



The principle of operation

From the etching of the cliché to the finished decoration.

The pad printing process can be considered as a synthesis of methods used in screen and rubber stamp printing, this combination has generated this new system that is entirely unique.

In the beginning copper plates were etched with recessed images similar to the photogravure process. In the centuries, materials and methods have changed but the main principle remained unaffected: depressions with images to be printed are etched on a plate (cliché) then filled with ink; after that a silicone pad is pressed on these depressions to pick up the ink from the cavity of the etching, the pad carrying the image is next compressed onto the substrate to release the ink.

The process can be easily explained in steps:

1. The surface of the plate (metal or polymer) is etched with an image, then it is mounted in a pad printing machine
2. The surface of the plate is flooded with ink to fill the etch. The exceeding ink is wiped clean by a doctoring system.
3. A pad (today from silicone) is compressed onto the plate to pick up the image
4. The pad is next lifted away from the plate and moved to the substrate to be printed. It is then compressed onto the object till it adapts the surface.
5. After that the pad is lifted away from the object after it released the ink or better the decoration onto the substrate.

The printing process is similar to the way a screen is flooded and squeegeed, but while in silk screen this operation means the immediate transfer of an image onto the substrate, in pad printing the graphic is first transferred on the pad surface (indirect print).

Unlike rubber stamp printing, the pad is not the source of the image but its means of transfer.

With suitable equipments, more images can be reproduced even onto different sides of the product, different heights, on inclined or vertical surfaces.

All pad printing machines are build on two basic principles of operation, commonly referred to as the "open principle" and the "closed principle".

The open principle

The image to be transferred is etched into a printing plate, commonly referred to as a cliché. Once mounted in the machine the cliché is flooded with ink.

The surface of cliché is then doctored clean, leaving ink only in the image area.

With the solvent's evaporation the ink's ability to adhere to the silicone transfer pad increases.

The pad is positioned directly over the cliché, pressed onto the surface to pick up the ink and then lifted away.

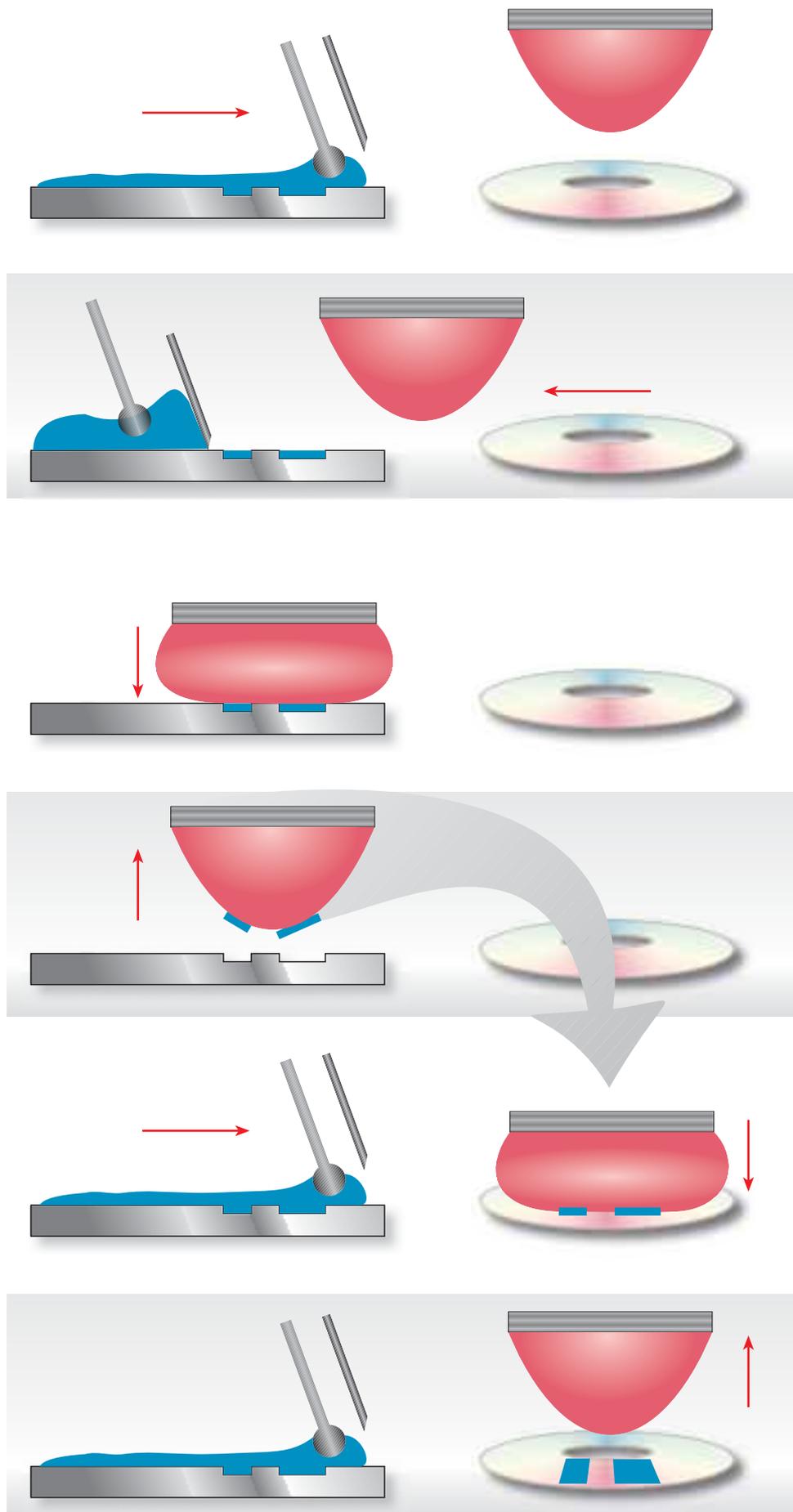
The physical changes that take place in the ink during flooding (and doctoring) account for its ability to leave the recessed image area in favour of the pad.

After the pad is lifted away from the cliché to its complete vertical height there is a delay before the ink is deposited onto the substrate.

At this stage the ink on the pad surface undergoes physical changes as solvent evaporates from the outside of the ink layer, making it tackier.

The physical changes that take place within the ink layer during the print stroke result in the ink developing more of an affinity for adhering to the substrate than to the pad. The pad is then compressed onto the substrate transferring the image. Even though the pad compresses considerably during this step, the contour of the pad is designed to roll away from the substrates' surface rather than press flatly against it. A properly designed pad, in fact, will never form a zero degree angle of contact with the substrate. Such a situation would trap air between the pad and the substrate, resulting in an incomplete transfer of the image.

The pad lifts away from the substrate and assumes its original shape. When the variables involved with all five steps are properly controlled, the pad should lift away clean and ready for the next print cycle.



The closed principle

The closed principle differs from the open principle in that the ink is not directly exposed to the air. In closed systems the ink is inside of a "sealed" container, usually referred to as an "ink cup".

Ink flooding occurs while the ink cup is positioned over the etched image area. The sharp edge of the ink cup, commonly referred to as the "doctoring edge" or "doctoring ring" acts like the doctor blade in an open system.

In some systems doctoring occurs when the ink cup slides across the top surface of the cliché, in others the ink cup is motionless, it is the cliché which slides under the doctor ring.

The pictures show the ink cup in motion.

In either cases the end result is that the top surface of the cliché is doctored clean and the recessed image area is left flooded with ink. From that point the theory is applied the same as in open system.

