

**Cal'i-co-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 *bandanna* style, in which spots are left white by topical pressure on the parts, preventing the access of the dye.

Of the *resist* style, the *pallampoor* may be cited. In this, the pattern was painted in wax upon the cloth, which was then dyed. (See PALLAMPOOR.) 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 imbrued, 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 marvellous 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 Hindoostanee 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 *printing*, as to the mode of its execution.

Variiegated 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.

Cortez found the Mexicans in possession of the art, their garments of cotton being adorned with Dolly Varden figures in black, blue, red, yellow, and green.

The art was practiced in Asia Minor and the Levant long before its introduction into Europe, and even then it came in at the southwest, with the Saracens. Abderahman III. founded the cotton, silk, and leather manufactures in Spain, about A. D. 930. He also devoted great attention to the sugarcane, rice, and the mulberry. This great Arabian people also taught Europe to make Chinese paper of pulped fiber.

It seems a pity that these gentlemen should be worsted by those gloomy tyrants, the Pedros and Philips, and that the liberality and civilization of Cordova should be superseded by the bigotry of Dominic.

About the close of the seventeenth century, Augsburg became famous for the manufacture of its printed cottons and linens. About the same time, that is, in 1696, calico-printing was introduced into England from France, by one of the French victims of the revolution of the Edict of Nantes. He established works on the Thames, near Richmond. This villainous act of Louis XIV. inured to the benefit of other nations, especially England, who gave an asylum to many industrious artificers and artists. About twenty-five years afterwards, the linen, silk, and woolen manufacturers obtained a law against the use of printed cotton goods, either imported or home-

made. This was relaxed in 1730 to this extent, that goods with linen chain and cotton filling were allowed to be printed, paying an excise duty equal to twelve cents per square yard. In 1774 this restriction was removed, all cotton printed goods were allowed to be made; the duty was reduced to six cents per square yard. This was afterwards increased to seven cents, and in 1831 was abolished.

The history of the fight in France of printed calicoes against the linen and woolen manufacturers is substantially similar to that just recorded, except that the government of France resisted the mobs instead of becoming subservient to them, as in England. Thus the French passed through the ordeal of absurd sumptuary legislation, and got rid of the incubus sooner than their more conservative neighbors north of “the Channel.”

“Sir Martin Noell told us the dispute between him, as farmer of the additional duty, and the East India Company, whether calico be linnen or no; which he says it is, having been ever esteemed so: they say it is made of cotton woole, and grows upon trees, not like flax and hemp. But it was carried against the Company, though they stand out against the verdict.”—*Pepys's Diary*, February 27, 1664.

Coloring substances for calico-printing are divided into *substantive* and *adjective*. The former are capable of producing permanent dyes of themselves; the latter require certain intermediate matters, called *mordants*.

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 *ageing*, that is, allowing the mordant to become firmly attached to the cloth, the superfluous mordant is washed away by a warm mixture of cowdung and water. It is then washed and *winned* 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 ageing, the thickening material is washed out, and the cloth finished in the usual manner by starching and calendering.

#### 3. *The padding* or *plauage* 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 *wincing* 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 dyed in the piece, and subsequent washing removes the dye from the part protected by the *resist-paste*.

#### 5. The *discharge* or *rongeant* 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.

6. The *china-blue style*.

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 surface-indigo to permeate the cloth and become precipitated in an insoluble form.

7. *Decoloring or enlevage 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 *spirits of tin*.

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

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 roller of soft steel, about three inches long and one in diameter, called the *die*, so as to exactly occupy its external surface; this is hardened by being heated to redness and suddenly plunged in cold water. The design is then transferred by means of a rotatory press from the *die* to a similar small roller in a soft state, called the *mill*, producing an impression in relief. The *mill* is then 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 barege 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 principally 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 en-

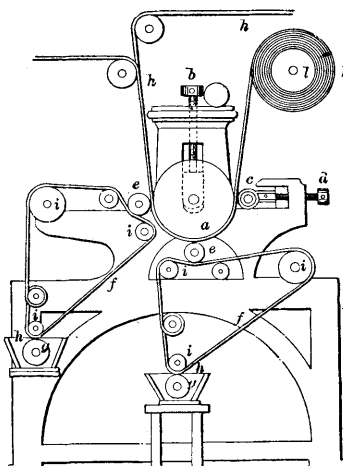
graved on cylinders of copper, which supply themselves with their respective colors during their revolutions, by means of inking-aprons *f* from the color-tubs *h*. Each cylinder is engraved with its portion of the pattern in relief, and they are so arranged that each makes its impression in the exact 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 *l*, and passes beneath the smooth roller *a*, receiving an impression from each of the rollers *e* 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 *f f*, which pass over the rollers *i i i*, the outside surfaces of the aprons coming in contact with the surfaces of the rollers *g g*, which revolve in the ink-troughs *h h*.

After receiving the impressions from the pattern-rollers *e e*, the cloth *h* is led off to be dried and folded.

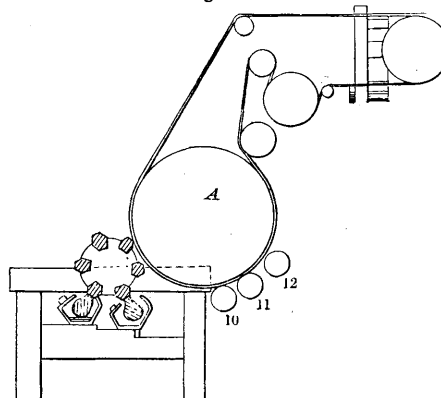
In another form of the machine, each copper cylinder is engraved with as much of the pattern as

Fig. 1027.



Calico-Printing Machine.

Fig. 1028.



Calico-Printing Machine.

the printing in a particular color; the pattern being sunken 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 as 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. The

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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.