IND POST
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APPEX 84 SPECIAL NUMBER

The Institute extends a warm welcome to all stamp collectors, dealers and visitors and wishes the exhibitors all success.

PRINTING PROCESS

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A. LITHOGRAPHY

Lithography (from the Greek work 'Lithos' meaning 'a stone' and 'Graphein' meaning 'to write') is the process of printing of the flat surface of smoothly polished limestone.

The prime principle on which lithography is based is the mutual antipathy of grease and water.

Principles of Lithography :

(a) Greasy ink of the lines drawn on the stone adhere to it so strongly that it can only be removed by mechanical aid.

(b) Those parts of the surface which are free from the greasy Ink will absorb and retain water.

(c) Greasy ink and water mutually exclude each other, or, greasy ink applied first on a surface will not permit water on the surface nor will water if applied first permit greasy ink to gain a foothold on the surface.

If, therefore, a stamp design has been transferred to a dry stone in greasy ink and the surface of the stone is then wetted, there will be no water on the lines of the stamp design. If greasy printing ink is then rolled over that ink will only cover the design on the stone. It will not mark the stone where there is no design, because the water will prevent it from so doing.

When the design has been transferred to the stone in lithographic ink, the stone is then treated with a weak solution of nitric acid in gum.

This has a two-fold effect on the stone :

(a) It neutralises the alkali or soap contained in the ink, so as to prevent the ink from spreading when the stone is damped.

(b) This neutralizing of the alkali fixes the drawing and the acid at the same time cleanses the stone.

The amount of actual etching is light but there may be a noticeable amount of relief in design.

The stone is then fixed on the bed so that it will not move under pressure, and all is ready to print the required impression upon paper.

B. OFFSET OR PHOTO-LITHOGRAPHY

Photo-lithography, though it still employs the basic grease and water principle except that the printing surface now used is either zinc or aluminium plates and the printing plates are prepared using photographic methods.

This process combines photography with economic plate making and the fast, efficient rotary press. It involves the unique third (offset) cylinder, a rubber blanket mounted on a cylinder, which relays the design image from plate cylinder to paper.

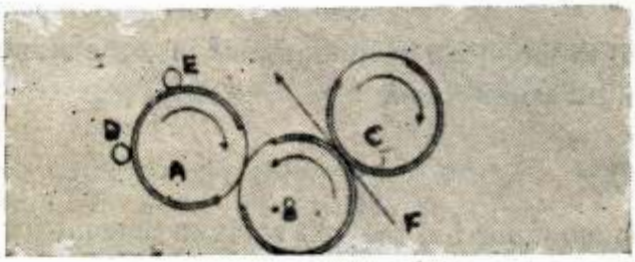
For plate making, the 'subject' is photographed and by using a 'step and repeat' camera, multiple images are prepared which forms the multipositive or multinegative as the case may be.

Usually zinc and aluminium plates are used. These polished sheets have to be grained to get rid of the smooth surface, so as to enable it to accept and retain moisture. The grain on the surface of the plate so made will give the necessary grip to the image printed on it and act as a reservoir for the film of water while printing.

The grained metal plate in made light sensitive by applying a coating solution (usually bichromate albumin). The negative is then placed in contact with the coated plate and is exposed to an arc lamp. The effect of actinic light on the solution is to harden the same where the light has penetrated through the negative. This is properly developed later on. This impression on the plate cylinder is a positive one-during the course of printing the impression is offset on to a rubber 'blanket' roller and then transferred on to the paper.

In keeping with the 'grease and water' principle liberal sprays of water on the plate cylinder precede inking process.

I. OFFSET PRINTING



A — PLATE CYLINDER
B — TRANSFER CYLINDER
C — IMPRESSION CYLINDER
D — DAMPING ROLLERS
E — INKING ROLLERS
F — PAPER FEED

Litho-printed stamps from Modern Offset presses can be identified by the sharp edges to letterings and solid colour, and by the honeycomb pattern of screened dots.

Errors & Varieties

(a) Common faults are white flecks or streaks on the stamps caused by marks and scratches on the metal printing plates which escape the inking rollers.

(b) Sometimes particles of dust and grit may build up on the plate, forming a 'bump' of colour surrounded by a white ring-the ink is prevented from reaching the immediate vicinity of the protrusion, and a 'ring flaw' is formed.

(c) Doubling of all or parts of stamp design is caused by 'blanket stretch' (also known as 'blanket offset') the rubber blanket of the offset roller expands when new and provides a duplicate impression.

This must not be confused with 'offset' or 'blanket prints' which are simply the reversed impression of stamp design on the back of the stamp.

C. ROTARY PHOTOGRAVURE

The postage stamps of India and many other countries are today printed by photogravure which as its name indicates is a combination of photography and 'gravure' or 'recess' printing.

The artwork or the prepared design is photographed in such a manner as to give a positive image on the plate. This photograph is reduced to the actual stamp size and it is then used for making a 'multipositive' plate, by using a 'step and repeat' camera.

A sheet of 'carbon tissue' is prepared, coated with a thin layer of gelatine, and sensitised with potassium bichromate. The whole of the coating is soluble in hot water until such time as light is applied to it. The effect of exposing it to light will be to render insoluble those portions which have been affected by light.

A grid or a screen is then photographed on the face of the carbon tissue, which covers the whole of the surface of the tissue with a network of the lines, usually crossing each other at an angle.

When the grid has been reproduced over the face of the carbon tissue a photograph of the multipositive is then superimposed. The existence of the screen breaks up the design of the unit of the multipositive into numerous tiny dots, which vary in depth according to the tones of the original design, each separated from its neighbour by the grid lines.

Then this sensitized carbon tissue is exposed behind the gravure positive under strong light, the light penetrates more or less into the depth of the gelatine layer according to the densities on the positive. The intensity of the light is accordingly registered in the layer in the shape of the exposed relief, the depth of which is relatively greater in the lighter tones of the positive and where the positive is completely transparent when the greatest depth is reached.

The light action causes the gelatine layer to harden, so that it loses its solubility in warm water, the degree of hardening corresponding to the intensity which the positive allows to pass through.

The carbon tissue which contains a positive impression is wrapped round the copper cylinder, face downwards by a machine, and pressed close to it. The

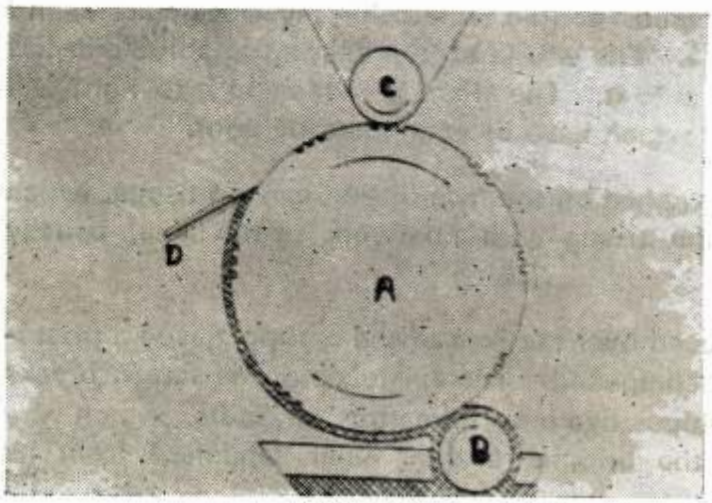
cylinder, with the tissue sticking to it, is then revolved and a jet of water is played on it. This has the effect of washing away both the paper backing of the tissue, and all the gelatine which has not been hardened by light and made insoluble.

The outer non-printing areas of the cylinder is then painted out with varnish to prevent the etching mordant from acting on those areas covered by the gelatine layer.

The cylinder is then etched in acid (Ferric chloride solution). The solution penetrates gradually the gelatine relief and the rate of penetration is dependent on the thickness and hardness of the relief as well as the concentration of the solution.

Once the solution reaches the copper surface it begins to etch the cylinder, creating miniature reproduction of the original design in which the images are composed of tiny recessed dots, corresponding in depth to the 'bite' of the acid on the gelatine tissue. When the cylinder has been etched, the control marks, register lines, perforation guides, cutting edges and the CYLINDER NUMBER are added. The cylinder is then ready for printing, but as a rule its life is prolonged by its being chromium plated.

II. PHOTOGRAVURE



(A) The printing cylinder, the spaced set of 'teeth' on the circumference represent units of the design etched on the cylinder.

(B) The inking apparatus, the shaded portion represents the film of ink being transferred to the printing cylinder by the roller.

(C) The impression cylinder.

(D) The doctor blade removing all surplus ink.

For multicolour design, several cylinders will be required. each representing parts of the design and their separate colours. Rotary presses may have four, five or more printing cylinders but additional colours may be obtained by over-printing one on another (see multi-colour printing).

Errors & Varieties.

To produce a perfect cylinder by the methods described must be difficult and probably many cylinders get spoiled and are not used.

Stamps these days are printed by the million and faults and blemishes are bound to occur:

Several distinct flaws or varieties can be created by this process depending on the plate creation sequence. They occur:

(1) With a flaw on a master negative, every stamp created from that master would also show that flaw.

(2) With a flaw on a multipositive every stamp printed from the plate created from that multipositive would show the same flaw at the same position on the sheet, which might involve an omission in the design or clear doubling caused by double exposure.

(3) Gelatine or printing plate flaws would show on each stamp printed in that position on the sheet printed from that plate although other plates created from the same multipositive would not show these.

The numerous dots and flecks inherent in this process occuring in the design of the stamp may produce sometimes interesting collectable varieties but usually are of minor nature. Larger and more obvious flaws are collectable items more especially when attempts at 'retouching' have been made after the cylinder has been put to press.

Retouches can be made to the multipositive, or to the cylinder. The flaws which, at first. are put to press unnoticed and which at a later stage, may be retouched on the cylinder, provide collectors with examples of 'before and after states of retouch.

The 'doctor blade' is a fixed steel blade mounted on a heavy base close to the revolving cylinder in a rotary press. It scraps off the superfluous ink as it moves slowly across the face of the cylinder, and if some dirt or grit lodges under the blade it leaves a 'trail' on the printed stamps. These lines are known as doctor blade flaws. They are of a transient nature and are not constant.

Ink :

The ink used for printing, as opposed to writing, is a stiff sticky paste.

The varnish medium used with the pigment depends upon the process of printing for which the ink is required. Letter press and lithographic inks are made up with boiled linseed oil but for photogravure a resin dissolved in a volatile solvent is used. The amount of pigment in the ink determines colour and opacity, but there are other points to consider, especially in postage stamps. Printed stamp must be able to resist the action of light, water and heat.

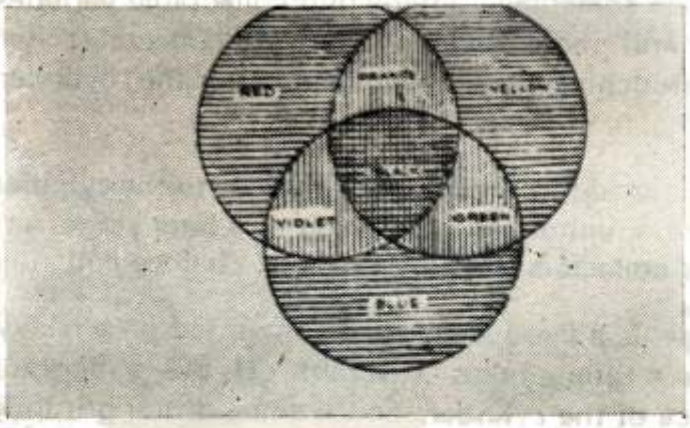
Lithographic and letter press inks dry partially by penetration in the paper and partially by chemical changes such as oxidation and polymerization. Photogravure inks dry partially by penetration and partially by the fact that the solvent evaporates and leaves the resin to bind the pigment to the paper.

In the printing of postage stamps it is important to maintain uniformity of shade. The ink maker can be relied on to provide an ink of consistent shade and colour strength once these have been standardized, and it then becomes most

important for the printer to standardize the printing conditions, especially with regard to the amount of ink carried in printing. Wide variations in shade can be obtained with the same ink if varying thickness of ink are used. A scarlet red, for example, may be converted into a weak pink tint solely by using insufficient ink during the printing of the stamp.

It is with these shade variations that the philatelic interest in ink is chiefly concerned. Several shades may occur in one impression if the ink is mixed several times, especially when the printer has blended his own colour from several standard inks, but on the whole a difference in shade may be taken as representing the difference between one printing and another from the same plate/cylinder.

III. MULTI-COLOUR PRINTING



Red, yellow and blue are the three primary colours, by suitably combining which almost any colour can be obtained. Green, voilet and orange are the secondary colours, where all the three primary colours overlap fully the result is black.

Orange and blue, red & green and yellow and voilet are said to be colours complementary to each other so that any such pair will give a black impression where the solids overlap as also a fair range of colour tones in between.

The theory on which multicolour printing processes are based in that white light consists of three primary sensations-Red, Green and Blue, Three exposures are therefore made on panchromatic plates using each of these three colours as filters, each filter absorbing almost one third of the spectrum each time. Printing plates are then prepared from the three positives thus obtained and are printed in the colours Yellow, Red & Blue (in that order) i. e in colour complementary to the three colour filters used. In other words a Red filter will eventually give the plate for printing with Blue ink, Blue filter with Yellow ink and Green filter with Red ink. A fourth printing in black is frequently used in the three colour process. For this the original is given a full exposure through a yellow filter using a panchromatic plate to obtain maximum density in all the colour areas, with transparency in the black parts only. This black printing helps to compensate for any lack of registration in the colour printing and covers up any flaws in the reproduction. The entire process is very highly skilled one.

Random white patches may occur on the stamps due to thickening of ink in the trough tending to strip off the ink from the stamp as they are printed a from of 'dry printing'.

Faulty registration of colour in multi-colour printing causing minor colour shift are very common and is of no significance unless the shift is very extensive, possibly with parts of the design missing also.

When two colours blend to form a design the shift of one gives the appearance of a 'double' impression.

Missing colours occur when the press is being slowed down to a stop for adjustment or at the end of the run.

Paper :

Paper is a sheet of material composed of compact web of cellulose fibres.

Although many types of paper have been used in stamp production they are all variations of only two main kinds, LAID (which shows a pattern of lighter parallel lines running through it) and WOVE (which has an even texture and shows no particular pattern).

The difference of texture, occurs during manufacture. In machine-made paper the pulp passes along the bed of the paper making machine and is squeezed by a wire roller known as the 'DANDY-ROLL'. If the wire is evenly woven, the paper will be wove. but if the roller contains prominent vertical or horizontal wire the paper will be laid.

The characteristics of paper determine its suitability for stamps production since it must at the same time provide a fine surface to receive the printed impression by the printing method abopted, to be able to hold the ink permanently both of stamp and the cancellation in order to prevent removal or forgery, to be strong enough to stand upto public usage but be easily and conveniently separated when perforated.

In the process where the paper is fed to the printing machine in the from of a roll (i. e web), occasionally it happens that the paper breaks and is simply joined by overlapping and sticking together the two ends. This gives rise to the joined paper varieties, where stamps are printed on paper of double thickness.

Watermark :

Watermark is a security device or design incorporated in the paper during manufacture and produced by passing the wet pulp under the dandy roller under pressure. The result is that the paper is slightly thinner where the watermark appears.

Watermark may be positioned upright, sideways or inverted in an issue, which then becomes normal for that issue. Difference in the position of the watermark from

the normal in an issue are caused by incorrect feeding of paper in the machine resulting in sideways, inverted or reversed watermarks.

Gum :

Gum is the adhesive applied to a postage stamp which enables the user to stick it to the envelope.

Various types have been used, the most prevalent being gum arabic (sometimes known as Gum Acacia) which is normally shiny and slightly yellow due to impurities. It is a natural resin exuded by some species of Acacia trees found in Middle-east countries. This gum has a tendency to become sticky in moist climates and has to be 'tropicalised' before using on stamps in tropical countries.

In the olden days, this process of gumming used to be done by hand, by means of a brush. The application of gum by those methods used to be tedious and messy business.

Nowadays it is done mechanically by means of a cylinder.

The sheet is fed to a large cylinder, seized by grippers and carried round in a single revolution. A smaller cylinder which is being coated with gum through riding against a roller revolving in a gum, fountain, is geared into the large cylinder. As the sheet is carried between these two cylinders it receives a coating of gum on the upper side and is then propelled by the momentum of the cylinder on to a travelling band which carries it through a heated dry chamber. After the sheets have passed through the drying chamber they are finally pressed between two steel rollers, which breaks the stiffness of gum and tends to prevent the sheet from curling.

In more recent years the use of Gum Arabic has been superseeded by certain polymers such as polyvinyl alcohol (PVA) which is colourless and often has a colouring agent, such as dextrin, added so that the user can see that the gum is actually there. Stamps having PVA do not curl and are less likely to stick together in humid atmosphere.

PVA gum has a matt appearance and can be differenciated from gum arabic by its shiny appearance.

The variety known as 'Brown Gum' is due to local discoloration in hot climates, probably brought on through the stamps not having been kept in a properly ventilated place.

When Gum Arabic was used more widely the browning of the gum tended to tone the paper, but since the introduction of dextrine one can sometime detect a slight discolouration of the gum without any reaction to the paper. Sometimes for a particular issue more than one type of gum is used, this can help in tracing the progressive changes in the type of gum used.

In the modern methods of printing, gummed paper is normally used for printing.

Accident printing of a stamp on the gum side of a sheet is an error which commands a very high premium.

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