any and every width, it is evident that contraction in width *has no influence* on the desired weight whatever, certain standard widths being recognised in the various trades, these being obtained very accurately by the milling and tentering. Contraction in length, however, has a direct influence on the weight of the piece. For example, if a cloth 40 yards long weighs 1 lb. to the yard, the whole cloth weighs 40 lb.: if this is milled up to 20 yards, supposing there is no loss in milling, the piece will still weigh 40 lb., *i.e.*, 2 lb. to the yard; or

As 20 : 40 : : 1 lb. : 2 lb. per yard.

So that the *contraction in length directly influences weight*.

This, however, in one sense, is not true, since the more a piece is milled, the greater is the loss in fibre, which is particularly so in the case of woollens. This loss of fibre can only be estimated by experience, but since a manufacturer never puts material into a cloth to mill out, the deduction that follows will give an accurate idea of what may be expected. Another influence to be carefully noted is the heat employed in the various finishing operations. For example, it is found that in finishing woollen and worsted cloths, if the heat rises above 100° F., a loss in weight occurs—probably due to some of the wool being dissolved. Much heat is also developed at times in the milling machine, so that it is evident these matters should be carefully watched and noted down. With certain silk goods variation, owing to loss of fibre, etc., is not so marked, but atmospheric influences should be carefully noted, and if filling (China clay, etc.) has been used, as is often the case with cotton goods, a careful estimation of the pure fibre should be made.

A long experience with woollen and worsted goods in various forms, *i.e.*, as unions, dress-face goods, serges, coatings, meltons, etc., is summed up in the following:—

*Allowance for Loss in Weight in Finishing*:—For *ordinary goods* allow about ½th on the calculation weight. For example, a cloth in the grey weighs 80 lb.; in the finished state it should weigh 64 lb. For *face goods* allow about ¼th on the calculation weight, *i.e.*, a cloth in the grey weighing 80 lb., when finished should weigh 60 lb. These numbers will, of course, vary slightly, according to the yarns, etc., employed, so that the matter cannot be thus summarily dismissed. The above must be taken as a general rule; but the details should be further considered.

For example, suppose the analyst has dissected a cloth on the lines laid down, has found the counts of warp and weft, threads and picks per inch, and weight per yard of the finished cloth, then the following points must be successively decided:—(1) Sett in the loom; (2) width in the loom; (3) picks per inch woven; (4) length of warp; (5) counts of both warp and weft in the grey; (6) weight per yard calculated. Each of these points must be dealt with in detail, and then to render thorough comprehension easy, an example shall be fully considered.

*The Sett in the Loom*:—This to the unexperienced may prove a difficulty, and, in fact, will be to any one a matter of estimation, since cloths, as already intimated, may be varied considerably in width during finishing; and variation in width will directly influence the threads per inch. For example, if a cloth 32 inches wide has 64 threads per inch, and when finished measures 30 inches, then

As 30 : 32 : : 64 : 68 picks per inch in finished cloth

Inversely, then, a cloth having 68 picks per inch as analysed, will have been sett 64 threads per inch in the loom, 32 inches wide, to finish to 30 inches. In estimating the sett in the loom, then, the finishing must be taken into account, and the sett based upon this.

*List VIII.** shews a variation of about 2 inches for narrow width, and 4 inches for broad width.

(2.) *Width in Loom*:—If the setts finished and in the loom are known, the width may be deduced by direct proportion. Taking the finished threads per inch to be 68, and the threads per inch in the loom to be 64, then any desirable finished width may be taken, say 30 inches, and the width in loom decided by the relative number of threads finished and in the loom as follows:—

As 64 : 68 : : 30 : : 32 inches wide in the loom.

(3.) *Picks per inch woven*:—Finding the picks per inch as woven, is very similar to finding the threads per inch in the loom, both depending upon shrinkage in finishing. The shrinkage warp-way is varied very considerably; but taking *List VIII.* as a guide, and allowing 9 per cent. for contraction in length, then 68 picks per inch finished will give—

As 109 : 100 : : 68 : 62 picks per inch woven.

In other words, the picks per inch will vary in direct proportion to the length of the finished and greasy cloths respectively.

(4.) *The length of Warp*:—This is a most important matter, and one to which, so far, little attention has been directed. In its simplest form the question may be put as follows:—A warp 100 yards long is put into the loom: what length of cloth will come out? There are two matters here involved—firstly, what allowance is necessary for twisting-in and finishing a piece; a fabric of the warp being usually left in the healds to which to tie the following warp? Secondly, what will the warp *take-up* in weaving?

The first matter will be influenced by the tier-in and starter of the loom, and can only be estimated when the time comes; but an allowance of 1½ yards under ordinary circumstances should be ample.

The second matter is one of much importance, since it affects not only the calculation, which we are considering, but also calculations relating to allowances for backing and figuring warps. The take-up in the case of single cloths must first be considered, and reference to *Diagrams 25 and 26* will render this easy of demonstration. *Diagram 25* is a plain cloth, and if constructed perfectly will give an equal curvature in both warp and weft; and since the warp threads change for every pick, it is evident that the take-up in the case of plain weave will be more than in the case of twills, etc. Now, as already demonstrated, the angle of warp with weft, or *vice versâ*, should be one of 60 degrees, and the triangle as shewn will have relatively 1 for altitude, 2 for hypotenuse, and 1·732 for the base; consequently, any line drawn straight through the centres of the warp and weft threads and picks, represented by the bases of all triangles similar to ABC, will represent the length of cloth, while finish hypotenuses BC will represent the length of warp to give the forenamed length of cloth; or, 1·732 yards of cloth will require 2 yards of warp, there being a take-up of ·268 yards in 2 yards, and this expressed as a fraction is about ¼th; so that for a perfect plain cloth, finished strictly to the theoretical conditions laid down, 100 yards of warp will yield about 87½ yards of cloth.

With the two-and-two twill there will be less take-up, since there are relatively fewer intersections. The calculation for take-up in this case will be two threads × 2 (1·732) intersections = 5·464 yards of cloth from 2 threads × 2 (2) intersections = 6 yards of warp, the take-up being ·536 in six yards; or about ⅑th. Another important calculation is that for the 8-end sateen, which is as follows:—

6 threads × 2 (1·732) intersections = 9·464 yards of cloth from warp.
6 threads × 2 (2) intersections = 10 yards of cloth from warp,

the take-up being ·536 in 10 yards, or about ⅑th take-up. In this case, however, warp and weft are supposed to bend equally, while actually the warp will do most of the bending.

In *weft-rib cloths*, the warp being almost straight, the yield of cloth will be almost length for length, *i.e.*, 100 yards of warp will yield almost 100 yards of cloth.

In the case of *warp-rib cloths*, the weft being straight throws all the bending upon the warp; but if the cloth is constructed strictly according to the principles laid down, the calculations for take-up will be precisely similar to the calculations for take-up in ordinary cloths, since the diameter of the yarn, and the altitude of the triangle, do not affect the result in the slightest, the take-up being relative to the base and hypotenuse of the triangle formed. Note should, however, be made of the fact that size of the weft, picks per inch, shrinkage of the wool, and weighting of the warp beam all influence the take up in some degree.

In weaving striped patterns of intricate construction, such as crammed stripes, or any single cloths in which weaves are combined in stripe-form, the above principles are a good indication of what may be expected, and the need for an extra beam must be judged accordingly. Many weaves, however, of slightly different wefting capacities may be woven from the same beam, if the warp is good; but, of course, all the strain will go upon the threads weaving with the most intersections: thus the extent of the various weave-stripes may influence the use or otherwise of our extra beam.

A method employed at times with success for these and backed cloths is to beam certain sections of the warp slacker than the other sections. The use of an extra beam may, by these means, be avoided; but its application is very limited.

In dealing with backed and double cloths, the same principles apply, with certain modifications. For example, working out, on the lines already laid down, a two-and-two twill-face cloth with 8-end sateen back, the following result is obtained:—

70 yards of warp — $\frac{1}{31}$ = 63·64 yards of cloth.
64 yards × $\frac{1}{16}$ (= 3) = 67 yards of backing-warp to yield 63·64 yards of cloth.

The take-up in the case of double cloths will be a compound of the single and backed cloths, the take-up in both face and backed cloth being first calculated and then the take-up for ties, whether in warp or weft.

We are quite aware that practical men may offer some objections to the above system, which, to the best of our knowledge, is here attacked systematically for the first time; but when we state that the results here worked out coincide with the best results obtained in practice, it must at once be admitted that there is something in the theory, and that it is worthy of the best attention.

*(To be continued.)*

* To appear next week.

## NEW DESIGNS.

### CANVAS CLOTH.

*Design A* is for a canvas cloth of a peculiar make, woven all grey, bleached, or piece-dyed in any or all the fashionable shades. It is on 8 shafts, 18-end draft, 18 to the round. We give particulars for one quality: 26 reed, 3 in a dent, 20's warp; 80 picks, 20's weft. These particulars may be varied: if a more open texture should be thought necessary, a finer grist of weft and warp, with less yarn in picks and reed, will be required.

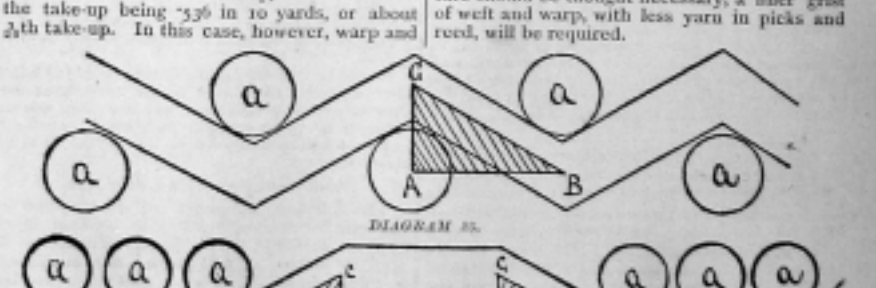
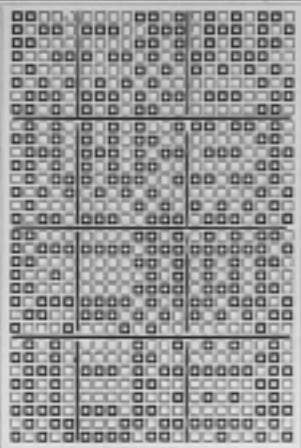


DIAGRAM 25.

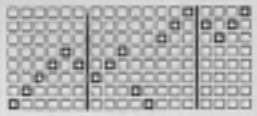
DIAGRAM 26.

## COTTON DRESS MATERIAL.

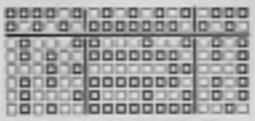
*Design B* will be found a novelty, either as a jacquard figure or for printing on the fashionable dark-blue ground with a white effect. We have given every salient point for carrying it out to a repeat, which can easily be done by observing the run and repeat of the figures in a diagonal form. This would form a very interesting study for those who wish to become proficients at designing. Space will not permit us to develop it fully, but quite sufficient is shewn to give the idea of construction. Although the ground is shewn as tabby or plain, it will be evident to practical manufacturers that a twill or satin ground may be formed, always observing that the figure is formed by the weft picks, the full black dots shewing this effect. Should a satin ground be decided upon, it ought to measure, both by the warp and weft, the extent of the figure, so as to obviate any break in the runs. There is no figure, whatever space it may occupy; but some one of the satin twills will coincide with the figure: for instance, taking one hundred and eleven, (rather a odd quantity of ends or picks to measure), the 3-shaft satin or twill ground would measure it 37 times for a repeat. If this design should be produced we would recommend for bleaching in white or light-dyed tints, that it be woven in the grey, with 40's warp and weft, 96 ends and picks per inch. This will give with a good finish, a neat and very handsome effect on a good foundation. If dark blue ground (either plain or satin), then the weft must be well bleached white, or be cream, very light primrose, straw, or maize; but under any colour arrangement it will be found requisite to have the colours fast and very pure. A fabric formed from the particulars given ought to be satisfactory, either for the home or export trade. We simply give these details from a belief that they will suit buyers, but of course the goods may be made from this design to meet many varieties in the way of vestings, negligé shirtings, blouses, etc.



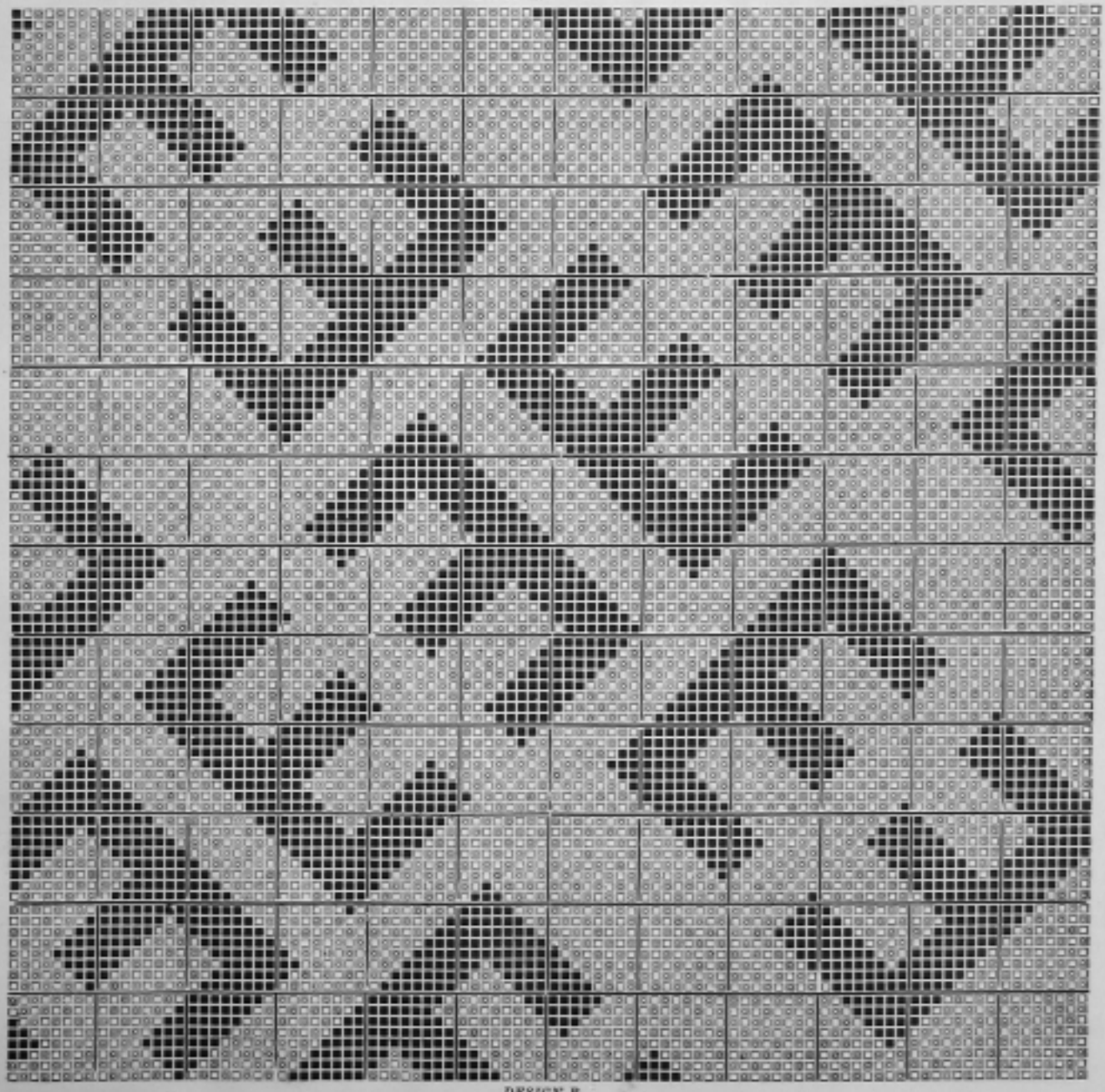
*DESIGN A.*



*A: DRAFT.*



*B: PEGGING PLAN.*



*DESIGN B.*