

SPECIAL HANDSTAMPS – THE PAD CANCELLER MACHINE

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Two years go [in 1990 -Ed] Royal Mail Stamps asked Royal Mail Research and Development to investigate the possibility of replacing the ageing philatelic cancelling machines currently being used in the Special Handstamp Centres and the British Philatelic Bureau to produce high quality impressions or privately sponsored designs.

These machines were of Swiss origin and, although were generally acknowledged as providing the best philatelic quality of cancellation, were limited in their application. The machines could only operate with slow drying oil based inks which made obtaining good impressions on glossy surfaces (postcards, photographs etc) almost impossible and the maximum impression size of only 33mm diameter constrained the sponsors' design options. In addition to these factors, maintenance of the Swiss machines was proving to be expensive, primarily due to the cost of spare parts.

R&D investigated various methods of printing impressions (including the traditional rubber or metal dies) and concluded that offset pad printers provided the best solution. Pad printing is technically an indirect gravure printing process directly related to a process invented several hundred years ago in Europe. Originally used in the Swiss watch making industry to decorate watch faces, pad printing has evolved into one of the major technologies used to print symbols and characters onto the surfaces of objects, in particular, three dimensional plastic parts. Today as much as 90% of the decoration in the interior of a car is applied by pad printing, the symbols on control panels, direction indicator and windscreen wiper handles, buttons and knobs are applied by pad printing. The economy and versatility

of pad printing make the process attractive to many markets such as printing onto the face of calculator and computer keypads, bottle tops, model cars, plates, tablets and even golf balls. It is the widespread use of pad printers, and consequential good value for money, that allowed their use as a philatelic canceller to be a viable option for Royal Mail.

Perhaps the most important element in the pad printing process is the transfer pad (also known in the industry as a tampon). It is also the job of the pad to pick up the inked image from a printing plate and transfer it to the item (the sequence is shown in the diagram). Pads are made of a mixture of silicon rubber, silicon oil and other fillers. The shape and hardness of the pad are crucial to the successful transfer of images. The largest possible pad is used to keep distortion to a minimum and the conical shape achieves good 'roll-off', minimising the possibility of air entrapment. It is the pad which guarantees a good print even on surfaces including irregularities, such as across the stamp/envelope edge on First Day Covers.

The printing plates, known as clichés, are made from various materials including hardened and lapped steel, steel shim, and plastic, the type selected depending upon the printing application and the volume of items being printed. For most production environments the hardened steel clichés are used with which several million impressions can be attained. For the Royal Mail requirements these would be 'over-kill' and following R&D trials with both the steel shims (known as foils) and the plastic plates, we concluded that the foils offered the most cost effective printing plate for typical sizes of cancellation runs in the Special Handstamp Centres.

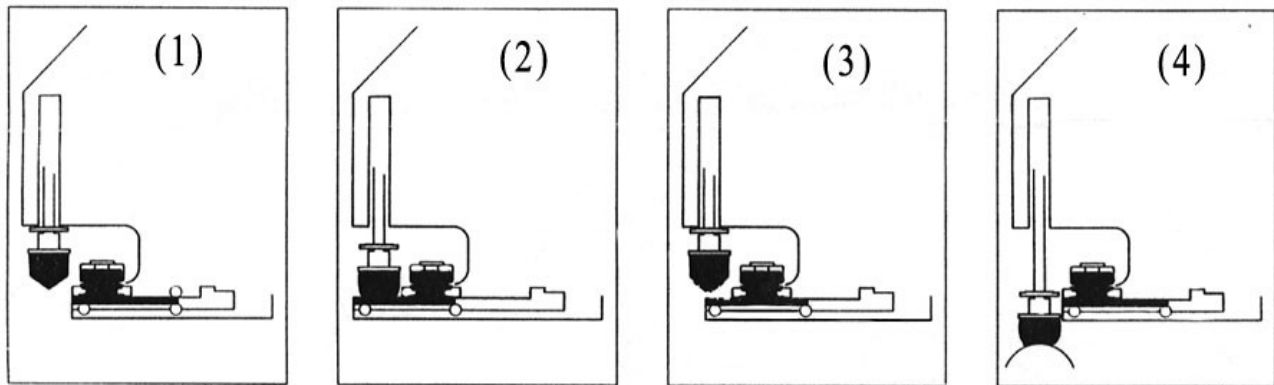
In preparing a cliché, a clean steel foil is dip coated with a photosensitive chemical which is allowed to dry on the surface. A clear positive (black image on clear film) is placed over the cliché surface which is then exposed to ultraviolet

light in a vacuum exposure frame. The ultraviolet light cures or hardens the exposed photosensitive coating (ie that not covered by the image on the film) and the remainder can then be washed away revealing the original steel surface. The foil cliché is then immersed in an acid solution and the revealed surface (which is a direct representation of the impression on the film) is etched to a depth of approximately 0.025mm.

The inks used in pad printers are similar to those used in silk screen printing but they have what is known as a higher pigmentation and tend to be faster drying. High pigmentation gives the printed impression a high contrast, even with very fine detail – black areas on a cancellation look black and not mottled or grey. The fast drying solvents used in pad printing inks allow good print quality on very glossy surfaces since the ink does not have to be absorbed into the substrate, but securely dries on the surface. Premature drying of the ink whilst it is being used in the machine is prevented by the hermetic seal around the ink pot and the cliché.

Having concluded that pad printing offered the best possible quality of cancellation R&D purchased and trialled two 'standard' industrial pad printers to establish whether the technology was operationally viable in the 'office environment' of the SHCs. Our task was to convert a piece of machinery that was originally designed to operate in a factory, printing over a conveyor belt of identical products, into a specialised stamp cancelling system that would be manually fed with items of various shapes and sizes. There were two main challenges. Firstly additional equipment had to be designed around the standard machine, to allow the operator to accurately align the customer's product for cancellation in exactly the desired position. Secondly, the machine had to be incorporated into a workstation that would provide a comfortable environment for the operator.

1. Ink is flooded over the surface of the printing plate so that the impression is filled with ink. A 'doctoring' device then moves across the printing plate which removes excess ink from the surface and only leaves ink within the engraved or etched impression. The then exposed upper surface of the ink which is left in the etched impression begins to dry and becomes tacky.
2. A silicon rubber pad then descends onto the printing plate and the tacky surface of the ink adheres to the surface of the pad. As the pad rises the impression is transferred onto the pad as it recovers to its undistorted shape.
3. The printing place is then moved away from the area of the pad, so that the pad is in a position above the item to be printed. As the ink is transferred to the pad the surface of the ink which was in the base of the etched impression becomes exposed to the atmosphere and begins to become tacky.
4. The pad then descends onto the item below and the then tack surface of the ink adheres to the item (with a greater level of adhesion than between the ink and the pad). Therefore as the pad rises, the ink is transferred to the item. [Note, diagram 4 shows the pad/ink being applied to a golf-ball-shaped surface, but this is where the first day cover would be. -Ed]



Various methods of alignment were considered and tested, including projecting 'cross wires' like a bomb sight, low powered laser line generators, fixed and movable guides or fences and finally a closed-circuit television system. The cctv system proved to be the most versatile arrangement and is now fitted to all the RM pad cancellers.

A monochrome ccd (charge-coupled device) camera is fixed in such a position and with a carefully selected lens so that a full-size image of the cancelling zone is produced on a small tv monitoring screen placed alongside the operator. To set up the system, the operator loads the appropriate cliché into the machine and prints an impression onto a piece of clear vinyl film (the type used to produce peelable stickers for windows – car license holders etc.). The film is removed from the canceller platen and replaced with a piece of scrap paper or card. The operator then prints an impression onto the card that is left in position on the

platen. The image printed on it is then visible on the monitor screen, thus providing a datum for the cancellation position. The operator then places the piece of film on the monitor screen and positions it so that it aligns with the printed image, thereby transferring the datum to the face of the screen. The piece of card can then be removed and the operator then uses the monitor to accurately align further cancellations by positioning the customer's product relative to the overlaid film. Some practice is needed to gain familiarity with this system but once proficient, the operators achieve a very good cancelling accuracy.

In addition to the cctv system a versatile alignment fence allows the operator to ensure that the products remain parallel with the horizontal axis of the cancellation as they are positioned, thus preventing skewed impressions.

Industrial design consultants were employed to develop an ergonomically correct and aesthetically pleasing workstation which in-

cludes such features as the alignment systems, task lighting, storage facilities for clichés and inks and the necessary support equipment provided with each machine. Initial design schemes were presented and scale models made of potential solutions from which a full-size mock-up was constructed. This was used for ergonomic tests, covering such points as operator reach, viewing angle of the monitor, leg-room, access to storage space, ease of cliché changing and led to the production of the prototype pad canceller.

The result from the development was christened the LSC4500 – Low Speed Cancellor (as opposed to the high-speed systems used in the Bureau) and 4500 designating the maximum size of impression (bounded by a circle of 45mm diameter) which can be printed.

The prototype LSC4500 was trialled in the London (North) Special Handstamp Centre and with minor modifications led to the design and manufacture of the production standard version. Eighteen

LSC4500 were produced at the R&D Centre and distributed throughout the UK. The product has attracted considerable interest from overseas administrations and consideration is now being made to Royal Mail licensing a manufacturer and distributor for what could prove to be a world-wide market.

This article was first published in the *British Philatelic Bulletin* (Royal Mail's magazine for stamp collectors) in April 1993. Thanks to John Holman, Bulletin Editor, who adds: "The technology as currently used (summer 2007) is essentially the same as described

in the article although some upgrades were introduced c. 2001. A recent step change was moving away from chemically etched foil clichés to Laser etch."

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