over the counters of New York, Boston, and other leading markets, in direct competition with goods made in Massachusetts, to say nothing of exportation, it will be seen that the situation is becoming somewhat serious, to say the least, even with the present hours of labour.

It is not true that the operatives have been able to make as good wages since as before the passage of the ten-hour law, even with the increased speed and modern appliances. Prior to 1874 there were very few eight-loom weavers, most of them tending six and less. A weaver who could tend eight looms could make, under eleven hours, at wages then paid, $10 to $11 weekly. In 1875, an eight-loom weaver could earn $8 and $9; in 1878, $7 and $8; in 1885, $6·25 and $7·25, and since 1888 about $8·50 to $9 weekly. Speed had to be increased and wages reduced from time to time, and new appliances had to be introduced to enable the manufacturers to keep pace with the competition with which they had to contend.

Mr. S. B. Ashley, treasurer of the Barnaby Manufacturing Co., Fall River, says that the situation of things at the time of the passing of the ten-hour law was entirely different from the situation of matters to-day. The machinery which was being built then and put into new mills was built upon the same old principle. When the ten-hour law came into effect then came a rapid change in machinery. All inventive genius was put into force to develop some means whereby they could change and make up this one hour of the time lost in labour. The result was ring spinning came in; increasing the speed of cards, of looms, and everything of that kind took place, so that in a few years the new mills which had been put up took advantage of these new improvements and made money. The old mills had to re-vamp and put in new machinery on account of the change from eleven to ten hours. For the past few years, says Mr. Ashley, we have been looking forward to see if these improvements could be carried any further. The spindle man spends thousands of dollars on spindles, making samples and running them to see if he can get an extra thousand turns. He has not succeeded in doing so yet. The loom man has been at work to see if he can change the relative position of the crank-shaft lathe and breast beam so as to get more speed and more product, but he has not been able to do it. This has all been accomplished since the ten-hour law enactment, and now, having reached almost the highest point, they come here and ask us to take another hour off the hours of labour, and say that the same condition of things and the same result will follow if this is taken off as did before.

Of Southern competition, Mr. E. C. Clarke, of the Boott Cotton Mills, Lowell, has a good deal that is interesting to say. The whole danger to our Massachusetts industries is from the south; that has been brought to his attention, especially within the last few years, by the fact that the southern mills are taking away his work, taking contracts from him. For instance, a man with whom he used to have large contracts, say 50,000 pieces of heavy print cloth, will now come to him and say, "I would like to get another 50,000 pieces; what can you give them to me for?" Mr. Clarke figures them down to the lowest price, and says, "I can't give it to you; I can get them down south one-quarter cent a yard cheaper."

He adds: "I am losing my contracts a great deal in that way. It is also the same in regard to the trade in China, because the southern States get ahead of me. That being so, I wanted to look at it and find out just how I did compare with the southern mills. I asked the selling agent of one of the mills if he would compare prices with me for his work down there—the price of cotton, weaving, all that goes to make up the price of cotton goods. A South Carolina mill was taken, making similar goods to mine, only I make a much larger variety. I make standard drills and he makes standard sheetings. He also makes some I make. I make 4-quarter sheets, 56 by 60, and he makes the same. So I got the prices from him and compared them with mine, and I found first, in regard to the time, his mill runs twelve hours a day. There are several good mills down there. The Pacolet is a good mill; so is the Clifton and the Piedmont. First, I found the number of hours each mill works a day. The southern mill works twelve hours; we work ten. Daily production of standard sheetings—Boott, 42 yards; Pacolet, 55 yards. In the extra two hours that ought to make only about 50, which shews they were speeding a little more than I was. I looked at their goods and found they were just as good as mine. Daily production of standard drills—Boott, 46 yards; Pacolet, 56 yards. They beat me actually in speed. Daily production of four-yard sheetings—Boott, 36 yards; Pacolet, 43 yards. That is just about the same speed; they simply get the increased product due to the extra two hours. In the cost per pound of 13 to 22 yarn I found they beat me out of my boots; we were not in it with them:—

Picking and carding	Boott	$ ·43
	Pacolet	·34
Spinning	Boott	·53
	Pacolet	·32
Spooling and warping	Boott	·28
	Pacolet	·18
Weaving	Boott	1·27
	Pacolet	·86
Total	Boott	2·50
	Pacolet	1·70

The average cost of cotton per pound was 10 cents during the winter of 1888-9. My cotton was costing me 10·2 cents per pound, and theirs 9·15 cents. The difference in the price of cotton was pretty near the profit. One cent a pound would not pay a dividend, but it is more than half of it. Apart from the cotton, which, of course, is cheaper, they work twelve hours a day, and I find they are getting about 60 cents where my men are getting $1. They are just as good weavers—just as good spinners—so those who have been there tell me. This is the sort of competition we are meeting with."

Designing.

THE ANALYSIS OF PATTERN.—XII.

THE WEIGHTS OF CLOTHS.

Having indicated as clearly as possible the various methods of finding the counts and sett of any cloth, two very important matters must now be fully dealt with, viz., the weight of the various yarns employed in any given cloth, and the weight of the same cloth finished. We are quite aware that this question has been treated by other writers at some length, and we should be tempted to be very brief but for the fact that it has been treated under one heading instead of under the two indicated above. As those engaged in the trade are aware, the weight of cloth in the loom and the weight in the finished state vary considerably, and in the following treatment we have endeavoured to define all possible conditions by a combination of actual results with theoretical practice.

THE WEIGHT OF VARIOUS YARNS EMPLOYED.

The simplest form in which a question may occur under this heading is that in which having a cloth made to given particulars the weight of warp and weft is required.

Example.—A cloth is made of 2/40's worsted for warp, and 20's single worsted for weft. Sett 64 threads per inch in loom, 64 picks per inch, 34 inches wide, 50 yards of cloth from 56 yards of warp. Find the weight of the cloth.

This question evidently involves the finding of the weight of both warp and weft, which two together give the weight of the cloth.

Rule I.—To find the weight of warp: (1) Ascertain length of material in the warp, *i.e.*, threads per inch × inches wide = threads in warp; × length of warp in yards = the length of material in the warp. (2) The length of material in the warp divided by the yards in 1 lb. of such material gives the total weight of warp in lb.

In the above example:—

64 × 34 × 56 = 121,856 yards of material in piece.
560 × 20 = 11,200 yards in 1 lb. of material.
Therefore 121,856 ÷ 11,200 = 10 lb. 14 oz. of warp in piece.

Rule II.—To find weight of weft: (1) Ascertain the length of the material in the piece by multiplying the picks per inch by the width in inches and by the length of the *cloth*. (2) The length of material thus obtained, divided by the yards in 1 lb. of such material, gives the total weight of weft in lb.

In the above example:—

64 × 34 × 50 = 108,800 yards of weft in cloth.
560 × 20 = 11,200 pards per lb.
Therefore 108,800 ÷ 11,200 = 9 lb. 11 oz. of weft in piece. Then 10 lb. 14 oz. + 9 lb. 11 oz. = 20 lb. 9 oz. weight of 50 yards of cloth., and 20 lb. 9 oz. ÷ 50 = $6\frac{3}{8}$ oz. per yard of cloth.

In the above rules, prominence is given to the reason for the procedure rather than to the shortest possible statement, since we cannot impress too strongly upon our readers the advantage of working by reason rather than by rule-of-thumb. Two points in the above, however, need further explanation. In the first place, the reason for the weft rule is not as clear as it might be, since there is an apparent mixing up of yards and inches, which to the uninitiated is very confusing. If the sum be thought out as follows, the reason for the abbreviation will be evident:—64 picks per inch × the width, will give the inches in 1 inch of cloth, and therefore the yards in 1 yard of cloth for 64 × 34 = 2,176 inches in the inch, and 2,176 ÷ 36 = yards in the inch = $60\frac{4}{9}$ × 36 = 2,176 yards per yard. From which it is very evident that dividing by 36 in one case and multiplying in another may be dispensed with altogether; thus the abbreviated rule above is obtained.

The other matter to which attention was directed is the fact that, although the warp calculation is for 56 yards, the weft is only 50 yards, since 56 yards of warp are assumed to yield only 50 yards of cloth, therefore weft will only be required for 50 yards. Since this will receive attention later, there is no need to go further into the matter here.

Having indicated the principles, the simplest method of stating the calculations for both warp and weft may now be given.

$$Warp = \frac{64 \times 34 \times 56}{560 \times 20} = 10 \text{ lb. } 14 \text{ oz. weight of warp.}$$

$$Weft = \frac{64 \times 34 \times 50}{560 \times 20} = 9 \text{ lb. } 11 \text{ oz. weight of weft; and the two together give 20 lb. 9 oz. weight of 50 yards of cloth.}$$

A calculation simpler in principle than the above cannot well be imagined; but the basis of all subsequent warp and weft calculations is present, and this being so, its thorough comprehension is most necessary.

Attention may now be directed to calculations for more complicated warps, two modifications on the above practically including all possible warp calculations.

Rule III.—To find the weights of the various colours of yarn in a given warp:—(1) Find the number of ends of each colour in the warp, *i.e.*, divide the threads in the warp by the threads in one repeat of the colouring, thus obtaining the number of repeats of the pattern across the piece; and this multiplied by the ends of each colour in the pattern gives the number of ends of each colour in the warp. (2) Multiply the ends of each colour by their length, *i.e.*, the length of the warp and ÷ the yards per lb. according to the counts of the yarn.

Example:—Find the weight of each colour of yarn in the following:—

Warp.

8	threads	2/40's black
2	,,	2/40's black and white twist
4	,,	2/40's black
2	,,	2/40's black and orange twist
—		16's reeds 4's

Threads in pattern 16.

Weft.

All 20's black; 64 picks per inch.

Sett 34 inches wide, warp to be 56 yards long, to yield 50 yards of cloth.

(1) 64 × 34 = 2,176 threads in warp, and 2,176 ÷ 16 = 136 repeats of pattern across warp, and 136 × 12 = 1,632 threads of black, 136 × 2 = 272 threads of black and white twist, and also of black and orange twist.

$\frac{1632 \times 56}{20 \times 560}$ = 8 lb. 2½ oz. weight of black yarn.

$\frac{272 \times 56}{20 \times 560}$ = 1 lb 5¾ oz. ,, black and white yarn.

$\frac{272 \times 56}{20 \times 560}$ = 1 lb. 5¾ oz. ,, black and orange yarn.

10 lb. 14 oz. total weight of warp.

For the weft $\frac{64 \times 34 \times 50}{20 \times 56} = 9$ lb. 11 oz. of weft.

The same method of working may be adopted whatever the order of colouring may be. The same principles may also be applied to weft colourings, as will be shewn later.

The second complication in warp calculation is the not unfrequent system of using yarns of two or more counts in the same warp. Two methods of finding the weight of the warp under these circumstances present themselves:

Firstly, the average counts of the two or more yarns may be found and the weight calculated for the average counts on the ordinary system.

Secondly, should the order of warping, etc., be very complicated, the system employed for finding the weights of various colours may be adapted to these conditions.

The cloths most easily dealt with under the first conditions are backed and double cloths, in which the warping plan seldom exceeds three or four threads.

Example.—A warp is composed of alternate ends of 2/40's and 2/30's worsted, sett 120 ends per inch. Find the weight if made 6 inches wide, 60 yards long.

Rule IV.—To find the average counts:—Find the resultant counts of the 2, 3, or 4 ends combined, and then multiply by 2, 3, or 4, according to the number of ends given.

In the above example $\frac{15 \times 20}{15 \times 20} = 8\frac{2}{3}$ and

$8\frac{2}{3} \times 2 = 17\frac{1}{3}$, the average counts, and

$\frac{120 \times 66 \times 60}{17\frac{1}{3} \times 560} = 48$ lb. 15 oz., weight of warp.

Or by taking each count separately:—

$\frac{60 \times 66 \times 60}{20 \times 560}$	=	21 lb. 3 oz.,	fine warp.
$\frac{60 \times 66 \times 60}{15 \times 560}$	=	28 4	thick warp.
Total weight		49 7	

The 8 oz. lost by the previous method is due to the fractions involved. The advantage of being able to reason a question out in more ways than one been here clearly shewn.

Erratum.—In last week's issue, the reference to the angle formed by the weft with warp, with half an equilateral triangle, was inadvertently lettered wrongly, but if the base of the triangle be lettered B, the altitude C, and the hypotenuse A, the deduction will be understood.

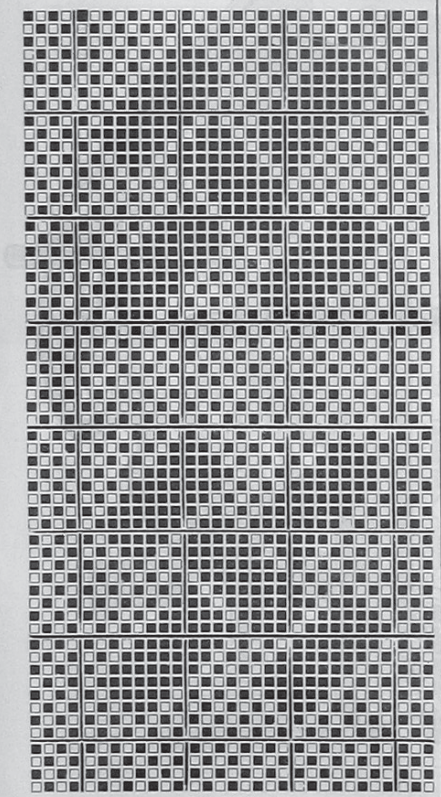
NEW DESIGNS.

COTTON DRESS DESIGN.

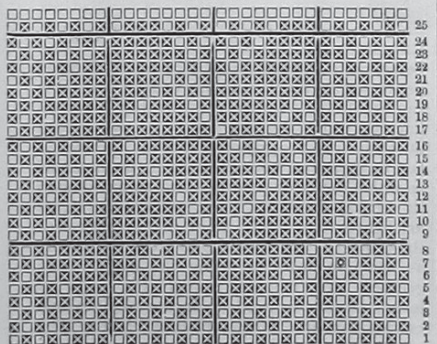
The colours at present most popular, although rich in costly materials, generally assume quieter hues in inexpensive fabrics. For ordinary every-day wear the most charming cotton dress goods are in every shade of brown, grey, electric blue, green, and pale fawn. There are a few greens almost black, and some queerly-shaped designs, which look as if they had been carefully prepared and then broken up, a confused arrangement being adopted. Many fabrics have a cotton ground plain, of neutral or sombre shades, shot with bright silk or mohair.

Design A will be found a good style in fancy cotton dress materials. The yarns must be of the very best quality: warp 2-60's, the extra warp for the figure 2-40's; and weft 40's. The draft and pegging plan will shew how the plain and figured stripes are formed; four shafts for ground, 21 for the figure, 40 dents per inch, two and four in a dent; 80 picks per inch of weft, all one shuttle. We give a pattern as a guide; but broader stripes and colours can be arranged at will; 36 white on the four plain or ground shafts; all the extra warp for figure on the other 21 shafts are two in a heald, and along with the ground ends, two in number, make four in a dent; it would be necessary to have this figured extra warp stripe upon a separate beam; 2 dark brown, 2 white (ground), 2 dark brown, 2 white (ground), 2 dark brown, 2 white (ground), 2 dark brown, 2 white (ground) 2 dark brown, etc., the dark brown up to 42 ends; the white drawn in on the ground shafts, one on each side of the two dark brown; 36 white, 36 dark dove; 42 dark brown along with the white ground ends as given above; 36 dark dove, and repeat from the first "36 of white"; weft all white. The entire pattern would read as follows:—

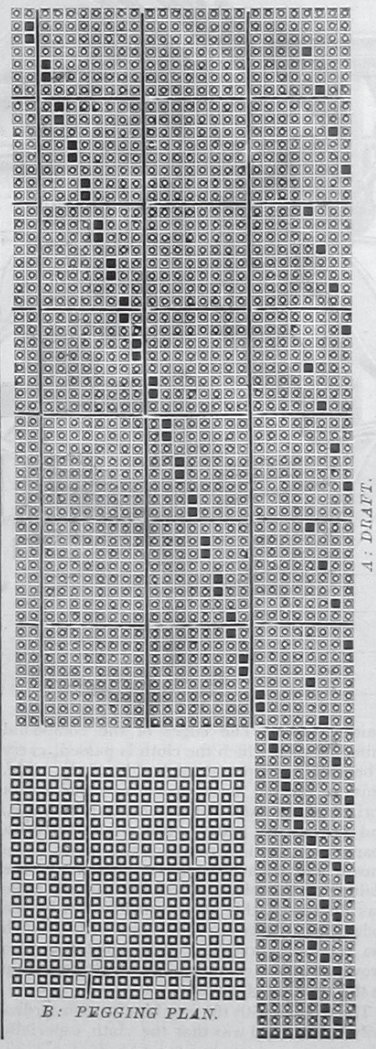
36 white, two in a dent, or on plain shafts.
{ 2 white; repeat 20 times on plain shafts.
{ 2 dark brown; repeat 20 times on the 21 shafts.
36 white on plain shafts.
36 dark dove on plain shafts.
{ 2 white; repeat 20 times on plain shafts.
{ 2 dark brown; repeat 20 times on the 21 shafts.
36 dark dove on plain shafts.



DESIGN A.



A: PEGGING PLAN.

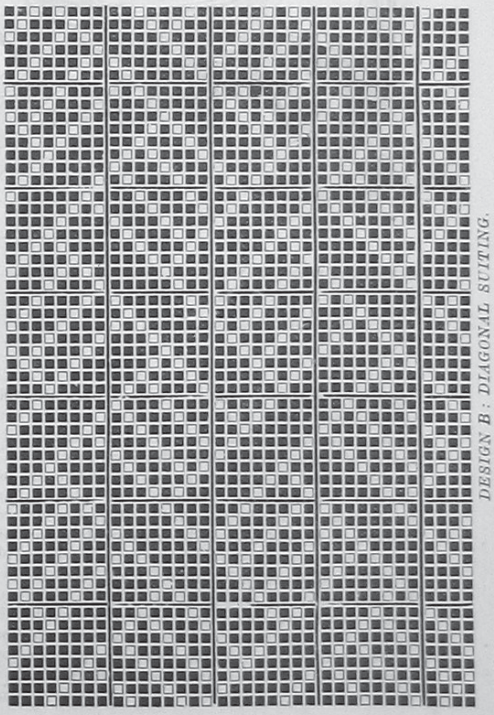


A: DRAFT.

B: PEGGING PLAN.

COTTON SUITINGS.

Design B is a broken diagonal, well adapted for blouses, cotton suitings, and many other purposes. On 18 shafts, 18 to the round, straight over-draft; warp 20's in a reed, 40 dents per inch, all two in a dent; warp drawn in two in a heald, one heald per dent; weft 20's, two in a shed, 80 picks per inch; must be of the best materials; the goods well bleached or piece-dyed in fawns, buffs, silver grey, dove, drab, light blues, or any of the fashionable shades, and beetle finished. This design worked out from particulars given will be found satisfactory.



DESIGN B: DIAGONAL SUITING.