and paper sacks. The consistently improving print quality remains a guarantee of the continuation of this course for success.

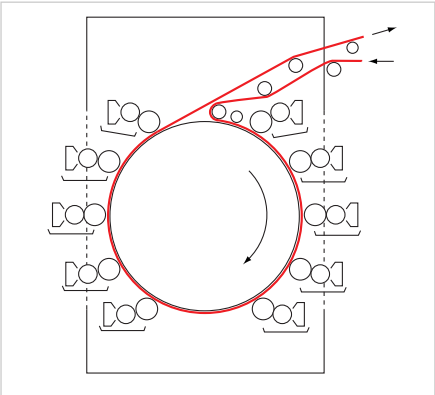

Figure 4: Central cylinder design

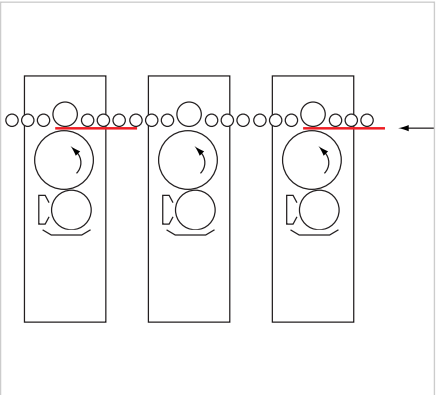

Figure 5: Unit design (sheetfed printing)

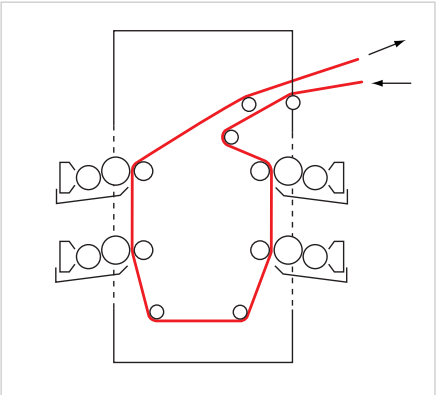

Figure 6: Compact design