in our own backyard

a simorgh screen printing manual

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Available from:
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INTRODUCTION

It is one of the ironies of history, that wherever industrialisation has occurred, its material benefits have been weakened by a further marginalisation of women in society. In Europe intellectual specialisation along with technological advancement led to the exclusion of women, who had little access to education, from trades hitherto practiced by them. Where, in a pre industrial society, spinning weaving, brewing, candle making - to name only a few - had been regarded as women's work, the advent of machinery and the separation of the work place from the home eased them out of these jobs and made them almost entirely dependent economically, on their menfolk.

In Pakistan too, the process of industrialisation has followed a similar pattern. Technological advancement along with the organisation of the work structure in factories within the framework of a capital intensive economy has snatched away from the woman the craft, skills and knowledge which had traditionally belonged to them and which had made them economically productive members of the family unit or community. Nor is the damage, thus done, limited to their material circumstances alone. In the final analysis, the mode of production influences the social formation at all levels, and this change, by excluding women from economic production, led to long term changes and reinforced the existing bias of the patriarchal way of life.

One of the results of the womens exclusion from the economic field was the development of the attitude that not to work, especially for women of the middle classes, was a mark of class superiority. That this change took place at a time when work, as a criterion of dignity and worth, was becoming the hall mark of respectability for men, was to have far reaching consequences. Women internalised the belief in their own incapability and helplessness and allowed the system to convince them that their role was strictly limited to that of being housewives and mothers.

In April 1987, Simorgh held a 10 day screen printing workshop in Lahore. The idea behind this workshop was twofold. It was seen (a) as home-based income-generation skill for women and (b) it aimed to break the hold of the idea that women are incapable of doing any work which is not connected directly with nurturing and domestic chores.

Ten women from the grass-roots level whose educational

Ten women from the grass-roots level and two resource people took part in this workshop from April 17 - 27, 1987 At the end of the workshop the participants printed a 6 colour poster. The result was seen by an advertising man whose remark was indicative of what society at large would have us believe. He said 'can women do this kind of work?' The answer was 'ofcourse they can and the proof is before you!'

This manual grew out of the workshop and was written by the Simorgh resource person and two of the participants who worked on its Urdu version.

HISTORY

Screen Printing is a relatively new printing method and only in the past 30 - 40 years has it developed into an industrial process. No one knows who invented it or where. The only thing that can be said definitely about it is that it evolved from the stencil. Stencilling is a process as old as humankind and practiced all over the world. The Japanese who are expert stencil cutters are most probably the inventors of the method of screen printing as Japanese products of the period between the 17th - mid 19th century reveal.

They used a find web of human hair on frames to connect cut-paper stencils which they used for printing on fabric and other manufactured goods. Later this was replaced by fine silk thread. This remained in use for centuries. In the middle of the 19th Century, stencils were first applied to a silk web, hence the term silk screen printing.

The equipment and techniques of silk screen printing was first brought from Japan to Europe in the middle of the 19th century. Here the process was developed and largely used during the first world war. Water-proof inks were developed during war time for

naval purposes in place of paint. In the early 20th century in America the silk screen process was used by immigrants as home based industry, and by sign painters, and the first photographic stencil was developed.

Once the textile industry picked up on the new process in the 1920's and 30's the development was rapid. Competing with the lithographic printing process, automatic screen printing machines were developed for printing paper in thousands. Varying degrees of fineness of the silk mesh was developed for high quality work and research led to the development of polyester and synthetic fabrics which facilitated greater accuracy in printing. The term 'silk screen printing' was dropped for simply 'screen printing' or the 'screen process'.

Today screen printing is a highly developed industrial process but has the advantage of also remaining a home-based craft, thanks to the use of the process by crafts people and artists (called serigraphy to distinguish it from the industry). It is largely used in the textile industry for printing fabric and by the small craftsman for a variety of purposes for printing on paper, stickers, cardboard, book jackets, plastics, sign boards, illuminated advertisements, sports and leather goods etc. and cloth i.e. T-Shirts, banners, fabric etc. In the western world huge advertisement posters on the streets are screen printed as the colours of screen printing inks are brilliant and do not fade quickly in the sun.

The advantages of screen printing for women are two fold:

(a) As income-generation or home-based business

The demand for a cheap printing process remains. Screen printing produces brilliant and attractive results, and quality and fine detail can be obtained. Small investments are needed for the initial setting up of equipment. The ongoing running expenditure of a printshop are limited. The number of people needed are two or three and only a small space is required.

(b) As a means to produce cheaply and to disseminate our own messages/ideas and visions to the public in the form of posters pamphlets, handbills, illustrated handbooks, manuals etc. or literature that printers may refuse to print on grounds that it is too subversive or controversial. You can do it in your own

backyard and remain independent.

In this manual we will discuss only the DIRECT PHOTO EMULSION Method in detail, as the most convenient, versatile and multi-purpose method for small scale printing. Maximum printing volume depends on your own limits.

Other information is for cheaper alternatives for which material is readily available but is at the cost of quality and therefore should not be used for the highly competitive market unless great skill through practice has been achieved.

THE PRINCIPLE

Screen Printing is a method of printing which is very versatile, and ranges from the simplest to the extremely sophisticated. The fundamental principle of screen printing is to push ink through a mesh onto the surface required to be printed. The areas of the screen mesh which are left open will allow ink to pass through to print and the blocked areas will prevent it. The non-printing areas can be blocked by any number of methods, i.e. paper, glue, lacquer stencils, photo emulsion etc. The mesh fabric itself can be a variety of materials as well, e.g. gauze, hair nets, nylon stockings, wire gauze, organdie or the synthetic fabric manufactured especially for the purpose. Each will give different results in quality depending on the materials used.

While using these different materials it must be remembered that some of the materials are easily destroyed and so can be used for only a few prints. Others are more permanent and can last indefinitely.

Similarly, various fabrics like gauze, net stockings etc. are delicate and will tear easily.

Organdie too is less durable but cheap, and with care will last. The synthetic screen printing fabric is very durable and will last for many runs with proper care.

Metal meshes are the most durable and also the most expensive, and only automated screen printing factories use them.

With so many different methods and materials we will limit ourselves to one major one. The DIRECT PHOTO EMULSION method for the best results and easy availability, and a few simpler ones for smaller printing quantities.

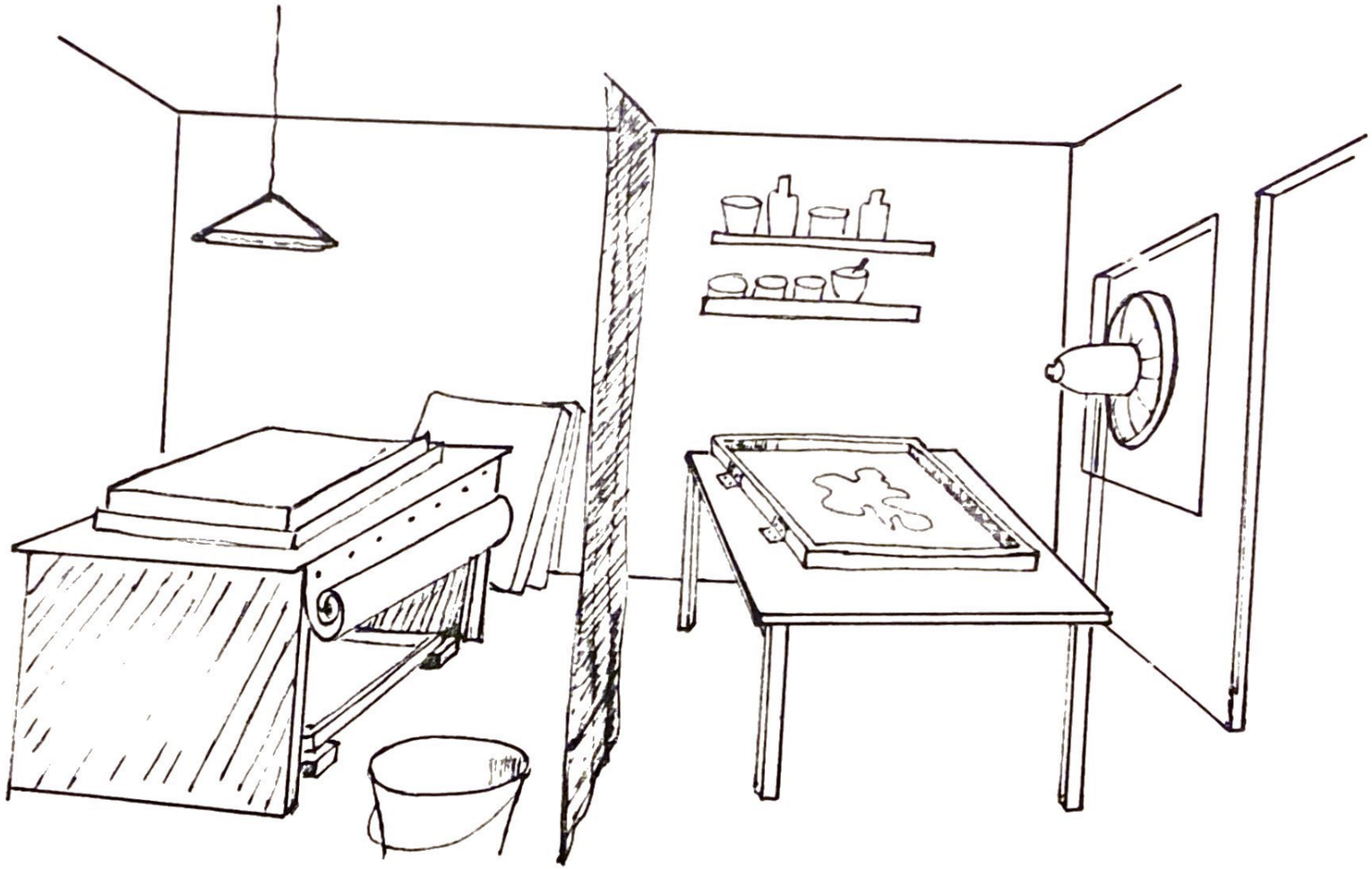


Fig. 1

CHAPTER - 1

STUDIO — SPACE AND LAYOUT

Studio Space requirements are very small. One small room divided into two is sufficient, or only a very small dark space 6' x 6' minimum for drying and exposing of screens etc. For printing, a shady area like a courtyard or rooftop will serve the purpose. There should be no wind here, especially when printing on paper.

a) One Room divided into two Portions
   1) Dark
   2) Light and Ventilated.

b) One or two tables

c) Water tub.

(See fig - 1)

SPACE DIVISION OF ROOM

1) Dark Room:- For screen coating and drying, and for exposing.

2) Light and Ventilated room:- For designing and printing.

1) Dark Room

This space can easily be divided by a dark heavy curtain, through which light cannot pass. If there is a window or ventilator which allows light to come in, it can be covered with black paper, cloth or painted black to make the room completely dark. One 40 watt bulb will provide enough light when needed.

In this dark room, one table is needed, which can be multi-purpose for:

a) Drying coated screens under the table,

b) Exposing of screens on the table top.

To create a dark space for drying coated screens, 3 sides of the table should be permanently closed from top to bottom and one wide side covered with a black cloth to allow easy placement of coated screens. The three sides can be closed with hardboard, black cloth or black paper.

If a ledge or projection in this dark space exists, it can be converted into the screen drying space. Then no table is needed. Exposing can be done on the floor.

The table top can be utilized for exposing of screens. A mercury halogen tube should be fixed on the ceiling above the centre of the table. The height of the tube from the surface of the screen should be the length of your largest screen e.g. if your screen length is

18 inches, the height of the tube should be 18 inches. Any change in this distance will need a change in exposure time.

A small tub/bucket of water, for immediate wetting of screens after exposing, should be placed in this dark room.

Other functions of this room are coating of screens with photo emulsion, and storing of bichromate and emulsion, foam, glass etc.

2) Light and Ventilated Room

a) One table for printing

b) Storage of chemicals inks, screens and positives, paper and other equipment.

Ventilation in this space is essential because the constant inhaling of fumes of chemicals are a health hazard, and can cause cancer. An exhaust fan should be fitted, or a table or pedestal fan facing out of the room can serve the same purpose, so that the fumes are thrown out of the room.

Printing can also be done in a shaded area outside when there is no wind. Apart from this room an open space is needed for drying of prints, as well as a tap for washing of screens. The tap should provide water with pressure and can be inside (like a bath room) or outside in the courtyard.

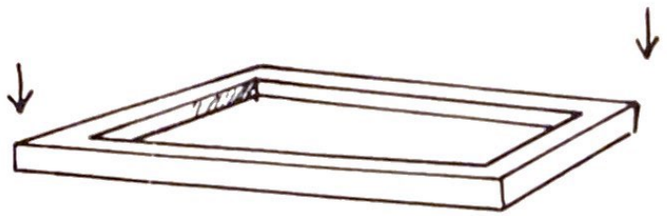


Fig. 2

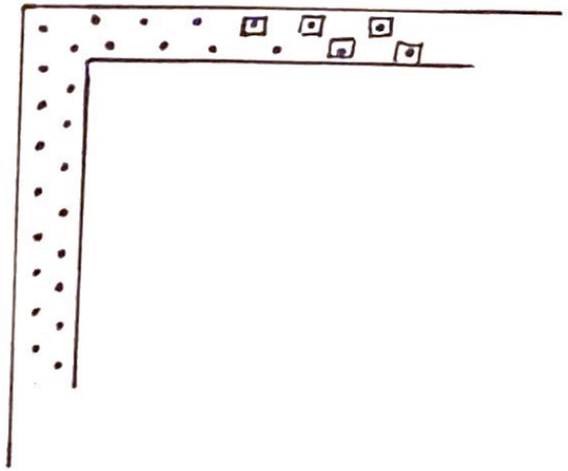


Fig. 4

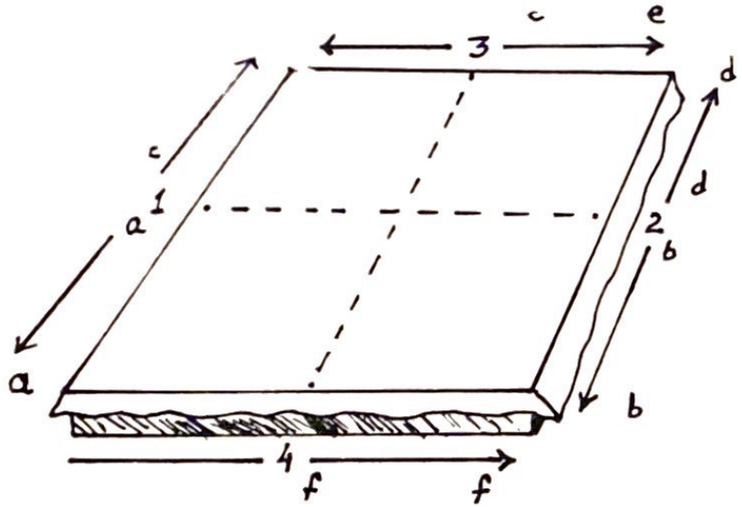


Fig. 3

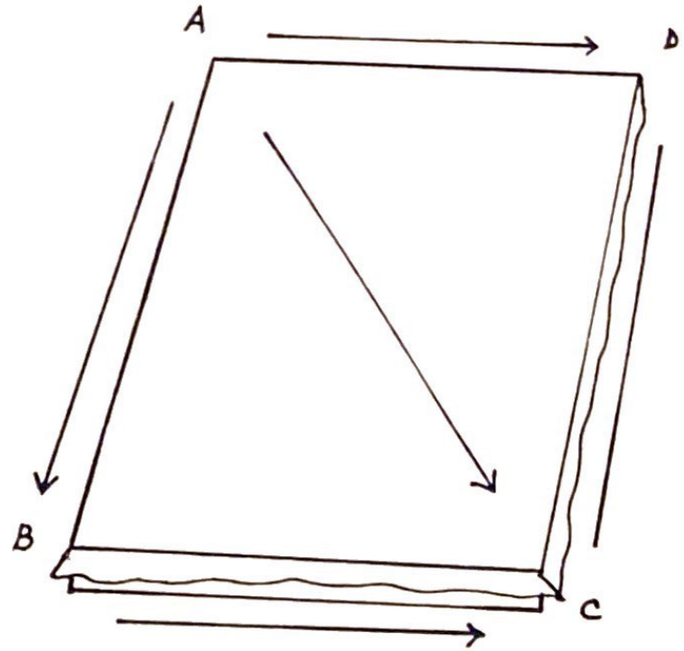


Fig. 5

CHAPTER 2

THE SCREEN

THE FRAME

Frames are made of metal or wood. Metal frames come prepared with stretched fabric/mesh from shops that supply them to flour mills. These frames are more expensive than wooden frames but do not warp. Wooden frames can easily be prepared by carpenters. Care should be taken in selection of wood. It should not warp with water, and should be properly sanded down to prevent tearing of mesh, and the joints should be strong.

To test if the frame lies flat, place the frame on a flat surface like glass and press diagonally opposite corners to see if it rocks. Sand down the frame to make it lie flat. (fig 2).

STRETCHING THE MESH

a) Ready made stretched screens as required can be obtained from agencies that supply screen meshes to flour mills. These are mechanically stretched to perfection, and will give accurate results.

b) Hand-stretched screens are easily made at home, although stretching is never perfect and chances of the mesh remaining loose are high. So it is recommended that the finer mesh be mechanically stretched whenever possible. The cheaper and commonly used locally produced mesh for the textile industry (commonly known as organdie cloth) has to be stretched by hand as the mechanical process tears the material.

b) Manual Stretching (Hand-stretching)

Fixing the mesh on the frame can be done in different ways e.g. with nails, staples, wooden dowels or cord.

METHOD 1

1) The mesh should be at least 1 inch larger than the frame on all sides.

2) The mesh should be soaked in water and laid on the frame.

3) In the centre on the longer side of the frame the mesh should be nailed or stapled at point 1. On the exact opposite side also in the centre, the mesh should be pulled tight and nailed at pcint 2. Weft/warp should be as straight as possible. This should be repeated on the 3rd and 4th side. (see fig 3).

4) Starting from the first nail or tack at the centre at point 1, start nailing down the fabric working outwards to one edge. At the same time the opposite side should also be stretched and nailed, so that two opposite sides are being nailed at the same time at a,a,b,b, and so on. Ensure that the pull across should follow a thread, so that the weft/warp are at right angles. (see fig.3).
This should be repeated in the same manner on the 3rd and 4th side.

5) The space between each nail should be approximately ½ inch. The nails should be staggered. (see fig. 4).

METHOD 2

Another better method can be used with nails, staples as well as wooden dowels or cords.For wooden dowals or cords, grooves have to be cut in the frame in which the dowels fit. When using wooden dowals the nails should be tacked on the dowels before hand. The fabric should be soaked in water before starting;

1) Start from one edge-corner A. and use a temporary nail to tack fabric to frame.

2) Stretch tightly and nail down fabric on the corner of the long side - corner B.

3) Nail down, starting from point A to B until completed. Wooden dowals, too should be nailed down in the same manner and direction.

4) Stretch and pull the fabric towards corner D. and nail down. Complete the nailing, starting from point A to D.

5) Now in a diagonal direction, pull fabric and nail to side C.

6) Continue nailing starting from point D to C, then B to C. (see fig.5)

To use dowels or cords the same method should be used. Nails or staples should be ½ an inch apart and in double rows, and staggered for maximum strength. A linen tape or cardboard strips under the nails makes it easier to pry the nails loose, and helps to prevent tearing of fabric. (see fig.4)

For further reinforcements a waterproof adhesive (glue) can be

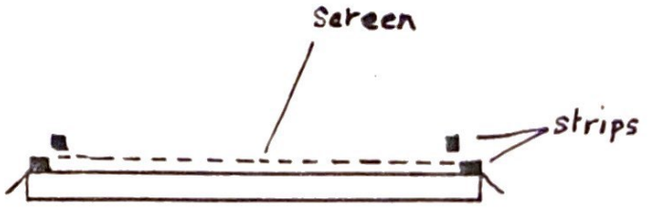


Fig. 6

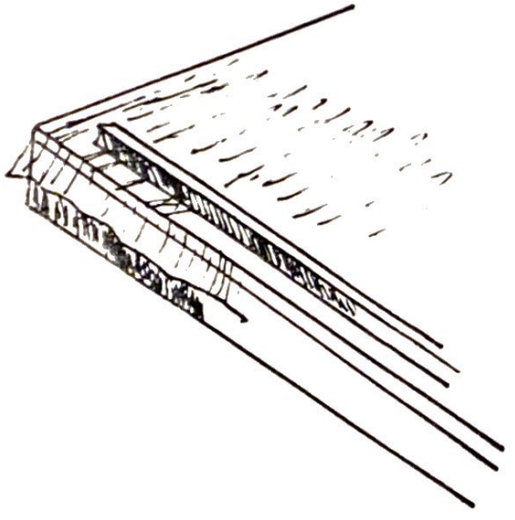


Fig. 7

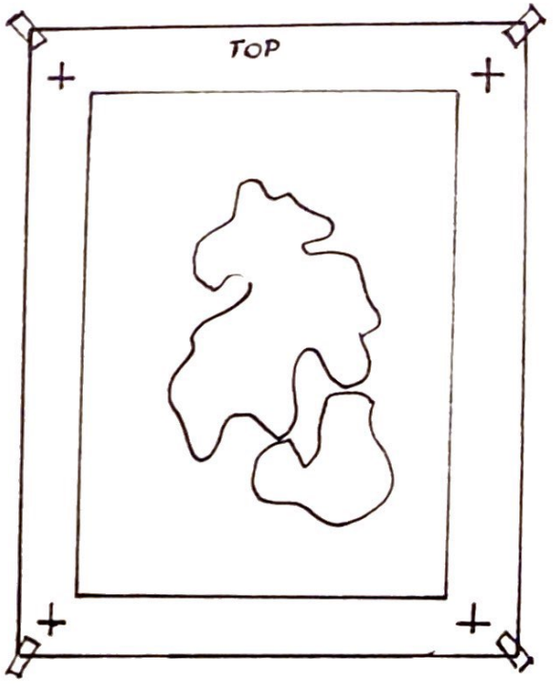


Fig. 8

used to bind fabric to frame like Synthetic resin adhesives, casein glues etc.

METHOD 3

Because hand stretching is never satisfactory a primitive but effective method for tightening the mesh is as follows:

1) Wooden strips of 1 inch width and 3/8 inch thickness properly sanded are needed. These should be as long as the length and width of the frame.

2) Take 4 strips of this wood and nail to the outer edges of the frame face - to make a stepped profile. (see fig.6)

3) Stretch the fabric and nail to the outside of the frame on all four sides.

4) Take the rest of the 4 strips and force them into the angles of the steps, forcing the mesh down, and nail with 3 inch distance between them. (see fig.7). This will stretch the mesh as tight as a drum.

Note: These methods for stretching screen meshes are the same for printing on all flat surfaces like textile printing, printing on paper, rexene leather, wood, plastics etc.

THE MESH

The screen meshes for screen printing are of cotton organdie, nylon, synthetic polyester and metal. Nylon and metal meshes are impossible to stretch by hand. Metal is extremely expensive and used for mechanized printing. For our purposes cotton organdie and polyester fabrics are commonly used.

Cotton and polyester organdie fabric is easily available and is most commonly used in textile printing factories in our countries. This fabric is cheap, between Rs.10 - Rs.12 a yard, but is useful only for coarse work, or for practice for beginners(.)

a) Nylon, polyester and metal meshes are classified in conventional codes. Polyester mesh is prepared in two forms:

1) Monofilament 2) Multifilament

1) Monofilament is made of a single strand of thread. Cleaning is easier.

2) Multifilament is prepared with more than one strand of thread twisted together, therefore multifilament fabric is rougher and thicker and ink deposits are more difficult to clean.

b) The fabric is classified into codes according to it's fineness or thickness.

S = (light) M; (light to medium) T = (medium), HD = (Heavy duty)

Old silk codes continue to be used (as in Japanese manufactured fabric).

S = (standard), X (Medium), XX (Heavy Duty)

Cotton Organdie does not fall into this classification.

c) 'Fabric Count.

All screen fabrics are measured by counting the number of threads in an inch, and described in mesh count numbers.

e.g. Cotton Organdie has a count of 90 threads to an inch.

The table given below describes the mesh and it's functions:

Mesh No.	Mesh count/inch	For Printing on
19T - 24T 28T 32T 34T	48 60 71 80 85	Terry cloth, curtain fabric, denim, T. Shirts, Large areas and designs
34T 40T	85 100	Large areas, Decor fabrics(curtain and sofa cloth) table cloths, sports goods, traveling bags, denim etc.
43T 55T	110 140	T. Shirts, Smooth fabric large areas
49T 55T 62T	125 140 160	Small areas without fine detail
77T 81T 95T	195 205 240	Posters, textured surfaces, Rexin, Wood, Plastic, details, small areas, big letters.
100T 110T	255 280	Medium lettering, fine detail
120T 140T	305 355	Very fine details and half tone. Half tones

For extremely fine details and half tone work, mesh numbers above 140 are available, but for our purposes may never be needed, unless you want to do full colour, half tone printing work.

The finer the detail in design, and the finer the surface to be printed, the higher the mesh count cnumber. The finer the mesh the thinner the ink deposit, the coarser the fabric the thicker the ink deposit.

Care of Screen

Screen mesh is stretched taut and is delicate, so care must be taken at all times. Screens should be kept safe from sharp objects, even the nails on your fingers. Screens should never be dropped, leant against sharp corners, or kept near a fire, and always cleaned of all ink immediately after printing. Ink should never be allowed to dry in the mesh, it will block the mesh.

CHAPTER 3

DESIGN + POSITIVES

a) Making your own designs + positives

b) Prepared designs or Ready made Positives

a) Making your own design + positive

Materials needed:

(1) Paper (2) Rapidograph or Calligraphy pens (3) India Ink

(4) Brush (5) Tracing Paper

PREPARATION OF DESIGN

The design you wish to reproduce should be completed to the last detail on paper i.e. the size, the colour, lettering etc. For example if a poster is required, the image and the slogan should be drawn and coloured in the size needed, and in all it's fine details. No change is possible at any later stage without destroying the print. This is the master drawing.

PREPARATION OF POSITIVE, AND REGISTRATION

1) Tape the master drawing on a flat, smooth and even surface like a table, drawing board, or smooth floor, The drawing should be perfectly stretched so that no crease is left.

2) At four edges of the master drawing, registration marks should be placed with a ruler. (see fig.8)
The registration marks should form parallel lines on a rectangle and be at 90^{o} angles.

The importance of registration marks is stressed here as the exact placement and registration of one colour on another is totally dependant on the precision of these registration marks.

The transfer of designs on transparent paper is called a positive. For each colour a separate transparent paper is used. Different types of transparent papers can be used e.g. butter paper, tracing paper, tracing film sometimes called film paper (used by architects). Tracing film is the best choice but is too expensive. Butter paper is the cheapest, but with the application of ink, it shrinks and wrinkles so it is suggested only for one colour printing jobs. Keeping expense in mind the better choice is tracing paper, as it also shrinks less than butter paper.

Butter paper can be prevented from shrinkage by rubbing mustard seed oil on it with a piece of cotton wool on the back side of the paper. This then should be stretched and tacked onto a board. The thumb tacks should be placed at a distance of 2 inches between each. Tracing Paper comes in a variety of thickness (weight), the thicker the paper the more expensive it is.

3) If your design consist of 3 colours, e.g. yellow, red and black, then the first positive to be made should be the lightest colour-that is yellow.

Take a sheet of tracing paper cut 2 inches larger than the master drawing, and tape it down on the master drawing. Make sure the tracing paper is stretched properly.

4) All the yellow areas in your master drawing are to be transferred onto the tracing paper with India ink. Fill in all the yellow areas with ink so that no light passes through it. This is done with a rapidograph or calligraphic pen.

5) Now the registration crosses/marks on your master drawing should be transferred to the tracing paper, exactly on top of

the registration marks on the master drawing. Precision is essential. Leave no room for error.

Your first positive for yellow is complete.

6) Without removing the yellow positive from it's position on the master drawing, tape another tracing paper on top, keeping the paper properly stretched. Now only the red areas of the design should be traced and filled with India Ink in the same manner. The registration marks are transferred in the end with the same care. The red positive is ready.

7) Black; the last positive, is prepared in the same manner without removing the first two. The three colour positives are now ready, all taped one on top of the other on the master drawing.

PRECAUTIONS

1. Positives of all colours should have registration marks. They should be so precisely placed one on top of the other, that only one registration mark should be visible.

2) On the positives, the colour areas and outside edges of the design should be sharp and clear. If the pen has slipped, the mistakes can be scratched off with a blade. Any mistakes, spots or spreads should be cleaned at this point otherwise they will print in the same manner.

3) India Ink should be thick enough on the positive so that no light can pass through. Take special care with fine lines and details.

4) Each positive should be marked with the word 'TOP' on the top edge of the design, so that the direction of the design is recognised and registration of each colour when printing, is in it's proper place.

b) Ready made Positives

Ready made Positives are prepared with a copy process camera easily done in the market. A master design is needed for this.

The master design can be in black and white only. Colour separation is done to prepare different positives for each colour. The colours should be indicated in pencil on the master drawing so that the camera processor can separate the colours.

A coloured design, like a printed poster, can also be given to the process camera, and separate positives for each colour will be prepared.

The advantage of using the camera process is that the design can be reduced or enlarged to your requirements.

REGISTRATION FOR TEXTILE - REPEAT DESIGN

Designing for textile printing is specialized and very technical. Repeat designs are created in such a manner that a design on a single screen is printed on several hundred metres of cloth without a break in the design becoming obvious. The printed fabrics available in the market are largely screen printed.

There are several methods of preparing repeat designs, but for our purposes we will discuss a very simple method:

1) Make a design in a rectangle which should measure 18 inches in width and 20 inches in length.
2) On the 4 corners of the rectangle, put the registration marks, as explained earlier.

Registration marks for repeat designs are essential, and must be accurate, since during printing on a continuous length of cloth, the marks must coincide with each other, in each printing step. (see fig.9)

3) Trace the design onto a tracing paper with a pencil as explained earlier, including the registration marks, and mark 'top' above the design.

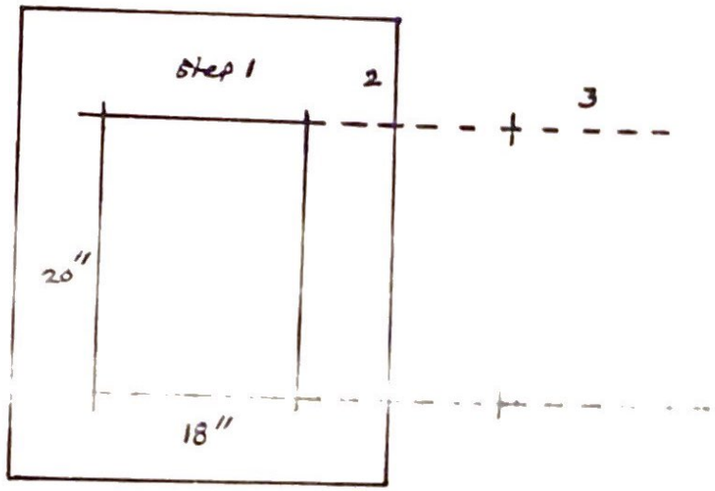


Fig. 9

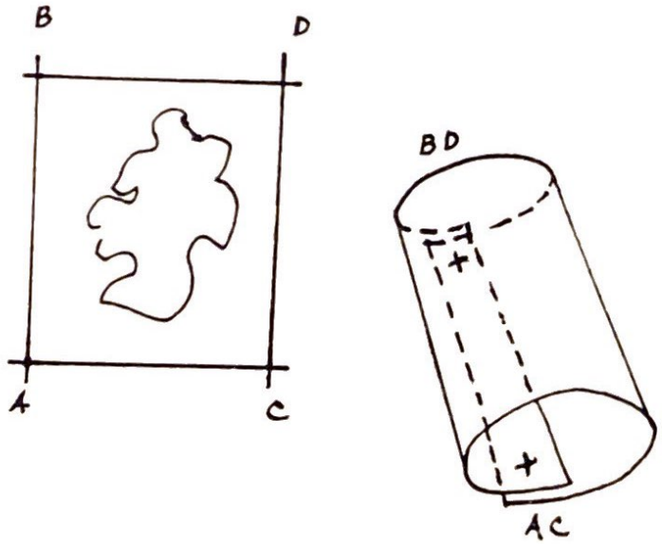


Fig. 10

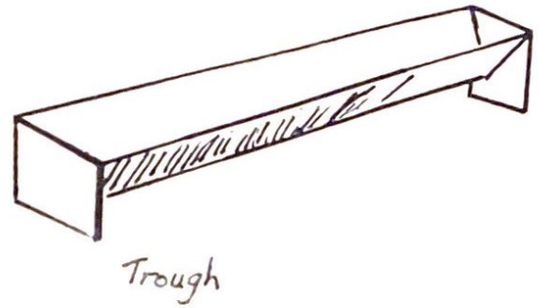


Fig. 11

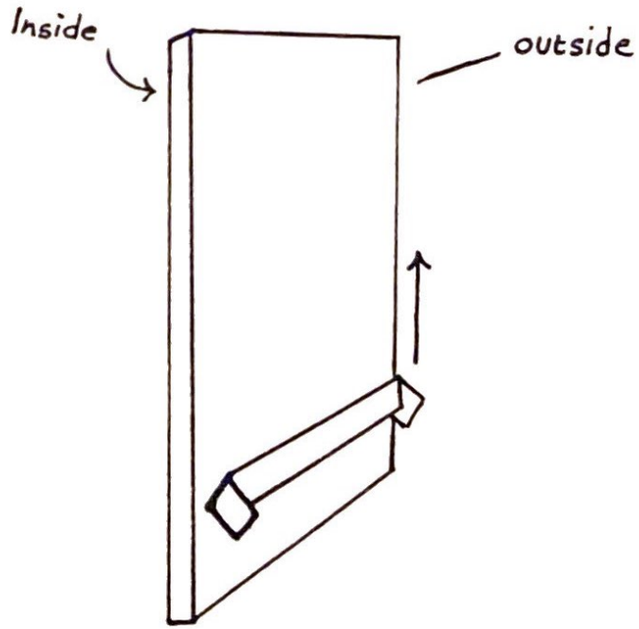


Fig. 12

4) To check that there is no overlapping of the design in repeat steps, roll the tracing paper in such a manner that the registration mark A is placed on C and mark B on D. Check to see that no part of one side of the design overlaps the design on the other side and that there are not too many empty spaces. (see fig.10)

5) Ink the design on the tracing paper with India Ink to prepare your positive, as explained earlier.

6) To make more than a single colour design, the method employed is the same as for paper.

Your repeat design is now ready.

CHAPTER 4

THE DIRECT PHOTO-EMULSION METHOD

The other printing processes started using photographic methods as far back as the middle of the 19th century. Naturally the screen printers also experimented with the possibilities of the photographic methods. It was discovered that when a solution of ammonium bichromate is mixed with a gelatin the result is a light sensitive emulsion. If exposed to light this emulsion becomes insoluble in water - if protected from light it remains soluble. From these experiments, two techniques were developed — the Direct and the Indirect method. In the Direct method the mesh itself is coated with this light sensitive mixture. In the Indirect method, a film of gelatine is sensitized, exposed and developed away from the screen, then applied to the screen. The materials for the indirect method are not available in our countries.

DIRECT METHOD

The Principle:

The screen printing principle is that ink is passed through a mesh to print on a surface. The areas of the mesh that are

blocked will prevent ink from passing through, therefore they will not print; the areas that are left open will allow ink to pass through to print. The screen can be blocked with different materials to make a direct stencil.

These stencils serve as cheap alternatives for broad and simple work in one colour.

DIRECT STENCILS

Direct stencils can be prepared with several different materials i.e. paper, wax or oil crayons, gum, nail polish, lacquer etc.

These will act as fillers to block parts of the screen mesh in the design you require. These fillers are applied directly to the screen, and no positive is needed. The areas of the screen on which the fillers are applied, will not print.

Experiments with these fillers should be done on the cheaper organdie cloth and not on expensive mesh.

1) GUM AND NAIL POLISH FILLERS

a) Gum is prepared by mixing saresh (glue) in hot water. Cool the gum before applying onto the mesh.
This can be applied with a brush or sponge for different effects, including broad designs.
After printing gum can be washed out with water.
Gum breaks down very quickly during printing and only 25 - 30 prints can be pulled.

b) Nail Polish is also applied directly to the screen, and is cleaned with acetone (nail polish remover). Approximately 50 - 60 prints can be pulled.

P.V.C. screen printing inks can be used for printing with these fillers.

2) WAX CRAYON AND LACQUER STENCILS

a) Wax crayons are used to draw with directly onto the screen. The drawn areas are blocked.

Spirits or thinner can be used to remove it from the screen. (Methylated Spirit)

b) Lacquer and lacquer thinner are available in the market with paint dealers.

Lacquer is thinned with a small amount of lacquer thinner, and applied to the screen directly with a brush.

Lacquer is durable and any number of prints can be pulled.

This is removed from the screen with lacquer thinner.

With Wax Crayon and lacquer stencils, water-based colours should be used.

PREPARATION OF WATER-BASED COLOUR

Maida (white flour), French chalk or magnesium white, a pinch of copper sulphate, and powder colour.

Boil water with maida (white flour)

Add slowly french chalk or magnesium white and mix until a consistency of thin cream is achieved.

Add a pinch of copper sulphate.

Take some of this paste and add powder colour of your choice and mix thoroughly. The water-based colour is ready for printing.

All the above methods are good for broad and simple designs. Fine details are difficult to obtain.

THE DIRECT PHOTO-EMULSION METHOD

In the Direct Photo-Emulsion Method, the positive is used, whether made by hand or by the camera process. The areas of the positives that were filled with Indian Ink, prevent light from passing through. When the positive is brought into contact with the light sensitive coated screen and exposed, these filled. areas prevent light from reaching the gelatine/emulsion. Therefore the emulsion will not harden with light, but remain soluble. These areas will wash out with water and keep the screen open. These open areas will then allow printing ink to pass through to print.

Today synthetic emulsions are prepared with P.V.A. (Polyvinyl Acetate) which is very tough and hard wearing, and does not break down or get damaged during printing. This is available already prepared in the market.

METHODS OF PREPARING EMULSION

METHOD 1

Mix 10 oz gelatine
100 fluid oz boiling water
Mix 1 oz . Bichromate powder
+ 60 fluid oz hot water
Mix the two together and apply to screen while hot with a trough.

METHOD 2

Photoengraving glue:- 7 oz.
1 oz . Bichromate powder
17 oz Water
Mix Bichromate with water, then mix with glue, filter through cotton. Apply to screen with a trough.

METHOD 3

FOR TEXTILE

Saresh (glue) ½ kg.

French chalk ½ kg. or zinc oide

Bichromate Powder 1 oz

.1 kg of water

Mix saresh in water and bring to boil 7 or 8 times until completely dissolved. Take it off the fire.

Slowly add French chalk until mixed thoroughly,

Add bichromate in pinches until the mixture takes on the colour of egg-yolk. Filter through cotton, and allow to cool before applying to screen. Application to screen is done with a trough.

NOTE: Indirect heat given to dissolve saresh in water will prevent the saresh from getting burnt.

METHOD 4

The ready made PVA photo Emulsion and bichromate come together. Bichromate is in liquid form already mixed in water and comes in a separate bottle. Bichromate should at all time be protected from light as it is light sensitive. The emulsion is not light sensitive until the bichromate is mixed in it, after which the emulsion should be protected from light.

Preparing the Emulsion

Emulsion	5 parts
Bichromate	1 part

Mix in a separate utensil, with a plastic spoon or stick. This is now ready to be coated onto the screen.

This solution lasts for only a week when protected from light. After this time the bichromate expires. It is better to mix it according to your needs, each time.

To rejuvenate the expired emulsion, bichromate should be added in the same quantity - e.g. 1 + 5.

Bichromate is also available in powder form. To mix it thoroughly in the emulsion it has to be converted into liquid form.

Take hot water in a very small quantity. Slowly add pinches of bichromate powder and stir constantly. Make sure all the powder has dissolved completely before adding more. Keep adding

powder until the colour of the liquid becomes a bright orange- the colour of an orange.

Note: Bichromate is a poison, therefore avoid using your hands, and wash immediately if it touches your skin.

PREPARING THE SCREEN FOR COATING

WASHING

The screen should be thoroughly clean before coating with Emulsion.

1) Mix a little bit of surf (detergent) in Acetone and scrub the screen with a clean sponge to remove any grease or ink.

2) Wash with water with a strong pressure to remove grit.

3) Lay the screen flat to dry in a clean shady place, with the mesh side up. Screens should be dried in the shade as the sun will warp the wood.

Now the screen is ready for coating with emulsion.

COATING

Applying the mixture of photo emulsion and bichromate to the screen is called coating of the screen. This must be done in a dark room where the maximum light you can use is a 40 watt bulb. Coating is best done with a trough(see fig.11).

The trough can be made in wood. This should be prepared carefully, sanded down to a smooth even surface and the edge must be perfectly flat, smooth and even. The trough has to be pulled against the screen with some pressure, any nicks, dents or projections in the wood will rip the screen. Equally importantly, the layer of emulsion has to be perfectly smooth and even to prevent problems in exposing. The trough should be 2 inches smaller than the screen.

APPLICATION OF EMULSION TO SCREEN

1) Pour enough emulsion in the trough to cover the screen in one pass.

2) Stand the screen up straight with a firm support, or take the help of another person.

3) Place the trough against the bottom edge of the screen and tilt to allow the emulsion to flow against the screen.

4) Hold the trough firmly and with pressure, and pull it upwards steadily and in an unbroken movement, without change in the pressure.

5) As you reach the top of the screen, tilt the screen

forward so that the excess emulsion flows back into the trough and does not drip on the screen.

6) Similarly apply a coat of emulsion on the other side of the screen. (see fig. 12)

Note 1: Make sure that the emulsion is evenly spread all over the screen, and no drips thicken any part of the emulsion, or any place is left uncovered. If a second coat has to be applied to cover these areas it will make the screen coating uneven, and therefore create problems in the exposing stage.

Using the trough does need practice so don't feel too upset if you don't get it perfect the first few times.

The emulsion prepared for textile printing must be applied with the trough.

Another, cheaper and easier method, although it takes more time, is the use of a plastic piece like a cassette cover, or plastic foot ruler. The edges and corners of the plastic piece must be rubbed against a rough surface or sanded down, to prevent tearing of the fabric.

Pour a small bead of emulsion at the edge of the plastic, and pull it across the screen. The emulsion will spread, but the entire screen cannot be covered in one stroke. Several strokes are needed to cover the screen. Apply on both sides until coating is perfectly even.

Note - 2 Hold the screen up against the light to check if the emulsion layer is even and smooth. This process has to be done in a dark room with a maximum light from a 40 watt bulb.

Immediately after coating is completed, the screen should be placed in a completely dark space to dry. This dark space is the one created under the table covered with black cloth or paper.

At the end of the coating process, wash the trough or plastic piece with water, otherwise the emulsion will harden on the plastic and make the edge uneven. (The remaining Photo-Emulsion should be protected from light when storing).

It is essential that the coating of the screen is done on both sides of the mesh. The two layers bind together to create a bridge. This makes your design independent of the weave of the mesh, and curved lines, which break into a saw-edge if they follow the weave, can become sharp and clear and with a

perfect unbroken curve.

The number of coats of emulsion depend on the fineness of the mesh. The finer the mess the higher the number of coats.

The inside and outside of the screen will take a different number of coats. In between layers of coating the emulsion has to dry, totally protected from light.

The outside of the screen is the side on which the mesh has been fixed. The frame side is the inside of the screen (see fig.13).

MESH NO.	COATING LAYERS					
	Outside	Inside	Dry	Outside	Dry	Outside
21 T	1	+ 1				
43 T	1	+ 1				
77 T	1	+ 2				
90 T	2	+ 2	_/	+ 1		
100 T	2	+ 2	_/	+ 1		
110 T	2	+ 3	_/	+ 1	_/	+ 1
120 T	2	+ 4	_/	+ 1	_/	+ 1
140 T	3	+ 4	_/	+ 1	_/	+ 1

This table gives the number of coats of emulsion needed according to the mesh code number.

The exposure time increases with the increase in the number of coats. A test exposure must be done separately for this.

DRYING

As long as the emulsion and bichromate solution remains wet, it is not affected by the light of a 40 watt bulb. When the emulsion dries it becomes light sensitive, and should be handled in total darkness. Some light is needed to work while preparing the screen for exposing. For this a 0 watt bulb, or an orange coloured light can be used without harming the emulsion.

To dry the screens, place the coated screen under the darkened table, or dark place. The screens must be placed flat with the outside of the screen facing downwards. To protect the wet emulsion, wooden blocks, strips or bricks can be placed under the wooden edges of the frame, to prevent it from touching any surface. If more than one screen has to be dried they can be placed one on top of the other with 2 strips of wood between them. These

wooden strips should be placed on the frame without touching the mesh (see fig.14).

Coated screens take some time to dry - upto 2 or 2½ hours. To speed up the drying process a fan or hair dryer can be employed. But care should be taken that no light other than the 0 watt bulb or orange light reaches the screen.

When the screen is completely dry it is ready for exposing.

To test if the screen is completely dry, with your finger, quickly touch the emulsion at one edge or corner. If any tackiness is felt, the screen needs to dry some more.

Note: If a slightly damp screen is exposed, the danger is that the emulsion will run in a thin film and block the open areas. This film is visible only on very close examination and will become apparent at the printing stage when ink will not pass through.

EXPOSING

Once the photo emulsion on the screen has dried completely, the next step is EXPOSING. The preparation for this has to be done in darkness.

Exposing is done with a close contact of screen and positive, through which light is passed. This can be achieved with the light of the sun or by an easily available Mercury Halogen lamp. (Commonly known as a halogen tube-light).

Preparation

The preparation and setting up for exposure must be done in darkness. Some light is needed for setting up, for which the 0 watt bulb or orange bulb can be used.

MATERIALS NEEDED:

1) Screen + Positive
2) Foam — the size should fit well inside the screen frame.
3) A sheet of glass — larger than the size of the screen.
4) Weight — like bricks wrapped in cloth.
5) A table, board, or floor (surface).
6) Black cloth or paper.
7) Tub or bucket of water.
8) A plastic or rubber hose pipe — tied firmly to the water tap.

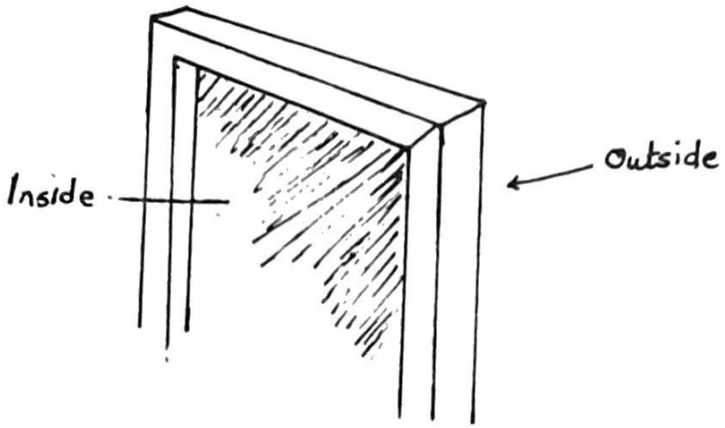


Fig.13

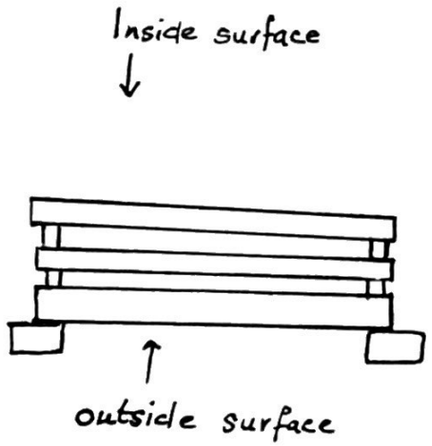


Fig.14

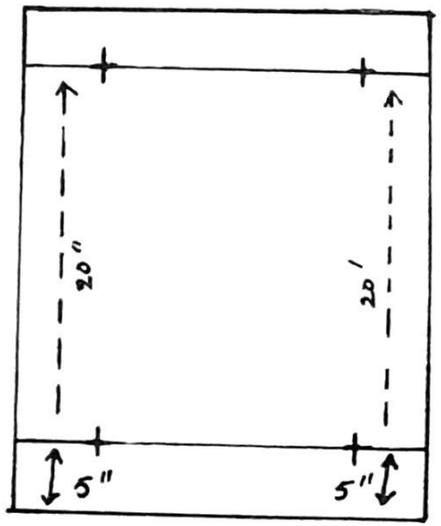


Fig.15

a) To Set Up:

All the exposing work is done in the darkroom.

1) Place the piece of foam on the surface you are using.

2) Place the screen firml on the foam. The foam should fit inside the screen frame. The 'outside' surface of the screen should face up.

3) The positive is placed on the screen. The side of the design on your positive which shows the correct side, should face down on the screen. Now you see the design upside down laid on the screen. 'Top' marked on the positive will indicate the correct side.

4) The placing of the positive should be in the centre of the screen.

5) Place the sheet of glass on top. The glass should be free of dust, spots and scratches, and handled carefully so as not to tear the screen.

6) Place weights (bricks wrapped in cloth) on the outer edges of the design, on the wooden frame on top of the glass. (see fig.16).

Note: The purpose of the weight is to bring the surfaces of the screen and positive in perfect contact, with no air bubbles or wrinkles. The positive can be taped down with cello tape. Perfect contact between the screen and positive is essential for good exposure, otherwise the danger is that light may pass in between the two and expose and block the screen in areas you want printed. This is especially important for very fine detail.

7) The halogen lamp should be placed directly above the centre of the screen.

The distance between screen and lamp should be the maximum length of the screen.

Note: The height of the lamp is determined once, with the largest screen size you work on. All test exposures should also be determined according to this height. Any change in height will demand a new test exposure.

Now you are ready to expose the screen.

EXPOSING FOR TEXTILES

TO SET UP

The setting up for exposing for textiles is done in the same manner as described above. However certain measures are

essential to facilitate the registration of the textile designs at the printing stage.

The placing of the positive on the screen for exposure is critical. The following must be done in the darkroom with a 0 watt bulb

1) From the outer edge of the width of the wooden frame and on the outside surface of the screen, measure 5 inches upwards - in the direction of the length of the design/ frame. The 5 inch distance should be measured at both ends of the width of the screen.

2) Draw a line with a pencil on the screen mesh, joining the two points thus marked.

3) The registration marks at the bottom of the design on the positive must be placed on this line.

4) For greater accuracy, measure and mark 20 inches from this line, towards the top of the design, and draw another pencil line on the screen. The registration marks at the 'top' of the design are placed on this line.

5) Tape down the positive, and expose the screen as described earlier. (see fig.15)

Note: If the design is of more than one colour repeat this process on each screen being exposed. While printing, the registration of one colour on top of the other will become trouble free.

b) Test Exposure:

Before beginning the final exposing of the design on the screen, a test exposure must be done, to determine how much light is needed to expose the screen. This test needs to be done once only under the given conditions, unless any changes are made later on.

1) Divide the design area on the screen into 5 equal parts.
2) Switch on the halogen lamp, take note of the time, and be ready with the black cloth or paper.
3) After the screen has been exposed for 6 minutes, cover the first part of the design with the cloth or paper. This part has been exposed to light for 6 minutes. The rest of the screen continues to be exposed to light.

4) After one minute, cover the second part of the screen, by moving up the cloth or paper, or by laying another sheet of black paper or cloth. The second part has now been exposed for 7 minutes.

5) After each additional minute, cover the next part in the same manner. Each part will then be exposed for an extra minute, the time of exposure to each part increasing with every step by one minute.

6) The last or fifth step need not be covered. The total exposure time on the 5th step will be 10 minutes.

7) Switch off the lamp immediately at the end of 10 minutes.

8) In total darkness remove the weights, glass and positive. Take the screen to the tub or bucket of water, again in darkness, and wet both sides of the screen properly. No part of the screen should remain dry. The dry areas will harden immediately in the light and become blocked.

Note: The bichromate in the emulsion is light sensitive. When mixed in emulsion, it will not be sensitive to light only as long as the emulsion is wet. Once it dries the bichromate becomes sensitive to light. By wetting the screen immediately after exposure the bichromate becomes insensitive to light again. After this the remaining steps of washing can be done in the light.

9) Take the screen to the tap immediately, wherever it is placed, and stand it up, with enough light behind the screen to enable you to watch the screen open.

10) The hose pipe should be manipulated to create a sharp thin jet of water. Spray the entire screen with the jet of water. The water should have a strong pressure.

11) Continue to spray the entire screen with the jet of water until every area of your design is washed out and open.

The remaining areas of your design should remain intact on the screen.

Note: The open and washed out areas on the screen will print, the remaining areas on which the emulsion remains fixed on the screen are the non-printing area.

ANALYSIS OF TEST EXPOSURE

On the washed screen we have in front of us 5 different effects, each dependent on the 5 different durations of exposure.

The five steps in exposure time exposed the screen for 6,7,8,9,and 10 minutes. The areas that received less light than needed, will wash out even where the emulsion needs to be hard. The areas that have received more light than needed will either not open, or not open completely.

The remaining areas of the 5 steps need to be examined to judge which duration of exposure is perfect.

The results of perfect exposing time will show that the fine detail areas have opened perfectly with sharp edges like in fine lines and small lettering. In the non-printing areas, the surface of the emulsion will be hard and even..No area of the design will be closed or broken. The duration of exposure which produces the best results, can them become the Standard Exposure Time, as long as no changes are made, in height of lamp, intensity of light and temperature of room.

Note: When the weather changes, a new test should be taken because changes in temperatures and humidity effect the emulsion. Hence winter exposure time will be different from summer exposure time.

This is now your Standard Exposure Time. On the basis of this test, the design you require can be exposed on a new screen.

EXPOSING IN THE SUN

Exposing in the sun, compared to artificial light, is cheaper and takes less than 50% of the exposing time. The preparation of this also has to be made in the darkroom.

For this a board is essential, because after the preparation the whole thing has to be carried outside for exposure.

The foam, screen, positive and glass with weight should be placed on the board as done earlier. Cover this completely with black cloth or paper so no light can reach the screen even from the sides. Hold everything firmly in place and bring out in the sunlight.

Take note of the time and lift the cloth to expose. Immediately after exposing, cover with cloth and remove to the darkroom. In the dark, wet the screen on both sides, as before.

Wash out the screen, in the same manner.

TEST EXPOSURE IN THE SUN

The test exposure in the sun is done in the same manner in steps. The first step exposed for 1½ minutes and upto 4 minutes approximately. The exposure time is reduced in bright or hot sunlight and increased in low sunlight or under the winter sun.

DRYING

After washing out the screen, lay the screen on a flat surface in a dust free and shaded place and leave to dry. The sun is not recommended for drying, as wooden frames warp in the sun. Once the Standard Exposure Time is established, there is no need to wait for this screen to dry. You can commence exposing your design immediately.

EXPOSING THE DESIGN

We have now established a standard exposing time in the dark-room with the halogen lamp, and a different exposing time with sunlight. For example let us assume that the standard exposing time with the lamp is 8 minutes, and with the sun, 2 minutes. Now with this standard time, you can expose your design. If your design is of 3 colours, then the 3 different prepared positives can be exposed on three different screens. Each of these positives are to be exposed in the same manner as described earlier for 8 minutes each in the darkroom, or 2 minutes each in sunlight. The washing and drying too, is done in the same manner.

Note - 1: If some areas of your design, like fine lines etc. do not open during washing then make a fine and strong spray against that area. If despite that the lines remain closed, then two pieces of wet cotton wool can be rubbed gently on both sides of the screen on the trouble spot, and sprayed with water. Stubborn areas will then open easily.

Note - 2: Exposing the emulsion for textiles takes between 10-12 minutes with the lamp, and approximately 4 mins in the sun - Test exposures must be made for accurate results.

SCREEN AND POSITIVE SIZES

The size of the screen should be a minimum of 2 inches larger than the design on three sides, and at least 3-4 inches

larger on the fourth side. This 3-4 inch border serves as a well to pour ink on while printing.

If your design is smaller than the screen, then two designs can easily be exposed on a large screen at the same time.

If you possess only one screen, and have to print 3 colours, then expose one colour at first, and after the printing stage has been completed to your satisfaction in the first colour, the screen can be washed clean, recoated and the next colour exposed and printed. Similarly the third colour, or any number of colour can be printed. The only disadvantage in this is that the time increases in completing the printing job.

Note: If you discover that the exposure is incorrect or the emulsion damaged on the screen after exposure which cannot be corrected or mended, wash out the emulsion from the screen immediately. This will save you a lot of time.

CLEANING EMULSION FROM THE SCREEN

Cleaning the emulsion from the screen is a simple and cheap method.

2 parts water

1 part Bleaching Powder

Mix thoroughly in a mug. Do not touch bleaching powder with your hands. Take a stick and wrap a piece of cloth on it. This will serve to mix the solution, as well as to apply it to the screen.

Lay down the screen and dip the stick in the solution and rub on both sides of the screen thoroughly. No corner or edge should be left without the application of the bleaching powder.

Lay the screen flat for approximately 15 minutes for the bleaching powder to be effective.

If there is more than one screen then you can lay one screen on top of the other, two outside surfaces of the screens facing each other, and apply and rub fresh bleaching powder to both sides of the screen. After 15 minutes apply fresh bleaching powder. The emulsion will start disintegrating.

Take each screen, stand it up at the tap, and with a strong jet of water wash out all the bleaching powder and emulsion thoroughly, until the screen is completely clean.

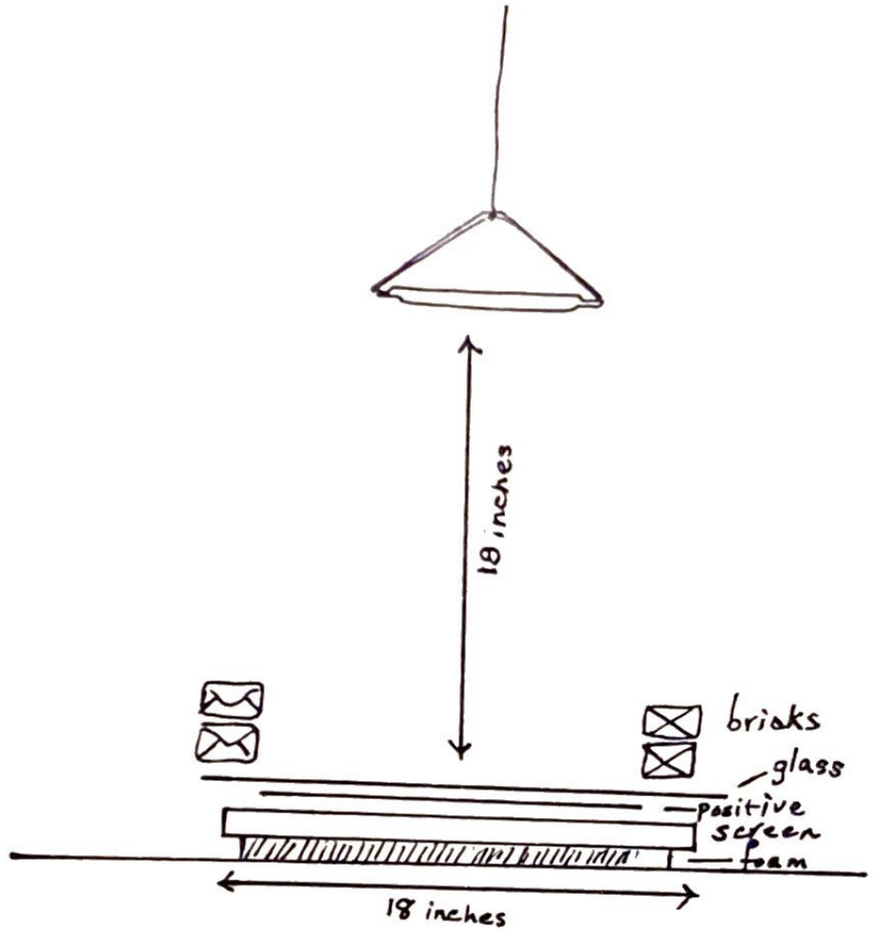


Fig.16

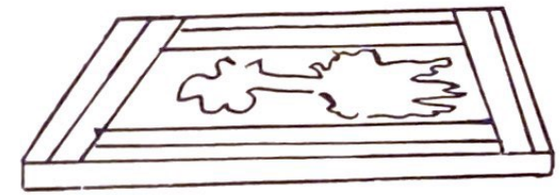


Fig.17

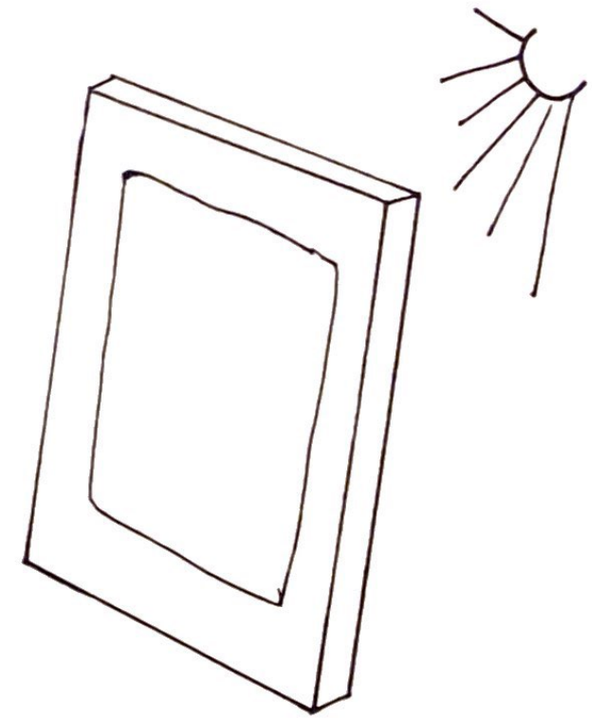


Fig.18

Dry in the shade.

PREPARATION OF SCREEN FOR PRINTING

Once the exposed screen has dried it has to be prepared for printing.

Take Paper tape, which is gummed on one side,

Cut strips to the size of the screens length and width,

Take a piece of cloth, dip in water, and squeeze excess water out. Apply this damp cloth to the gummed side of one strip in one movement.

Apply it immediately to the screen, and press down until the tape is stuck firmly onto the screen.

A) METHODS OF APPLYING TAPE TO SCREEN

Take one strip of tape at a time and dampen. Apply to screen starting from the outer frame edge on the outside surface of the screen. Apply tape on all four sides of the screen. Continue applying more strips moving inwards towards the design, until the surface upto the edge of the design is covered. Each additional strip should overlap the first one (fig.17).

It takes a few minutes for the tape to dry on the screen. The screen should be left in a horizontal position to dry so that there is no danger of the glue on the paper tape dripping, and blocking the open parts of the screen.

The advantages of the application of paper tape are:

1) The borders of the design are reinforced for printing purposes.

2) It prevents ink from leaking out of the edges and corners while printing.

3) The emulsion on the edges and borders of the design usually remains open due to various factors, and can allow ink to pass through while printing. This mends any damaged parts of the emulsion.

B) CORRECTION OF FAULTS IN EMULSION

Examination of the emulsion in the design area is essential, as thin layers of emulsion and some damage to the edges of the design are normal. These have to be corrected before printing, as these problems get magnified as printing progresses.

To correct these minute problems in the emulsion a small amount of prepared emulsion is needed and a small brush.

Stand the screen up against the light. The minute pinholes in the emulsion will become apparent only in this way. Where the emulsion layer is too thin, as well as damaged edges of the design also become clearly visible. (fig.18).

With the brush apply small thin amounts of fresh emulsion onto the damaged areas on the outside surface. It takes a few minutes for the emulsion to dry on the screen. The screen is now ready for printing.

Note: The remaining emulsion that has been exposed to light is now useless. Wash the brush with water, and clean out the emulsion utensil..

PREPARATION OF SCREEN FOR TEXTILES:

The emulsion prepared for textiles has to be further reinforced with synthetic enamel paint before printing:

1) Mix synthetic enamel paint with kerosene oil or turpentine to thin it to a consistency for easy application.

2) With a soft brush - no 2 or 3, used for house painting, paint the inside surface of the screen. At the same time rub vigorously the outside surface with a clean dry cloth.

Note: If the open areas get blocked, wet the cloth with kerosene and rub the outside surface till these areas are cleaned of paint.

3) Lay down the screen with the painted surface facing up to dry overnight.

4) After drying, the other side of the screen is painted in the same fashion.

5) Apply paper tape on all sides, as explained earlier.

CHAPTER 5

PRINTING

MATERIALS

Printing Inks

Chemicals

1) Butyle
2) Nitrobenzene

Squeegee

Exposed Screen

Printing surface:

Table or flat surface like chipboard

Paper for printing

Door hinges and screws

Cups

Waste cloth for cleaning

Strips of Cardboard

Cellotape

SETTING UP FOR PRINTING

The space needed for printing, can be the room described earlier or an open courtyard with a roof, or verandah. As mentioned earlier, this space must be very well ventilated. The room must be set up with an exhaust fan, table or pedestal fan, facing out of the room as described earlier. (fig. 1).

This is essential to disperse the fumes of chemicals which are dangerous for health.

If you work in a verandah or courtyard there should be no wind as it will disturb the paper during printing.

PRINTING BED

The surface which is used for printing is called the printing bed. Very sophisticated printing tables are manufactured, which are very expensive and not available here, but make the job of printing very easy. However we can make our own printing beds with the minimum of expenditure and from objects easily available from our own houses.

You can make a printing bed in two easy ways.

1) A sheet of chipboard cut to a size larger than your largest screen.

   For printing fine details on paper the chipboard surface is too rough. To solve that problem, whenever needed, the sheet of glass you use for exposing can be placed on the chipboard for a smooth surface. But the glass must be thoroughly cleaned before and after use. The advantage in using the chipboard is that different kinds of material you need to print on can be

fixed easily on to it. e.g. leather, plastic, thick boards, cardboard, plywood etc., in addition to paper

2) Chipboard on which formica has been fixed in the factory.

This is an excellent bed for printing on paper. However, since these sheets have only one side covered with formica, and the other side is chipboard this can serve a dual purpose, and both sides of your sheet can be used as printing beds for different purposes. Care should be taken then to protect both sides from damage.

With both these methods, a table is needed. The printing bed of your choice is placed on the table. The height of the table is important for printing as printing is done while standing. The table should be the height of a writing table or desk.

Note: For textile printing a sheet of chipboard 4ft X 12ft, covered with smooth rexene or plastic serves the purpose.

SQUEEGEE

The squeegee is a very important part of the printing equipment. The function of the squeegee is to pull ink across the screen and force it through the open parts of the screen onto the printing surface.

The squeegee is made with a strip of rubber fixed onto a wooden handle. The rubber blade is available in strip rolls in the market, and can be made from very hard rubber, neoprene, polyurethane or vulkollan. The latter three are synthetic, and have a longer life. Rubber is not so durable and dissolves in some chemicals. The width of the blade can be between 2½ - 3 inches. This is fixed into a groove in the wood and nailed down firmly, leaving approximately 2 inches of blade exposed (fig.19).

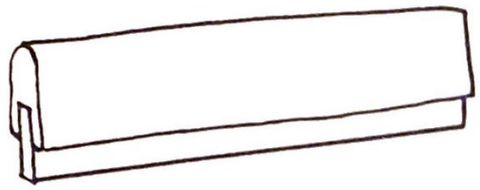
Softer rubber blades are used for textile printing.

The care of the blade is essential. It should not be damaged. Any nicks or cuts will produce bad printing results.

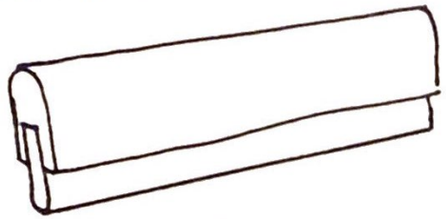
In length the squeegee should be approximately two inches smaller than the inner width of the screen frame. If your screen is larger and the design much smaller, then a smaller squeegee should be used, but which is at least two inches larger than the design.

Squeegees can be made by you or by a carpenter.

SQUEEGEE



FOR PAPER



FOR TEXTILES

Fig.19

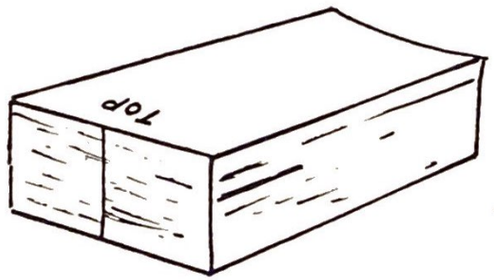


Fig.20

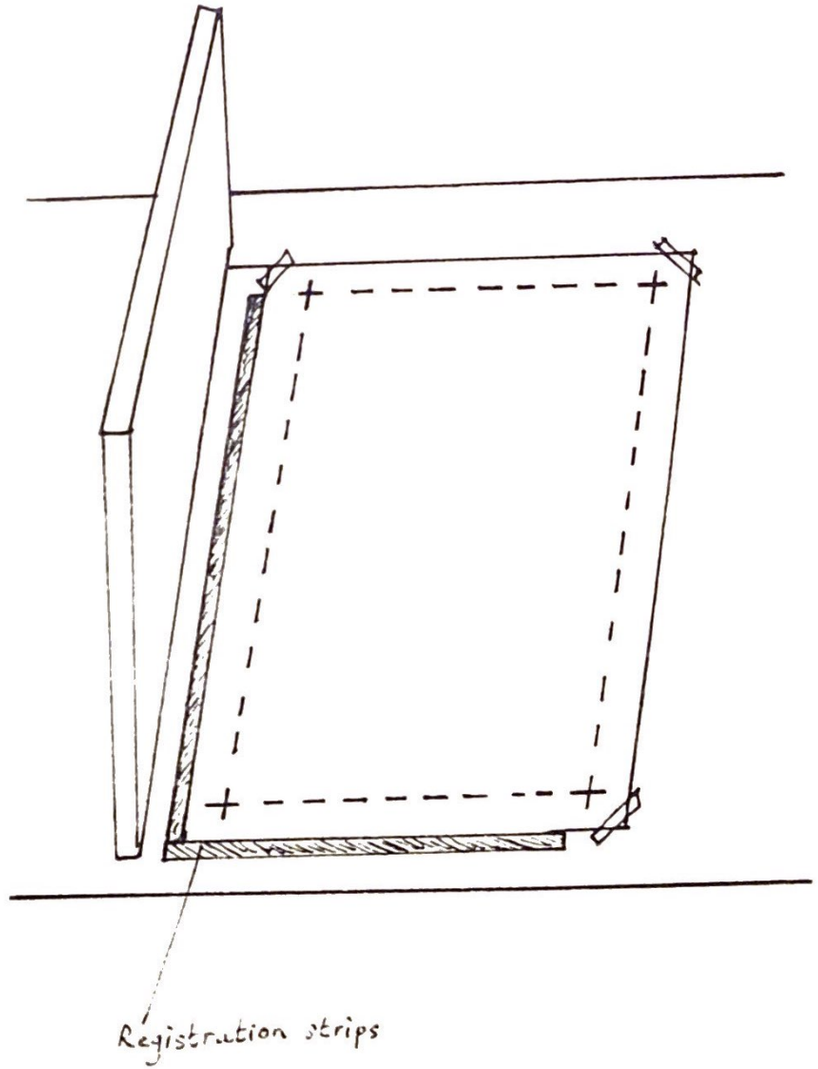


Fig.21

Note: Test the squeegee blade by placing it on a flat and even surface to check that it is flat.

FIXING THE EXPOSED SCREEN ONTO THE PRINTING BED

In the centre of the longer side of the printing bed, and close to the edge, fix two door hinges with screws. The distance between the two hinges should be able to accommodate smaller screens as well. The hinges should be fixed on the bed permanently, and so firmly that they cannot shift even a hair-breadth under the pressure of printing.

Place the screen with the outside surface facing down, the frame side facing up. Fix the screen to the hinges firmly with screws. The screen should be placed in the centre of the printing bed.

Now the screen is fixed on one side of the printing bed with hinges and can be lifted and laid down in the same place each time. This movement will be like a door opening and closing. The screen should fall in exactly the same place each time.

The next step is the registration of the paper to the design.

REGISTRATION FOR PRINTING

The first step in printing is the placing of the design on the paper surface to be printed.

The paper should be cut by machines to the size required.

The quantity of paper should be more than the number of prints required. e.g. if a hundred prints are needed then the number of sheets should be at least 130 - 140. These are used for test prints or proofs.

Examine the edges of the cut paper, and stack up all the paper with all cut edges on one side.

On one side of the stack of paper, draw a line from top to bottom as shown in fig.20. This mark should coincide with the 'top' side marked on your design.

The purpose of this is that the direction of the paper will always remain the same.- and each paper will have the print impression in the same place.

In the case of printing more than one colour, the correct direction

and registration of one colour on top of the first one can be easily achieved.

1) Lift the top sheet from the stack of paper and without changing the direction of the paper, place it on the printing bed. Lay the screen on top of the paper.

2) Shift the paper to place it under the design, as close to the placement of the print impression you want on the paper.

3) With a soft pencil, coloured chalk or charcoal, rub on the registration marks in your design on the screen so that the marks are transferred onto the paper.

4) Without shifting the paper, tape it down onto the printing bed.

5) Very precisely join the four registration marks in the shape of a rectangle/square (fig..21).

6) For greater accuracy a simple method is to place another sheet of paper on top so that the rectangle below is visible.

7) Adjust the top sheet on the bed, so that the borders of your design are placed according to your requirements and tape it down to the printing bed.

8) Take two strips of cardboard and very carefully place them along the sides of the paper on two sides to form an "L" (fig.21) .

These are the registers for paper placement. The register strip should be placed on the side on which the screen is fixed for easy placing of paper. These register strips must be so firmly fixed to the bed that no shifting is possible.

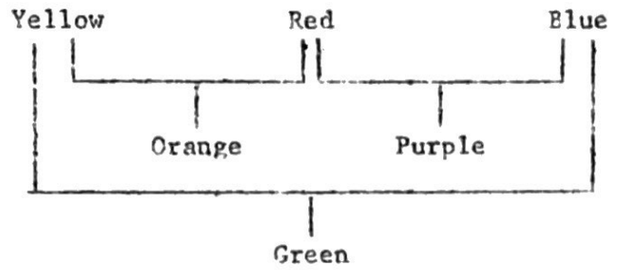
You can now remove the sheets of paper from the bed.

PREPARING PRINTING INKS

P.V.C. Silk Screen Printing Inks are available in the market, as is their solvent - Nitrobenzene. This is used to thin the inks for printing facility.

The sequence of colour of inks in printing is from light to dark. e.g. first yellow, then red and in the end black.

Colours can be mixed together to create a third colour, or mixed with white to create a lighter shade.



Mixing white will create lighter shades, and black or blue will create darker shades. To create different shades or colours, the darker colour should be added to the lighter colour in very small quantities, and mixed thoroughly before adding more until the required colour is obtained.

When mixing colours, small quantities should be mixed separately in another utensil and only in quantities needed. Colours should never be mixed in the original box.

To print, ink has to be thinned to a consistency to allow it to pass easily through the screen mesh. Care should be taken as too thin a consistancy of ink will make it spread on the paper. If the ink is too thick printing will become difficult, and there is a danger that the screen may get blocked by ink drying quickly in the mesh.

To thin ink, add nitrobenzene to the ink in small quantities and mix thoroughly with a stick or spoon. Continue to add more nitrobenzene and test until the required consistency is achieved.

The ink consistency should be the thickness of heavy oil or thin runny cream. To test lift the stick and allow ink to fall back into the utensil. This should fall in a thin unbroken line and remain separate from the body of ink for only a couple of second.

The ink is ready for printing.

PRINTING

Two or three people are needed for printing. One person for printing, the second and third person for lifting and placing paper. These two must always keep their hands clean and free from ink.

1) Place a sheet of paper in the registers on the bed and lay the screen on it.

2) The wider border that was left on the screen while exposing is the area where ink is poured for printing Pour a bead of ink here, as long as the length of the squeegee, and in just enough quantity so that ink does not spread too much.

3) Place the squeegee behind the ink and with a firm and even pressure pull the ink across to the other side.

The angle of the squeegee and the screen should be approximately 45° in the direction you pull the squeegee. In this fashion ink is pushed through the mesh and onto the paper below. (see fig.22).

4) Lift the screen, remove the printed paper and place it carefully in the drying area.

5) Without laying the screen down, immediately place a new sheet of paper in the register marks.

6) Lay the screen down on the paper and pull the next print.

In the same fashion pull 8 or 10 prints. There prints are the 'proofs'. On these proofs, the registration marks should be clearly visible. Any problems in ink consistancy or in the print have to be corrected here.

The problems can be of the following nature.

1) There may be ink leaking from some area.
2) Emulsion may break from some spot
3) Some pinholes are left open in non-printing areas.

To correct these faults, lift the screen and apply masking tape to patch the problem areas. This is done on the outside surface which is now in contact with the paper and away from the ink.

To make corrections the printing has to be stopped. Ink will dry in the mesh. The ink in the mesh must be cleaned and opened to start printing again.

To clean ink another chemical - Butyle - is used with two clean pieces of cloths.

1) Pour a generous amount of butyle on one piece of cloth.
2) Lift the screen, and rub this soaked cloth firmly on the outside surface of the screen.

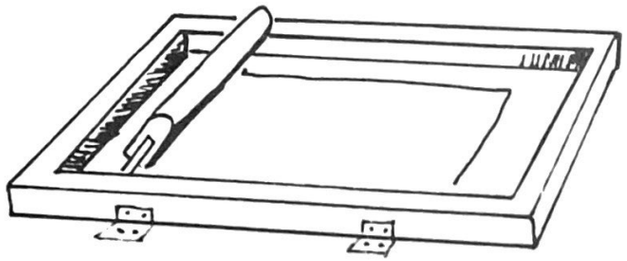


Fig.22

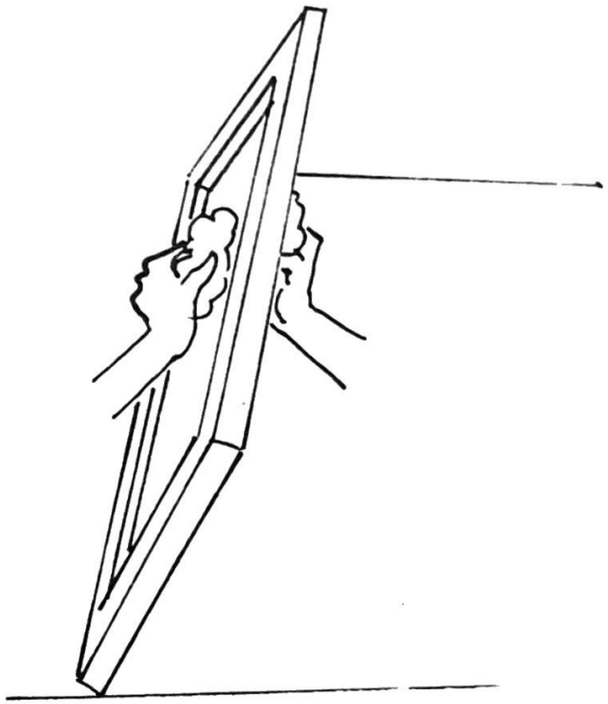
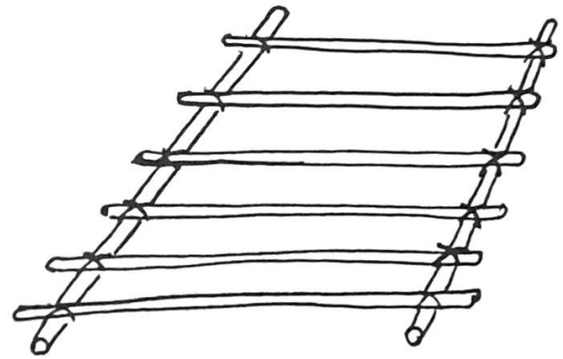


Fig.23



Drying Rack

Fig.24

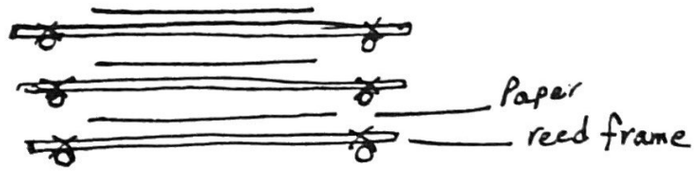


Fig.25

3) Now rub with the dry cloth firmly.

4) Repeat until the entire mesh is clear and open.(fig.23).

Now printing can commence, and should continue uninterrupted. This will ensure a smooth flow of ink through the screen.

Each time printing is interrupted the whole process of cleaning will have to be done, and time and paper are wasted.

5) Clean the screen thoroughly, immediately after printing is completed and remove from the printing bed.

PRINTING OF SECOND COLOUR

After all the prints in one colour have dried stack up the printed paper. Check to see if the pencil marks on the sides of the paper are all in the same direction. This will ensure that the second colour printed will fall in the correct place.

1) Fix the screen for the second colour onto the printing bed as done earlier.

2) Take one of the first 10 proofs and adjust it on the printing bed under the screen.

3) Take two extra sheets of paper and tape them to the top and bottom of the sheet, so that the extra length is exposed outside the edge of the frame.

4) Lay the screen on top of the sheet. The added length enables you to move the printed sheet in any direction needed. You can observe visually where the paper should be placed from above through the screen. When the two colours are exactly registered tape down the paper onto the bed, and place the registration strips along the sides of the paper edge as done earlier.

5) Commence printing the second colour.

The first sheets to be printed at the beginning of each colour, should be the ones which you have already printed first as proofs. This will save time, labour and paper as the first few prints are always proofs, and are used as experiments to test ink consistency and quality.

Any number of colours can be printed like this.

DRYING OF PRINTS

For drying of prints, a clean dust-free place is needed, where there is no wind. While the prints are drying the danger with dust is that it will settle on wet ink and dry on it. Wind will spoil prints while wet and these must be weighed down, to prevent smearing.

If there is a lack of space for drying there are some cheap methods to overcome this.

1) A wire strung across the room with clothes pins can serve the purpose of hanging up the prints to dry. This is good for smaller prints. Care should be taken though to attach another clothes pin at the bottom to weigh the paper down.

2) Another method for larger prints which is equally cheap and space saving, and can be made by you with reeds.

Take two reeds and lay them parallel to each other. The distance between the two should be the length of your largest screen.

Across and on top of these two sticks, lay more reeds at a distance of about 3 inches and join them together by tying them at the joints with a strong string, wire or tape. (fig.24).

Make several frames like this.

As you pull out the first print, lay it down on the floor.

Place one frame on top without touching the paper.

The next print can be placed on this frame and another frame laid on top of this. In this way all the prints can be placed one on top of the other with one frame in between, and allowed to dry. This will save space as well as prevent prints from flying off in the wind. (fig.25).

Note: It is essential that when placing each print to dry, the direction of each paper be the same. After each print has been pulled out, and placed to dry, the 'top' of the design should face the same direction. For this the movement of lifting the paper from the printing bed and placing of it in the drying area must be repeated exactly each time. After the prints have dried, and you pick them up and stack them together the direction of the paper should not change.

This will ensure that the direction of the design does not change and is in the correct position for the next colour to be printed on top.

CLEANING THE SCREEN AFTER PRINTING

As soon as you finish printing with one screen it should be cleaned thoroughly before the ink dries on it.

Take old newspaper or waste paper and spread it on the printing bed under the screen. Take a stiff cardboard piece and scrape all the extra ink from the screen. Pour butyle generously all over the screen and with waste cloth clean as much of the ink as possible.

Place fresh paper under the screen and repeat, until the screen is visibly clean.

Now with fresh waste cloth soaked in butyle and a change of paper under the screen, clean the screen from both sides until the cloth used picks up no more ink.

Corners and wooden frame should be carefully cleaned as well.

Unscrew the screen from the printing bed.

If you need to print the same design at a later stage, then this screen, cleaned thoroughly of all ink, can be kept. Store it in a safe place to protect it from damage.

REMOVING EMULSION FROM SCREEN

Emulsion is removed from the screen with bleaching powder as done earlier. If parts of the emulsion do not get clean, it means that there is a film of ink preventing the bleaching powder from reaching the emulsion.

These areas should be cleaned again with butyle and cloth till the screen looks clean.

Now lift the screen against the light to check if any part of the mesh is blocked. Clean those parts with butyle and wash the screen with bleaching powder and strong water pressure.

Once the screen is cleaned thoroughly, store it in a safe and clean place.

TEXTILE PRINTING

Preparation of pigment

Materials needed are:

Alka paste

U.D. Binder

Dyes of different colours

Water

To prepare 7 kg of alka paste, take

100 gms of alka paste

7 kgs of water

1) In a large tub pour 100 gms of alka paste
2) Add some of the water and mix thoroughly with your hands until the solution becomes thick and stiff like the consistency of jelly.
3) Continue to add small quantities of water and mix until all the 7 kg of water has been utilized and the solution has thickened.

The alka paste is ready. This can be stored indefinately.

Note: Alka paste comes in large drums and sold in small quantities therefore there is no gaurantee that water has not been mixed already.

The amount of water needed to prepare the paste, therefore, cannot be a fixed amount. If you discovere that water is no longer mixing with the alka and the solution is not becoming hard stop adding more water. Some may have already been mixed by the salesman.

The role of the binder is to bind the colour to the fabric. Binder is added to the alka paste and only small quantities as as required should be prepared as the binder degenerates with time.

3 parts prepared alka paste.

1 part binder

Mix them together thoroughly using your hands. Binder will make the consistency slightly softer.

To this paste, colour is added in very small quantities. Take a drop of dye at a time and mix thoroughly. Add more, drop by drop until the colour required is obtained. Mix only the amount of paste and colour as is needed.

Note: These colours are good only for cotton materials, canvas or 40% polyester mixed with cotton.

PREPARATION FOR PRINTING

1) Take the centre on the 18 inch width of the design exposed on the screen and mark it on the wooden frame. This mark will be at 9 inches.

2) On the right side of the mark nail a block of wood 1 inch X 3 inches so that the block is projected out of the frame.

3) On the printing bed measure out 9 inches from one edge of the longer side, and fix another block to the bed with nails.

4) From this point measure spaces 18 inches apart and nail blocks of wood all along the length of the bed(see fig.26)

Note: All the blocks of wood should be fixed so that all are placed on the right side of the 18 inch mark. The wooden block on the screen from will hook against the blocks on the bed, so that the placing of the design on the fabric falls in the correct place each time. These blocks are registers for printing.

FIXING FABRIC ONTO THE BED

1) Lay the fabric on the bed and smooth out the wrinkles.

2) Starting from one edge of the long side, pin the fabric down onto the bed. Steel thumb tacks are suitable for this purpose. The fabric should lie straight on the bed and the tacks should be at a distance of 4 - 6 inches from each other.

As you tack down the fabric pull and stretch it lengthwise to keep the fabric tight and wrinklefree.

3) Now tack down the other side of the fabric to the bed pulling it taut and stretched.

Printing can now commence.

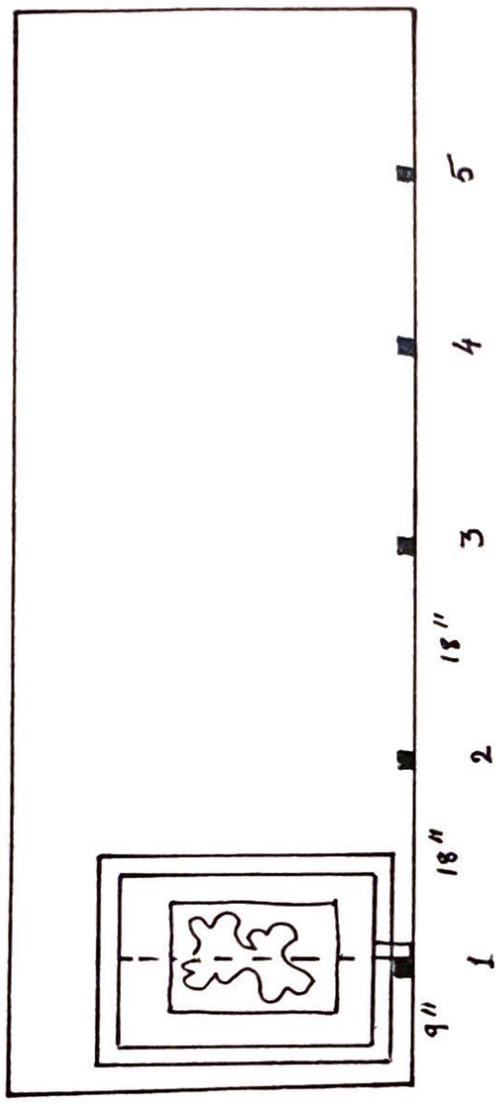


Fig.26

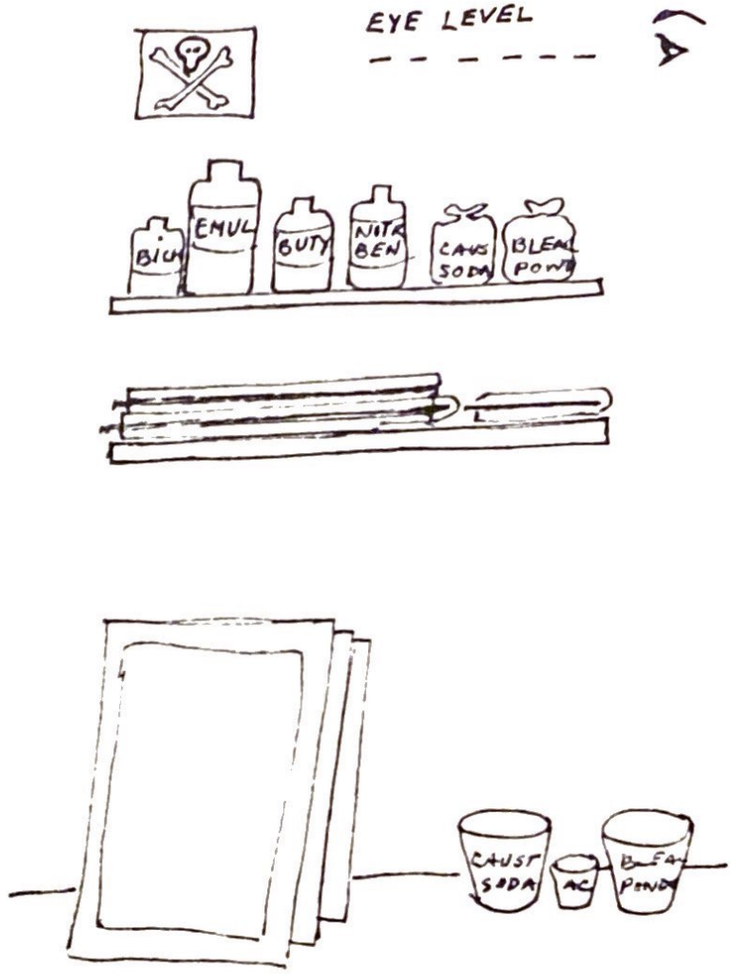


Fig.27

PRINTING

The placing of the screen on the bed is important. The length of the design on the screen is placed to coincide with the width of the fabric to be printed. The wooden projected block on the screen frame is hooked against the blocks on the edge of the bed.

1) Pour the colour in the well of the screen and pull it across with a squeegee to print the first step.

2) Lift the screen and move along the length of the bed and place the screen hooking it to the 3rd block on the bed, and print.

3) The printing is done in this fashion, at alternate steps/blocks e.g. 1,3,5,7 etc. to prevent smearing of colours.

4) After this is completed move back to the point where printing started and print against the even numbered blocks e.g. 2,4,6,8, 10 etc.

Multi-coloured printing is done in the same fashion.

PRECAUTION

If any part of the design gets blocked with colour during printing, rub a clean cotton cloth on the outside surface of the screen. If the blockage is stubborn, wet a piece of cloth to open the screen, but use a dry cloth to wipe any water left on the screen.

Similarly, if smearing occurs or a faint ghost impression is being printed onto the fabric which is unwanted, clean the screen with a dry cloth, rubbing the outside surface of the screen.

WASHING THE SCREEN

Textile colours are water-based and therefore water soluble. Wash the screen with water immediately after printing is completed. The water pressure should be strong to remove all colour from the screen. Stubborn areas can be cleaned by rubbing them with cloth.

FIXING COLOUR ON FABRIC

Textile colours need to be given some heat treatment to make them colourfast on the fabric.

After printing the fabric should be taken out in the sun to dry and to make colours fast. In addition, iron the back of the fabric with a hot iron. This will make colours permanent.

CLEANING THE SCEEEN

To remove the design, emulsion and enamel from the screen, caustic soda is used.

Caustic soda 1 part

Boiling Water 3 parts

Precaution

Caustic soda is highly dangerous and must not be touched with your hands. Even a minute splash will burn you immediately. While pouring water in the caustic extreme caution should be taken.

Take 3 parts of water and mix it with one part of caustic soda.

Using a stick, of which one end is wrapped in cloth, apply the caustic solution to the screen on both sides.

Lay the screen flat in the sun for several hours or leave it overnight for the caustic to act.

Wash the screen with water thoroughly so that no traces of caustic enamel or emulsion are left.

Wash now with surf and water to remove any remaining caustic in the screen.

CHAPTER 6

ORGANISATION OF TIME AND LABOUR

If you are properly prepared for every step in print making, there can be a lot of saving in time and labour.

One of the most important factors in saving time is to have all the relevant materials and equipment in their proper place and in working order.

Whatever equipment is needed should be cleaned and put back in it's place immediately after use.

All the materials needed for exposing should be organized in the darkroom area the materials for printing in the printing area.

TIME SAVING

Some planning beforehand can help in saving time.

1) The washing and coating with emulsion of the screen can be done one night earlier and left to dry overnight.

2) Exposing can be done in the morning. This can be done if your positive has already been prepared.

   OR

3) If the positive is not ready, the drying time needed after washing and coating of the screen, can be utilized for preparing the positive.

4) After exposing the screen, the time needed for it to dry can be utilized best to prepare for printing. All materials can be organized and put in place, the printing bed cleaned, paper organized and marked, squeegees inks and chemicals checked etc

5) Drying time of the screen at any stage can be reduced to a few minutes by using a fan or hair dryer. It would be remembered though, that drying of the coated screen with emulsion must be done in the dark.

The organization and direction of the paper should follow a pattern to save yourself time and confusion. To emphasize the importance of this we are repeating here the various stages in which the paper can get disorganized.

1) After cutting the paper to the size needed all the cut edges should be placed on one side the uncut edges on the other and the paper stacked.

2) If the paper has to be cut on all four sides, then care should be taken that when the paper is stacked up for printing the two sides to be placed against the register strips must be perfectly cut and even.

3) One side of the thickness of the stack of paper should be marked with a straight line to determine the direc tion of the paper. This mark should coincide with the 'top' marked on your design.

4) During the printing process, while feeding the paper onto the printing bed and removing it to dry the direction of 'top' marked edge must always remain the same in each sheet.

5) This is essential for correct registration of colours when more than one colour needs to be printed.

5) After the prints dry while collecting and stacking up the paper again, the same precautions must be taken to keep the direction of the paper uniform.

6) After all the printing has been completed the extra borders outside the design often need to be cut. For this it is also essential that the design on each sheet faces the same direc tion.

The alignment of the 'top' mark serves this purpose as well.

DIVISION OF LABOUR

Washing coating and exposing of screens can be done by one person only. But at the time of printing three people can do the job efficiently although two people can do the job as well. Of the three one person works with the ink and squeegee to print. The second person feeds the paper on the printing bed, and the third removes it and places it to dry. Both these people must keep their hands free from ink.

Paper feeding and removing can be done by one person if you have a drying rack.

CHAPTER 7

PRECAUTIONS

Here we will identify a few precautions which will save you from health hazards as well as other problems that may occur due to lack of care.

1) A separate utensil must be kept for different uses or functions and labelled.

   a) To mix emulsion and bichromate a separate utensil should be used, and should be kept only for this purpose. This can be either of glass or plastic with a lid, and must be protected from light at all times. A thick opaque paper can be wrapped around it, and it should not be removed from the darkroom.

   b) Utensils for water bleaching powder caustic soda surf + acetone and different chemicals should always be separate and labelled so that utensils don't get contaminated. This will prevent several problems and save you from frustration.

2) Care of skin and clothes is essential - using your bare hands should be avoided as much as possible.

   a) Bichromate is a poison. If you touch it, wash your hands thoroughly.

   b) Bleaching Powder has a cutting action and can damage your skin. Always apply it with a stick wrapped in cloth.

   c) Caustic Soda, in crystal form or in solution is highly dangerous. Never allow it to touch your skin or clothes. Even a little drop will burn you immediately. Keep a safe distance from it when adding water to it to avoid the danger of getting splashed.

   Wash immediately in running water in case of contact and apply burnol. Show it to a doctor if burns are serious.

   d) Every chemical is dangerous to health. Keep them tightly closed at all times. Open the lid only for the duration of use, and close the lid immediately as chemicals evaporate.

3) Fumes of chemicals are heavy and do not disperse easily. Especially in the use of nitrobenzene, ventilation is essential as it causes cancer. It is essential to use it in an open atmosphere or with an exhaust fan, as explained earlier.

4) The timings at each stage, should be kept, to avoid problems.

   a) The coating of emulsion on the screen should not remain for more than 12 hours, otherwise the emulsion hardens on the screen and exposing and removing of emulsion from

the screen becomes impossible.

b) The exposing time too should not go beyond the standard exposing time established. Again the danger is that the emulsion will harden.

c) There should be no time lapse between exposure and washing out for the same reasons as well as to get a proper exposure.

d) After printing the ink should be cleaned out thoroughly while still wet. If ink dries in the mesh it becomes very difficult to remove and ruins the mesh by blocking it.

SAFETY MEASURES IN STORAGE OF MATERIALS (FIG 27)

ALL MATERIALS, EQUIPMENT AND CHEMICALS SHOULD BE KEPT SAFE FROM THE REACH OF CHILDREN

Chemicals especially should be stored at a height:

1) So that children cannot reach them.

2) The height of storage should be below your eye level to eliminate the danger of chemicals falling in your eyes or face in case of accidents.

3) Screen meshes are delicate and expensive. To protect the mesh from damage, screens should always be stored in a safe place. Screens should be stood up against a flat surface like a wall the outside surfaces of two screens facing each other and protected by a board or cardboard.

Care should taken to prevent any sharp or heavy objects touching the mesh or falling on it at all times.

4) The squeegee blade must be protected from damage at all times as the print quality depends on it. The blade should never touch any surface at any time.

A damaged blade can be resharpened with a fine sand paper but there is no guarantee that this can be achieved to perfection. The sand paper should be attached to a flat surface and the blade rubbed on it with an even pressure.

5) Positives should be stored flat between sheets of paper to protect from dust. Another sheet of paper should be placed between each positive.

ALL MATERIALS, CHEMICALS AND SCREENS SHOULD ALWAYS BE PROTECTED FROM FLAMES OR FIRE