

Equally well, it would be pointless to use a quicksetting ink on a highly absorbent uncoated paper such as newsprint. The advantage of good finish for instance would be lost on such papers and other types of ink are more suitable for this purpose. These dry by penetration only and are the exception to the rule that drying is conversion of a liquid to a solid. They are absorbed into the pores of the stock and remain liquid at all times although protected from anything but the most vigorous rubbing. Penetration takes place very rapidly and the inks have excellent press stability but the final print is generally only of limited quality and does not have good resistance to physical and chemical influences. Penetration drying finds application in rotary letterpress news inks, many cold-set web-offset inks and some small offset inks.

#### Ultra-Violet Curing

The use of infra-red radiation as a heat source has already been mentioned, but other energy sources have been investigated. Of these, ultra-violet radiation has proved to have a wide range of practical and commercial applications.

The use of ultra-violet is not, however, as a source of heat but provides energy in a

form which stimulates a totally different curing mechanism. A typical UV curing ink contains pigment, UV curing vehicle (or prepolymer), UV diluent (or monomer), photo-initiators and additives. When the photo-initiator is exposed to suitable wavelengths of ultra-violet radiation, it becomes extremely reactive and starts a chain-reaction between the prepolymer and monomer which causes them to form a dry, tough, highly cross-linked film. The difficulties for the ink formulator are that he is dealing with new fields of chemistry and having to work with raw materials that do not readily satisfy all the other needs of a lithographic ink, particularly in their reaction to the presence of water.

Because of the significant advantages that can be gained, inkmakers and machinery manufacturers have combined in the last ten years to develop the process into a viable and successful commercial proposition in certain applications, particularly decorative packaging. Benefits on the press include elimination of spray, instantaneous drying and excellent press stability. On the print, no spray gives a smooth print more suitable for varnishing or lamination and high film-weights give improved visual impact.

The dried ink film has low odour for food packaging work and is tough and resistant. Set against these are high ink costs plus the cost of installing and running the curing units. UV radiation is potentially dangerous if not properly controlled and the range of blankets, rollers and plates suitable for use with UV inks is limited.

UV curing has found its major application in carton work where high filmweights of ink are being printed on smooth board. High quality work on foil-lined board, such as cosmetic or whisky cartons, has also benefited. The extremely high gloss UV cured overprint varnishes when printed wet-on-dry over conventional inks now provides an alternative to film lamination, for instance for record sleeves. The potential for the use of UV in the metal coatings field is considerable as large savings in space and energy are achieved.

The change has been slow in many cases due to the higher cost of inks and the capital cost of replacing expensive stoving equipment. However the use of UV curing finishing inks is now well established both on set-stack and interdeck lines. In the area of enamels and varnishes, problems of producing economical and technically satisfactory products are still considerable.

#### Evaporation drying

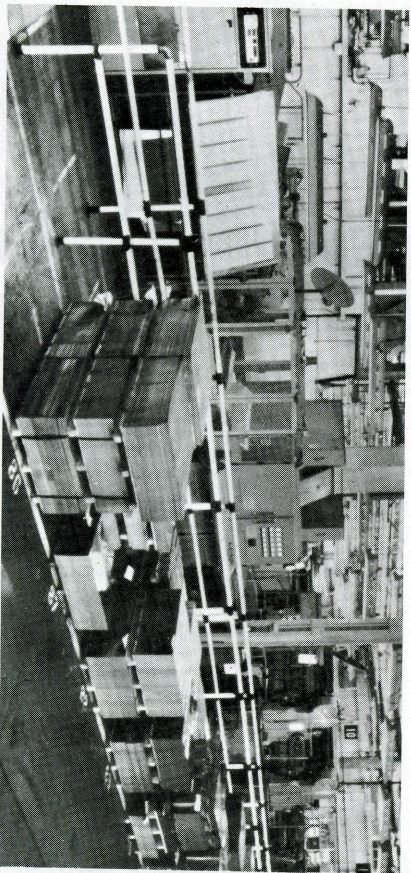
Most of the methods of drying so far discussed were initially exploited with letterpress and lithographic inks and some have subsequently been adapted for use in other fields. Evaporation drying has come the other way, having first found application for flexo and gravure inks.

Evaporation drying requires the very rapid release of solvent from the ink film, leaving only the solid components behind on the substrate. This is relatively easy to achieve with flexo and gravure inks as highly volatile solvents are used. But the requirements for letterpress and lithographic inks are different.

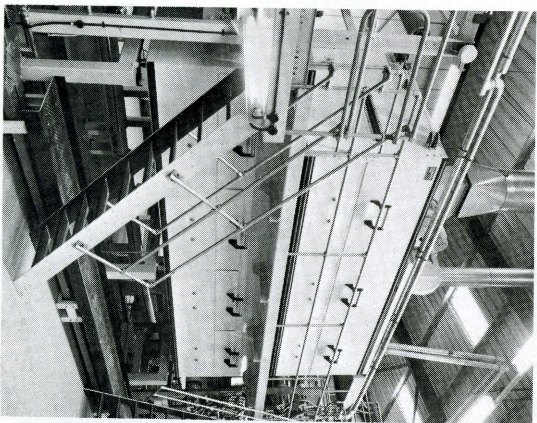
The majority of inks of this type are the so-called 'heatset' inks used in offset printing of a paper web (web-offset). Press

design is basically the same as a conventional offset machine and therefore stability on the rollers and in the duct is important. The solvents used must therefore be much less volatile than flexo or gravure solvents and the problems of removal from the ink film are considerable. The problems are met by using solvents (high boiling hydrocarbons) which do not evaporate appreciably at ordinary temperatures but can be removed by the use of heat - gas flames being the usual source.

The advantages of this method are three-fold, and applicable to both rotary letterpress and web-fed offset. First, few limitations are placed on the type of paper; one is not restricted to rough porous papers of the newsprint type, and it is common practice to use process coated stock. Second, a full film of ink can be carried, without fear of marking in the folder, thus improving the appearance of the print. Third, superimposition and process colour work which is otherwise not practical on web-fed processes can be undertaken.



*The relative dimensions of a UV installation (foreground) against a conventional oven (background) show the space saving that can be achieved with UV in the metal coatings field. Photograph courtesy of Metal Box Ltd.*



*This Crossfield-Tec drying oven is typical of those used in heatset-web printing.*