

WELCOME TO THE HOUSE OF QUESTA

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Compiled from lectures given by
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1 - THE PRINTING PROCESSES

The four basic printing methods are:

- (a) Letterpress or flexography, which is printing from a raised surface,
 - (b) Lithography, which involves printing basically from a flat surface. However, scientifically it is being printed from a very slightly recessed surface - dependant on plate making system,
 - (c) Gravure, which has a cell structure where the metal section of the cylinder has square shaped cells that hold the ink, and
 - (d) Screen printing, which is mainly used in the field of poster printing, gives a tremendous film weight on the paper or material that is being printed on and is ideally suited to plastic bottles and containers. Ink is squeezed through a screen and this method (it is believed) has never been used for the printing of postage stamps.
- The printing process is basically in two sections:
- (a) An area that has got to be kept free of ink - the non-image area, and
 - (b) The part to be inked - the image area.
- Scarcely ever used today for stamp printing, the letterpress method is exactly what it says. The ink is applied to the plate or type and is then transferred onto the paper directly. There are no intermediate processes.

The method of printing from recess or gravure involves a recessed area that carries the ink. Square shaped cells are etched into the cylinder to make them deeper or shallower as required. With a deeper cell more ink is used and the image is denser, whilst with a shallower cell less ink is put onto the paper. The ink is saturated over the cylinder and a doctor blade (which is like a huge squeegee) takes away the unwanted ink, leaving the required ink in the recessed cells, which is then pulled-out onto the paper.

The method of lithography introduces a new medium into printing, namely water. Lithography was invented about 150 years ago by Senefelder and involves making ink and water work against each other. The water protects the non-image areas and the ink only goes onto the image areas.

With direct lithography a damping roller passes across the printing plate and adds water to the non-image areas. The inking roller then passes across, and, being greasy, will adhere to the receptive (or image) areas and the ink and water will not mix.

The offset is obtained by ink cylinders applying ink to the plate cylinder and dampeners applying moisture to the plate cylinder. The moisture given is very slight. When the machine is in operation the plate cylinder is showing in the positive (correct way) reading. It is then transferred onto a rubber blanket and the image appears in the negative (wrong) reading. It is then transferred onto the paper by pressing the paper between the impression cylinder and the blanket cylinder.

This method is used because it is easier to transfer an image onto a rubber blanket at

speed and then onto paper by offsetting it rather than going direct because of paper stresses and tensions. Incidentally, the plate cylinder runs anti-clockwise, the blanket cylinder runs clockwise and the paper runs between the blanket cylinder and the impression cylinder, which is going anti-clockwise.

2 - THE INGREDIENTS

Paper and Coating

Questa work very closely with the paper manufacturers because each printing process behaves differently to the material and is further complicated when applying phosphor coating for automatic sorting because the phosphor is very hard and blunts the dies very quickly.

The base paper is made of wood and various other ingredients such as rag and esparto grass. This is beaten up into a pulp resembling porridge and is spread out onto a deckle that is constantly vibrating. It is then dried through various calendar rollers, put into a reel and coated.

Questa's suppliers (paper processors) then apply their own coating of starch and china clay which gives a nice smooth surface to allow the printing ink to take to the paper. It would not, however, be any good if used for the gravure process because offset-lithography needs a damping agent. Similarly, if gravure coating is used for offset-lithography efferescing occurs due to the chemicals in the ink reacting to the coating on the surface of the paper.

A standard paper for all processes has yet to be developed and various paper mills supply Questa with their paper such as Wiggins Teape, Samuel Jones Group, Harrison and Sons, Inveresk and Henry and Lea Slater Coated Papers Limited. In their own way they all make equally good papers but variations in paper colours can

occur together with different coating constituents which means that Questa have to apply different coatings of their own specification to the paper.

Early in 1980 paper was costing about sixty pounds per thousand sheets, despite the bulk tonnage rates that Questa are able to buy in at.

Gumming

Gum Arabic was once used almost universally throughout the stamp printing industry but was subject to problems when climatic changes occurred as it was necessary to interleave each sheet with wax paper tissues to prevent the sheets adhering to each other.

Polyvinyl Alcohol (PVA) gum is now used. It produces a great deal of static electricity which accounts for the number of sheets that still have some of the swarfage in the holes. When the pins punch through the paper and withdraw again they bring back up some of the confetti on the bottom of the pins and give the impression of mis-perforating. PVA is not subject to climatic changes.

Printing Inks

Printing inks cause their own special problems as it is not possible to take a tin of ink and print straight from it. If used on one type of paper it will dry perfectly but try and use the same ink on a different type of paper and a chemical reaction will occur.

Colours

The pigment colours that are used for printing inks are yellow, cyan (blue) and magenta (red) and are referred to as tri-chromatic colours. They can cover the entire colour range and are a combination of tints in their various percentages. These can go from 0% which is virtually a nil dot formation, to a 100% solid dot formation. These combinations superimposing on one another will give the required colours.

Each coloured dot is screened at a slightly different angle so that there is about a 22.5 degree angle between each set of dots. Eventually, when the black is added and, if viewed under a high-powered microscope, a rosette formation is evident provided that the stamp has been perfectly printed.

With modern techniques of printing it is possible to produce any colour facsimile. There are a lot of stamps produced by the four colour range at the moment but unfortunately they tend to look like pictures that have been cut out of a holiday brochure with the value and country name added. If one is designing a set of stamps for a Caribbean country, for example, it is nice to have pretty pictures on your stamps but it is possible to do so much more with other colours, and not necessarily the process range.

A few years ago Questa were commissioned to print an issue for a territory that portrayed butterflies. It is not unusual for the printers to receive correspondence from people who are in the know about a specialised subject saying that various colours on a stamp have been incorrectly reproduced. However with this issue (which consisted of four values in a miniature sheet) a total of twenty two colours

were employed to make them precise.

Metalllic colours can be printed very successfully by offset-lithography. Silver in particular (which is often used for the Royal insignia or profile of the Queen), prints very well. The gold metalllic unfortunately does not reproduce as well as when printed by gravure, although now the gap is much less, and some very good litho golds are being printed.

3 - PRE-PRINTING OPERATIONS

Artworks

Artworks are received from around the world and it is possible that one week an artwork will arrive that has been prepared by a local tribesman, for example. Some years ago Questa printed an issue for an African country where the actual artwork was a montage of pearls, skins, diamonds and furs and it was an enormous size. Whilst it was a beautiful piece of work, eventually it had to be brought down to postage stamp size.

There is normally a white margin around the engraved area of a stamp of 1.5mm. Occasionally this size does vary slightly, either by design or accident (if, for example, an artist has drawn an artwork that does not scale exactly). This white margin appears on both sides and also top and bottom of the stamp. This means that when you prepare an artwork four-times-up and the finished stamp size is, say, 40mm square you have to multiply the 40mm by four giving 160mm which is the stamp size in large form. You then multiply the 1.5mm by four giving 6mm and, bearing in mind that you have a margin top and bottom, you end up with 12mm. The measurement of the artwork should therefore work out at 148mm in both directions.

Retouching is done by craftsmen where intricate detail is required to often correct artworks.

Unless the artwork is the precise size it is necessary for re-scaling to be done by craftsmen, which is very expensive and delicate

to undertake. One important thing that applies equally to gravure printing is to ensure that any lettering such as country name or value appears on a separate overlay because it is given a separate treatment by the printer. It is much simpler for him when he does the colour separations because if there is a build-up under the black it causes problems with registration.

Early on in the days of lithography it was necessary to have what are known as key lines around the images. Instead of colours bleeding or vignetting into one another you had to have black lines to cover any mis-registration the presses or the stability of the paper. However, there are also stamps referred to in the trade as being bled. This means that the white margin that normally appears around the stamp is not there. Instead the image area extends right to the edges of the stamp.

Camera Work

A gallery camera with copyboard is used to photograph the artwork. It is lit with arc lights placed in such a way as to ensure that there are no highlights or shadows (i.e. flat lighting). A densitometer reading is taken to check that the lighting is the same across the entire artwork.

The gallery camera makes a continuous tone negative which has to be broken down into dots and spaces. A newspaper photograph has these dots clearly visible and there are approximately 75 dots and 75 white spaces per linear inch; whilst normal commercial printing works at about 120 to 150 dots. However, stamps printed at The House of Questa work to 300 dots owing to the considerable detail required in stamp printing.

Using an enlarger (which is virtually an upright camera), the continuous tone negative is placed at the top of the machine and on the baseboard is placed a magenta screen, which is a piece of acetate film with gelatine on it broken down into screen dots. The image is passed down from the top of the machine, through the bellows where the lens housing is and either enlarged or reduced onto the film.

A fibre optic (another piece of quality control equipment) measures the density of the negative or positive and a recording is kept so that it will be possible to supervise and control very closely any subsequent work. Once the positive has been made it is ready for further processing.

Film Development

The development that used to be employed was the same as home processing with development in one tray, washing in the next, followed by a fixing agent and final wash.

The method used today is automated. A negative or positive is inserted into one end of the machine (in the darkroom, of course) and in the General Planning Room two and a half minutes later bone-dry ready to use copy is available. Previously it was necessary to hang them up or use a hairdryer to dry off the prints and this took considerably longer.

Retouching

The man who is responsible for correcting any faults made to the artwork at this stage is called a retoucher. He is something of a

magician being able to put in or take out any part of the image and to alter the colour, values or shape. Using the original artwork as his guide he works on the positives or negatives. There is a separate positive and negative, with a complete set for every colour printed.

Even if there is very little red in an artwork, due to the inefficiency of the photographic processes available to the printer the camera may produce too much red on the negative. If this was to be printed exactly as recorded on the negative and positive it would produce a very sore looking subject and so "staging-out" is undertaken with a red lacquer.

Proofing

Proofs are only produced at this stage once the inefficiencies have been corrected and are only made in singles. They are never stepped out into blocks or sheets because it is much easier to retouch and correct one stamp sized negative than, say, one hundred as the mistake will appear on each image.

Reproofing and Approval

Once the stamp has been proofed it is submitted to the destination territory for approval. In the case of many Commonwealth territories both the Post Office and Her Majesty The Queen need to give their consent to proceed with printing. It is not unusual for comments or variations to be made and it is often necessary for a further set of proofs to be submitted.

Stepping into Sheets

Once the proofs are accepted the artwork is stepped out into sheets. A piece of equipment called a chase with a vernigraph and high powered magnifying glass is first used to place registration markings. These are used to ensure that the artwork is perfectly square. If the master negatives are not correctly aligned in the chase each stamp will appear progressively askew, which will cause perforating problems.

The negatives are then placed into the step-and-repeat camera which steps film into the required number of stamps. By 'dialling-in' on the machine it is possible to step, say, five stamps across one way and twenty down the other.

The film is placed into position on the bed of the machine under protective lighting. The operating method is set and by compression and vacuum the step-and-repeat camera will then expose a row of five, come back to the beginning, move down one row and then move along again until the desired number of rows have been individually exposed.

Owing to possible fluctuations in the power supply Questa do not work on a measurement of light in a sense of time. Instead units of light are used so that there will not be a stronger exposure on one stamp compared with another.

Film storage used to be a problem because it was difficult to get film material stable enough to hold 300 screen registration. Laterally you are working to a measurement of one six-hundredth of an inch and when stepping film the machine is capable of an accuracy of three decimal places of a millimetre.

4 - THE PRINTING STAGE

Preparation of Printing Plates

A machine called a 'whirler' (which works by centrifugal force) is 'fed' with a dichromate solution by the operator. The machine spins at great speed and the centrifugal force throws out the solution evenly towards the edges of the plate, giving a perfect coating ready for the screen to be etched. Recently, new technology has meant that the process has been automated.

The plate is then exposed, as with a camera set-up, whereby film is positioned onto a machine and the operator uses a bar of colour that appears in the sheet margin to check the density of the image. The plate has had the 'traffic lights', stamp value, etcetera added before this stage.

The automatic plate processing machine is not capable of giving a debris free plate and so it is developed-out by hand to ensure that the high quality required for stamp printing is attained. The developer is poured onto the plate by the operator and rubbed in by hand.

An experimental piece of scanning equipment was used to cut out filters and the need for camera work so that one could go straight to a screened piece of film. A scanning head passed over the image, took its reading and a piece of foil was cut by a cutting tool then contacted to the film and a positive was made. Equipment now in use transfers from a transparency four separate films (black, red, yellow and blue) in only 20 minutes! This shows how craftsmen are

being lost from the printing industry whilst the technician is increasing. This procedure is still advancing.

The White Paper Warehouse

The paper is stored under very stringent conditions. The most difficult material to be printed on is a piece of fibrous paper as it has a gumming on its reverse side and a coating on its face side. This gives two different tensile stretches, one on each side of the paper and so it only takes a slight change in the humidity to cause stretching which is disastrous enough when printing in one or two colours but makes correct colour registration impossible in multi-colour printing. The factory is therefore completely air-conditioned (20 degrees celsius) and humidity controlled (55% humidity) which provides ideal operating conditions.

The sheets of paper are counted-out, witnessed and balanced. If, say, 10,000 sheets are removed from stores, there needs to be 10,000 sheets left at the end of the day. To ensure this there are Questa, CAPHC0 and British Post Office security officers in residence at all times.

The Printing Presses

A Heidelberg single colour press is in use that prints one colour on each pass through the machine. The best way of printing is slowly and one sheet at a time. Unfortunately, economics do not permit this to be used very often and so larger machines are employed that print more than one colour with each pass

through the press. Two colour presses and also five and four colour presses are now in use at Questa.

The presses operate as follows. A duct feeds up the moisture by a vibrator roller. The roller drops down onto the duct roller and picks up the required amount of moisture, which is preset by the machine operator for each particular job, and transfers it onto a pyramid of dampening rollers and then onto the printing plate. The two pyramids of inking rollers then ink the printing plate cylinder (the image is in the positive form) from an ink duct located at the top of the press. (In order to avoid technical problems, the inking rollers are of different sizes). The ink then adheres to the image area, whilst the moisture keeps the non-image area free of ink and the image is offset onto a rubber blanket in the negative form. It is then transferred onto the sheet of paper in positive form.

The rubber blankets used are very hard surfaced so that the 300 screen dots are pinpoint sharp.

The sheets then pass through the machine to the delivery end.

Drying the Printed Sheets

A bowl of anti-set-off spray powder at the delivery end of the press discharges a film of starch based powder onto the sheet of paper in the form of tiny globules. It does not dry the ink but merely keeps the sheets very slightly apart to allow the air to get through as inks dry by oxidation, penetration and evaporation in various percentages. Inks can be dried at faster speed but there are dangers.

respace accordingly. This accounts for the difference in the vertical and horizontal perforations that sometimes occur (14 x 14.75 for example).

An engineer drills the hardened steel by hand and because the drill tends to move slightly when going through the metal it can result in small errors of spacing between each hole when the stamp is viewed under a high powered magnifying glass.

The sheets are inserted into the machine using the same grip edge and side lays that were used for the printing process so that the stamp image is centralised within the perforations as accurately as possible. This is essential because there is very little adjustment possible at the perforating stage. Consequently it is necessary to work backwards, i.e. from the perforation size - hence the reason for the artwork having to be drawn to a very exacting standard.

A library of some sixty-odd dies is available and at a cost of well over £5,000 each gives an idea of the kind of monetary involvement in the industry. These dies can be modified but great care needs to be exercised when carrying out changes.

On the die is a carrier that bears all the pins, beneath which is contained a baseplate that has been drilled to accept the pins. When a sheet of paper is placed on the baseplate the carrier punches through the paper and baseplate by compression.

It is possible to perforate an average of about 75,000 sheets before it is necessary to grind and resharpen the dies. This is however, totally dependant on the type of paper that is used.

Examination

Despite the technical achievements made in the print industry there is still nothing to rival the visual control of stamps. There is, therefore, a team of some twenty ladies who examine stamps for misregistration, missing colours, bad perforations, broken corners and the like. They are so experienced that they are capable of scanning the master sheet and straight away begin to check the stacks. Sometimes the error that they spot is so small that it is virtually invisible to the naked eye. It generally transpires that there is an "ickie" or "bullseye" (pieces of foreign matter adhering to the printing plate), which have formed a halo around, say, a gum slither. On average 1,000 sheets an hour are capable of being checked by each examiner.

When the sheets come off the printing press there are various legends that are inserted in the margins and before any operations are carried out in the finishing department a large sheet examination is made.

Guillotining

A guillotine is used to cut the machine sized sheets into Post Office sheets and "magic eyes" ensure that the operator is not in the way of the cutting edge. It is also necessary for him to have each hand on a start button which further ensures his safety.

The machine cuts through 500 sheets of paper at a time and is electronically controlled by a computer. The program is "dialled-in" and once a sheet has been ruled-up the operator will knock the paper into perfect register and, using the same grip edge and side lay, insert

the stack into the back guage of the machine. As soon as the first cut has been made the memory of the machine will automatically rearrange the back guage and the operator will turn the paper and reinsert for the second cut. By the wrong turn of the paper the operator is liable to ruin the entire stack of paper.

Once guillotining has been completed the sheets are counted and balanced again.

Counting of Sheets

An English machine made by Vacuumatic Limited is used to do a count of the number of printed sheets. As it is possible to have a half sheet or a sheet with a corner folded over, nothing is left to chance and each corner of the sheet is checked in turn thereby eliminating the possibility of a misreading. At the top of the machine is a digital display that shows how many sheets have been counted. This may be a continuous count or be stopped at, say, 500 sheets and reset to zero again.

The finished sheets are sequentially numbered on the selvage if this is required by the territory concerned and a further count and balance is made afterwards to ensure that the number on the selvage and the number on the digital display balances.

Sometimes with overseas administrations Questa are asked to insert coloured sheets of paper, say, every 100 sheets so that at the end of the day the counter clerk can look at the number on the margin and know that in between each pair of coloured sheets he has got 100 sheets of stamps. This piece of equipment is also capable of inserting a small green tab so that when removed from the counting machine the

operator can insert the sheets of coloured paper with ease thereby helping production.

Prior to the invention of this machine the officers from the Crown Agents would count each sheet by hand.

Selvage Numbering

A numbering machine was especially manufactured for Questa because once the sheets of stamps have been printed and perforated it is difficult to feed the sheet of paper through any piece of equipment as complete suction is not possible because of the perforation holes expelling some of the air. There is obviously no point in numbering the sheets at the printing stage because some of the stock will be rejected due to imperfections found at the examination stage and so numbering is one of the final operations.

Packing and Despatch

The finished stamps used to be packed into waxed paper to keep moisture out when in transit, placed between mill boards top and bottom and secured with a lead seal. A declaration label detailing the contents, consignment number, value, the destination, numbering sequence, signature of the examiner and supervisor of the work was then affixed. This was superceded by shrink wrapping.

A ream of paper (500 sheets) is placed onto a printed sleeve of film which is then automatically cut to shape and fed through a heating tunnel which seals the plastic around the pack of stamps. This method was adopted because it was proved that by using a schoolboy compass it was possible with extreme care to

gain access to the contents by undoing the seal and wax paper, removing a sheet of stamps and rewinding. Shrink wrapping cannot be undone and resealed without leaving visible signs of tampering.

Similarly, the plastic tape that is placed around the pack of stamps is friction and heat sealed where it overlaps. A loop is placed one way around the pack and then the other way passing under and around the first loop, thereby preventing the bands from being removed each in turn. It is not possible to cut and rejoin bands because the tension used in sealing would make the bands too short to fit. Any attempt at using glues would not work either, instead the plastic burns and shrivels.

The stamps are placed into tin lined wooden cases, soldered, sealed and are then ready for despatch to the destination territory. It would be possible to accidentally drop the case into the sea without any adverse effect.

Destruction of Defective Stamps

There are three methods open to security printers for the destruction of defective stamps. Shredding is not a practical solution due to the sheer volume involved and incineration is not without its problems.

The method adopted by Questa is to go to a paper mill and count into the beater each sheet of stamps which then gets mixed in a vat with various acids and ends up as recycled paper.

When quoting for a job, Questa look at the artwork and decide how many colours are going to be needed. Then the print run is noted and on a small run of 500 sheets perhaps as many as

one thousand extra sheets will be allowed for waste. If on the other hand there are to be one million sheets perhaps two or three percent extra will be printed. On an average over the year possibly around twentyfive percent of all sheets printed will end up as waste.

... and finally

It is hoped that you now have a greater understanding of what goes into stamp production at the House of Questa. If not, why not read it through again?