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EUROPEAN ROTOGRAVURE ASSOCIATION

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Doctor Blade Problems

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One of the fundamental advantages of gravure is the comparatively simple system of inking the forme cylinder. Doctor blade inking units, however, have become a weak point on gravure units in consequence of the demands of increased production and better quality.

As you know, the unwanted ink on the forme cylinder is removed by a very thin well sharpened knife-blade which leaves ink only in the etching cells. Doctoring should proceed in such a way that during the run neither ink variations nor doctor streaks appear and that a long durability of the doctor blade is guaranteed. These requirements involve considerable design and technological problems.

The main reasons for ink variations are:

1. Variations of doctor pressure caused by speed variations of the press or changes of the rheological properties of the ink during printing and doctor vibrations caused by untrue cylinders or unevenness of the cylinder surface;
2. Uneven wear of the blade;
3. Close contact between blade edge and cylinders over the etched areas under high pressure.

To solve the doctor problem it is therefore necessary to meet the above-mentioned errors by suitable design and technological measures. So my following lecture will deal with the more recent development trends.

One of the deciding factors in reducing colour variations is the reduction of doctor pressure. Doctor wear and unwanted doctor distortions can thus be considerably reduced. Several ways are open to achieve this aim. Fuchs uses an elastic pressure bar in contact with the doctor blade, assuring by means of compressed air even contact of the blade tip and the forme cylinder with resulting low line pressures. In this way he achieves that the necessary doctor pressure has only to be about half the normal one, compared with the conventional systems. The drawback of this design is that it is rather complicated.

According to practical experience complications are less when a 50 per cent. reduction in doctor pressure is achieved with the blade supported in its centre in a universal bearing. On wide machines stability problems may arise from this.

Of particular interest is the design by Rogge and Roehm. Its main feature is that the doctor is verging against the direction of rotation of the cylinder and has been given a curvature. A variation of this system has been published by Lilien. The drawbacks connected with the curvature are eliminated by the fact that in this case the reverse blade does not require to be curved. The fulcrum has been positioned higher than in the original suggestion. Several important advantages

are claimed for the reverse blade. The required tip pressure is only 1/5th to 1/10th of the normal pressure. With this system no ink wedge can form between blade and cylinder. The presence of hard particles in the ink therefore is not critical.

With the increase of machine speeds the tip pressure on the reverse doctor blade increases contrary to that of the normal doctor position because the speed-depending forces which are exercised by the visco-elastic ink sheared off by the blade press the blade tip harder against the cylinder. Central blade bearing should also be considered for reverse blade arrangements.

It is very important to adjust etching to the doctor system.

In this connection it must be briefly mentioned that the doctor blade must be supported in such a way that the doctor blade angle affecting the doctor pressure as well as the tip pressure can be adjusted independently.

A further possibility to decrease colour variations is the solution of the problem of the most suitable doctor stroke. It is well known that the doctor action is least in the moment of the movement reversal, especially on the current constructions. The time of reversal becomes less important the faster the movement reversal occurs or the slower the traverse movement is. As extremely fast reversals present design difficulties the Americans use in some cases extremely slow doctor traverses (e. g. up to 400 cylinder revolutions per doctor stroke). KOENIG & BAUER has recently developed a universal hydraulic doctor drive permitting wide variations of doctor blade travel and axial stroke direction. Rhythm, period, and phase can be freely chosen.

The endless blade which Mertens suggested as early as 1909 is superior to all other blade drives on account of the absence of reversal. The idea was abandoned because the required blade butt joint presented difficulties. However, we are in a position now to roll endless spring steel bands; it appears that costs and possible vibration difficulties caused by the drive fitted to the doctor carrier has prevented the use of this design.

Technological success in chroming steel doctor blades brought about the increase in durability and helped to overcome the problems mentioned. Systematic research into the wear of blades made from different materials in conjunction with chrome and copper cylinders should be undertaken. The INSTITUT FÜR DRUCKMASCHINEN UND DRUCKVERFAHREN DER TECHNISCHEN HOCHSCHULE DARMSTADT has developed electronic measuring procedures which allow investigations on doctor pressures under various running conditions. Such small-scale investigations are taking place at present at the gravure machine available in Darm-

stadt. It would be advisable to undertake such investigations on a modern experimental printing unit of 2 m width and at press speeds of up to 30,000 r.p.h.

The various doctor systems suggested should be submitted to a critical study as to their value to remove once for all the uncertainties existing when assessing the various types.

The action of the doctor blade on gravure ink will soon be studied by means of an improved slow-motion micro-camera. The investigation by means of normal picture-taking yields only limited information. It would be better if blade action and ink transfer from cell to paper could be investigated by means of a shadow profile technique. High-frequency X-ray cinematography might give a possibility to achieve this. The high-frequency X-ray cinematography, however, is still very new but promises to supply a great deal of new fundamental knowledge. Of particular interest might be the results of X-ray cinematographic slow-motion pictures of the ink-splitting process. Unfortunately the required equipment is not yet at the Institute's disposal.

After this short survey of the Institute's future research plans concerning gravure inking units I may end my lecture.