

of a bright blue shade just now being put on the market. The so-called copper treatment renders the color slightly duller, but it increases materially its fastness to washing and light.

The fastness to washing and milling attained with Diamine Jet Black SS and Diamine Jet Black OO by the above process, is excellent, and the dyeings do not bleed even when being washed repeatedly. But the shade changes to a brownish black after the treatment with sulphate of copper, and this process is therefore not to be recommended where these two colors are used alone. They are, however, very useful when dark browns must be produced from the shading Diamine Brown M and Diamine Brown B, two of the latest dye-stuffs, showing of all the known direct dyeing brown colors the best resistance to light. Diamine Brown B is in this respect excellent, even in light shades, whereas Diamine Brown M is at its best only when dark shades come under consideration. The fastness to atmospheric influences and alkaline solutions increases in these two colors when the treatment with sulphate of copper is resorted to. Still better effects are obtained with a mixture of equal parts of bichrome and blue vitriol, and these will be referred to later.

Diamine Orange B.—The shade alters materially to a brownish hue with increased permanency. Diamine Brown 3G.—Like Diamine Orange B. Diamine Bronze G.—The greenish tint of the color is replaced by a browner shade. The fastness to both light and scouring increases considerably. Diamine Yellow N.—The color becomes thinner, reddens and gains in fastness.

By mixing the above colors a large variety of fast shades may be obtained, ranging from a yellowish brown down to a full seal-brown.

The fact seems to be well-established that the chemical effect obtained by the saddening of the above brown and black colors with blue vitriol differs from that caused by the action of the same copper compound on Benzo Azurine and Diamine Brilliant Blue G, as it may be reasonably supposed that in the latter case fixing by oxydation takes place. This conclusion may be drawn from the fact that the saddened blues will show a considerable alteration in shade after soaping and washing, a change which is not perceptible with the first named series of colors.

II. *Treatment after dyeing with chromium fluoride.*—This can be effected by passing the goods for  $\frac{1}{4}$  to  $\frac{1}{2}$  hour through a boiling solution of this salt, the quantity of which is regulated by the amount of color to be fixed, or in other words by the depth of shade required. Heavy shades take 3 per cent., and, speaking generally, each pound of color supposed to be on the fibre requires one pound of chromium fluoride. The effect of chroming is shown as follows:

Diamine Fast Red F.—The resistance to washing increases considerably and the color bleeds less on to white cotton than when not chromed. The fastness to light suffers somewhat by the fixing process. As a substitute for camwood in the dyeing of cotton warps intended for plush backings, Diamine Fast Red F, fixed as above, can hardly be surpassed.

Diamine Bronze G becomes fast to washing and milling and does not bleed on to the white even in heavy shades. Diamine Brown B and Diamine Brown M.—The fastness to washing increases.

Diamine Yellow N behaves similarly to the browns. Dyeings intended to be fixed with chromium fluoride may be shaded with any of the other Diamine colors, as their shades are not affected by this process. But the fixing takes place only in the case of the above mentioned colors.

III. *Treatment with Bichrome.*—This is effected by boiling the dyed goods for ten to fifteen minutes with 3 to 4 per cent. bichrome. With piece goods this may be done on a pad. It is important to bear in mind that all such dyeings which are intended for this process ought to be dyed with the addition of either common salt or Glauber's salt, since the presence of carbonate of soda in the piece goods will impair the action of the bichrome on the color. A favorable result of this treatment has been observed with Diamine Jet Black SS, a dyeing of which with 5 to 6 per cent. of color, treated for 15 minutes in a boiling solution of 4 per cent. bichrome, is very

fast to washing and milling, with only a slight tendency to bleed on the whites, and with the additional advantage of possessing a great resistance to acids. It is, however, possible to maintain an equally good and fast black by the diazotising and developing process, starting from a 3 per cent. dyeing of Diamine Jet Black SS, or, if a better shade of black be required, a grounding of 4 per cent of either Diamine Black BO or BH developed with phenylene diamine. But there are cases where the diazotising and developing process is not desirable, and then the fixing with bichrome deserves every consideration. For in spite of its short existence this process is already well established with linen thread dyers, as the blacks obtained by this method have, when compared with logwood black, the advantage of being faster in every respect, of leaving the thread smooth and free from lumps and surface coloring matter, which tends to clog the eye of the needle.

Diamine Jet Black OO is in point of fastness not inferior to Diamine Jet Black SS, but its shade is less pleasing than the latter. Diamine Brown M and B.—Although bichrome fixes these colors by itself, the mixture of equal parts of bichrome and sulphate of copper must be recommended on account of the very good results obtained from it. The amount of each of the fixing agents is regulated by the quantity of color to be fixed, and should not be less than two pounds each of bichrome and sulphate of copper for each four pounds of color.

The possibility of fixing the colors mentioned in group III with oxydizing agents admits of their combination with either aniline black or cutch. As a bottom of aniline black Diamine Jet Black SS must be considered superior to Diamine Black RO, hitherto recommended for this purpose, as it admits of producing a bottom of any depth of shade, with the possibility of fixing both the ground colors and the aniline topping simultaneously by oxydization or by a passage through a bichrome solution, resulting in producing absolutely fast dyeings. For a bottom of 4 per cent. Diamine Jet Black SS a topping with an aniline mordant may be considered most advantageous.

When dyeing with cutch, the colors may be added to the cutch liquor. The bichrome used in saddening of cutch browns also fixes the two Diamine Blacks and Diamine Browns M and B and renders them absolutely fast to washing. In point of bleeding, however, they are not quite as fast as pure cutch, since they lose slightly in color on being washed repeatedly.

The dyeing process is conducted in the same way as with pure cutch, with the exception that either Diamine Brown M or B or Diamine Jet Black OO or SS are added to the cutch liquor along with 30 per cent. Glauber's salt crystals. These colors may also be mixed in any proportion among themselves in the dye-bath charged with cutch. Otherwise the dyeing takes place at the boil, the cotton is left in the liquor as usual over night, the liquor drawn off to be kept for succeeding lots, and the dyed cotton is saddened with a mixture of bichrome and sulphate of copper. The advantage of this method is of course quite patent, as dark brown shades may be obtained in one dip, dispensing with repeated steepings in the cutch liquor and also saving a topping with either iron or logwood liquors. It must be pointed out that dyeings obtained with an addition of Diamine Brown B are faster to acids than if Diamine Brown M had been used, and that either Diamine Yellow N or Diamine Fast Yellow B will be found useful for flattening the shades. Although the saddening may be done in the dye-bath itself, it will be found more economical to conduct the dyeing and the fixing as separate operations in different vessels.

The requirements of the trade ought of course to be consulted to find out in which cases fast colors must be dyed and saddening resorted to.

The colors mentioned above and fixed in the way explained—with the exception of Diamine Brilliant Blue G, which alters thereby in shade—are in all cases fast to severe washing without changing in shade or intensity. If it is, however, a question of producing colors which must not bleed on to whites and also stand milling and light, the following can be strongly recommended:—Diamine Jet Black SS fixed with bichrome. Diamine Brown B with bichrome and sulphate of copper. Diamine Bronze G with chromium fluoride.