The mordanting method is the one most generally useful. It consists in first causing a combination of the metal with the wool fibre. This is carried out by boiling the wool in solutions of the metal, such as bichromate of potash, chrome alum, or chrome fluoride, when chrome is to be used as a mordant; with alum or sulphate of alumina when alumina is required to be deposited on the fibre; and with copperas when iron is to be the mordant. It is best to add a little oxalic acid, cream of tartar, or tartaric acid to the mordanting bath, which addition helps in the decomposition of the metallic salt and in the combination of the metallic oxide with the wool fibre. With bichromate of potash, sulphuric acid is often used, much depending upon the character of the mordant required. Some dye-stuffs, such as logwood for blacks, work best when the wool is mordanted with chromic acid, which is effected when sulphuric acid is the assistant mordant; other dye-stuffs, such as fustic, Persian berries, and alizarine yellow, are best dyed on a basic chrome mordant, which is effected when tartar or oxalic acid is the assistant mordant used, or when some other form of chrome compound than bichrome is employed.

The actual mordanting is done by boiling the wool in a bath of the mordant, the quantity of which should be varied according to the particular mordant that is being employed and to the quantity of dye-stuffs which is to be used. It is obvious that for fixing a deep shade of, say, alizarine on the wool, a larger quantity of mordant will be required than to fix a pale shade; sometimes this point is overlooked, and the same amount of mordant employed for pale or deep shades. The best plan of carrying out the mordanting is to enter the wool in the cold or at a hand heat, and then raise to the boil and continue the boiling for one hour; of course the goods should be kept turned over during the process to facilitate the even mordanting of the wool. A great deal of the success of dyeing with the dye-stuffs now under consideration depends upon the success with which the mordanting has been carried out: if this is at all unevenly done then no amount of care in the succeeding dyeing process will lead to the development of an even dyeing. After the mordanting is finished the goods should be rinsed with water, but it is not necessary to dry them.

(To be continued.)

VALUATION OF INDIGO.

It is an acknowledged fact amongst analysts who have paid any attention to the subject, that the valuation of indigo by the methods most commonly employed is by no means satisfactory, some processes giving results which are below the actual truth, while others are much above it. The method proposed by Leuchs of determining the amount by ascertaining the specific gravity is fairly satisfactory, while that of estimating the indigotin by a sublimation process, even as modified by Tennant Lee, is by no means satisfactory, the results being sometimes too low, at other times too high.

The methods proposed by Rawson, Leuchs, Ullgren and others, based on first the reduction of the indigo, and then a subsequent oxidation, are by no means satisfactory, usually owing to over-reduction, which causes a loss of indigotin from destruction, and the latter cannot altogether be avoided. The process of titration by means of sodium hydrosulphite, proposed by Bernthsen and Drews, also gives too low results.

The methods depending upon the oxidation of the sulphonic acid by means of a solution of potassium permanganate, generally give too high results, with the exception of Rawson's modification, in which the results are a little more regular; but even with this there is a tendency to obtain high figures.

Other oxidation methods, based on the use of other oxidants than potassium permanganate, such as chlorine water or potassium bichromate, are subject to the same defect as the permanganate method, namely, too high results.

It has been proposed to convert the indigo into the sulphonic acid, and to make dye trials against pure indigotin, but it is obvious that this method must be defective, owing to the imperfect or over-sulphonation; some indigoes take longer to dissolve than others, and it is not possible to know how long to carry on the sulphonation, nor when to stop it, and either under or over-sulphonation would lead to low results.

Perhaps the best method of valuing indigo consists in obtaining the indigotin in the pure form and weighing it. A solution of stannous chloride is prepared by dissolving 88 grammes of $SnCl_2 2H_2O$ in one litre of water, which is mixed with a strong solution of caustic soda until the precipitate which is at first formed has just re-dissolved; 10 c.c. of this solution of sodium stannate is then mixed with 0·8 grammes of finely-powdered indigo. The mixture is well shaken up and allowed to stand for one hour, when the reduction will be complete, a yellowish green solution being obtained. The solution is promoted by shaking at intervals. There is now added 15 c.c. of a fresh 10-volume solution of hydrogen peroxide, the mixture being well shaken and then allowed to stand for one hour, after which it is acidified with sulphuric acid, and then boiled and filtered. The precipitate of indigo is well washed, first with water, then with dilute caustic potash, and next with warm alcohol, after which it is dried and weighed. It is carefully incinerated, taking care that most of the indigotin is sublimed, and that the amount of ash which is left is determined. This weight deducted from the weight of the precipitate gives the amount of indigotin in the indigo.

Any attempt to obtain indigotin from indigo by alternate treatments with acid, alcoholic potash, water, and alcohol, will not give satisfactory results.

THE following mixture is recommended by a French contemporary:—Four litres hydrochloric acid of 20° to 22° Be. and one litre liquid sulphurous acid of 4½° Be. are dissolved in 100 litres of water; the solution will stand at about 1° Be. After being scoured, the wool is laid down in this solution for a few minutes and then dried.

SILK may be dyed and printed with alizarine Bordeaux and alizarine cyanine with good results. The dyeing is best done in one bath by using fluoride of chrome as a mordant, entering the silk in the cold bath, and then slowly raising to the boil; or the silk may be mordanted with chloride of chrome as in cotton dyeing, and then dyed in a separate bath of the dye-stuff. For printing, the colour is made with a thickening of gum tragacanth, starch, and a little oil, glycerine, oxalic acid, sulphate of alumina, acetate of chrome, and the dye-stuff, printing and steaming in the usual manner.

Designing.

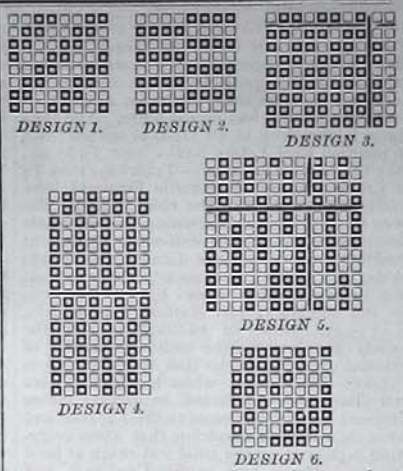
THE ANALYSIS OF PATTERN.—III.

WEAVE ANALYSIS.

Since any further calculations than those already dealt with will relate definitely to the cloths that happen to be under consideration, the next step will be to obtain the weave, or order of interlacing of the warp and weft threads, since, as will be shewn later, this may prove of great service in the subsequent analysis, such as determining the threads and picks per inch.

Practically there are two methods of determining the make of cloth, viz., by analysis and synthesis. By the former method is implied pulling a cloth to pieces, thread from thread, pick from pick; and by the latter, building a cloth up, according to the principles of interlacing, which experience enables the designer to detect in the cloth that it is desired to reproduce.

The second method is quite out of reach of the uninitiated. They must fulfil the laborious task of following every end and pick throughout the cloth, whereas the experienced analyst would pull a thread or pick out to confirm his



surmise respecting the make, and proceed at once to build up his cloth. Often the experienced can judge of the make of a cloth from the appearance alone: thus the fallacy of would-be analysts simply pulling cloths to pieces is fully demonstrated. Of *infinitely greater service* is the experience gained by experiment with the various makes of cloth.

Let us now suppose there is before us a pattern which it is desired to reproduce and of which we know nothing. Then the first consideration will be—is it a single, a backed, or a double cloth? This as a rule can readily be decided by pulling out a few threads and picks, and observing whether any of them keep to one side of the fabric or not. If one series, say of threads, form the face and the other the back, while the picks interweave both face and back, then the fabric is backed with warp, and it will be necessary to find not only the face weave but also the backing ties. Weft might be used as backing instead of warp, when there would be two series of weft threads and one of warp, and the interweaving of each must be obtained as in the case of warp backing. Should there be both backing warp and weft, then the fabric will usually be a double cloth, in which case three points must be decided: firstly, the face weave; secondly, the back weave; and, thirdly, the system of tying the back cloth to the face. Since backed and double cloths will be treated at length later, we proceed at once to consider the analysis of single cloths.

SINGLE CLOTHS.

In the case of single cloths, as already pointed out, it may not be at all necessary to pull the pattern in pieces, a very effective way of obtaining the weave being to place an ordinary piece-glass on the face of the cloth, when probably the make or makes (should it be a fancy) will be recognized; or, in the case of ordinary worsteds, the threads may even be followed throughout the repeat. In analysing woollens and rough-surface cloths singeing often renders the make clearer. Under any circumstances, however, it is advisable to pull out a few threads or picks, and, since there is a right and a wrong way of doing this, it is worthy of further consideration. All single cloths may be divided into three classes as follows:—

CLASS 1. — *Ordinary Makes*: Plain, hopsack, twills, etc,, which are usually woven on the square, *i.e.*, an equal number of threads and picks per inch.

CLASS 2.—*Weft Rib Makes*: Usually woven with a finer weft than warp, and consequently more picks.

CLASS 3.—*Warp Rib Makes*: Usually woven with slightly finer warp than weft, with a greater number of threads per inch.

ORDINARY MAKES, ETC.

Since in this class warp and weft interweave in the same, or nearly the same, order, either warp or weft may be pulled out. *Diagram* 3 is a micro-photographic reproduction of a thread and pick taken out of a two-and-two twill cloth, as shewn in *Design 1*. Notice first that the curves are equal, this being a necessary condition where a thread is up and down an equal number of times; and, secondly, that the

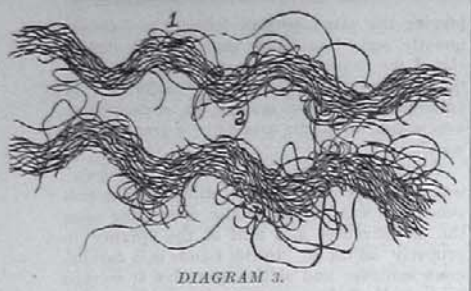


DIAGRAM 3.

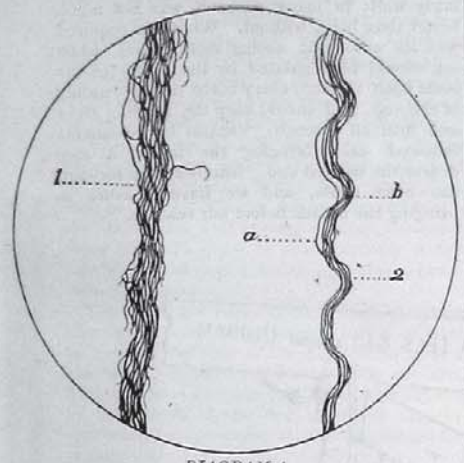


DIAGRAM 4.

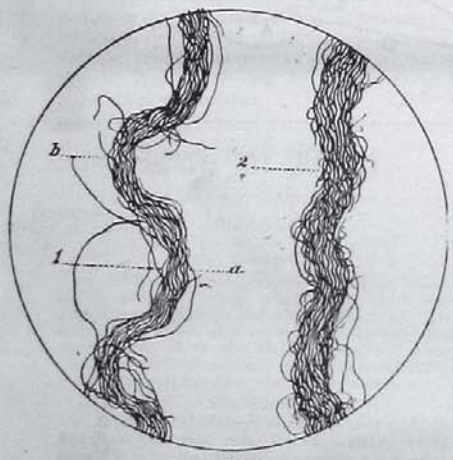


DIAGRAM 5.

deflection in warp and weft coincide, thus proving that, whatever the weave is, equal quantities of warp and weft are on the surface. A glance at *Diagram* 4 will shew clearly the possible difference between this class and the other two. There is usually no difficulty in deciding whether a fabric is plain or hopsack, but in the case of so-called ordinary twills a slight difficulty may arise, since, although all should run at an angle of 45 degrees, yet a very considerable variation in this respect is observable, owing to the insertion of rather more picks than threads, or *vice versa*. Recognizing this fact and noting the bending of warp and weft should enable even the uninitiated to arrive at the order of interlacing with little trouble.

Class 2: Weft Rib Makes.

In this class are included all those fabrics in which the warp lies straight and the weft bends round it. *Design* 2 is a typical weft rib, under favourable circumstances the warp being quite straight, and the weft doing all the bending, thus forming a prominent rib running with the warp. *Design* 3 is the 2 and 1, or cashmere twill, of which a micro-photographic reproduction of actual threads is given in *Diagram* 4. We notice at once the thick warp thread 1, comparatively speaking, straight, and the fine weft 2 practically doing all the bending. The fact that the threads and picks are not up and down for an equal number of picks and threads is clearly indicated by the wave of the pick here represented, (a) indicating the pick floating over two threads and (b) where it is down for one. It is very evident, then, that if there is any doubt as to whether the ribs or twills in a pattern are of the same breadth, a careful examination of the curvature of a pick will solve the question. In this class of goods it will be found expedient usually to dissect the pattern by extracting the picks in preference to threads.

Class 3: Warp Rib Makes.

The only difference between these and the preceding class is that the warp bends while the weft lies straight *Diagram* 5 shews this clearly, (1) being the warp thread and (2) the weft pick. *Design* 4 is a typical warp rib, but *Design* 5 was employed in the cloth from which this thread and pick were taken, this being practically a 12 end corkscrew weave, (a) indicating the thread up for 7 picks, and (b) down for 5 picks. In this case the structure will be most easily arrived at by carefully pulling out the threads. Should the weft be single yarn, however, it may be impossible to decide how many individual picks the warp floats over or under, each pick becoming merged with its neighbour. Under these circumstances it may be necessary to extract a few weft picks; in fact it is always advisable to do so, for it must be remembered *that it is not upon one circumstance alone that the structure of any cloth will be decided, but by the combination of circumstances, which practice alone will enable the analyst to combine in one harmonious whole.*

The sateens and sateen derivatives are a type of design which have representatives in all three classes, but the sateen twill may be recognised at once by its fine appearance and upright or horizontal angle, while the derivatives may usually be recognised by noting the principal weave feature along with its repeat; for example—the twilled hopsack is remarkably like ordinary hopsack, but when the relative positions of each flush of two by two are noticed the sateen distribution is at once apparent.

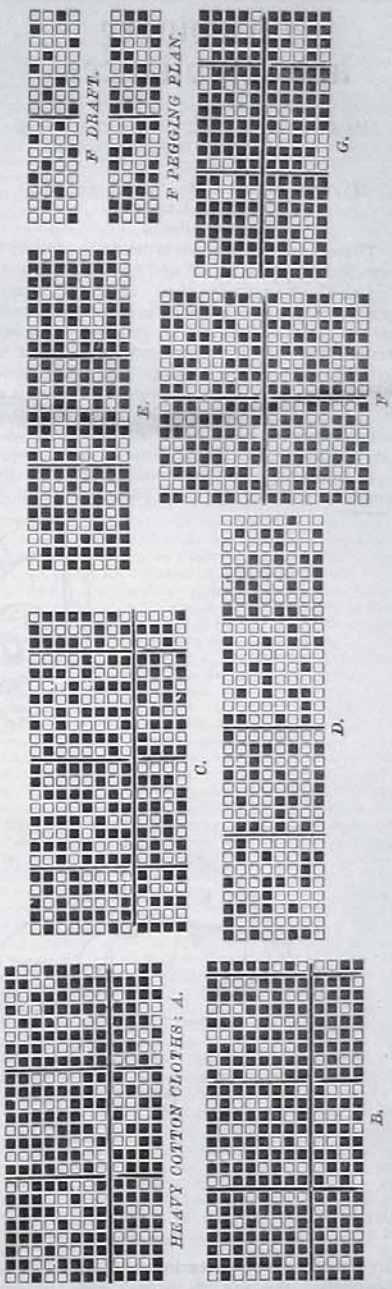
NEW DESIGNS.

COTTON SUITINGS.

Designs A, B and *C* are on 12 shafts, straight-over drafts, 24 to the round, and are so constructed as to form a back without extra material, making them specially suitable for out-door wear. If made from the following particulars a good useful cloth for many purposes can be fabricated. Warp, 2/20's cotton, 60 ends per inch or 15 dents, four in a dent; 50 picks per inch of 8's soft spun cop weft; woven all grey, and piece-dyed in drabs, buffs, stones, or any shade. These designs will be found of advantage to the makers of heavy cotton cloths.

Design D is a cotton cloth, having one face pick alternately with a back pick, which will give a fabric of any weight required. The back may be carded, thus providing a lining for cotton garments and giving all the heat of a woollen material; 8 shafts, straight draft, 32 to the round. Where it is not convenient to have drop boxes on each side of the loom, one count of weft will suffice for both face and back, therefore one shuttle will effect this object. On the other hand, with the shuttle boxes, it is possible to make the back with a coarser count, or any material that may be deemed advisable. Let the warp be 2/36's, in 20 dents per inch, 4 in a dent, 60 picks per inch of 12's soft cop.

Design E: Nearly same particulars, warp 2/30's, in 20 dents per inch, 4 in a dent, 8's weft, 60 picks per inch. As will be seen by the design, there are two picks of weft for the face to one on the back. We need scarcely draw attention to the fact that end-and-end colour



arrangements can be produced in these goods with the greatest freedom, either in warp, weft, or both combined; but they are generally woven grey and piece-dyed.

Design F is in cotton for ladies' jackets, vests, etc., on 4 shafts, 16-end draft, 16 to the round. Warp, 2/24's cotton, 18 dents per inch, 4 in a dent; weft 8's cotton, 60 picks per inch. This cloth, woven in the grey, may be dyed in all the fancy shades, or well bleached.

Design G is also a cotton fabric for suitings, on 10 shafts, straight draft, 20 to the round, one pick face, and one for a backing cloth. If a heavier cloth be desired the warp or weft, or both, may be increased, either in the number of ends or picks, by the use of coarser counts; also in the weft the same result may be obtained. The following particulars will furnish some idea of how to obtain a good cloth:– Warp 2/36's, with 20 dents per inch, 4 in a dent; 12's weft, 70 picks per inch; woven all grey and piece-dyed. We have by these designs shewn how this class of cotton goods may be backed in as simple a manner as possible.