The use of REACTIVE MEDIA other than oxygen has been suggested and is claimed to give greatly increased drying speeds. Prints are passed through an atmosphere of vapour (for example ammonia) which reacts with a special ink. The advantages of fast drying and low operating cost are significant but the disadvantages are such that the idea has not made progress. Capital costs can be high and there are environmental problems with both the special ink and the catalyst.

The use of EXTERNAL ENERGY SOURCES. The most significant advance in chemical drying in recent years has been the introduction of ultra-violet curing for a wide range of applications. UV radiation is used to initiate a chemical reaction within the special ink and gives almost instantaneous drying with excellent press stability. The application of UV to the various print processes will be discussed under the relevant sections.

Many surface coatings are formulated to undergo CHEMICAL REACTIONS with themselves without any external influences. This method is most important in the field of enamels and varnishes used in the metal coatings industry. These products are stable at normal temperatures but their constituents undergo condensation and polymerisation in the elevated temperatures of heating ovens. The principle of chemical reaction is also used in two-pack inks often wrongly called 'catalytic' inks. These differ from enamels and varnishes in being reactive at room temperature. For this reason they need to be supplied in two separate parts, one being the activator chemical the other the base ink, which are only mixed just prior to printing. Such systems find most applications in gravure and screen printing, when high resistance properties and/or gloss are required, but they are inconvenient to use.

(b) All the major print processes use EVAPORATION in some application making it the most versatile of all drying methods. It relies on the volatility of solvents and is most familiar in the fields of flexography and gravure where the highly volatile solvents used require the minimum energy to achieve rapid drying.

(c) PENETRATION (or absorption) is one of the traditional drying methods and is the only one, when used exclusively, that does not require the conversion of a liquid into a solid. The whole of the ink is taken up by the absorbent paper (rather like a blotting-paper effect) and the ink, whilst remaining liquid, cannot be smudged or transferred to another surface. Penetration drying is an extremely rapid drying method.

It is common for two or more of these methods to be combined to take full advantage of the benefits of each. Such combinations will depend on the process and the stock being used and the end use of the product. No one method has found exclusive use at the expense of all the others. As will be seen, the reasons are many and include the distribution system on the press, cost factors, or the type of stock being used.

LETTERPRESS AND LITHOGRAPHY

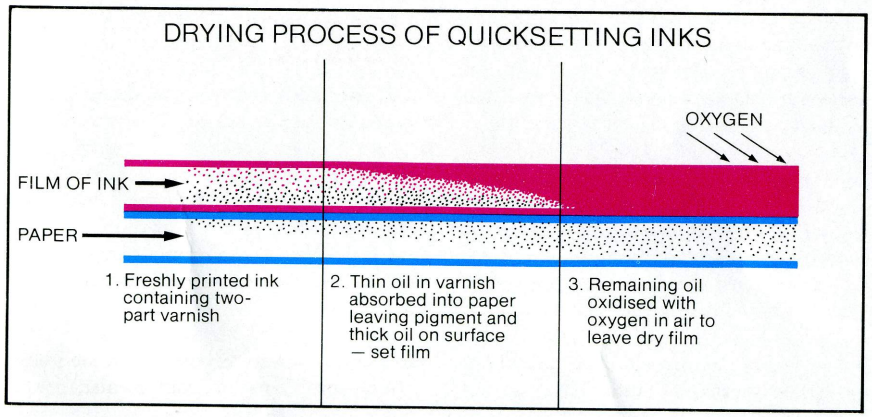
The letterpress and lithographic processes have traditionally relied on the use of a stout ink which needs to be evenly distributed, before impression, by a bank of inking rollers. This immediately poses a severe restriction on the type of ink that can be used, as the ink must remain stable on the distribution rollers both when they are in motion and for certain periods when they are static. At the same time, the ink must dry as rapidly as possible on the stock.

Such problems of compromise are a constant challenge to the inkmaker and it is interesting to trace the history of ink drying for letterpress and lithographic inks. Early inks were based on non-drying oils and dried by penetration into the absorbent stocks used. Such inks were ideal for newspaper and jobbing work but as increased demands were made on quality, the switch was made from penetration drying inks to ones drying solely by chemical means. Linseed oil was an ideal base for such later inks as it satisfied the need for roller stability and was capable of reacting with oxygen from the atmosphere. But the rate of this reaction was extremely slow and whilst many attempts were made to introduce other drying oils or to modify linseed oil, no significant advances were made for many years. The most important break-through was the introduction, in the 1930's, of quicksetting inks.

Penetrate and Oxidise

In simple terms, quicksetting inks rely on a combination of the two drying methods already mentioned i.e. penetration and oxidation. The varnish in quicksetting inks consists of two parts, the first of which contains synthetic resin and drying oil. It is very stout. The second part is a thin mineral oil and when the two are blended, a varnish of workable consistency is obtained. Inks made from such a varnish are perfectly stable until they come into contact with certain types of absorbent paper (such as art) having many fine pores. The thin mineral oil is sucked out of the printed film by capillary action and leaves the much stiffer pigment/resin/drying oil on the surface. At this point the film is said to have 'set' and is practically solid, although it is not dry until the drying oil has oxidised some hours later.

Continued development in the selection of raw materials and in varnish manufacture has established the quicksetting principle as the single most important drying method for letterpress and lithographic inks. Quicksetting inks have an extremely wide range of applications and can now be used on all types of coated stocks. Initial problems of achieving acceptable gloss levels in conjunction with fast setting were apparent Quicksetting inks rely to some degree on the incompatibility of the mineral oil with the rest of the system. Such incompatibility, though leading to very rapid separation of the two phases on contact with the paper, is not conducive to a high gloss finish. This is an area where compromise is essential although considerable improvements have been made in recent years through careful raw material selection.



Quicksetting is the principal drying method employed by letterpress and lithographic inks for paper and board. It relies on rapid separation of thin mineral oil from the ink film followed by oxidation/polymerisation of drying oil.