



MODERN DYESTUFFS APPLIED TO STENCILING: BY PROFESSOR CHARLES PELLEW OF COLUMBIA UNIVERSITY: NUMBER X

The illustrations for this article were made from old Japanese stencils from the collection of E. T. Shima.

A branch of handicraft work which has recently been attracting a great deal of attention is the graceful and interesting art of stenciling on textiles. This art has been known and practiced in many parts of the world for a considerable period, but its greatest development has been in Japan, where it was in constant use for over three hundred years, and carried to the greatest perfection. From the cheap cotton towels used by the common people for washing and for head covering to the wonderful silk garments worn by the nobility, the almost universal method of decoration has been by the use of stencils.

A few months ago some of my friends among the craftsmen suggested that I assist them in getting effects comparable in some respects, at least, to the Japanese. They and many of their friends had taken up the art quite seriously. They were good designers and were perfectly capable of cutting out patterns in sheets of stiff, waterproof paper, and then of applying suitable colors by means of these paper stencils upon various kinds of fabrics. But they did not know how to make the colors permanent.

The best that they could do was to apply oil paint, more or less thinned with gasolene or turpentine. The drawback to this was evident. In an oil paint the pigment is fastened to the fabric, whatever it may

be, by the boiled linseed oil with which it is mixed, this oil having the property on exposure to air of drying to a hard strong varnish. But if oil paint is applied to a piece of cloth so thick that there is enough oil to hold the color firmly, it is usually so thick that it looks sticky and feels stiff and is liable to crack on washing.

If, on the one hand, the paint is thinned down so much by gasolene that it can be applied as a delicate thin wash it will look all right, to be sure, and show the grain and texture of the cloth, but there will be so little oil present that the pigment will have hardly anything to make it adhere to the fiber and is apt to wash out. In the Japanese stenciled goods, on the other hand, the colors are evidently applied as dyestuffs, and the cloth, whether calico, crape or silk, is fairly and truly dyed, so that the colors will stand washing well and the texture of the cloth is not hidden—and it was this effect that my friends wished to obtain.

Another point about which numerous inquiries were made was that of "resist stenciling." It appears that in Japan when a girl wishes a new dress, she will sit down and sketch off designs on pieces of brown paper until she gets one that she likes; very probably the family will all take a hand, suggesting improvements and alterations. Finally, when a suitable design has been selected, some one, with

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a thin, sharp knife, will carefully cut it out in the paper, varnish it properly to make it waterproof and more durable, and then the stencil is taken down to the local dyer to apply the color.

Now, if, as is generally the case, the girl wishes a white dress with colored pattern, the colors are dabbed on to the white cloth through the stencil and there properly fixed. But sometimes the dress is to be blue, or pink, or orange, or even black, and they want the pattern to be white or light against a dark background; in this case the dyer paints or dabs on a peculiar paste which protects the cloth from the action of the dye, "resists" the dye, as it is called; and after this has dried, the dyer dips the goods in the dye-pot, dyeing it the proper color, and later the paste is washed off, leaving the pattern on the white cloth.

Of course, the first thing to do was to find out how the Japanese did the work themselves, and, fortunately, I soon found a friend—a very capable dyeing chemist who had been in the East and had carefully noted everything he saw of interest in the line of textile work. He told me that the colors were fixed by steaming, and



JAPANESE VINE STENCIL.



JAPANESE PINE CONE STENCIL.

were prepared as we prepare colors for calico printing, and that the resist paste was made from rice flour, wheat bran, lime water and carbonate of lime boiled up and stirred together to form a paste.

With these facts as a basis it was possible to make experiments with some degree of intelligence, and before very long we could get very satisfactory results.

(a) *Resist Stenciling.*—In this kind of stencil work the only dyes to use are those which can be applied cold, as the Sulphur Dyes and the Indigo or Vat Dyes, both described in previous papers. We have had the best results so far with the Sulphur Dyes, using strong baths and immersing the goods, cotton, linen and silk, for a very short time. With silk, it will be remembered, special precaution must be taken to avoid the weakening action of the alkaline sodium sulphide on the fiber.

This resist paste can be made very easily without the use of the rice flour, wheat bran, etc., by simply making a rather thin paste with wheat flour and boiling water, in which latter zinc sulphate has been dissolved, and then, while hot, stirring in

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some white inert powder, like zinc oxide (zinc white) finely powdered, or fine calcium carbonate. The exact proportions are not of much importance. We have obtained good results from the following formula:

In a small agate or china saucepan or casserole boil a small cupful of water, to which has been added half a teaspoonful of zinc sulphate. With this make a smooth paste with a large teaspoonful of wheat flour and then while it is still hot add as much zinc oxide (finely powdered) as you have of dry flour, and stir it in thoroughly till smooth and uniform.

When cool, this paste is brushed into the cloth through the stencil. After it is dried, the cloth can be dyed rather quickly in the Sulphur Dyes and when taken out after the cloth has been wrung smooth and exposed to the air for a few minutes

the pattern can be developed by boiling in soap and water.

It generally gives rather softer effects if the pattern is not a dead white, but slightly shaded. Of course, this depends on the composition of the paste, the care with which it has been applied, and, above all, on the length of time the cloth is exposed to the action of the dyestuff.

Before leaving this subject it may be well to explain the composition of the paste. The wheat flour paste is used because it is more sticky and adhesive than starch or corn-meal paste. (The Japanese, it will be remembered, mixed wheat bran boiled with lime water to their rice flour paste for the same purpose.) The white pigment, zinc oxide, or, which answers just about as well, carbonate of lime, gives more consistency and body to the paste; while the addition of sulphate of zinc is a little chemical trick, known to modern calico printers, for protecting the cloth from the action of the Sulphur Colors. These latter, it will be remembered, are insoluble in water, but dissolve in a solution of sodium sulphide and soda. Now zinc sulphate decomposes the sodium sulphide, forming a white powder, zinc sulphide, and at the same time throwing the color out of solution.

(b) *Color Stenciling*.—The method for obtaining permanent colors used by the Japanese is out of the question for most craftsmen, because of the great difficulty of properly steaming the goods to fix them. In Japan they are so clever with their hands that in every little village the local dyer has built himself a little steam box, with an iron or copper pot underneath, and with a top and sides of lacquered cloth or even of paper, with a light wooden frame, and he can steam his goods there with dry steam by the hour, if necessary. But I know, by experience, how difficult and uncertain it is to steam small quantities of



A FISHING STILL LIFE: DESIGN FOR JAPANESE STENCIL.

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printed or stenciled goods satisfactorily, even with all the resources of a university laboratory.

Fortunately, a process has been worked out by which very satisfactory results can be obtained with the use of the modest flatiron, applied with some skill and judgment, and without any need, except indeed for very elaborate pieces, of a steam box or any apparatus of that sort.

Stencil Paste.—The colors used in this process are the Basic Colors described in a previous article, and the pastes are made up in much the same way that chemists have long employed, when using these dyes for calico printing. The dyestuff is dissolved in considerable acetic acid and water, a little tartaric acid is added, and then a small amount of a strong solution of tannic acid. After this the mixture is made into a paste of the proper consistency by the addition of a gum of some kind, such as that made by soaking finely powdered gum tragacanth in some 30 parts of hot water.

In the above mixture the tannic acid combines with the Basic Color, forming a tannate, which, though insoluble in water, dissolves readily in acetic acid. When the paste, thinned with a little water, if necessary, is applied to the cloth, it should be allowed to dry, and then, as soon as convenient, carefully ironed over and under a damp cloth, so as to steam it well for a few seconds. Care must be taken here not to have the color run, for until it has been heated in this way it is liable to bleed.

This ironing and the slight accompanying steaming accomplishes, if done carefully, the work done in calico printing by half or three-quarters of an hour in the steam box. It melts the paste and carries it through and into the fibers of the cloth, and at the same time drives off the acetic acid, leaving the insoluble tannate of the dyestuff behind.



FLYING BIRDS IN A
JAPANESE STENCIL.

Fixing Bath.—To make the color quite fast to washing, however, it is necessary to pass the material, generally after rinsing in warm water to dissolve out the gum, in a weak bath of tartar emetic (one small teaspoonful of tartar emetic to one gallon of warm water). The antimony in this compound combines with the color and the tannic acid to form a result which is markedly resistant to washing.

Patents have been applied for to cover both paste and process, not with any idea of interfering with the individual craftsman wishing to prepare his own materials, but in order to make it worth while for some reliable person to put up and keep for sale these pastes, properly prepared.

General Remarks.—The results obtained with the resist paste described above are really very satisfactory from every standpoint. One great advantage for the craftsman in this process is the absolute permanence of the results. The pattern is the color of the original cloth, and the best

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Sulphur Colors are as permanent as any dyes can be. The same paste, without the zinc oxide, can be used as a resist for the Indigo or Vat Colors, and also for the old Mineral Dyes, iron and manganese, described in my first article. Effects in two, three or more colors can also be readily obtained by starting with cloth already dyed, or by after-dyeing, or by successively applying resist paste to different portions of the fabric, between successive baths of different dyestuffs. These latter effects, however, can be better obtained by the Batik, or wax resist process, to be described later.

The use of the colored stencil paste will not prove quite so simple. On silk it gives extremely pretty, bright effects, quite fast to washing, with great ease, but on calico it takes some little experimenting.

Great care should always be taken to have the cloth, whether cotton, linen, jute or what-not, free from sizing before applying the paste. It is always best to thoroughly boil it out in a soap bath, and then rinse it well, to be sure and have the fibers clean and in a receptive condition. We have found the paste to penetrate better if the cloth is just slightly and evenly dampened before applying the color.



BAMBOO DESIGN IN JAPANESE STENCIL.



WEED DESIGN IN JAPANESE STENCIL.

A serious drawback to this process is the fact that not many Basic Colors are really fast to light. The blues, Methylene Blue in many shades, are very permanent; so, too, are some of the violet shades. The yellows are strong and powerful—but not very fast, and, unfortunately, the reds, even the best, are not nearly as fast as the best reds of the other classes.

Experiments are now being made in my laboratory to obtain a satisfactory black paste for cotton, and also to get some good metallic pastes, gold and silver, to use against dark and light backgrounds.

We are also experimenting on different varieties of stencil paper, and of varnishes and lacquers. Thanks to Mr. E. T. Shima, of this city, some of whose large and beautiful assortment of Japanese stencils are shown in the accompanying illustrations, we have some Japanese stencil knives and stencil brushes, as well as a good variety of large and small Japanese stencils, with which to experiment.

In conclusion, I would call the attention of my readers to the great possibilities of this art. For art instruction, for household decoration, and for dress goods its uses are limitless.