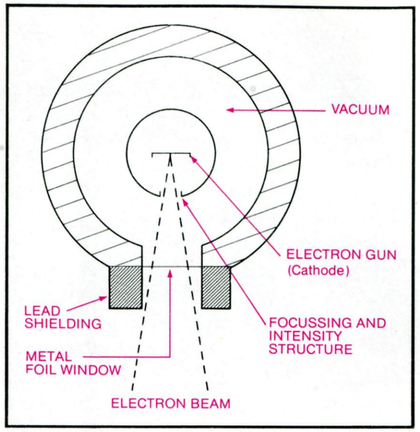
Other Methods

The use of 'breathable emulsions' (or aqueous overcoatings) was first suggested several years ago. At that time, infra-red was also beginning to have some impact and their use was pushed into the background, mainly because of limited availability of application machinery. More recently, a lot more interest has been shown in the idea. Breathable emulsions are applied in-line from a specially designed coating head and dry by a combination of penetration and evaporation within 60 seconds of application. They are designed to be porous even when dry thus allowing the inks underneath to continue to absorb oxygen for complete drying. Apart from the advantage of elimination of set-off, the use of such coatings can improve rub resistance. The surface can also be glued, can resist grease and oil and will not yellow. Renewed interest has brought about the introduction of a wider range of coatings which can be tailor-made to have specific properties such as heat stability or heat resistance.

For the future, UV curing seems to offer many advantages but other sources of high energy are currently being investigated. The most popular of these is an electron beam unit which is already in commercial use for drying wood finishes, car paints etc. despite the very high cost. These units make use of the very high energy of electrons generated by a metal cathode and have the advantage of being able to rapidly cure thick films of highly pigmented coatings, which has yet to prove possible with UV at reasonable speeds.

Electrons from the cathode gun are accelerated by a high electrical potential towards an aluminium foil window, through which those of sufficient energy pass to bombard the print. Curing must be done in an atmosphere of nitrogen to avoid both generation of ozone and oxygen inhibition. Also, X-rays are produced by the action of the electrons on the metal surface and the whole apparatus must therefore be sheathed in lead.



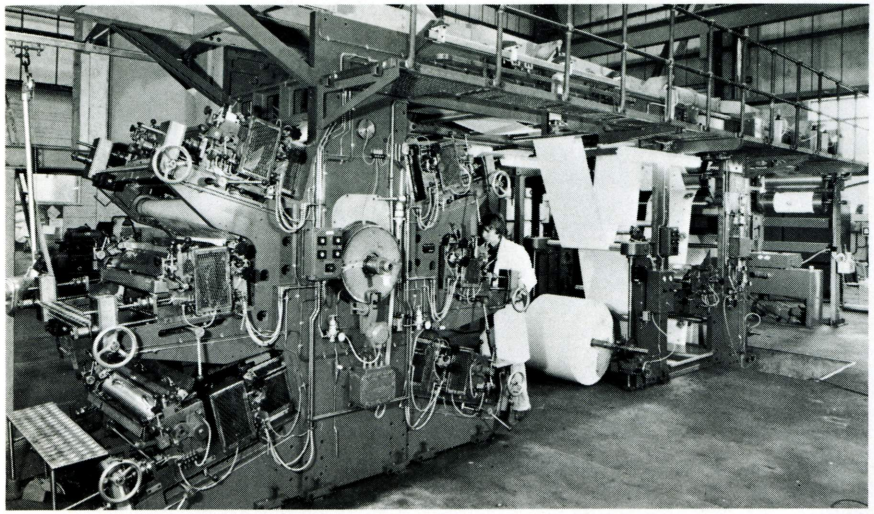
Cross section of a typical curtain type electron beam generator.

Another idea which is being investigated is the powderset process. It is very similar in principle to thermography as the wet print is dusted with a fine powder. The excess powder is removed with an air knife and that which sticks to the ink film is fused by passing under a heater. The result is a dry print. The powder used is very much finer than that used in thermography and thus the raised effect is not achieved.

FLEXO AND GRAVURE

It is inevitable in an article such as this that a lot of space will be taken up discussing the drying methods of letterpress and lithographic inks. Both processes adapt very readily to all the major drying methods, unlike flexo and gravure which are restricted by a number of basic factors.

By far the most important method for liquid inks is evaporation, primarily because much of the work is designed for application on non-absorbent substrates where penetration has no significance. The use of highly volatile solvents such as alcohols and esters ensures very rapid drying. At the same time, the more volatile the solvent,



This Cobden Chadwick flexo press illustrates both inter-colour and overhead tunnel dryers which are essential for rapid and efficient solvent evaporation.

the less press stable is the ink and the familiar problem of compromise is repeated. However, flexo and gravure are adapted to this need through the use of very fluid inks which do not require a large number of distribution rollers. In flexo, there is usually only a maximum of two distribution rollers whereas in gravure, the forme roller (or engraved cylinder) does this job itself.

The rate at which evaporation takes place is dependant on a number of factors. Firstly for a given solvent it will depend on the 'solvent release' of the resin. The more effective the solvent is in dissolving the resin, the less readily it will be released by the resin in the ink film. As an example, large proportions of normal propanol in flexo polyamide inks can give rise to problems. The extent of such a problem is greatly reduced or eliminated providing oven temperature is high enough and removal of solvent vapours is adequately carried out. But in these days of high energy costs, it is important to keep temperature down to the minimum consistent with adequate drying and/or good keying.

A temperature that is too high can cause drying problems particularly with the thicker filmweights deposited by the gravure process. For efficient drying the solvent must be able to diffuse quickly through the ink film to the surface. Very high temperatures can cause rapid surface skinning which will trap solvent in the ink film, thus retarding the diffusion process.

Two physical properties of the solvent are also important in determining evaporation from an ink film. The first is the vapour pressure of the solvent which is defined as the pressure exerted by the liquid when it is in equilibrium with its own vapour. All this means is that, at a given temperature, only a certain amount of solvent will evaporate from the film above which point the excess will condense back into the film, thus setting up an equilibrium.

The vapour pressure of the solvent or solvent mixture must be low enough, at the temperature at which the machine is run, to avoid excessive loss of solvent before the ink reaches the stock. Conversely, the vapour pressure at the temperature in the