Calico-printing. A mode of impressing figured designs upon cloth; the term also including modes and processes not strictly mechanical.

Calico is printed cotton cloth. In England, such are called prints; calico being the plain white cotton cloth, bleached or unbleached.

The name calico is derived from Calicut, a seaport of Malabar, visited by Vasco de Gama in 1498, and afterwards the principal seat of the Portuguese power in India. Calico was brought from India to England in 1631.

Where the art originated, it cannot be said to be useless to inquire; for, though the positive answer may not appear, the inquiry leads in directions which will be either "fresh fields and pastures new," or to regions which we tread again with pleasure and enthusiasm.

The Chinese have used printing-blocks from time immemorial. Printing on cloth preceded printing on paper, but it cannot now be determined how long ago. The Chinese applied the art to printing on bark, leaves, skins, or scale-board:
The natives of India were far in advance of all other people, both in the variety of their styles and the excellence of their execution. They used wax as a resist; used mordants of different kinds, so as to produce different colors by boiling the cloth in a solution of one color. They also had the benzamine style, in which spots are left white by topical pressure on the parts, preventing the access of the dye.

Of the resist style, the pallampoo may be cited. In this, the pattern was painted in wax upon the cloth, which was then dyed. (See Pallampoo.) Of the mordant style we have an excellent account in Pliny (d. A. D. 79):—

“Robes and white veils are painted in Egypt in a wonderful way; they are first imbedded, not with dyes, but with dye-absorbing drugs, by which, though they seem to be unaltered, yet, when immersed for a little while in a caldron of the boiling dye-liquor, they are found to become painted. Yet, as there is only one color in the caldron, it is marvelous to see many colors imparted to the robe, in consequence of the influence of the excipient drug. Nor can the dye be washed out. A caldron, which would of itself merely confuse the colors of cloths previously dyed, is thus made to impart several colors from a single dye-stuff, painting as it boils.” See MORDANT.

It will be noticed that Pliny credits the Egyptians with the work; this may be true as to the goods he saw, but it is also quite likely that the goods he saw were of Hindostanies manufacture, brought to the Mediterranean by the Arabians. It is evident that the Egyptians also practiced the art, but it was upon linen, and not cotton, the peculiar stuff which Herodotus calls tree-wool and rightly ascribes to India. (See Cotton.)

In the latter country, the calico-printing, whether of the resist or mordant styles, was performed by hand, and was rather painting than painting, and in the mode of its execution.

Variegated linen cloths of Sidon are mentioned by Homer; and Herodotus speaks of the garments of the inhabitants of the Caucasus as variegated with figures dyed by infusions of leaves, etc., when immersed for a little while in a caldron of the boiling dye-liquor, they are found to become painted. Yet, as there is only one color in the caldron, it is marvelous to see many colors imparted to the robe, in consequence of the influence of the excipient drug. Nor can the dye be washed out. A caldron, which would of itself merely confuse the colors of cloths previously dyed, is thus made to impart several colors from a single dye-stuff, painting as it boils.” See MORDANT.

The commonest mordants are the acetate of iron, the acetate of alumina, and some solutions of tin.

1. Madder or chintz style.

The parts of the cloth which are to have a madder color imparted to them are printed with a mordant. After aging, that is, allowing the mordant to become firmly attached to the cloth, the superficial mordant is washed away by a warm mixture of cow-dung and water. It is then washed and oxidized in a weak solution of alum and size. It is then drawn through a colored solution, and this becomes fixed in the parts where the mordant has been applied. The cloth is washed in soap and water, bran and water, or dilute solution of chloride of lime, which removes the dye from the unmordanted portion of the cloth. It is then ready for rinsing, drying, starching, calendering, and folding.

2. Printing by steam.

In this process the colors printed with a mordant are fixed by steam driven through the cloth and acting upon the mordant. After drying and aging, the thickening material is washed out, and the cloth finished in the usual manner by starching and calendering.

3. The padding or plagiage style.

By this a pattern may be produced on white or colored ground, or a ground may be formed for a design in other colors. The cloth is spread with a colored paste, dried, and then printed with another colored solution; a chemical reaction takes place where the colors are mingled, forming a pattern upon the general ground of the former color. This is the style referred to by Pliny,—“a design on a white ground is produced by printing with one solution and wining in the other.”

4. The resist or reserve style.

The white cloth is printed with a paste which resists the action of color when the cloth is placed in the vat. The cloth is then printed in the reverse place, and subsequent washing removes the dye from the part protected by the resist-paste.

5. The discharge or rompet style.

The dyed or mordanted cloth is printed with a discharger, which renders the color, where it is im-
pressed, colorless or soluble, so that it may be washed out.

This is only practiced with indigo, of which several shades may be associated with white. The bleached calico is printed with a combination of indigo and other materials, aged, and immersed successively in three solutions. The effect is to cause the soaps to permeate the cloth and become precipitated in an insoluble form.

7. Decolorizing or encaustic style.
The dyed goods are treated with chlorine or chromic acid to discharge the colors at the required places.

8. Spirit-color printing.
The colors are produced by a mixture of dye extracts and solution of tin, called by the dyers garde of tin.

9. The bandanna style, in which spots are left white by topical pressure on the parts, preventing the access of the dyce.

There are several mechanical modes of printing calico:

a. Wooden blocks prepared with a pattern on one surface and pressed down on the cloth by hand.
b. Several such blocks fixed in a frame and worked by machinery.
c. The pattern engraved on a flat copper plate, which is pressed down upon the cloth.
d. The pattern is engraved on a copper cylinder, over the surface of which the cloth is made to travel. By a combination of cylinders, various colors are laid on to form a various-colored print.

All the cheaper printed cottons are now printed by the cylinder process. The pattern is engraved on a cylinder about three inches long and one in diameter, called the die, so as to occupy its external surface; this is hardened by being heated to redness and suddenly plunged in cold water. The die is then transferred by means of a rotary press from the die to a similar small roller in a soft state, called the mull, producing an impression in relief. The mull is hardened and placed in a rotary press, imprinting the pattern on the copper cylinder from 30 to 40 inches long and from 4 to 12 inches wide, from which the calico is printed; the impression has to be repeated a sufficient number of times to cover the face of the copper cylinder, care being taken to make the junctions of the small cylinder accurately fit each other.

For costly and delicate goods, such as shawls and velvets, the block method of printing is still adhered to. In this method, each color has a block to itself, on which a certain portion of the pattern is cut or engraved; the blocks are used singly and by hand, each printing as much as its size will permit. Where the whole design is but a repetition of one small pattern, the whole surface of the cloth is printed by a succession of applications of the same two or three blocks; but where a large shawl, for example, displays a design which is not merely a repetition of small bits of pattern, the number of blocks often becomes multiplied to an extraordinary degree. A fine barge shawl is mentioned as having required more than five hundred blocks to produce the entire pattern, every one representing a different part of the device, either in color or pattern, from any of the others. The great number of the blocks in such a case is primarily due to the fineness, intricacy, and the non-repetitive character of the pattern, and not to its size, unlike the loud trousers pattern of Regent Street, which required that three gentlemen should walk abreast to exhibit it.

In the calico-printing machine, the pattern is engraved on cylinders of copper, which supply themselves with their respective colors during their revolutions, by means of inkingsprings f from the color-tubs a. Each cylinder is engraved with its portion of the pattern in relief, and they are so arranged that each makes its impression in the exact spot in relation to the other parts of the pattern. The machine illustrated is adapted for two pattern rollers. The cloth to be printed is unwound from a roller h, and passes beneath the smooth roller a, receiving an impression from each of the rollers c as it passes. The roller a runs in journal boxes, which are regulated by a set screw b at each end, and a smoothing-roller c, actuated by a set screw d, holds the cloth against the roller a. The pattern-rollers e e are inked by the aprons ff, which pass over the rollers s s, the outside surfaces of the aprons coming in contact with the surfaces of the rollers g g, which revolve in the ink-troughs b b.

After receiving the impressions from the pattern rollers e e, the cloth h is led off to be dried and folded. In another form of the machine, each copper cylinder is engraved with as much of the pattern as the printing in a particular color; the pattern being sunk in, not raised upon, the cylinder. The cylinders are arranged horizontally, and each as it rotates, dips into a trough containing its own particular color, mixed with a thickish liquid. A long knife, called a doctor, then comes in contact with the surface, and scrapes off all the color, except that contained in the engraved lines of the pattern.
cloth is made to travel over rollers and beams, and to come in contact with the printing-cylinders in succession, being pressed upon each in its passage, and receiving from each an impression. The cylinders are exactly placed in reference to the pattern, and the tension and rate of the cloth is so regulated that it comes to each cylinder in exact time and place to receive each color in proper relation to each other.

Fig. 1028 shows a form of machine in which the cloth is presented serially to a set of hexagonal prisms whose facets, at each rotation of the prism-carrier, receive their color from cams which rotate in their respective color-troughs. Two of these troughs are shown, but more may be applied if desired. The motion of the prism-reel and of the color-cams is so prearranged that the salient portion of each cam advances to give color to its appropriate prism, while the others pass by uncolored. 10, 11, 12, are ordinary printing-rolls, which may be auxiliary to the prismatic colorers. $A$ is the main cylinder which carries the end apron on which the cloth passes from the pay-off roller, past the printing, and thence to the dryer or ageing-loft.