which the ends are arranged 1 face, 1 back throughout. In the warping plan the chief point to note is that the face ends are coloured according to the form of stripe which is required on the surface, and in the following examples the colouring of these ends only is indicated below the designs.

Three-colour Patterns arranged 1 *Face*, 1 *Back in the Warp.*—Examples C, D, E, and F in Fig. 79 show different ways of constructing a vertical hairline in three colours. It will be noted that the arrangement of the face warp colours is the same in each case, but in C and D the shades in the weft are in the order of 1, 2, 1, 3, and in E and F in the order of 1, 1, 2, 3. In C and E the weaves do not cut; in D

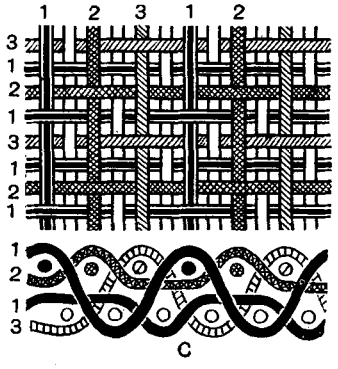


Fig. 81.

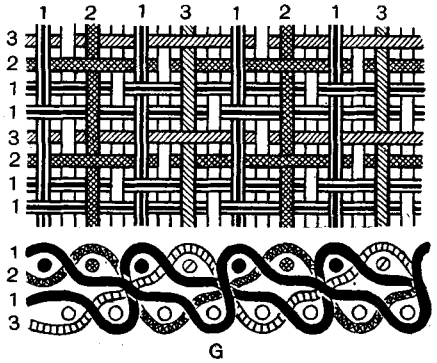


Fig. 82.

one cut, and in F two cuts are made. The flat views of the weaves C and F representing two repeats in each direction, and sections showing the interweaving of the picks, are given at C and F respectively in Fig. 81. In the drawings the backing ends are not shaded, because, so far as regards the face of the cloth, they may be in any colour. Thus, the complete warping plan may be two of shade 1, two of shade 2, and two of shade 3, etc. If, however, solid lines of colour are required on the underside, it is necessary for each backing end to be in the same colour as the pick over which it is raised. For example, in the design C, the first backing end is raised on the pick in shade 3, and the second and third on the picks in shade 1. If, therefore, the backing ends are coloured to correspond, when the cloth is turned over the shades on the underside will be in the order of 1, 1, 3. The arrangement of the backing

ends as to colour, which will produce solid lines on the underside, is indicated above each plan. It will be noted that the pattern is not the same as that on the face, except in the design E, for which the shades in the complete warping plan will be in the order of 1, 3, 2, 1, 3, 2.

Two standard three-colour hairline arrangements are given at G and H in Fig. 79, and the corresponding drawings at G and H in Fig. 82. In the pattern produced by G the shades on the surface are in the order of 1, 2, 1, 3, and by H in the order of 1, 1, 2, 3, as indicated by the numbers above the warp threads in the flat views. The complete warping plan for G may be two of shade 1, two of shade 2, two of shade 1, and two of shade 3; and for H, four of shade 1, two of shade 2, and two of shade 3; but if the backing ends are coloured in the order indicated above the designs, the pattern on the underside will in each be exactly the same as that on the face.

So long as two of the colours are used only to form single-thread stripings, a great variety of stripe effects can be

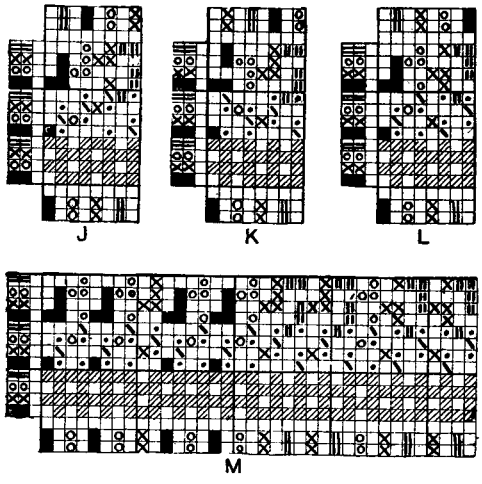


Fig. 83.

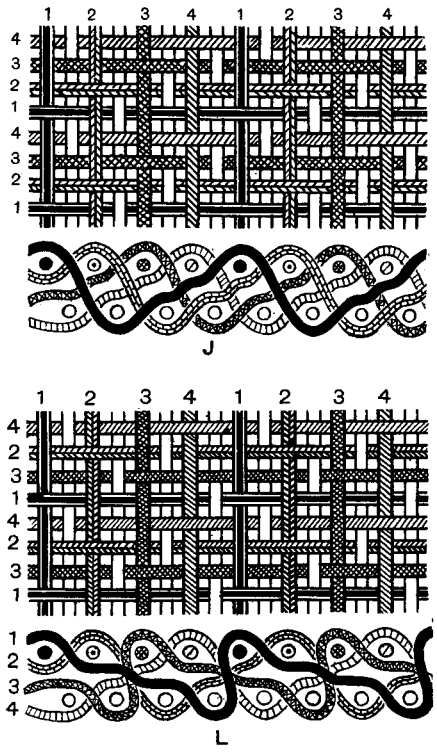


Fig 84.

produced by varying the spaces occupied by the third or ground colour. An example is given at I in Fig. 79, which will produce the following pattern on the surface :—

Shade 1—	1	2	3	2	1	1
Shade 2—	1	1	1	1	.	.
Shade 3—	.	.	.	.	1	1

Four-colour Patterns arranged 1 *Face*, 1 *Back in the Warp.*—The designs J, K, and L in Fig. 83 show different methods of arranging the weaves and the colours for producing the vertical hairline in four shades, with the ends arranged in the order of 1 face, 1 back. It will be noted that in J the weft colours are in the same order as the face warp colours, but in K and L the second pick is in the same colour as

the third face end, and the third pick as the second face end. For the reason that each colour of weft must pass over its own colour of warp in producing the vertical hairline, the arrangement shown at J is somewhat defective, because the intersections of the face ends forms a twill line. With the double-plain weaves combined as in J, the warp-backed 3-and-1 warp twill is really formed. In the same manner K is the warp-backed 4-thread warp sateen weave. In the design L, however, the weaves are purely double plain, arranged to cut every four ends. The flat views (showing two repeats) and the sections given at J and L in Fig. 84, correspond with the weaves J and L. An examination will show that in each case vertical lines of colour in the order of 1, 2, 3, and 4 are formed on the surface.

The same remarks apply with reference to the colouring of the backing ends, as in the case of three-colour effects. If they are arranged in the order indicated above the plans, solid lines of colour will be formed on the underside. The shades in the complete warping plan for L, in Fig. 83, will then be arranged in the order of 1, 4, 2, 3, 3, 2, 4, 1.

Although in the four-colour effects the pattern is limited to single lines of each shade, considerable variety of effect can be obtained by suitably arranging the face warp colours and the weaves to correspond. For example, the design M in Fig. 83 will produce the following single-thread stripe :—

Shade 1—1.1..1.1.....
Shade 2—.1.1..1.1....1....
Shade 3—....1....1.1..1.1.
Shade 4—.....1.1..1.1

In constructing such a style, however, it is necessary to remember that when more than two colours are used, a change of colour may not cause an interchange of the picks to take place. Thus in M no interchange takes place between the shades 1 and 2 and the shades 3 and 4. Care must therefore be taken to group the shades in such a manner that the weave in any one section does not occupy too large a space, or the cloth will be liable to cockle. In making a design, each pick of weft requires first to be marked on its own colour of warp, the marks on the backing ends being then added to the best advantage. If on completing the design it is found unsatisfactory, experiments may be made in changing the order of wefting and altering the weaves to correspond.

DOUBLE TWILL AND SATEEN STRIPE DESIGNS

While the double plain, owing to the neat appearance, firmness, and good wearing quality of the cloth, is the standard weave used in the production of patterns in which each section requires to be in solid colour, similar effects may be obtained by using other double weaves. These also enable a larger number of colours to be introduced. Thus the double 3-thread twill permits of the use of six colours, the double 4-thread twill and the 4-thread sateen of eight colours; while with the double 5-thread sateen any number of colours up to 10 may be employed. In addition, if the pattern is required in large sections, firmness of structure may be obtained by tying the weaves on the ordinary principle. In small patterns, however, the interchanging of the threads where the weaves are combined gives sufficient firmness.

Numerous examples might be given to illustrate the various ways in which patterns may be formed; but since the principles involved are the same as in the

construction of the double-plain effects, the examples N to Z in Fig. 85 will be sufficient for the purpose. N and O are the opposite double 3-thread twill weaves, arranged on the system in which two face or two backing ends are brought together where the weaves are combined. The weaves marks indicate weft, and the cloth is warp surface on both sides. In N the odd threads are on the surface and the even threads on the back, while in O the even threads are on the surface, and the odd threads on the back, as shown in the bottom portion of the plans, which, as before, are in three portions. Various schemes of colouring, each necessarily repeating on six threads, are indicated above and alongside the plans, each shade being represented by a different kind of mark. At P the order of colouring in warp and weft is 1-and-1 throughout; and assuming that six threads of each weave are combined in stripe form, as shown in Fig. 85, the pattern formed on the surface will be three threads of shade 1 and three threads of shade 2. Q will produce a solid coloured stripe pattern in three shades, arranged on the surface in the order of 1, 1, 2, 2, 3, 3. R is a four-colour arrangement, the shades being brought up in the order of 1, 1, 3, 2, 2, 4. S is in five shades, the order on the face being 1, 1, 2, 3, 4, 5; while T produces an effect in six shades in the order of 1, 2, 3, 4, 5, 6. In following the surface arrangement of the threads only the odd threads above the design N, and only the even threads above the design O, should be included. It will be noted in the plans that each face end passes under its own colour of weft and over the other colours, while each backing end is raised over its own colour and passes below the other colours. Solid vertical lines of colour are thus formed on both sides of the cloth. The double 3-thread weft twill weave may be arranged in the same manner to form horizontal lines.

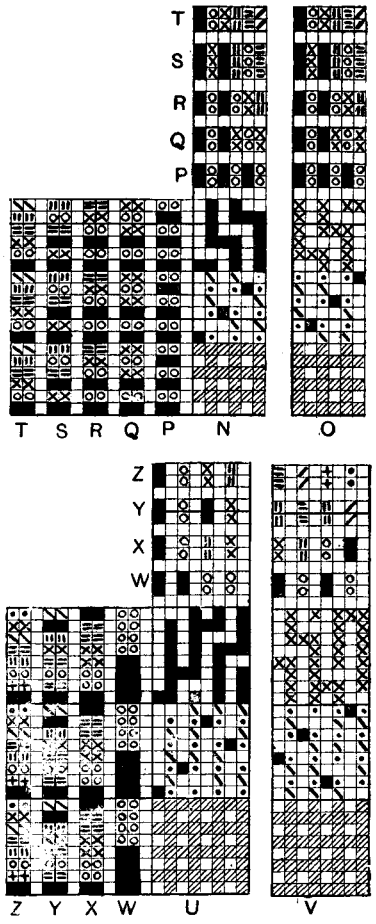


Fig. 85.

Although the list is by no means complete, the foregoing examples illustrate the diversity of effect which can be obtained in one design by varying the arrangement of the threads as to colour. In any of the schemes of colouring, however, still further diversity can be produced by varying the spaces occupied by the weaves. In addition, the weaves may be combined as in the double plains to form check and figured patterns in two or more colours.

The plans given at U and V in Fig. 85 are the opposite double 4-thread warp sateen weaves constructed on the system in which the ends are arranged 1 face, 1 back throughout. Four schemes of colouring the face ends are given above the plans at

W, X, Y, and Z, and the corresponding weft colour plans, similarly lettered, are shown alongside. It is assumed that eight threads of each weave are combined in stripe form, although, as will be understood, the space occupied by each may be varied as desired. The face warping plans indicate the colour patterns which will be formed on the surface, while the chief point to note in arranging the weft colours is that each pick passes over its own colour of warp. W is a two-colour pattern, the shades on the surface being in the order of 1, 1, 2, 2, 1, 2, 1, 2. X is in four shades in the order of 1, 2, 4, 3, 3, 4, 2, 1 ; Y in six shades in the order of 1, 2, 1, 3, 4, 5, 4, 6 ; while Z shows how a single-thread stripe in eight shades may be arranged. The colouring of the backing ends is not indicated, but if solid lines are required on the underside, each must be in the same colour as the pick over which it is raised.

CHAPTER IV

WADDED AND CENTRE-STITCHED DOUBLE CLOTHS AND TREBLE CLOTHS

Wadded Double Cloths—Weft-Wadded Double Cloths—Warp-Wadded Double Cloths. *Centre-Stitched Double-Cloth Designs*—Centre Warp Stitching—Centre Weft Stitching. *Treble Cloths*—Systems of Stitching—Treble Cloth Designing in Stages—Construction of Drafts and Pegging Plans—Systematic Construction of Treble-Cloth Designs—Use of Centre Fabric as Wadding.

WADDED DOUBLE CLOTHS

A WADDED double cloth consists of a face and a back fabric, tied together by floating backing ends over face picks, or backing picks over face ends, as in ordinary double cloths, with the addition of a special series either of weft or warp threads introduced independently of the face and backing yarns. The weft-wadded cloths thus consist of three series of weft and two series of warp threads, while in the warp-wadded cloths there are three series of warp and two series of weft threads. The wadding threads lie between the two fabrics, and are visible neither on the face nor back ; hence a thicker and cheaper yarn than that used for the face and back may be employed for wadding without the appearance of the cloth being affected. The principle is therefore useful in cases where increased weight and substance are required to be economically obtained in conjunction with a fine face texture. The wadding threads may be introduced into any arrangement of the face and backing threads, but the common proportions are 1 wadding to 1 face and 1 back, 2 face and 2 back, or 2 face and 1 back. The first arrangement is suitable when the wadding yarn is not much thicker than the face yarn, and the second and third when very thick wadding is used.

Weft-Wadded Double Cloths.—The construction of designs for these cloths is illustrated by the examples given in Figs. 86 and 88, in which the marks indicate weft. In each figure, A is the plan of the face weave, and B of the backing weave, while the marks between the squares indicate the positions of the ties. Since the wadding yarn simply lies between the two fabrics without interweaving with either (being retained in position by the passing of the face and backing threads from one

fabric to the other where the ties occur), the same conditions are necessary, so far as regards the face weave, the ties and the backing weave, as in the construction of ordinary double cloths. The wadded design is therefore exactly the same as the double design except for the inclusion of the wadding threads; and in order that comparisons may be made,

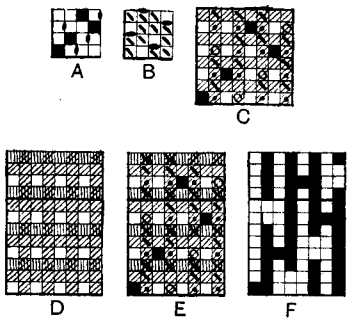


Fig. 86.

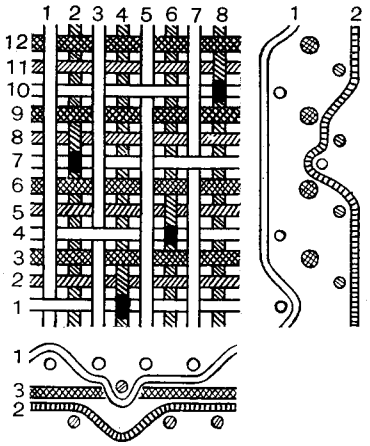


Fig. 87.

the double weave without the wadding threads is given at C. D shows the first stage in the construction of the wadded double-cloth design, the positions of the backing and wadding threads being indicated by the shaded lines. Diagonal strokes are used for shading on the backing threads and vertical strokes on the wadding threads, a convenient method in practice consisting of using different colours. In the complete design, given at E the full

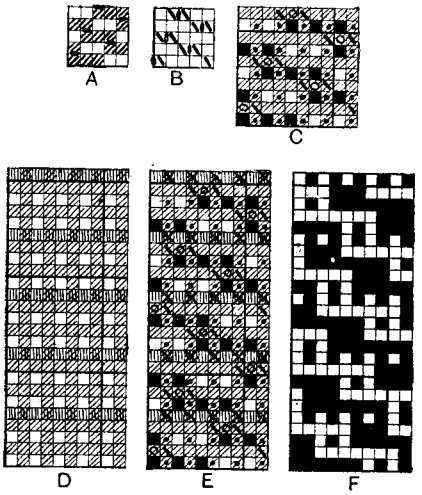


Fig. 88.

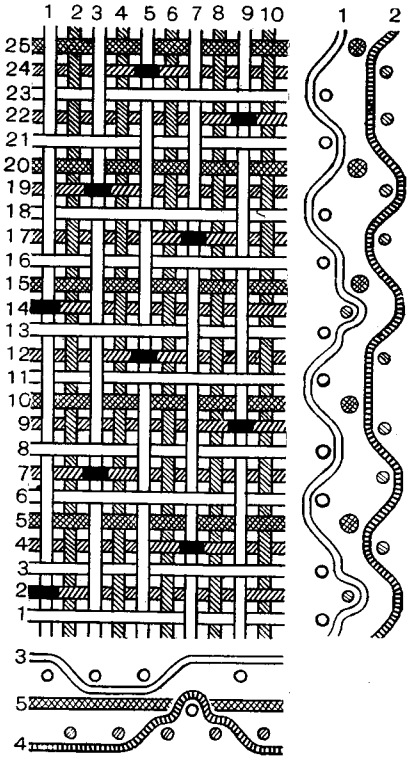


Fig. 89.

squares indicate the face weave, the circles the ties, the diagonal marks the backing weave, the dots the backing ends down on the face picks, while crosses are inserted to show the interweaving of the wadding threads. All the marks indicate weft, except where circles are used for the backing warp ties. F is similar to E, but only one kind of mark is used to indicate where the weft is on the surface.

In the diagrams given in Figs. 87 and 89, which correspond with the complete designs shown in Figs. 86 and 88 respectively, the backing and wadding threads are shaded in different ways in order that they may be readily distinguished. The wadding threads are also represented as being of larger diameter than the face and backing threads. In the flat views the threads, for convenience, are placed alongside each other at approximately uniform distances apart in the same order as in the designs. The positions of the ties are indicated by the solid marks.

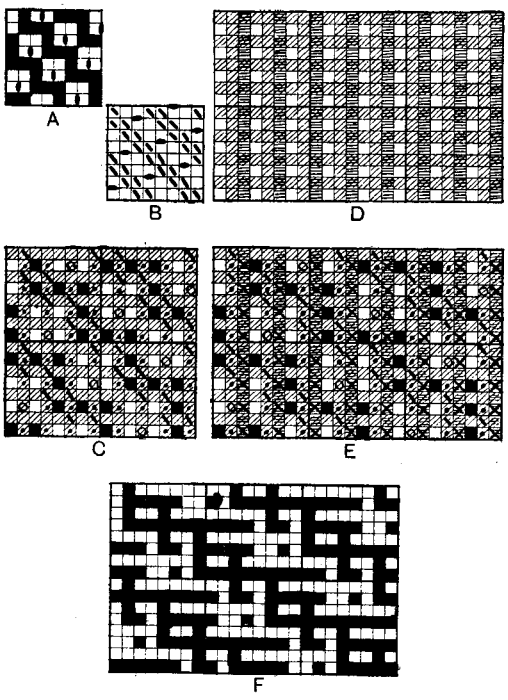


Fig. 90.

In the example given in Fig. 86 the picks are arranged in the order of 1 face, 1 back, 1 wadding; and the ends 1 face, 1 back. The 4-thread sateen weave, warp surface on both sides of the cloth, is employed, the tying being effected by raising the backing ends in 4-thread sateen order over the face picks. In the corresponding drawings, given in Fig. 87, the section on the right of the flat view shows the interweaving of the ends 1 and 2, and that below of the picks 1, 2, and 3.

In Fig. 88 the ends are arranged 1 face, 1 back, but there are two face and two backing picks to each wadding pick. The 5-shaft Venetian weave, weft surface on both sides of the cloth, is employed, the tying in this case being effected by passing the backing picks in 5-sateen order over the face ends. It will be noted that the arrangement renders it necessary for the design E to include two repeats of the double weave. In the corresponding drawings, given in Fig. 89, the section on the right of the flat view shows the interweaving of the ends 1 and 2, and that below of the picks 3, 4, and 5.

In the weft wadded cloths the only point to note, in addition to the correct construction of the double weave, is that marks are inserted where the wadding picks intersect the backing ends, as shown by the crosses in the designs lettered E in Figs. 86 and 88. All the face ends are thus raised, and the backing ends depressed when the wadding weft is inserted, as is distinctly shown in the flat views in Figs.

87 and 89. On the other hand, if warp is indicated in the designs, marks require to be inserted where the wadding picks intersect the face ends.

Warp Wadded Double Cloths.—The wadding yarn is more economically and conveniently introduced in the warp than in the weft principle, but the greater strain put on the threads in weaving necessitates the use of a better quality of wadding material. The construction of the designs is illustrated in Figs. 90 and 92, in which the marks again indicate weft. The face and back weaves are given at A and B respectively in each figure, while for the purpose of comparison the double weave, without the wadding ends, is indicated at C. The arrangement of the threads in the warp-wadded design is illustrated at D, the horizontal strokes indicating the wadding ends. The complete design is given at E, in which the same marks are used as in the weft-wadded designs, while F shows the design indicated in one kind of mark.

In Fig. 90 the ends are arranged in the order of 1 face, 1 back, 1 wadding; and

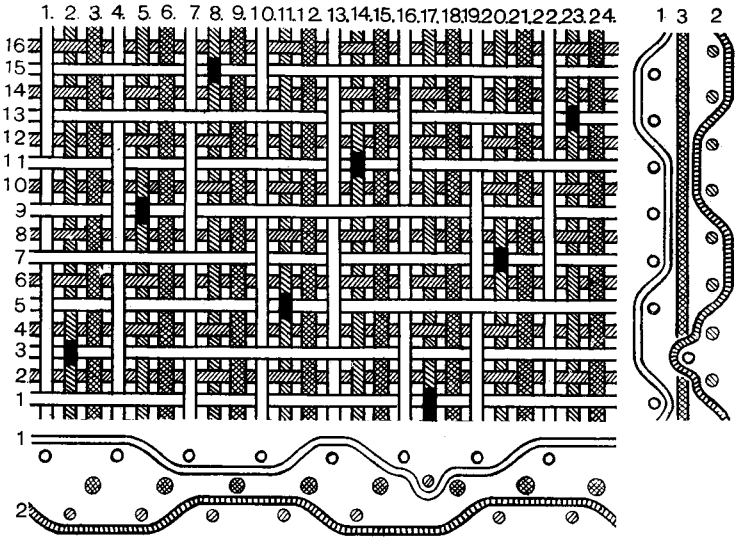


Fig. 91.

the picks 1 face, 1 back. An 8-thread twilled hopsack weave is employed for the face fabric, and a 2-and-2 twill for the back, and the backing ends are raised for tying in 8-sateen order. The drawings in Fig. 91 correspond with the design E in Fig. 90, the section on the right of the flat view showing the interweaving of the ends 1, 2, and 3, and that below of the picks 1 and 2.

The warp in Fig. 92 is arranged in the order of 1 face, 1 back, 1 face, 1 wadding; and the weft 1 face, 1 back, 1 face, the arrangement permitting of the use of much thicker backing and wadding than face yarn. The face weave is a 3-and-3 twill, and the backing weave a 2-and-1 twill; the two fabrics are tied together by raising each backing end over two consecutive face picks. In the corresponding drawings given in Fig. 93, the section on the right of the flat view shows the interweaving of the ends 2, 3, and 4, and that below of the picks 1 and 2. An examination of the designs E in Figs. 90 and 92 will show that, so far as the wadding ends are concerned,

marks are inserted where they intersect the face picks. All the face picks thus pass over, and all the backing picks pass under, the wadding ends, as shown in the flat views in Figs. 91 and 93. If, however, warp is indicated in the designs, marks are inserted where the wadding ends intersect the backing picks.

The draft for the design E in Fig. 92 is given at G, and the pegging plan at H. The wadding ends only require one heald, since they all work alike; but in fine setts, in order to avoid crowding the heald, they may be drawn on to two or more healds, which are then operated as one.

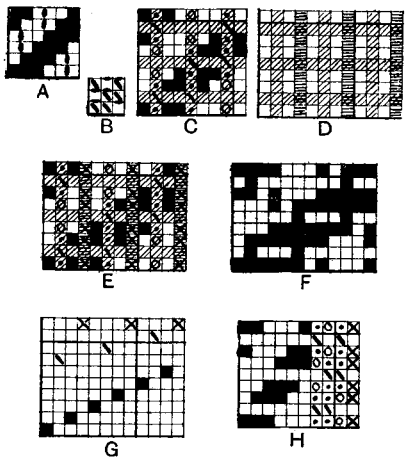


Fig 92.

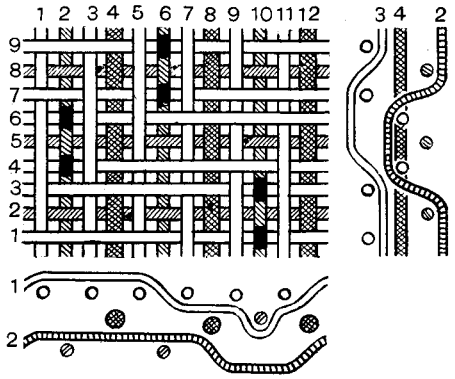


Fig. 93.

CENTRE-STITCHED DOUBLE CLOTHS

It has been shown that in wadding a cloth the chief object is to get a heavy structure by introducing a centre yarn which is usually thicker and cheaper than the face and backing yarns. In centre stitching, however, although the threads may be introduced in the same order as in wadding, and additional weight thereby be obtained, the specific purpose is to bind the two fabrics together with the centre threads, which as a rule are finer than either the face or backing threads. In this system the threads of one fabric do not interweave with those of the other fabric; the centre threads pass alternately from one to the other, and lie between them when not employed for tying. It is a useful method for cloths in which there is a great difference either in the thickness or the colours of the yarns used for the face and back, as, for example, for overcoatings in which a check lining is woven with the face fabric, and for heavy cloaking and mantle cloths which are made with coloured checks on one side and solid shades on the other. In such cloths the ordinary method of tying is not suitable, as the contrast in colour and the difference in thickness between the face and backing yarns make the ties liable to show.

In the accompanying designs and diagrams (Figs. 94 to 100) the backing and stitching threads are shaded in different ways, while, in addition, in the diagrams the centre threads are represented as being of smaller diameter than the face and backing threads. In the flat views the threads are shown alongside each other in the same order as in the plans, the solid marks indicating the positions of the ties. The face and backing weaves, with the positions of the ties indicated between the

squares, and a plan showing the positions of the backing and stitching threads, are given separately for each example. In the complete designs the full squares indicate the face weave, the diagonal marks inclined to the left the backing weave, and the dots the backing ends down on the face picks. On the centre threads a circle indicates a thread lifted, and a cross a thread depressed for tying; while diagonal marks inclined to the right are inserted where the stitching-threads are required to lie between the two fabrics. All the weave marks indicate weft, with the exception of the circles.

Centre Warp Stitching.—The plans in Fig. 94 are illustrative of the construction of double cloths arranged 1 face, 1 back, in which the two fabrics are stitched together by means of centre warp. The design D is a double 2-and-2 twill, the face weave being as at A, and the backing weave as at B, while the ends are arranged in the proportion of 4 face and 4 backing to 1 stitching, as indicated at C. The drawings in Fig. 95 correspond with the design D, the section on the right of the flat view showing

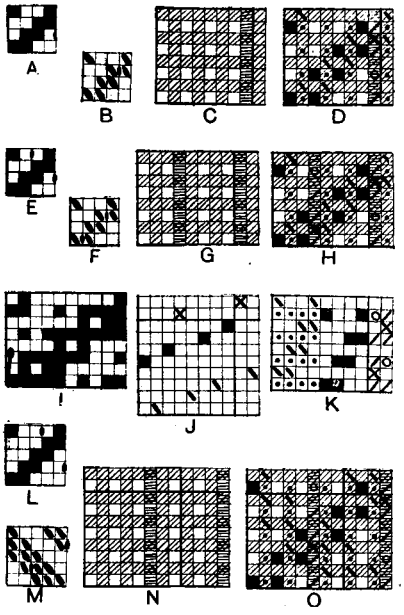


Fig. 94.

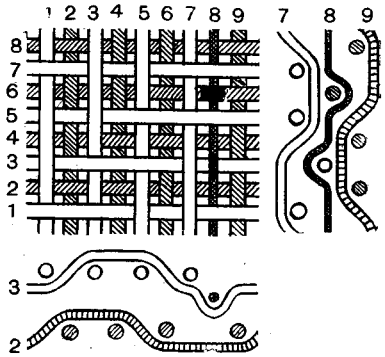


Fig. 95.

the interweaving of the ends 7, 8, and 9, and that below of the picks 2 and 3.

As each repeat of the double weave given at D contains only one stitching end, the ties always occur in the same line, both on the face and back of the cloth. A better arrangement is given in the design H, in Fig. 94, in which the ends are in the proportion of 2 face and 2 backing to 1 stitching, as shown at G. The face weave is given at E, and the backing weave at F. In this case there are two centre stitching ends in one repeat of the double weave, which not only causes the fabrics to be more firmly united, but enables an alternate distribution of the ties to be made. This is clearly shown in the corresponding flat view given in Fig. 96. The section on the right of the flat view shows the interweaving of the ends 3, 4, and 5, and that below of the pick 2 and 3.

An examination of the designs D and H in Fig. 94, and a comparison with the corresponding diagrams in Figs. 95 and 96, will show that in centre warp stitching

it is necessary for the following to be observed :—(*a*) In tying to the face fabric the centre ends are floated over the face picks in places where a face end is raised on each side, as shown by the circles in the plans. (*b*) In tying to the back fabric the

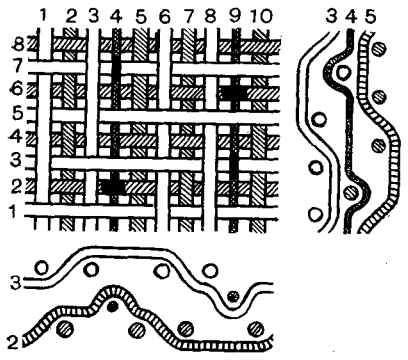


Fig. 96.

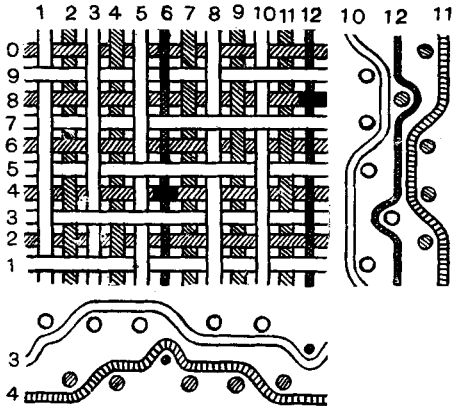


Fig. 97.

centre ends are depressed on the backing picks in places where a backing end is down on each side, as shown by the crosses. (*c*) Where no ties occur, the face picks pass over and the backing picks pass under the centre ends ; thus marks are inserted where the face picks and the centre ends intersect, except where there are circles. If warp is indicated marks are inserted where the centre ends intersect the backing picks.

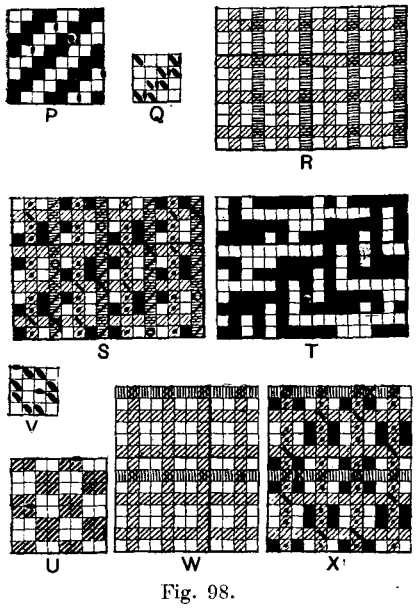


Fig. 98.

The design I in Fig. 94 shows the appearance of the weave H when only one kind of mark is used to indicate where the weft is on the surface. The draft is given at J, and the pegging plan at K, the blanks and circles in the latter indicating the healds lifted. Since the stitching ends are usually strong enough to withstand considerable strain in weaving, they may be drawn on to the healds which are farthest from the front, as shown by the crosses in J.

The design O, in Fig. 94, is the double 3-warp and 2-weft twill weave with two stitching ends in each repeat, as shown at N. In this example the face and backing weaves (given at L and M respectively) are so arranged that the direction of the twill line when the piece is turned over is the same as on the face side, the cloth being thus perfectly reversible. The corresponding drawings are given in Fig. 97, the section on the right of the flat view showing the interweaving of the ends 10, 11, and 12, and that below of the picks 3 and 4. As shown here, in centre-stitched cloths

the backing weave requires to be placed in such a position in relation to the face weave that the ties on each stitching thread will be about half the repeat distant from each other. Thus the second stitching end (end number 12) in Fig. 97 is raised for tying on the third pick, and depressed half the repeat distant on the eighth pick.

An example is illustrated at P to T in Fig. 98, in which the proportion of face threads to backing threads is 2 to 1, an arrangement which permits of the use of very thick yarns in the under-fabric. S is a double 2-and-2 twill, with the face weave as at P, and the backing weave as at Q. The tying is effected by means of four centre ends in the repeat, the complete order of warping being 1 face, 1 back, 1 face, 1 centre, as shown at R. The plan with only one kind of mark used to indicate where the weft is up is given at T. The corresponding drawings are given in Fig. 99, the interweaving of the ends 2, 3, and 4 being shown on the right, and of the picks 1 and 2 below the flat view. The example shows how a tartan-lined cloaking cloth is constructed. The tartan-check side is composed of the finer yarns, and is taken as the face in weaving, although in the made-up garment it forms the back; while the solid side consists of the coarser fabric which forms the back in weaving and the face when made up.

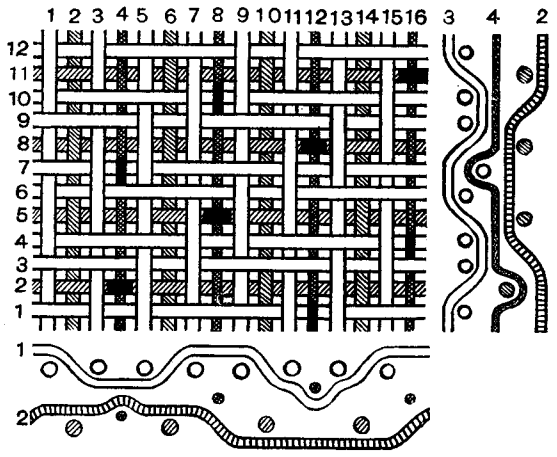


Fig. 99.

Centre Weft Stitching.—The plans U to X in Fig. 98 illustrate the principle of stitching by means of centre weft. The double 2-and-2 hopsack weave is employed, the face weave being given at U and the backing weave at V. The picks are in the proportion of 4 face and 2 backing to one stitching as indicated at W, one repeat of the double weave thus containing two centre picks. The complete design is given at X, and in the corresponding diagrams represented in Fig. 100, the interweaving of the ends 2 and 3 is shown alongside, and of the picks 12, 13, and 14 below the flat view. In this system it is necessary that the following be observed:—(*a*) In tying to the face fabric the centre picks are passed over the face ends in places where there is a face weft

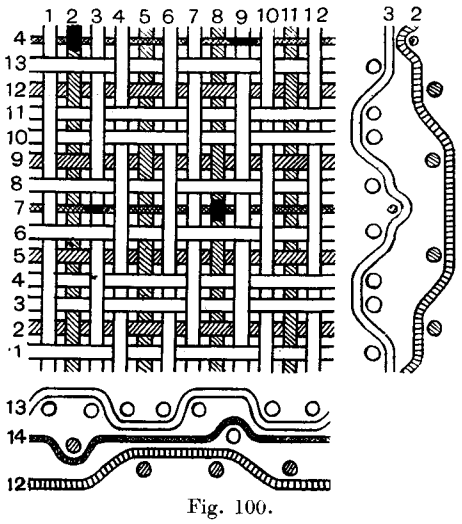


Fig. 100.

float on each side, as shown by the crosses in X. (*b*) In tying to the back fabric the centre picks pass under the backing ends in places where, on the underside, there is a backing weft float on each side, as shown by the circles. (*c*) Where no ties occur the centre picks pass under the face ends and over the backing ends; thus diagonal marks (to the right) are shown where the backing ends and the centre picks intersect, except where circles are inserted. In marking for warp, the diagonal strokes will be indicated where the face ends and centre picks intersect.

TREBLE CLOTHS

In treble cloths there are three series of warp and weft threads which form three distinct fabrics, one above the other. Except for the ties, when a face pick is inserted all the centre and backing ends are left down; when a centre pick is inserted all the face ends are raised, and all the backing ends are left down; while when a backing pick is inserted, all the face and centre ends are raised. The face ends and picks interweave with each other to form the face fabric, the centre ends and picks to form the centre fabric, and the backing ends and picks to form the back fabric. By interweaving the centre ends or picks with the face and backing picks or ends, the three fabrics are joined together, and the resulting cloth is equal in thickness and weight to the three single fabrics. Greater weight combined with equal fineness of appearance can thus be obtained in this than in the double system of construction. The weight of double-woollen structures is frequently increased by excessively shrinking the cloth in the felting process, the chief disadvantage of which is that its elasticity is liable to suffer. This does not occur when increased weight is obtained by making the cloth three-fold, hence the treble principle can be advantageously employed in preference to the double system in adding weight to cloths which require little shrinking in the finishing processes.

The chief factors which it is necessary to observe in the construction of treble-cloth designs are illustrated by the plans in Fig. 101, and the diagrams in Figs. 102 and 102A. The threads are arranged 1 face, 1 centre, 1 back, and the 2-and-2 twill is employed for each fabric, the face weave being as at A, the centre weave as at B, and the backing weave as at C in Fig. 101. The ties are distributed in 8-thread sateen order.

The complete designs H, I, J, and K, in Fig. 101, are alike, except that different methods of effecting the tying are employed. In order that comparisons may be made, the plans A, B, and C, with the position of the ties indicated by the marks between the squares, are shown on the left of each complete design. In Fig. 101 the centre and backing threads are shaded in different ways (horizontal strokes being used for the centre threads, and diagonal strokes for the backing threads). The following marks are employed:—Full squares for the face weave, diagonal marks inclined to the right for the centre weave, diagonal marks inclined to the left for the backing weave, dots to indicate the centre ends down on the face picks, and the backing ends down on the face and centre picks, circles to show where the centre is tied to the face, and crosses where the centre is tied to the back. The circles and crosses indicate weft in one case and warp in another, but the other marks indicate weft.

In the drawings given in Figs. 102 and 102A the centre and backing threads are shaded in different ways, but in order that they may be readily distinguished,

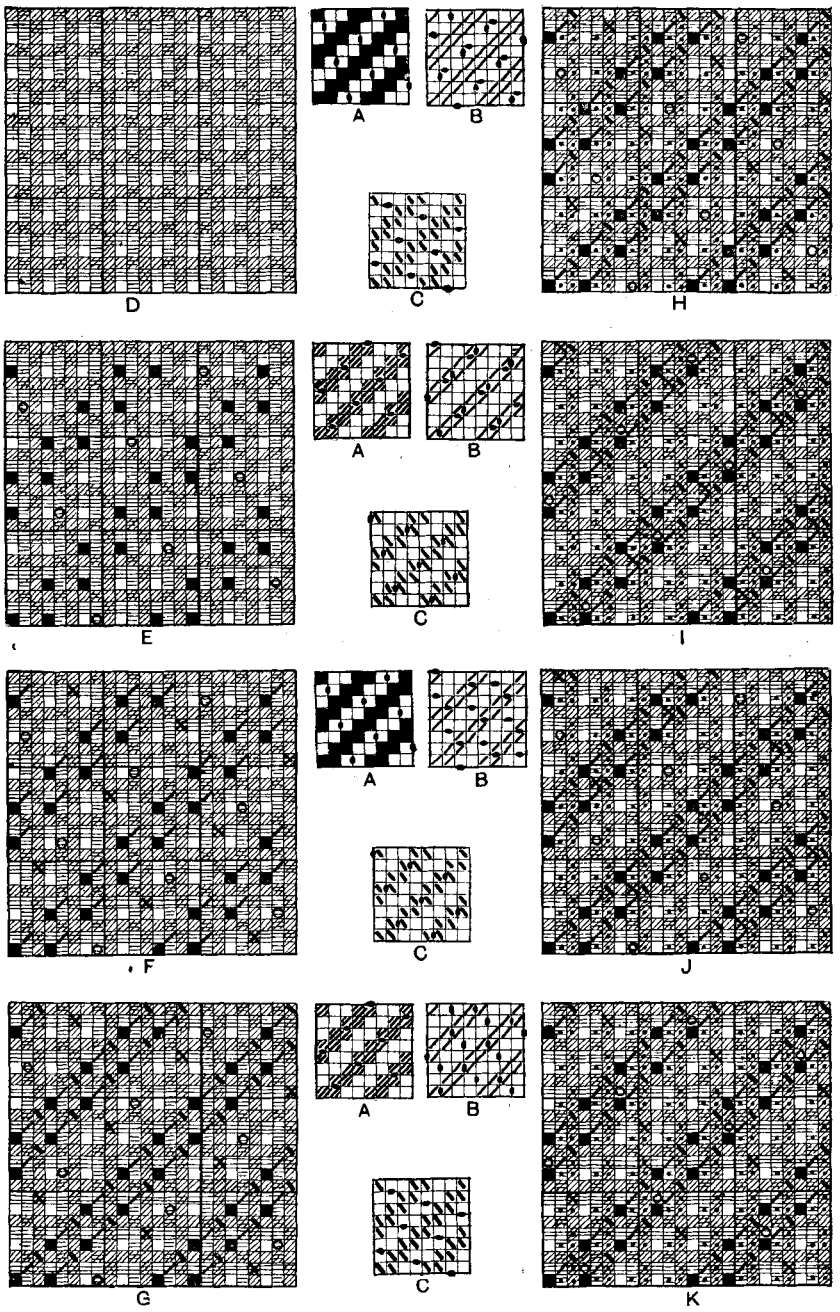


Fig. 101.

the backing threads are represented as being of larger diameter than the centre threads, and smaller than the face threads. The flat view in Fig. 102 corresponds with the design H in Fig. 101, the solid marks indicating the positions of the ties. The sections H, I, J, and K below the flat view respectively show the interweaving of the picks 1, 2, and 3 of the designs similarly lettered in Fig. 101, while in the same manner those given in Fig. 102A show the interweaving of the ends 1, 2, and 3.

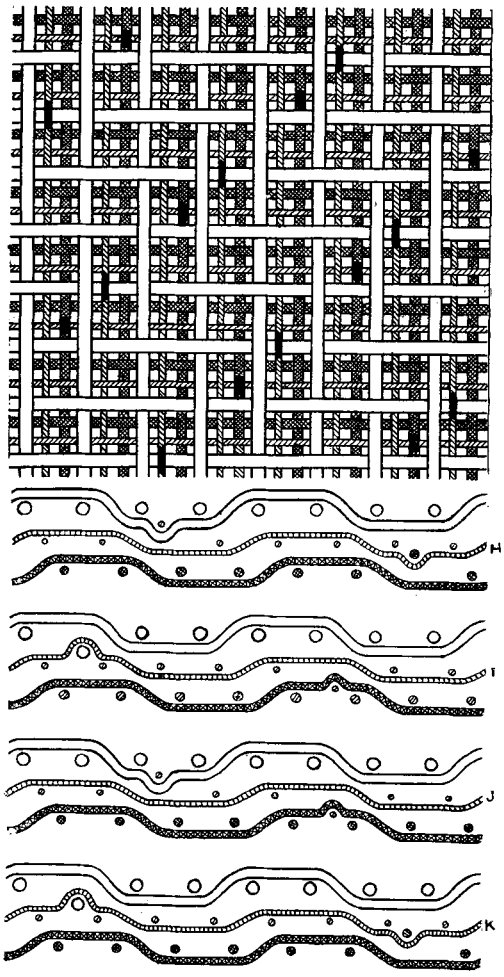


Fig. 102.

Systems of Stitching. — The principle of tying is the same as in ordinary double cloths—that is, each tie on the face and back should be covered on both sides by corresponding floats. There are four ways in which the tying may be effected by the centre yarns:—(1) As shown at H in Figs. 101, 102, and 102A, by passing the centre ends over the face picks, and the centre picks under the backing ends. (The circles and crosses in the design H thus indicate warp up.) (2) As shown at I, by passing the centre picks over the face ends, and the centre ends under the backing picks. (Here the circles and crosses indicate weft up.) (3) As shown at J, by passing the centre ends over the face picks and under the backing picks. (In this case the circles indicate warp and the crosses weft up.) (4) As shown at K, by passing the centre picks over the face ends and under the backing ends, the circles thus indicating weft and the crosses warp up. The method of tying which is most suitable is mainly decided by: (*a*) The positions of convenient binding places in the face and backing weaves; and (*b*) the thickness and quality of the centre yarns, compared with the face and backing yarns. The first method, illustrated by the design H in Fig. 101, is most commonly employed, but the centre yarn—warp or weft—which is the finer and smarter, should be used if possible, particularly in tying to the face.

If an examination of the drawings H, I, J, and K in Figs. 102 and 102A be made, it will be noted that while the centre threads enter both the face and back fabrics, the face and backing threads enter the centre fabric. Thus

in H the face picks and backing ends tie with the centre fabric, in I the face ends and backing picks, in J the face and backing picks, and in K the face and backing ends. So far as regards the appearance of the cloth, the position of the ties in the centre fabric is of no importance. It is necessary, however, for care to be taken that none of the floats in the centre fabric are broken by the ties, as this results in the cloth being harder woven, and may cause the wefting capacity of the fabric to be seriously affected. The most perfect conditions prevail when the ties in the centre are between corresponding floats, the same as in the face and back. The following rule will enable the best possible conditions to be obtained, assuming that weft is indicated :—Where an end is raised for tying (whether centre or backing), if possible the tying mark should be placed between two blanks alongside each other of the weave to which the tie is made, and should be preceded and followed by blanks on its own picks, as shown in H. Where a pick is floated for tying (whether centre or backing), if possible the tying mark should be preceded and followed by marks of the weave to which the tie is made, and be placed between two marks alongside each other, on its own ends, as shown in I. If warp is indicated the conditions are the reverse of the foregoing.

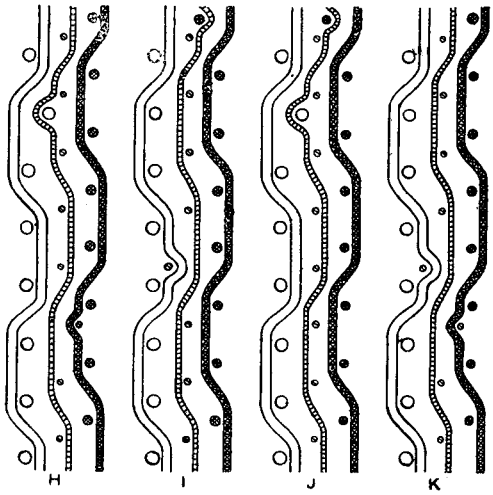


Fig. 102A.

Treble Cloth Designing in Stages. —The plans D to H in Fig. 101 show how the different stages in the construction of a treble-cloth design may be conveniently arranged in working according to the foregoing rule. At D the arrangement of the threads is indicated. At E the face weave is shown inserted on the squares where the face ends intersect with the face picks. At this stage the positions of the centre ties in relation to the face weave are indicated, as shown by the circles. At F the centre weave is inserted on the squares where the centre ends and picks intersect, and in a suitable position in relation to the circles. The ties which bind to the back are then indicated as shown by the crosses, their positions being determined by the positions of suitable binding places in the centre weave. At G the backing weave is inserted on the squares where the backing ends and picks intersect, and in a suitable position in relation to the crosses. At H the design is completed by marking down the centre ends on the face picks, and the backing ends on the face and centre picks, except where ties are placed.

An examination and comparison of the designs will show that in tying to the face, in H and J each centre warp tie is indicated where a centre end intersects a face pick, and in I and K each centre weft tie where a centre pick intersects a face end. In tying to the back, in H and K each centre weft tie is indicated where a centre pick intersects a backing end, and in I and J each centre warp tie is shown where a centre end intersects a backing pick.

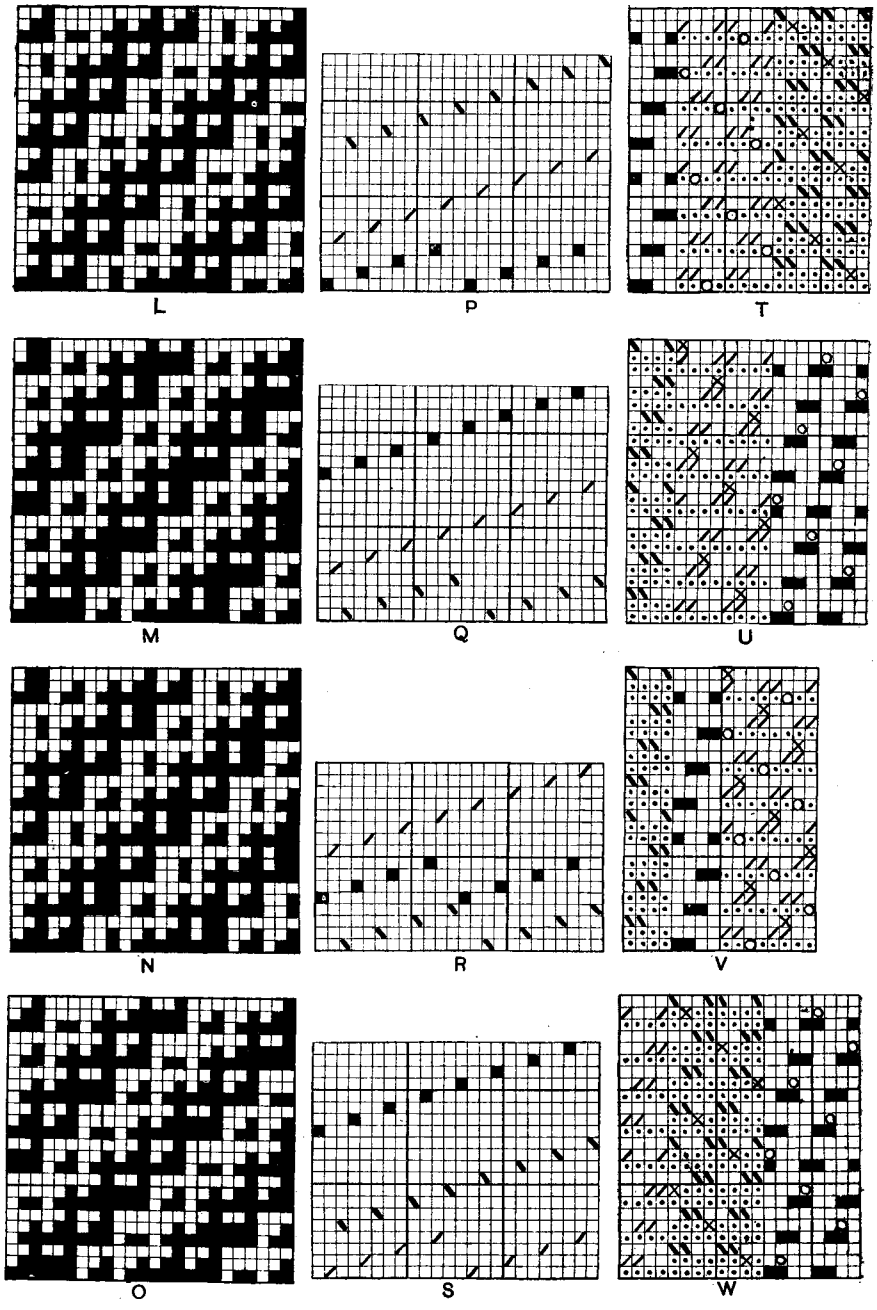


Fig. 103.

The plans L, M, N, and O in Fig. 103, which respectively correspond with the plans H, I, J, and K in Fig. 101, will enable further comparisons to be made, since they show how the weaves appear when only one kind of mark is used to indicate where the weft is up.

Construction of Drafts and Pegging Plans.—The respective drafts for the designs H, I, J, and K in Fig. 101 are given at P, Q, R, and S in Fig. 103, and the pegging plans at T, U, V, and W. Three sets of healds are necessary, and in deciding upon their positions the rule has been followed of placing the most crowded healds at the front, with the face healds preferably behind those which are equal to them in fineness. Thus, taking the healds in order from front to back, the design H requires 4 face, 8 centre, and 8 backing healds ; I, 4 backing, 8 centre, and 8 face healds ; J, 4 backing, 4 face, and 8 centre healds ; and K, 4 centre, 8 backing, and 8 face healds. Two other arrangements of the sets of healds are possible—viz., the centre healds at the front of, and the backing healds behind, the face healds ; and the face healds at the front of, and the centre healds behind, the backing healds. Other factors which require to be considered in deciding upon the positions of the respective sets of healds are the relative strengths and intersections of the face, centre, and backing yarns. Other things being equal, the weakest yarns should be drawn on the healds at the front, and in the same manner the threads which interweave the most frequently. The given drafts show the designs reduced to the lowest possible number of healds, but for such an example it would usually be more convenient to use 8 healds in each set, in order to simplify the drawing in, and so that changes could be readily made either in the system of tying, or in the positions of the healds. In the pegging plans all the marks indicate healds down, except where a dot is replaced by a circle or a cross.

Systematic Construction of Treble-Cloth Designs.—The foregoing example shows that when the same weave is used throughout, and the threads are arranged in equal proportions, favourable conditions for tying are obtained by commencing the weave always in the same relative position. The weft and warp floats on the upper surfaces of the centre and back fabrics respectively are then directly below the warp and weft floats on the under-surface of the face and centre fabrics, hence there is no obstacle to the interweaving of the threads of one fabric with those of another. When different weaves are employed, however, it is necessary for their positions to be found by experiment. If the treble design is constructed directly, this is not always an easy matter, while, in addition, on the extended design it is frequently difficult to judge when the best results are obtained. A system of working which enables the most perfect relation of the weaves and the ties to each other to be conveniently found before the design is commenced, is shown at A to F in Fig. 104. The principle is similar to that described and illustrated in reference to the construction of double-cloth designs (see p. 55) ; therefore only a brief description is given here. A 4-thread sateen weave, warp surface, is used for the face fabric, a 2-and-2 twill for the centre fabric, and a 4-thread sateen, with the weft on the underside for the back fabric, the weave marks indicating weft up. The threads are arranged 1 face, 1 centre, 1 back, as shown at G, and the tying is effected by passing the centre ends over the face picks, and the centre picks under the backing ends. At A the face weave is inserted, and the positions of the centre ends, between the face ends, are indicated along the bottom, and of the centre warp ties between blank squares of the face weave. At B the positions of the face picks, between the

centre picks, are indicated at the side of the space reserved for the centre weave, and the face weft ties are copied from A and marked between the squares. At C the centre weave is inserted, care being taken that weave marks do not occur both above and below a tying mark. Experiment will show that no other position of the 2-and-2 twill is suitable. At D the centre weave is copied from C, and the positions of the backing ends between the centre ends are indicated along the bottom. The places where the backing ends may be conveniently raised to tie with the centre weave are then indicated, as shown by the marks between the squares of D. At E the positions of the centre picks, between the backing picks, are indicated at the side of the space reserved for the backing weave, and the centre weft ties are copied from D. At F the backing weave is inserted, if possible with a blank square above and below each tying mark. The complete design (given at H) can now be readily constructed from the plans A, C or D, and F, with the certainty that the conditions of a perfect treble cloth will be secured.

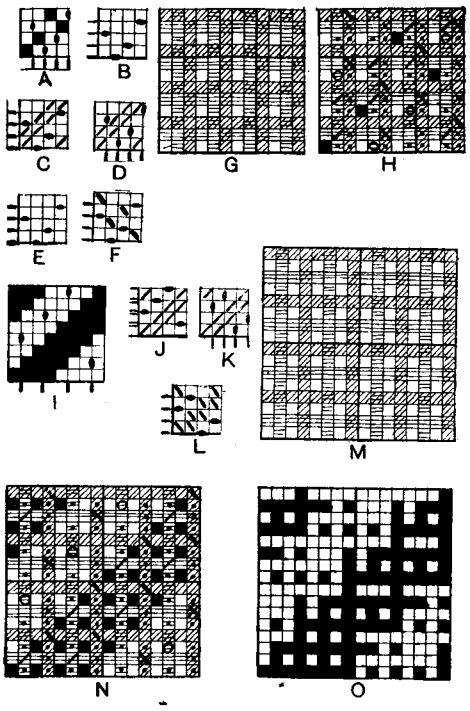


Fig. 104.

The flat view given in Fig. 105 corresponds with the design H in Fig. 104, while the interweaving of the picks

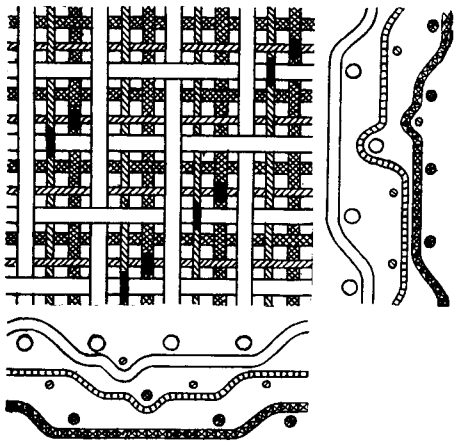


Fig. 105.

1, 2, and 3 is shown below, and of the ends 1, 2, and 3 alongside the flat view. (The weave marks and the shading are the same as in the examples given in Figs. 101 and 102.) It will be noted that the solid marks in the flat view correspond with the circles and crosses in the design H. The section below the flat view shows how the second centre end is raised for tying on the first face pick, and the second backing end on the first centre pick; while in the section alongside the first centre end is shown passing over the third face pick, and the first backing end over the third centre pick. A comparison of the flat view with the plans A to F will enable the different stages of working to be more readily followed. Thus it will be seen that where there are solid marks

on the centre ends in the flat view, there are corresponding marks between the ends of plan A and between the picks of plans B and C. The former show where the centre ends are tied to the face, and the latter where the face picks are tied to the centre. In the same manner, where there are solid marks on the backing ends in the flat view, there are corresponding marks between the ends of plan D, and between the picks of plans E and F, the former indicating where the backing ends are tied to the centre, and the latter where the centre picks are tied to the back. It will be noted that while in the face and back fabrics the ties are covered on both sides, in the centre some of the ties have a corresponding float on one side only. The

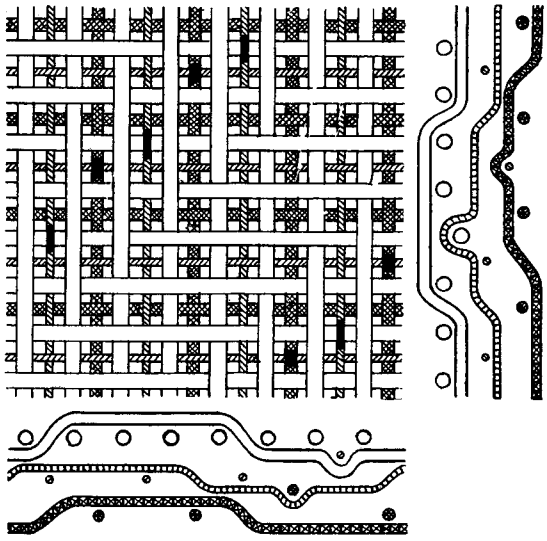


Fig. 106.

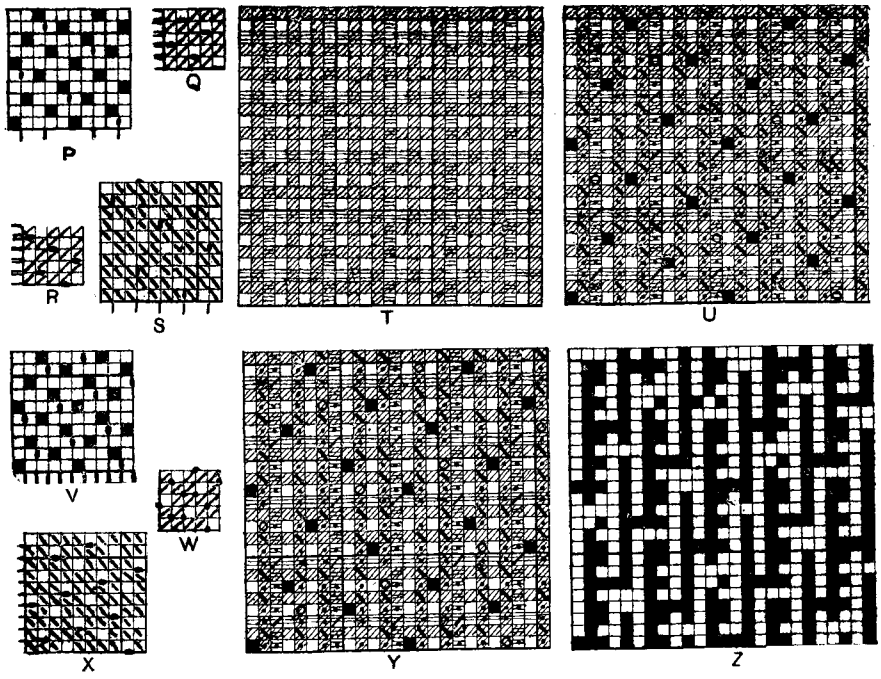


Fig. 107.

arrangement, however, is the best possible, and is not defective, because the floats of the centre ends are not broken.

The plans I to N in Fig. 104 show the working out of a treble-cloth design, in which the threads are arranged in the order of 1 face, 1 centre, 1 face, 1 back, as indicated at M. A 4-and-4 twill is used for the face fabric, and a 2-and-2 twill for the centre and back fabrics, the method of tying being the same as in the last example. The face weave, with the positions of the centre warp ties indicated between the squares, is given at I ; the centre weave, with the positions of the face weft ties, at J, and of the backing warp ties at K ; while the backing weave, with the positions of the centre weft ties, is shown at L. The plans I, J, K, and L, thus respectively

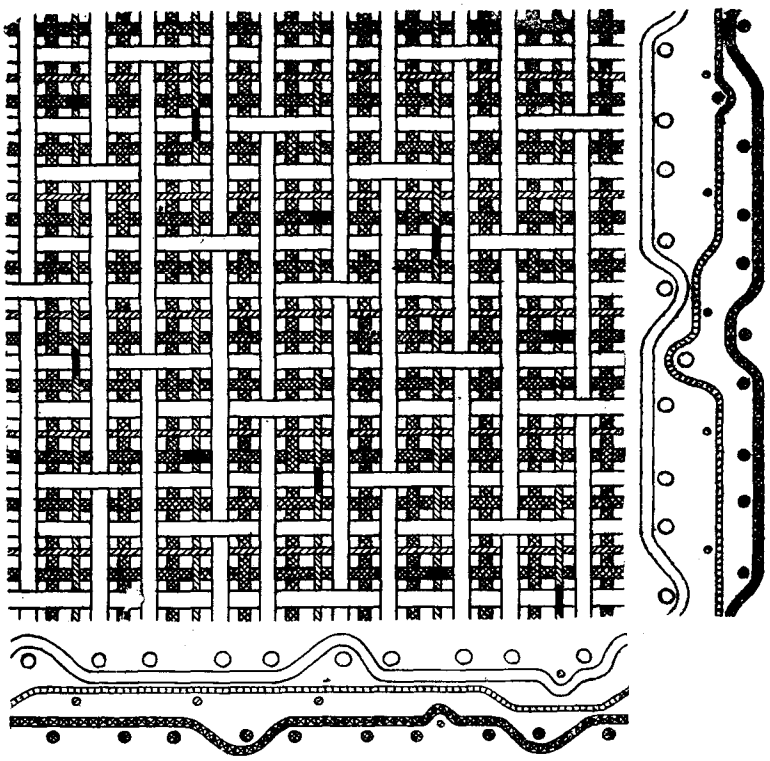


Fig. 108.

correspond, as regards the system of working, with the plans A, C, D, and F, the only difference being that there are two face threads to each centre thread, as indicated at the side of J. The complete design is given at N and O, the latter showing the appearance of the weave when only one kind of mark is used to indicate where the weft is up. The corresponding drawings are given in Fig. 106. In the section below the flat view, which shows the interweaving of the picks 2, 3, and 4, it will be noted that the fourth centre end is raised for tying on the second face pick, and the third backing end on the first centre pick. The section alongside the flat view shows the interweaving of the ends 2, 3, and 4, the first centre end passing over the fourth face pick, and the first backing end over the third centre pick.

The plans in Fig. 107 illustrate the construction of a treble cloth, in which there are 2 face and 2 backing threads to 1 centre thread, the arrangement being 1 face, 1 back, 1 centre, 1 face, 1 back, as shown at T. Five-thread sateen weaves are used for the three fabrics, the cloth being warp surface on both sides, or reversible, while the centre fabric has the weft float on the upper surface. For the purpose of illustration two different principles of joining the three fabrics together are given. In the complete design, shown at U, the tying is effected by the centre ends interweaving with both the face and backing wefts, this being a suitable method for the reversible warp surface, while it is also very applicable to structures in which the centre warp is not much thicker than the face and backing yarns, whereas the

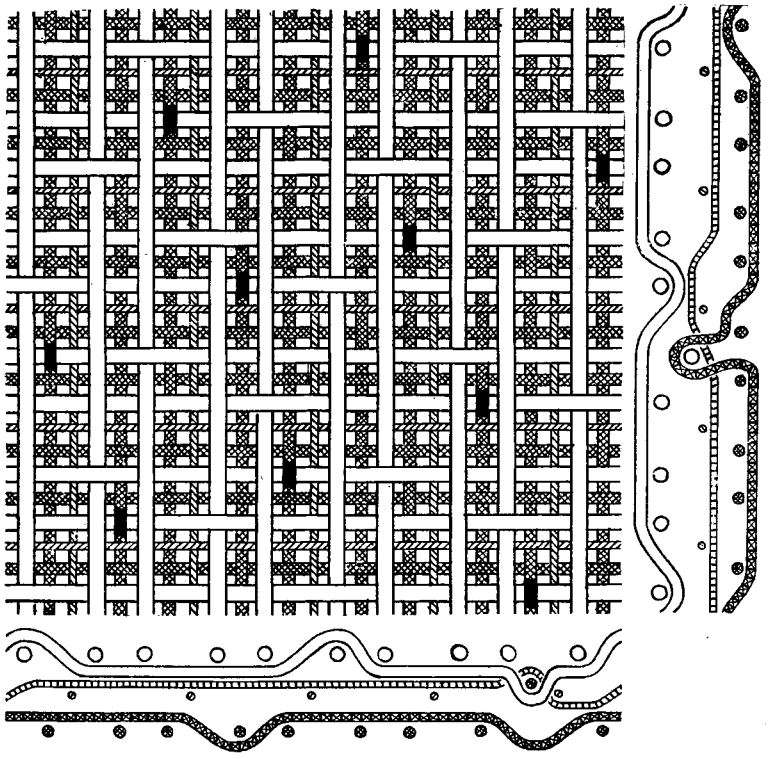


Fig. 109.

centre weft is much thicker. P, shows the face weave with the positions of the centre warp ties indicated ; Q, the centre weave with the face weft ties ; R, the centre weave with the backing weft ties ; and S, the backing weave with the centre warp ties. It will be noted that the weaves and ties are arranged in such positions in relation to each other that (1) the ties both on the face and back are between corresponding floats, and (2) the floats in the centre are not interfered with by the interweaving of the face and backing picks with the centre ends. This may be readily seen if the drawings given in Fig. 108 are examined and compared with the design U with which they correspond. The section below the flat view shows the interweaving of the picks 1, 2, and 3, and that alongside of the ends 1, 2, and 3.

Use of Centre Fabric as Wadding.—The design Y in Fig. 107 and the corresponding drawings in Fig. 109, show a method of uniting the three fabrics which is different from any of the foregoing. In this case the centre threads do not interweave with either the face or the backing threads, but are used purely in forming a wadding cloth, the tying being effected by passing the backing ends over the face picks in 10-thread sateen order. The system can be advantageously used when the centre yarns are of lower quality and much thicker than the face and backing yarns. In arranging the positions of the weaves and ties it is only necessary to consider the face and back fabrics, as in ordinary double cloths. Thus, V shows the face weave with the positions of the backing warp ties indicated between the squares, and X the backing weave with the positions of the face weft ties indicated. The centre weave is given at W, and in order that comparisons may be made, the positions where the backing ends and picks interweave through the centre fabric, are indicated by the marks at the corners of the squares. The circles in the design Y indicate the positions of the ties, while Z shows the appearance of the weave when only one kind of mark is used to show weft up.

An examination of the flat view in Fig. 109 will show that the centre ends and centre picks interweave only with each other. The interweaving of the picks 1, 2, and 3 is shown below the flat view, and it will be noted that the first face pick passes under the ninth backing end between the fourth and fifth centre ends. In the section alongside the flat view, which shows the interweaving of the ends 1, 2, and 3, it will be seen that the first backing end passes over the fifth face pick between the second and third centre picks. The tying may also be similarly effected by the interweaving of the backing picks with the face ends.

CHAPTER V

EXTRA WEFT FIGURING

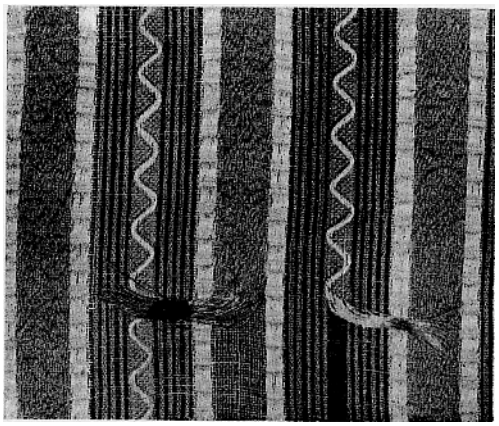
Principles of Figuring with Extra Materials—Methods of Introducing Extra Figuring Threads—Methods of Disposing of the Surplus Extra Threads. FIGURING WITH EXTRA WEFT—Continuous Figuring in one Extra Weft—One-and-One Wefting—Two-and-Two Wefting—One-and-Two Wefting—Two-and-Four Wefting—Selection of Suitable Positions for the Figuring Floats—Extra Material Cut Away—Extra Weft Stitched In—Modification of Ground Weave—Intermittent Extra Weft Figuring—Combination of Ground Weft Figure and Extra Weft Figure—Stitching by means of Special Ends—*Figuring with Two or More Colours of Extra Weft*—Pick-and-Pick Figuring—Methods of indicating Pick-and-Pick Ground Weaves — Pick-and-Pick Weave Shading — Pick-and-Pick Reversible Tapestry Style—Multiple Weft Persian Style of Figuring—Chintzing—*Reversible Weft-Face Figured Fabrics* — Simplified Methods of Designing — Treble-Wefted Reversible Fabrics.

PRINCIPLES OF FIGURING WITH "EXTRA" MATERIALS

A DISTINGUISHING feature of fabrics in which extra materials are employed is that the withdrawal of the extra threads from the cloth leaves a complete structure, which is more or less perfect according to the manner in which the ground threads have been interwoven under the figure. This is illustrated in Fig. 110, where the lower portion of the extra warp figured stripe, lettered A, is shown with the extra

ends removed, leaving a perfect plain ground texture. The figuring ends in stripe B are not extra, but are simply crammed in the reed, and, as shown in the lower portion of the stripe, their withdrawal completely destroys the cloth structure since only the weft picks remain. The formation of a figure by means of extra threads thus does not detract from the strength or wearing quality of a cloth, except so far as the extra threads are liable to fray out, whereas in ordinary fabrics, in which the figure is formed by floating the weft or warp threads loosely, the strength of the cloth is reduced somewhat in proportion to the ratio of figure and ground.

One of the advantages of figuring with extra materials is that bright colours—in sharp contrast with the ground—may be brought to the surface of the cloth in any desired proportion. Pleasing colour combinations, bright or otherwise, may thus be conveniently obtained, since the extent of surface allotted to the figuring colour may be readily proportioned in accordance with the degree of its contrast with the ground shade, without the latter being affected.



A B

Fig. 110.

Methods of Introducing Extra Figuring Threads.—The extra threads may be introduced either as weft or warp, or the two methods may be employed in combination. They may be inserted in the ordinary manner, or by special means—*e.g.* as weft in the swivel loom, or as warp by means of the lappet mechanism; while after the cloth is woven the embroidery frame is now largely requisitioned for producing the desired pattern. Compared with the ordinary system, the special methods usually give greater fulness to the figure, combined, in most cases, with considerable saving of material.

In the ordinary method of introducing the extra materials the form of the design may render it necessary for the extra threads to be inserted in continuous order with the ground threads, or in intermittent order, while where they are introduced the arrangement of the figuring and ground threads may be 1-and-1, 1-and-2, 1-and-3, etc., according to the structure of the cloth and solidity of figure required. In extra weft figures, for looms with changing boxes at one end only, similar results to the 1-and-1 order may be produced by wefting 2-and-2; while the 2-and-4 order may be substituted for the 1-and-2, with, however, less satisfactory results as regards the solidity of the figure.

Methods of Disposing of the Surplus Extra Threads.—The disposal of the extra warp or weft threads, in the portions of the cloth where they are not required to form figure, is of great importance, and one or other of the following methods may be employed:—

(1) The extra yarn is allowed to float loosely on the back in the ground of the cloth. This method is suitable when the space between the figures is not excessive,

and the ground texture is dense, but it is usually not applicable to cloths in which the ground is so light and transparent that the positions of the extra threads on the back can be perceived from the face side.

(2) The extra yarn is allowed to float loosely on the back, and is afterwards cut away. This method is eminently suitable for light ground textures, but it the extra picks float somewhat loosely on the surface in forming the ornament, it is necessary for them to be bound in at the edges of the figure, or the loose figuring floats will readily fray out from the surface. The firm interweaving of the extra picks at the edges, however, makes the outline of the figure less distinct, and is rather objectionable unless employed in such a manner as to assist in forming the figure.

(3) In compact fabrics the extra threads are bound in on the underside of the cloth, either between corresponding floats in the ground texture, or by means of special stitching threads.

(4) The extra threads are interwoven on the face of the cloth in the ground for the purpose of giving a rich and full appearance to what would otherwise be a bare ground texture.

FIGURING WITH EXTRA WEFT

Extra weft figured fabrics nay be formed with one, two, or more extra wefts ; thus, including the ground threads, they consist of two or more series of weft threads and one series of warp threads.

Continuous Figuring in one Extra Weft—One-and-One Wefting.—A simple

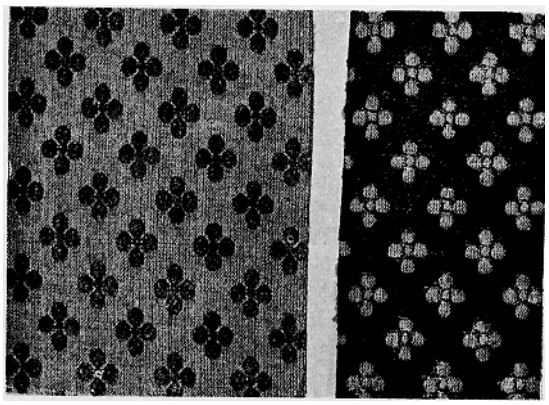


Fig. 111.

example is shown in Fig. 111 in which one extra weft is introduced continuously with the ground weft in the order of a pick of each alternately. The face of the cloth is represented on the left of Fig. 111, and the underside on the right. The ground ends and picks interweave in plain order, while the extra picks float loosely on the back where no figure is formed on the surface. The method of designing for the style is very simple, since it is only necessary for the weft figure to be indicated on the paper, as shown in the corresponding design given at C in Fig. 112. The card-cutting particulars are—cut blanks for the extra picks, and cut the ground

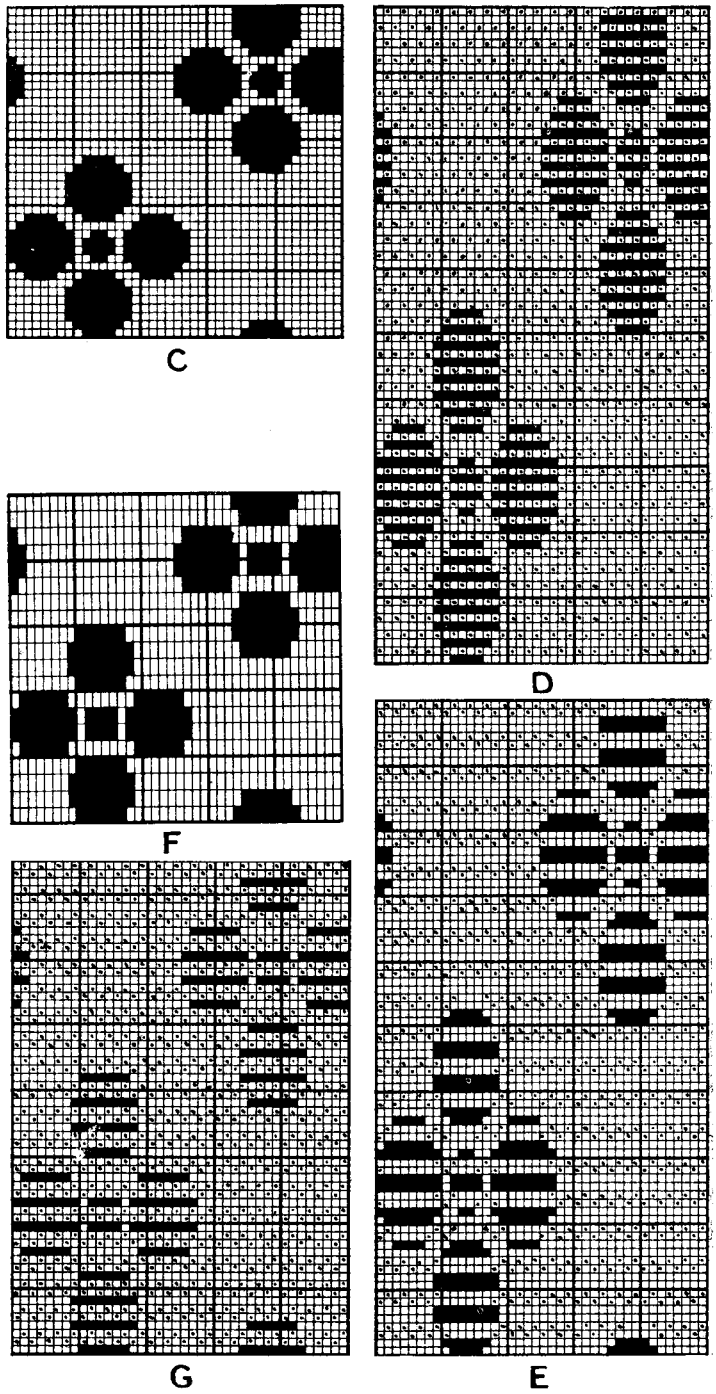


Fig. 112.

(*Note.*—A portion of figure is omitted on the first and third picks of D.)

cards plain; the latter, however, are readily obtained by repeating. The complete structure, given at D in Fig. 112, shows the figuring picks arranged in alternate order with the ground picks, the former being indicated by the full squares and the latter by the dots. A sectional drawing is given at D in Fig. 113, which shows how the picks 2, 3, and 4 of D in Fig. 112 interweave with the ends 1 to 20.

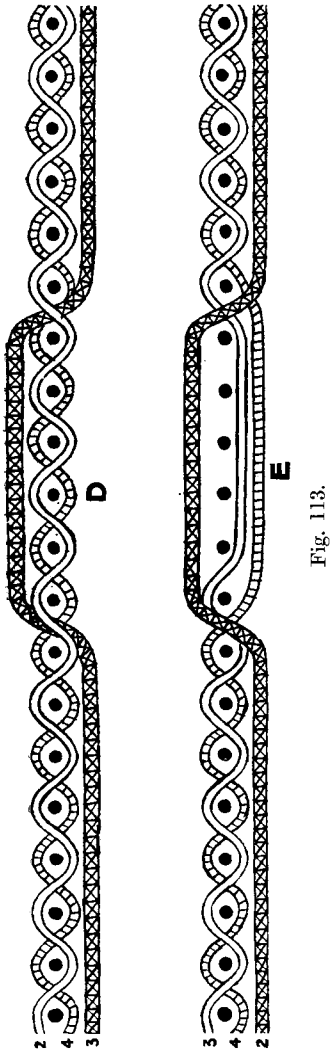


Fig. 113.

Two-and-Two Wefting.—E in Fig. 112 shows the full development of the design C, assuming that it is produced in a loom with changing boxes at one end only, in this case two figuring picks alternating with two ground picks. Unless the figuring weft is heavy there is a tendency, in the 2-and-2 order of wefting, for the extra picks to show in pairs where the figure is formed, this being particularly noticeable if the ground picks interweave firmly underneath. Greater solidity of figure can be obtained by discontinuing the weave of the ground picks, beneath the extra weft floats, in the manner shown in the design E. The warp threads under the figure thus lie between the extra weft floats on the surface, and the ground weft floats on the underside, and no obstacle is offered to the pairs of figuring floats approaching each other. This is illustrated by the sectional drawing given at E in Fig. 113,

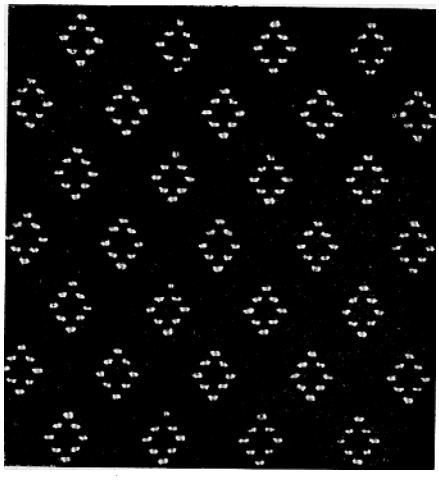


Fig. 114.

which shows the interweaving of the picks 2, 3, and 4 of design E with the ends 1 to 20. With this arrangement it is not possible to repeat the ground cards, but they may be cut from the design painted solid, as at C. Each pick on the design paper is cut twice, the card-cutting instructions being—1st card, cut all but the marks; 2nd card, cut the marks, and the ground plain. The cards are then laced together in the order of two figuring cards and two ground cards.

Suitable weaving particulars for the fabric represented in Fig. 111 are—2/80's cotton warp, 80 ends per inch ; and 40's cotton ground weft with 80 ground picks per inch ; while the counts of the extra weft may be varied from the equivalent of 40's to 20's cotton according to the desired prominence of the figure. In designing an extra weft figure solid the counts of the point-paper is decided by the relative number of ends per inch to figuring picks per inch. In the 1-and-1 and 2-and-2 arrangements the number of extra picks and ground picks per inch are the same, therefore the counts of design paper for the design C, with the foregoing particulars, is as 80 ends : 80 picks $= 8 \times 8$.

One-and-Two Wefting. — The 1-and-2 order of introducing the extra weft is more economical than the 1-and-1, but with the same number of ground threads per inch the extra weft requires to be thicker, and the figure should usually be more massive. Assuming that the figure given at C in Fig. 112 is required to be produced in the 1-and-2 order, and that the ground threads per inch are as before, the extra picks per inch will be 40, and the counts of the point-paper as 80 ends : 40 picks $= 8 \times 4$. To correspond with C the solid plan will then be as indicated at F, and the complete structure as shown at G, in Fig. 112.

Two-and-Four Wefting. — In the 2-and-4 order of wefting, a similar appearance could not be given to the figure shown at F in Fig. 112, although the proportion of extra picks to ground picks is the same as in the 1-and-2 order, because the splitting of the figuring picks in pairs would be too pronounced. When the 2-and-4

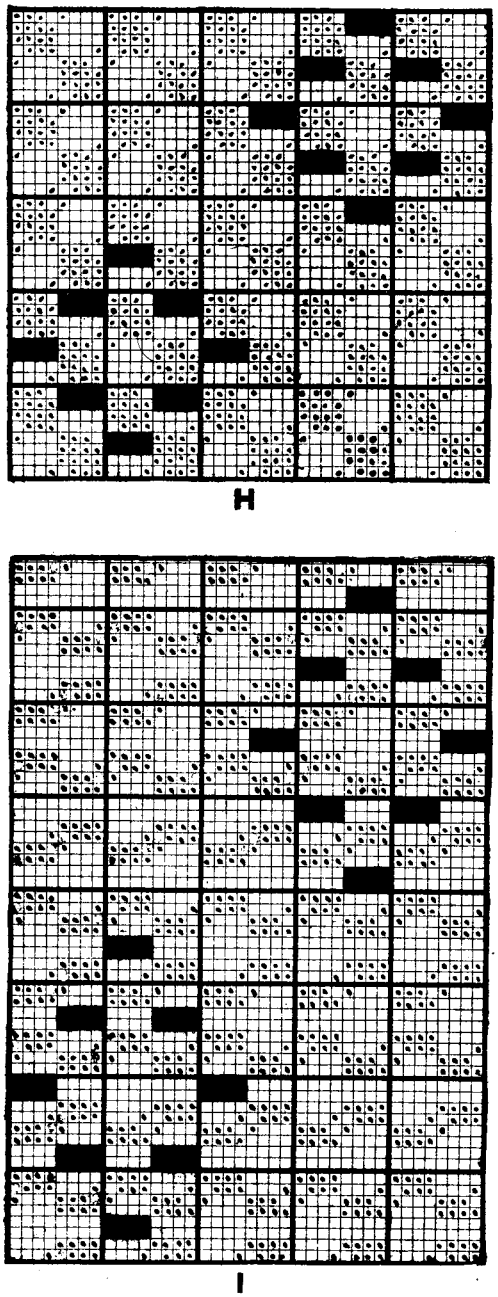


Fig. 115.

arrangement is employed it is preferable to adapt the form of the figure to the wetting order, in the manner illustrated by the pattern represented in Fig. 114, which is a spotted vesting style. In the corresponding design given at H in Fig. 115, and the complete structure shown at I, the full squares show where the extra weft floats on the surface, while the dots represent the ground weave, which is a modified hopsack.

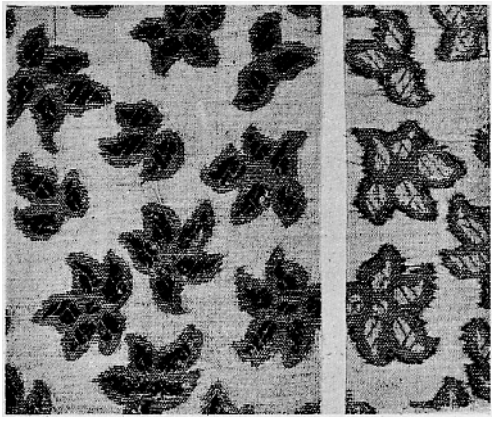


Fig. 116.

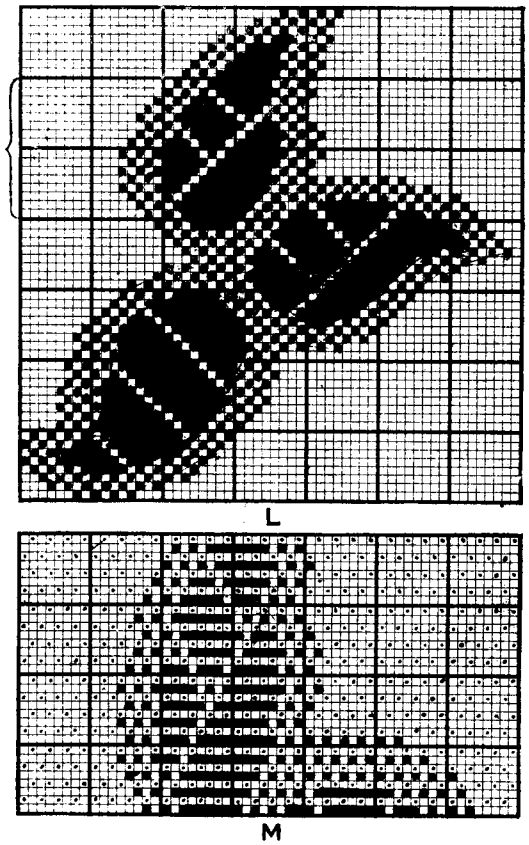


Fig. 117.

Selection of Suitable Positions for the Figuring Floats.—Fig. 115 illustrates an important principle in extra weft spotting—viz., the selection of suitable positions for the figuring floats in relation to the ground weave. It will be noted in the plan I that the extra weft spots are formed in the centre of the warp floats in the ground, so that the best possible conditions are secured for showing the figuring floats prominently on the surface. It is necessary to avoid covering the figuring floats by adjacent ground weft floats (which would have occurred in the example if they had been placed four ends to the right or left) as much as possible.

Extra Material Cut Away.—In the example given in Fig. 116 the figure is formed in extra weft on a plain transparent ground texture, which necessitates that the extra material be cut off on the underside. The face of the cloth is represented on the left and the underside on the right of Fig. 116. In order to avoid the liability of the severed picks fraying out, the extra weft is interwoven in plain order at the sides of the figuring floats, but

as this causes the shape of the figure to be modified, the plain interweaving is shown extended completely round so as to produce an opaque outline between the weft figure and the thin ground texture. More plain weave is shown than is really necessary to bind the figuring floats, the idea in this case having been to form distinct shapes upon which to develop the figure.

The plan L in Fig. 117 illustrates the method of indicating the design upon point-paper. The figure is first painted in solid, then weaves are inserted for the purpose of developing it, and to stop long weft floats, after which the plain binding is indicated round the figure. The complete structure of the portion of L indicated between brackets is shown at M in Fig. 117; while N in Fig. 118 shows how the last extra pick of M and the ground pick on each side interweave with the ends 15 to 34.

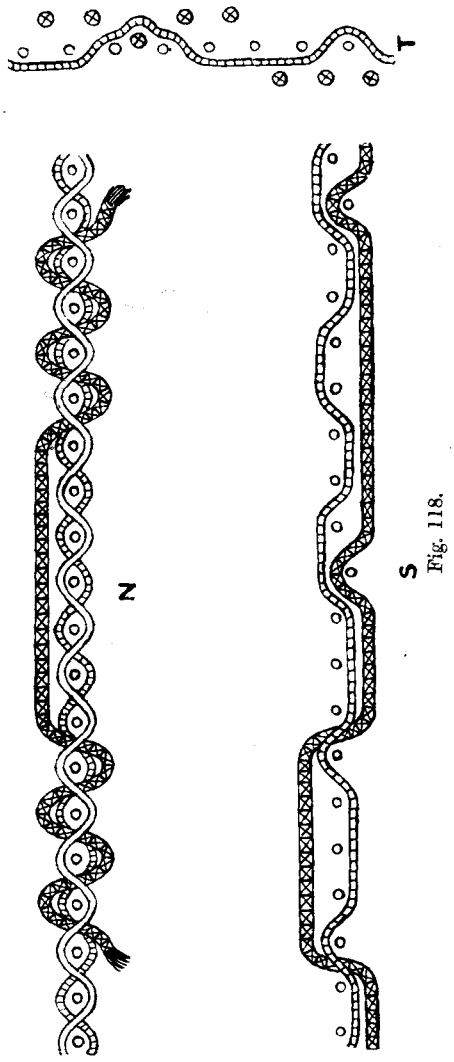


Fig. 118.

Extra Weft Stitched In.—The example given in Fig. 119 and the corresponding plans in Fig. 120 illustrate the principle of stitching in the extra weft on the underside of the cloth in places where it is not required for forming figure. For fabrics in which the additional weight is not objectionable, the method is useful, since the binding in of the extra weft gives greater substance to the cloth. The ground weave is 2-and-2 twill, and the picks are inserted continuously in the order of 1 extra, 1 ground. Q in Fig. 120, which corresponds with a portion of the design, illustrates the system of painting in the figure, and shows how the stitches are indicated; while R represents the complete structure of the bracketed portion of Q. In Fig. 118 a sectional drawing is given at S, which shows how the picks 20 and 21 interweave with the ends 17 to 36 of R; and, similarly, T shows how the twentieth end interweaves with the picks 17 to 32 of R. In the drawings the extra picks are shown larger in diameter than the ground threads.

In arranging the positions of the stitches the system is similar to constructing the backing weave of a weft-backed fabric (see Chapter I)—that is, the end on which a weft stitch is made should be down on the ground picks which precede and succeed the stitch. Thus in R, Fig. 120, each stitching mark is preceded and

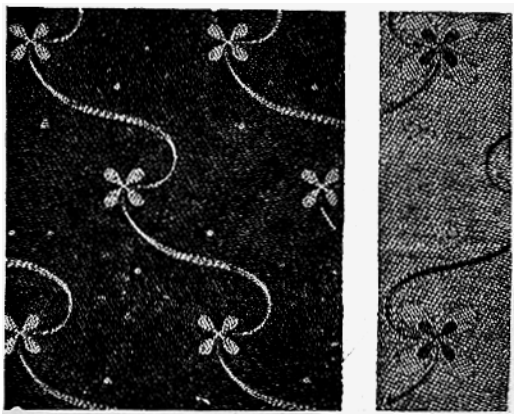
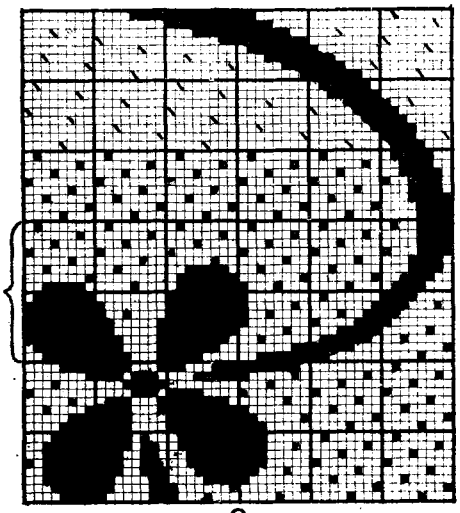
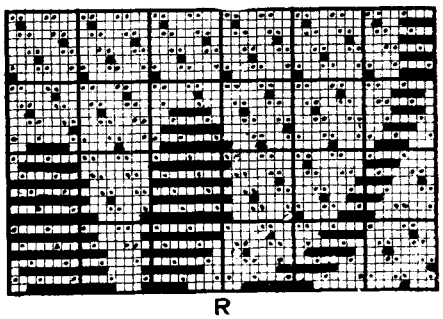


Fig. 119.



Q



R

Fig. 120.

followed by a ground weave mark, the effect of the arrangement being clearly shown in the sectional drawings given at S and T in Fig. 118.

Generally the ground weft floats will close together and effectively conceal the binding points, but if the figuring weft is much thicker than the ground weft there is a liability of the stitches forcing the ground picks apart and showing on the surface, particularly if there is a strong colour contrast between the figuring weft and the ground. In such a case the stitches should be as infrequent as possible, in order that the extra picks will hang loosely on the back. For the purpose of illustration, two methods of stitching the 2-and-2 twill are given at Q in Fig. 120. The 16-thread sateen order, shown in the upper portion of the plan is more suitable if the stitches are liable to show on the surface, and the 8-thread sateen order indicated in the lower portion, for giving a firmer and more satisfactory back to the cloth. In a figured fabric the production of a firm back is not so important as in a backed cloth, and as there is usually greater contrast in the colours of the respective weft yarns, a looser order of stitching is generally employed in extra weft-figured cloths than in backed cloths.

Modification of Ground Weave.—The continuation, under the figure, of a ground weave in which the weft passes over two or more ends, is sometimes not satisfactory, because the ground weft floats tend to cover up the figuring floats, and cause the edges of the figure to appear indistinct. In such a case the ground weave should be changed to warp surface under the figure, as shown at R in Fig. 120, in which the 2-and-2 twill is changed to 1-and-3 twill. The

warp surface shows up the figure distinctly, but the system makes it necessary for all the ground cards to be cut from the design, whereas they can be repeated when the ground weave is continued under the figure.

Intermittent Extra Weft Figuring.—The fabric represented in Fig. 121 illustrates the principle of introducing the extra weft in intermittent order with the ground weft, for the purpose of producing a detached spot effect. The ground weave is a compound of several weaves arranged in check form, and where the extra weft is introduced it is arranged in 2-and-2 order with the ground weft. The face of the cloth is shown on the left and the underside on the right of Fig. 121. In the corresponding plan given at C in Fig. 122 the shaded marks indicate the ground weave, and the solid black marks between the picks the position of the extra weft figure and the stitches. This method of indicating the design is convenient, since it enables the figure and the stitches to be readily placed in the best possible relation to the ground weave, while any ground weave marks that are liable to detract from the clearness of the spots are easily seen and removed. Also the cards can be cut, or the draft and pegging plan be prepared, directly from the condensed plan. D in Fig. 122 shows the complete structure of the picks 1 to 16 of C, the circles against the extra weft floats indicating ground weave marks, which may, with advantage, be taken out. (A spotted gauze effect is shown in Fig. 262.)

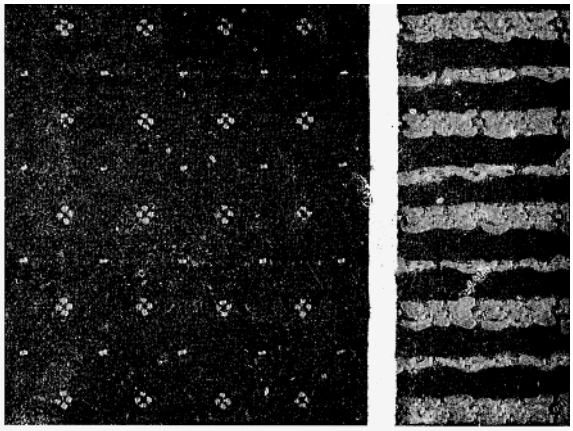


Fig. 121.

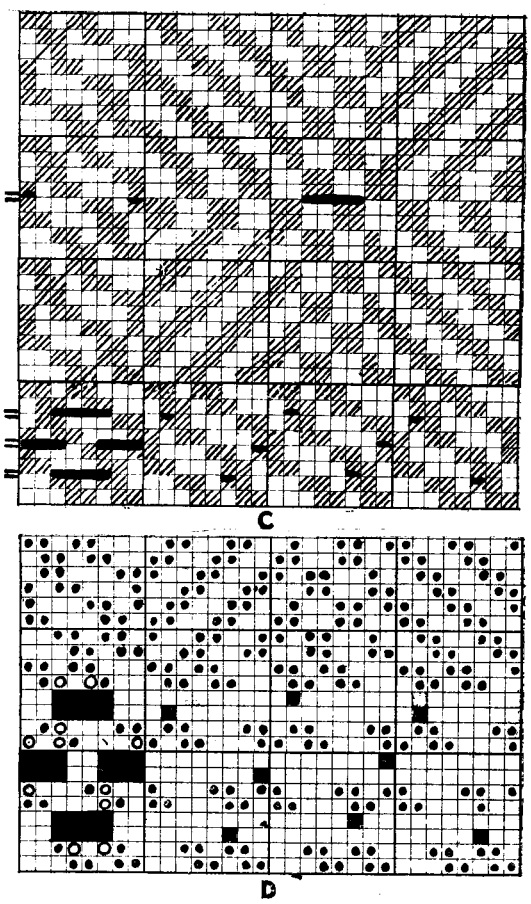


Fig. 122.

Compared with a continuous order of introducing the extra weft, an intermittent order is economical, both as regards the productiveness of the loom and the quantity of extra material which is required. The weaving of the cloth, however, is more complicated, since the boxing and take-up motions require to be regulated in accordance with the irregular order of wefting; while if odd picks of extra weft are introduced the picking is also more complex. The best arrangement consists of manipulating the boxing, picking, and take-up motions from the shedding mechanism, with which they are thus kept in unison.

Fig. 123.

Combination of Ground Weft Figure and Extra Weft Figure. — Fig. 123 shows the face and back of a cloth in which an intermittent extra weft figure is combined with a figure formed by the ground weft; while the sectional design, given in the upper portion of Fig. 124, shows the most convenient method of indicating such a style on point-paper. All the figure is painted in solid, the ground weft figure in one colour (represented by the full squares), and the extra weft figure in a second colour (represented by the crosses). The 5-thread warp sateen ground weave is then indicated in the same colour as the ground figure, except where a third colour is employed (represented by the dots) to show where the extra weft is stitched in on the back. White may be used for stopping the floats of the figure.

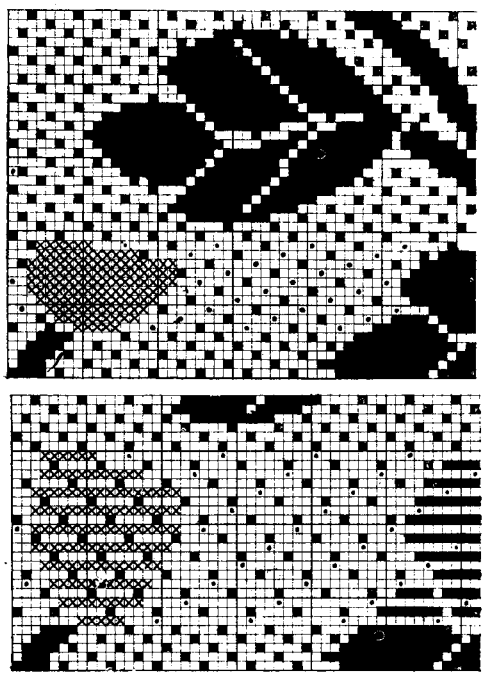


Fig. 124.

From each horizontal line where the extra weft is indicated, two cards are cut as follows:—(1) For the extra pick, cut all but the crosses and the dots, and continue the binding weave under the ground weft figure. (2) For the ground pick, cut all but the full squares and the dots, and continue the 4-and-1 ground weave under the extra weft figure. The complete structure is then as shown

in the sectional plan in the lower portion of Fig. 124, where the picks 1 to 20 of the solid plan are represented in full.

Stitching by means of Special Ends.—The method of binding in the extra weft on the underside by means of a special stitching warp is illustrated by the fabric represented in Fig. 125, and the corresponding examples given in Fig. 126. The ground of the cloth is 2-and-2 twill, and the following are the weaving particulars :—

Warp : 2/56's green botany worsted. 72 ends per inch.
Weft : 1 pick 30's green botany worsted (ground).
1 pick 12's soft spun brown worsted (figuring).
64 ground picks and 64 extra picks per inch.

In this case the purpose of binding in the extra material where no figure is formed is to give substance and softness of handle to the cloth. There is such a great differ-

Fig. 125.

ence, however, in colour and thickness between the figuring and ground wefts, that in the ordinary method of binding (illustrated in Fig. 120) the stitches would be very liable to force the finer ground picks apart and show on the surface. The binding is therefore effected by the warp, every ninth thread of which is employed as an extra thread for the purpose, as shown in the sectional plan given at A in Fig. 126. In the plan the crosses indicate where the binding ends are left down ; the diagonal marks where the ground weft passes over the ground warp in 2-and-2 twill order ; and the full squares where the figuring weft is on the surface. The binding ends are down on all the figuring picks, and are raised alternately on every fourth ground pick. B in Fig. 126 represents the interlacing of the second ground pick and the second figuring pick of A. In the ground portions of the fabric the figuring weft lies between the extra warp threads and the ground texture. The interweaving of the stitching warp with the ground picks is invisible on the surface of the cloth because it is of the same thickness and shade as the ground warp, and at each binding place it lies between two ground-warp floats.

C in Fig. 126 shows the method of designing the figure on point-paper. As the extra threads, which are used for binding, interweave in exactly the same order throughout, they can be operated by two healds placed in front or behind the harness. The cards for the ground picks can be obtained by repeating; hence, in working out the design on point-paper it is only necessary to consider the interweaving of the figuring picks with the ends which are drawn through the harness. The figure is therefore painted in solid, and the long weft floats are stopped by inserting suitable weaves, as shown. The card-cutting particulars are: Cut all but the weft figure.

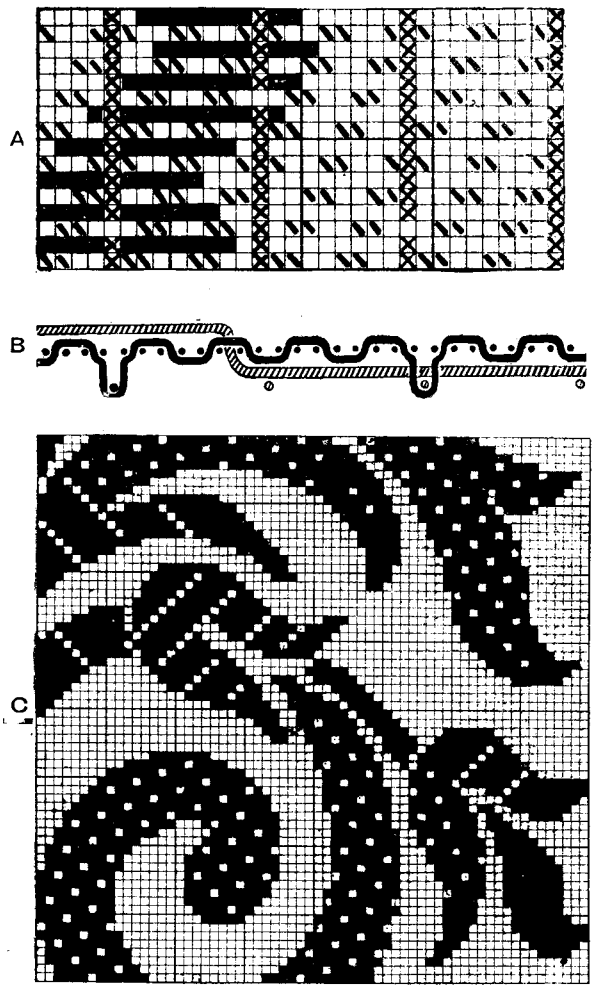


Fig. 126.

Figuring with Two or more Colours of Extra Weft.—When a figure is required in two or more colours of extra weft, it is most economical to so arrange the design that there are never more than one colour employed for figuring in the same horizontal line of the fabric. The type is illustrated in Fig. 127, which shows the face and back of a cloth in which an intermittent figure is developed in gold and white extra wefts; the portion formed by the white weft commencing immediately that formed by the gold weft is completed. Only the same weight of extra material is thus required as for a figure of the same size in one colour of extra, but the boxing plan is rather more complex.

A in Fig. 128 illustrates the principle of indicating such a figure on design paper, the full squares representing one extra colour and the crosses the other, while the dots show additional figure formed by the ground weft. B shows the complete structure of a portion of A, with the extra weft stitched between the ground weft figuring floats. The order of wefting is as follows:—

4 picks ground.
1 pick first extra. } 10 times.
1 „ ground. }
1 „ second extra. } 6 times.
1 „ ground }
8 picks ground.

Continuous Figuring with Two Extra Wefts.—Fig. 129 represents the face and back of a cloth in which a continuous figure is developed in two colours of extra weft, a pick of each being introduced regularly with each pick of the ground weft. Assuming that the number of ground picks per inch is the same as the number of ground ends, the figure may be painted solid in two colours on 8 × 8 design paper, as indicated at A in Fig. 130. The full squares represent one colour of extra, and the crosses the other colour, each horizontal space on the paper being equivalent to three picks, of which one is a ground pick. B in Fig. 130, shows a portion of the complete structure which results from cutting each horizontal space of A as follows :—First card, cut all but the full squares ; second card, cut all but the crosses ; third card, cut plain. C shows the corresponding structure, assuming that the wefting order is arranged 2-and-2 to fit a loom with changing boxes at one end only.

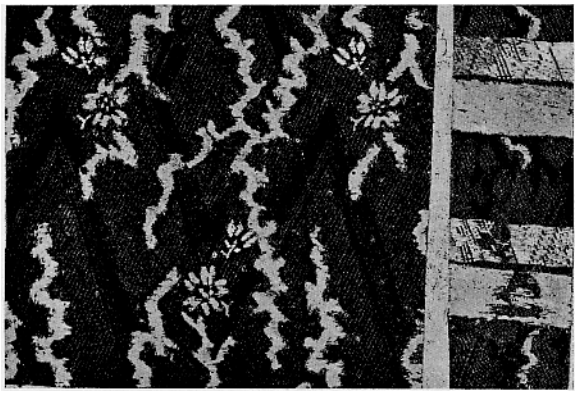


Fig. 127.

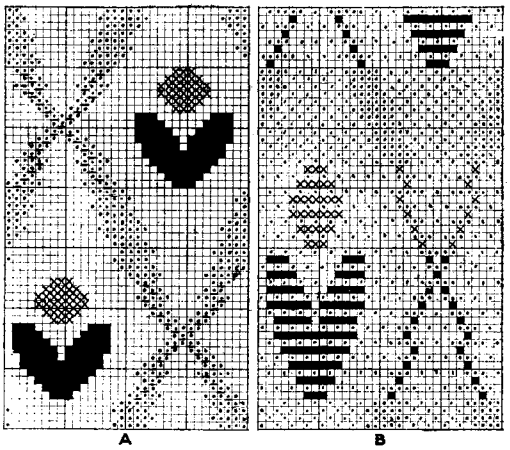


Fig. 128.

A more productive and economical method of introducing the two extras continuously consists of doubling each extra, and wefting in the order of 1 double-pick—first extra ; 1 ground ; 1 double-pick—second extra ; 1 ground ; as shown at D in Fig. 130. The figure, however, is not so solid, and it is necessary to note that with an equal number of ground ends and picks per inch, 8 by 4 paper will be required in painting the design solid, since there are two ground picks to each double pick of each colour.

Pick-and-Pick Figuring.—A class of extra weft fabric is used for trimmings, and for tapestry and upholstery purposes, etc., in which no separate ground weft is employed in forming the foundation. All the wefts are floated on the surface as required in producing the figure, but each also assists in making the ground structure. Fig. 131 represents a cloth in which the figure is formed in two colours of weft—woven pick-and-pick—upon a sateen foundation, which is produced by the two wefts interweaving with the warp. The following are suitable weaving particulars for a tapestry cloth :—Warp, 60/2 spun silk, 180 ends per inch. Weft, 50/2 spun silk, 180 picks per inch.

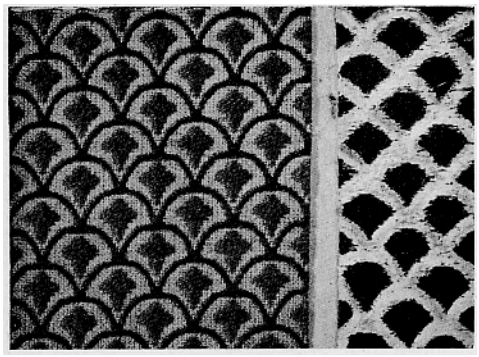


Fig. 129.

A in Fig. 132, which corresponds with a portion of Fig. 131, illustrates the system of constructing the point-paper design. The figure is painted in solid in two colours to represent the different wefts, and the ground is indicated in a third colour; while it is convenient to use white in binding the floats of the figure. Each horizontal space corresponds to a pick of each colour, and the counts of the design paper is therefore in the proportion of the number of ends per inch to the number of picks per inch of each colour, or 8×4 with the foregoing particulars. Two cards are cut from each horizontal space, as follows :—

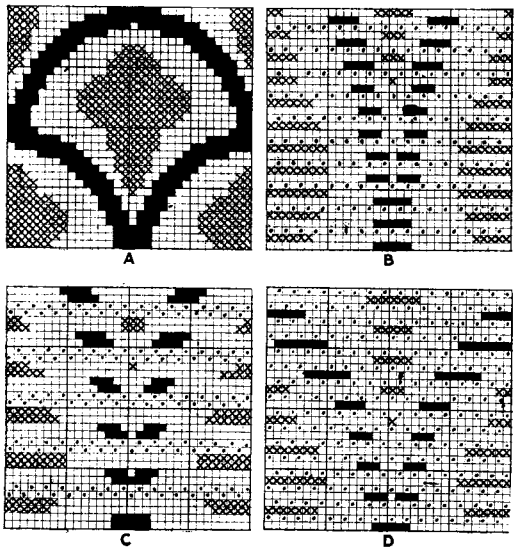


Fig. 130.

First card : Miss the marks of the first colour and the ground marks, and cut the marks of the second colour plain.

Second card : Miss the marks of the second colour and the ground marks, and cut the marks of the first colour plain.

The effect of the cutting is illustrated at B in Fig. 132, which shows the full weave of the picks 1 to 12 of A. It will be seen that the ground weave is 8-sateen—two picks in a shed, while where one weft is floated on the surface, the other weft forms plain weave underneath. The warp threads are usually so finely set in these cloths

that the weft intersections in the ground have scarcely any effect upon the solidity of the warp colour.

If it is necessary to insert the weft colours in 2-and-2 order, on account of the loom being provided with changing boxes at one end only, the system of cutting the design given at A in Fig. 132 will be the same as before but in the following order :

Odd horizontal spaces—
- First card : cut for the first colour.
- Second card : cut for the second colour.

Even horizontal spaces—
- First card : cut for the second colour.
- Second card : cut for the first colour.

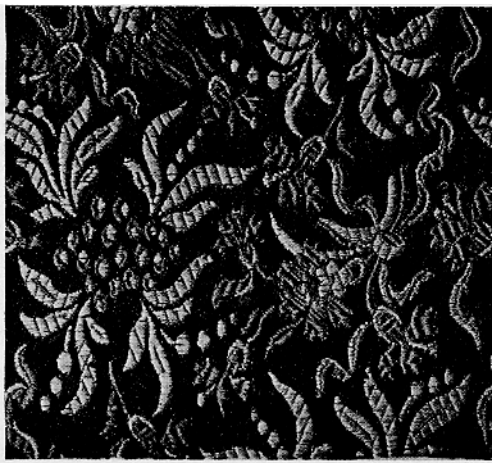


Fig. 131.

The cards are arranged to coincide with the 2-and-2 order of wefting, and the 8-sateen ground weave then produces the structure shown at C in Fig. 133, in which the weft intersections are two in a shed.

Methods of indicating Pick-and-Pick Ground Weaves. — A number of ground weaves, which are used in the pick-and-pick system of figuring, are given at D to L in Fig. 133. A fine warp-rib ground is formed by employing plain ground weave, as shown at D, the cutting of two cards from each space producing a 2-and-2 warp-rib structure, as indicated at E.

The ground weave given at F is based upon 5-sateen weave, but two colours are represented by the solid marks and crosses, each of which is in 10-sateen order. The idea in this case is to interweave one weft more firmly than the other, which is effected by cutting the ground weave as follows :—

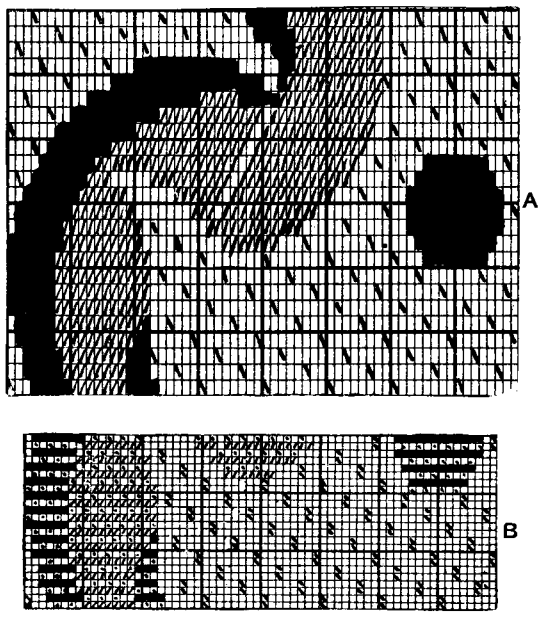


Fig. 132.

First card : Miss only the full squares.
Second card : Miss both marks.

The complete ground weave is shown at G in Fig. 133, in which it will be seen that the odd picks float in 9-and-1 order on the back, and the even picks in 4-and-1 order. The longer float of the odd picks causes them to stand out behind the even picks on the underside of the cloth, and as they interweave with the warp in the same shed as the even picks they are prevented by the latter from showing on the surface. The method enables a weft which is thicker, or in stronger colour contrast with the warp than the other, to be thrown chiefly to the back in the ground, so

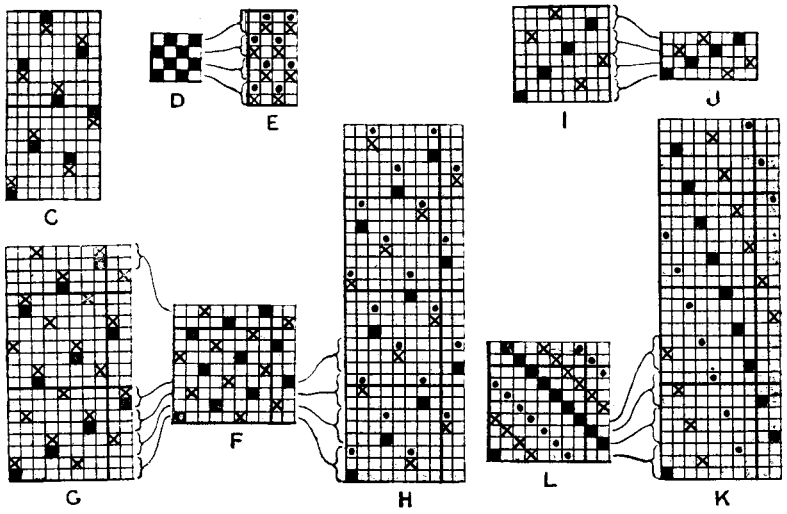


Fig. 133.

that the solidity of the warp colour is affected as little as possible. Other sateens can be arranged in the same manner as the 5-sateen.

If three colours of weft are employed—a pick of each alternately—the system of marking, shown at F in Fig. 133, will enable two of the wefts to be thrown more to the back than the third, by cutting as follows :—

First card : Miss only the full squares.
Second card : Miss only the crosses.
Third card : Miss both marks.

The corresponding complete weave is given at H.

The preceding system of indicating and cutting sateen-ground weaves is liable to produce warp floats that are too long when the cloth contains only a comparatively few picks per inch. In such a case firmness can be obtained by changing the weft intersections on succeeding picks, as in the ordinary method of weaving sateens. The ground weave is then indicated on the solid plan in such a manner that two or more picks of the sateen weave can be cut from each horizontal space. The method will be understood by comparing I with J in Fig. 133 ; I shows the ordinary 8-sateen weave formed by two wefts, while each horizontal space of J includes the marks upon two consecutive picks of I. In the same manner K shows the full 10-sateen weave formed by three wefts while each horizontal space of L includes the marks upon three picks of K. The card cutting particulars which

will form the 10-sateen ground weave in three wefts from the marking indicated at L, are as follows :—

First card : Miss the solid marks.
Second card : Miss the crosses.
Third card : Miss the dots.

However many wefts are employed in forming a design, the figure is painted in solid in different colours to represent the separate effects, as shown at A in Fig. 132, and as many cards are cut from each horizontal space as there are figuring colours indicated upon it. Suitable weaves are inserted on the figure to develop it and to stop long weft floats. For the purpose of illustration, the method of designing a three-colour effect is shown at M in Fig. 134, while N represents how the threads are interwoven by cutting three cards from each horizontal space of M as follows :—

First colour : Miss the solid marks (figure) and the circles in the ground, and continue the ground weave where the other colours form figure.

Second colour : Miss the crosses (figure), and the circles and crosses in the ground, and cut the first and third figuring colours plain.

Third colour : Miss the dots in both figure and ground, cut the second figuring colour plain (the crosses), and continue the ground weave where the first colour forms figure (the full squares).

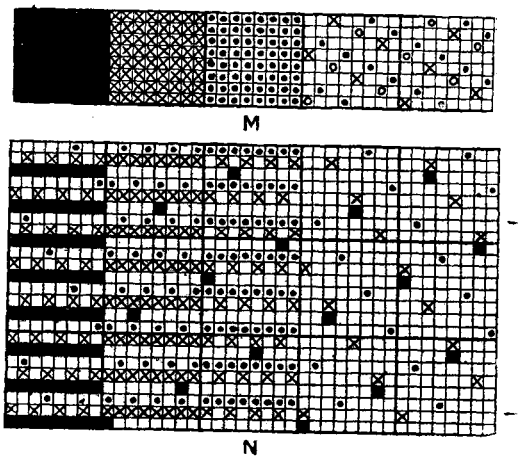


Fig. 134.

From an examination of N it will be seen that the first figuring colour floats in 15-and-1 order on the underside, except where it forms figure, while the third figuring colour floats in 7-and-1 order in the ground and under the figure formed by the first colour. Plain weave is formed by the second colour under the figure formed by the first and third colours, and by the third colour under the figure formed by the second colour. In the ground 8-sateen weave is formed by the second and third colours together, and the first colour is stitched on alternate ends in the same shed as the second colour. (The method of designing for multiple-weft figured fabrics in a split harness mount is illustrated at E, F, and G in Fig. 189).

Pick-and-Pick Weave Shading.—A fabric is represented in Fig. 135 in which different degrees of light and shade are formed by means of weave shading, in a pick-and-pick order of wefting. The warp is white, while the weft is arranged 1 pick green, and 1 pick white. Similar weaves to those employed in the cloth are given in full in Fig. 136, in which the solid marks represent the green weft floats, and the dots the white weft floats. A portion of white weft figure, under which the green weft interweaves in plain order, is produced by section A. In section B a

white surface is formed by the white weft interweaving in plain order with the white warp, the green weft floating on the back in 7-and-1 order. Section C is in slight colour contrast to section B, as the green weft interweaves in plain order with the white warp, so that a mixed green and white surface is formed, under which the white weft floats in 7-and-1 order. In section D, above a plain white foundation formed by the interweaving of the white weft with the white warp, the green weft is passed in gradually increasing lengths of float, so that the white surface gradually merges into a green surface. Section E shows the weave which is used in forming a solid white ground, the white warp interweaving in 8-sateen order with the white weft, and in 16-sateen order with the green weft. As in the previous examples, the design can be painted in such a manner that two cards—one for each colour of weft—may be cut from each horizontal space.

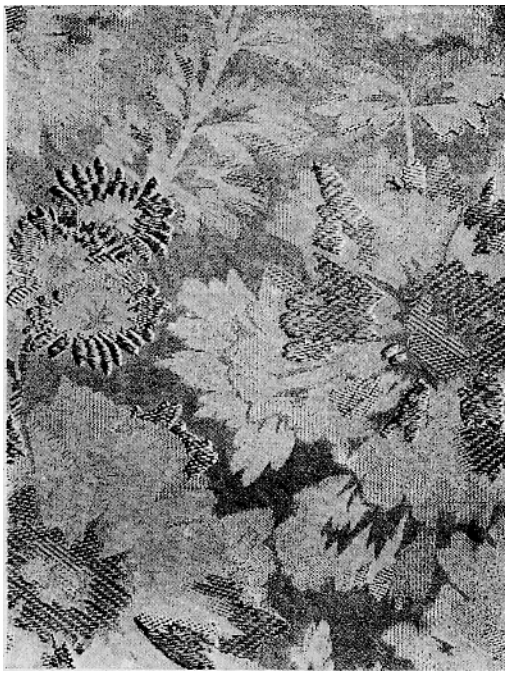


Fig. 135.

Pick and Pick Reversible Tapestry Style.—A perfectly reversible fabric, which is figured in two colours of weft arranged in pick-and-pick order, is represented as viewed from opposite sides, in Fig. 137. Where one weft forms figure on one side, the other weft forms a similar figure on the other side; also the ground weave (a warp rib) is the same on both sides. The style of structure is particularly suitable for use as a hanging fabric.

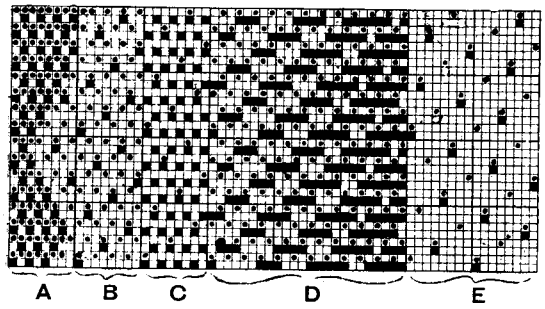


Fig. 136.

A portion of the design is given in the upper portion of Fig. 138, in which three different kinds of marks are indicated; one for each weft where figure is formed, and the third for the ground weave. The figure is painted to fit with plain ground, and a few threads of plain weave are inserted all round. Then, in order that the floats on the underside will be exactly the same as on the surface, a ground weave mark is inserted on the right-hand edge of each float of figure. Two cards are cut from each horizontal space of the design, as follows:—First card, cut blanks and crosses; second

card, cut blanks and solid squares. The complete structure is then as shown

Fig. 137.

in the sectional plan given in the lower portion of Fig. 138, in which it will be noted that the plain weave at the edges of the figure in the solid design produces 2-and-2 warp rib, while the 2-and-2 warp-rib ground is changed to 4-and-4 warp rib. A similar reversible figure, upon the 2-and-2 rib ground shown at E in Fig. 133, can be produced without the ground weave being indicated by simply painting the figure solid in two colours, but the plain edge of one colour requires to be opposite to that of the other colour. The ground is cut plain in reverse order on the two cards that are cut from each horizontal space.

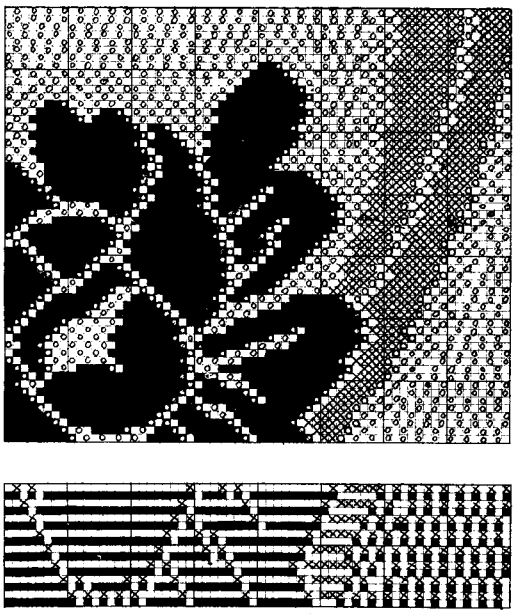


Fig. 138.

Multiple Weft Persian Style of Figuring. — Fig. 139 illustrates a Persian style of texture in which a figure is produced in three colours

of weft, while a fourth colour is formed in the ground by the warp. The following are suitable weaving particulars :—

Warp.

All 2/80's dark green cotton. 100 threads per inch.

Weft.

1 pick 30's soft spun white cotton.
1 pick 30's soft spun gold cotton.
1 pick 30's soft spun brown cotton. 150 picks per inch.

The surface of the cloth is almost entirely covered by the figuring floats of the three wefts, and a feature of the example is that the weft floats are not bound in by the warp on the back of the cloth, except in odd places where one of the wefts is used to stop long warp floats in the ground.

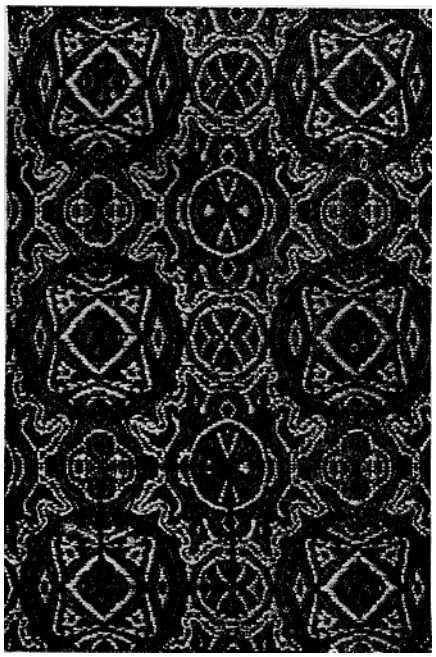


Fig. 139.

The method of drafting the style is illustrated in Fig. 140, in which it will be seen that the design is arranged in such a manner that each weft changes from one side of the cloth to the other very frequently, so that long floats on the back are avoided. Three cards are cut from each horizontal space of the design, as follows :—

First card (white weft) : cut all but the full squares.
Second card (gold weft) : cut all but the dots.
Third card (brown weft) : cut all but the diagonal strokes.

Chintzing. — In all the preceding styles of extra weft figuring more colours of weft can be introduced than there are series of extra threads employed, by "chintzing"—that is, by replacing one colour with another in succeeding horizontal sections of a design. The manner in which the different colours are required to be brought to the surface in forming the design determines the order of wefting, and for economical reasons as few colours as possible should be employed in each horizontal line. The figuring wefts may be inserted in very diverse orders—*e.g.*, a regular order of wefting may be employed, but with all the wefts chintzed ; or one weft may form figure regularly, while another, which is inserted either continuously or intermittently, is chintzed. Examples of chintzed effects are given in Figs. 309 and 313.

Reversible Weft-Face Figured Fabrics.—These cloths are chiefly used for shawls, wraps, dressing-gowns, and rugs, a considerable trade being done in the last type of cloth with the natives of Africa and other countries. The weave is the same in

every part of the cloth, and a weft surface is produced on both sides. The design is due to the manner in which differently-coloured wefts are interchanged from one

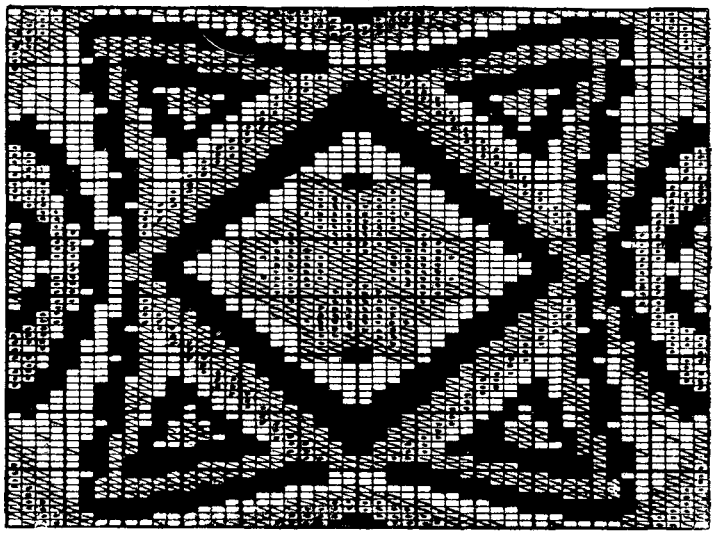


Fig. 140.

side to the other, a dark figure on a light ground on one side corresponding with a light figure on a dark ground on the other side. This is illustrated by the fabric represented in Fig. 141, in which the reverse side of the cloth is shown in the bottom

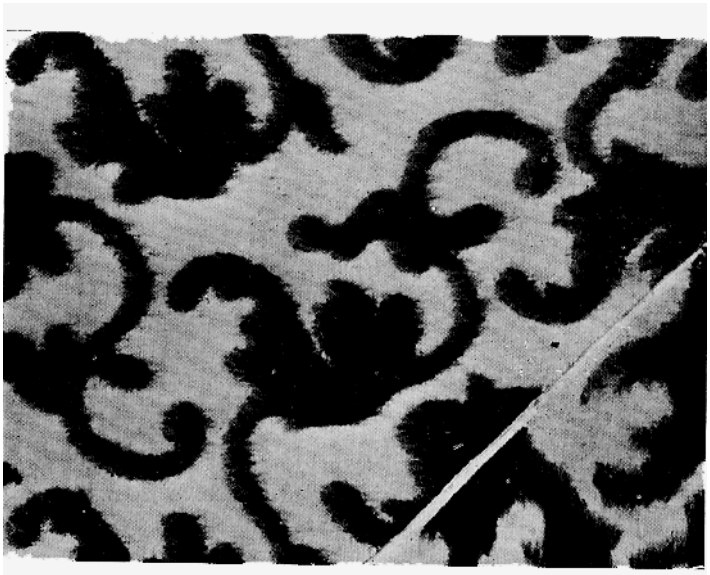


Fig. 141.

left-hand corner. A portion of the corresponding design is given in Fig. 142. Generally, the wefts should be brought about equally to the surface on both sides

in order that one side will not appear darker than the other, this being particularly the case when the cloth is seen on both sides at the same time. A raised finish is applied alike to both the back and face, and when woollen weft is used the shrinkage in width ranges from 15 to 30 per cent. The warp is almost invariably cotton, and suitable weaving particulars for a heavy double-weft fabric in a 4-thread weave are :—2/20's cotton warp, 24 ends per inch, and 96 yards per ounce woollen weft, 48 picks per inch ; and for a lighter cloth : 2/30's cotton warp, 36 ends per inch, and 16 yards per dram woollen weft, 72 picks per inch. The felted and raised finish causes the cotton ends to be entirely concealed, and gives a full soft feel to the cloth. Cheap cloths are made entirely of cotton, the flannelette class of weft being used, which is generally inserted in even picks, and the following weaving particulars are suitable :—

Warp, 16's cotton, 48 ends per inch.
Weft, 12's cotton (soft spun), 84 picks per inch.

The weaves for the figure and ground are constructed upon the same principle as the weft-backed designs illustrated in Figs. 6 and 7 (p. 7), and as shown in Fig. 143, in which the most commonly used reversible plans are given. Both A and B in Fig. 143, in which the marks indicate weft, show the double-face 3-and-1 weft twill weave, but in A the odd picks are on the surface and the even picks on the back; whereas, in B the odd picks are on the back and the even picks on the surface. If, therefore, the picks are arranged 1 dark, 1 light, weave A will produce a dark surface and a light back, and weave B a light surface and a dark back. By combining the two weaves in sections the wefts interchange between the face and back, and a design in two colours is formed, as represented in the diagram C in Fig. 143, which shows the interlacing of the picks 1 and 2 of A and B in combination.

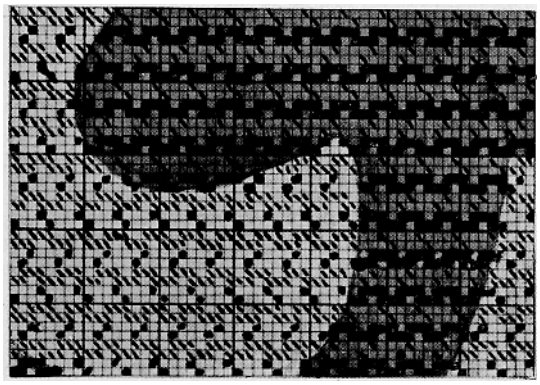


Fig. 142.

D and E in Fig. 143 show the 4-thread, and F and G the 5-thread weft sateens made double face in the same manner as A and B, while H and I illustrate the construction of the double-face 4-sateen weave to fit with a 2-and-2 order of wefting. Other weft-face twill and sateen weaves can be similarly arranged, but, as a rule, a sateen produces a smoother surface, and is therefore more suitable for the raised finish than a twill weave upon the same number of threads. As in weft-backed cloths the chief point to note in each weave of a pair, is that the intersections of the back picks occur between face-weft floats.

Fig. 142, which corresponds with a portion of Fig. 141, illustrates the method of painting out a design in full. The double-face 4-thread weft sateen weaves are combined, and the order of wefting is 2 dark, 2 light. The figure is indicated lightly in a wash of colour, then, in order to produce a dark figure upon a light ground,

the weave H in Fig. 143 is indicated in the figured portions, and the weave I in the ground. As the design shows the complete interlacing of the threads, one card is cut from each horizontal space, and the cutting particulars are : Cut all but the weave marks.

Simplified Methods of Designing.—It is a tedious process to paint out a design in full, and in most cases a method can be employed which enables a card for each colour of weft to be cut from each horizontal space, the designing of a figure being then much simpler. For instance, in combining the weaves given at A and B in Fig. 143, the method illustrated in the upper portion in Fig. 144 can be adopted. The figure is indicated by a wash of colour, and 1-and-3 twill is inserted upon both the figure and the ground ; or design paper with the 1-and-3 twill printed upon it is used, in which case the twill marking is not required. Two cards are then cut from each horizontal space as follows :—

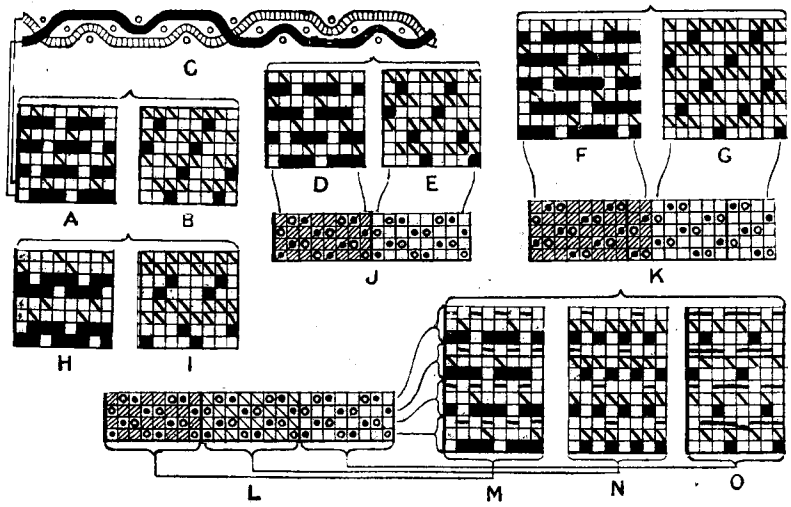


Fig. 143.

On odd horizontal spaces—First card, cut the marks in the figure, and the marks and even threads in the ground ; second card, cut the marks and even threads in the figure, and the marks in the ground.

On even horizontal spaces—First card, cut the marks in the figure, and the marks and odd threads in the ground ; second card, cut the marks and odd threads in the figure, and the marks in the ground.

The result is the same as if the weaves A and B had been indicated in full, as will be seen from an examination of the lower portion of Fig. 144, which shows the complete structure of the first four horizontal spaces of the solid design. In painting a design in full the design paper requires to be ruled in the proportion of the ends per inch to the total picks per inch, and in the simplified method in the proportion of the ends to the picks of each colour per inch. In the heavily-shrunk cloths it is particularly necessary to use design paper which is ruled in the same proportion as the ends are to the picks in the finished cloth.

J in Fig. 143 shows a method of indicating the figure and ground which enables

the weaves D and E to be combined by cutting two cards from each horizontal space, while K similarly represents the combination of the weaves F and G. In both cases each horizontal space is cut twice as follows :—

First card : Cut dots only in the figure, and miss circles only in the ground.
Second card ; Miss circles only in the figure, and cut dots only in the ground.

In the double-wefted cloths only two colours can be brought to the surface in each horizontal line, but more than two colours can be obtained by chintzing. In a pick-and-pick order of wefting, however, a third effect can be formed by combining two weaves such as D and E in Fig. 143 with a third weave, such as H or I, while in a 2-and-2 order of wefting, two weaves, such as H and I, can be combined with a third weave, such as D or E. In each case two of the weaves produce solid effects, whereas in the third the weft colours are intermingled and a subsidiary pattern is formed which can be used to give variety to a design.

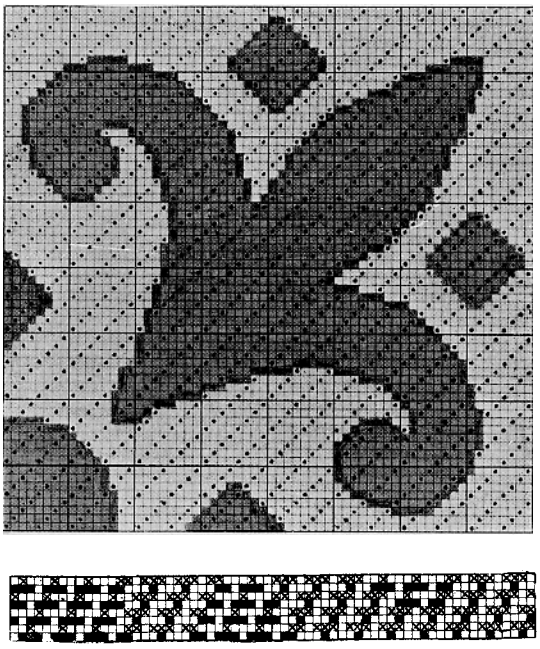


Fig. 144.

In certain low qualities of the woollen-weft cloths the structure is strengthened by the insertion of extra cotton picks at intervals which interweave in plain order with the warp threads. The arrangement may be 4 picks of wool to 1 pick of cotton, or 10 to 2, 12 to 2, etc., plain cards being laced with the figuring cards in the required order. The appearance of the cloth is not altered, but the presence of the cotton picks prevents any tendency of the woollen picks to slip. The production of a loom is, of course, reduced by the insertion of the extra cotton picks.

Treble-Wefted Reversible Fabrics.—The structures are made to a limited extent with three figuring wefts, which enables an effect to be woven in three colours ; while increased weight can be obtained combined with greater firmness, as in the centre the threads may be interwoven more frequently than on the face and back. A figure in two colours on a ground in the third colour may be formed on both sides of the cloth, or one of the wefts may be used to form a solid colour effect on one side of the cloth, while the other two wefts interchange so as to form a figure on the other side.

The plan L in Fig. 143 illustrates a method of indicating a treble-wefted design, arranged a pick of each alternately, in which each weft interweaves on the face, in the centre, and on the back so as to produce a figure in two colours upon a ground

in the other colour, on both sides of the cloth. The weave on the face and back is 4-sateen, and in the centre plain. Three cards are cut from each horizontal space of the plan L, as follows :—

First card : Cut the dots in the first figuring colour ; cut the second figuring colour plain ; and cut all but the circles in the ground.

Second card : Cut all but the circles in the first figuring colour ; cut the dots in the second figuring colour ; and cut the ground plain.

Third card : Cut the first figuring colour plain ; cut all but the circles in the second figuring colour ; and cut the dots in the ground.

The complete weaves to correspond are shown separately at M, N and O in Fig. 143 in which it will be seen that in M the first weft floats 3-and-1 on the face, the second weft floats 3-and-1 on the back, and the third weft weaves plain in the centre. In N the first weft weaves plain in the centre, the second weft floats 3-and-1 on the face, and the third weft floats 3-and-1 on the back. In O, the first weft floats 3-and-1 on the back, the second weft interweaves plain in the centre, while the third weft floats 3 and-1 on the face. A figure formed by the first and second wefts on the face is similarly formed by the second and third wefts respectively on the back, while the third weft forms the ground on the face and the first weft the ground on the back. The plain centre weave gives the cloth great firmness, and may be too firm for a heavily-wefted cloth, and in such a case another weave may be used, such as 2-and-2 twill, or 2-and-2 weft rib. The floats in the centre require to be shorter than those on the face and back in order that they will be invisible on both sides.

CHAPTER VI

EXTRA WARP FIGURING

Comparison with Extra Weft Figuring—Continuous Figuring in one Extra Warp—Heald and Harness Mounting—Alhambra Quilts—Binding in Extra Ends between Face Floats—Intermittent Figuring in One Extra Warp—Drafting and Denting Extra Warp Stripes—Figuring with Two Extra Warps—Stitching by means of Special Picks—Extra Warp Planting—End-and-End Figuring—Reversible Warp-Face Figured Fabrics.

Comparison with Extra Weft Figuring.—In extra warp figuring there are two or more series of warp threads to one series of weft threads, and the method has the following advantages and disadvantages, as compared with the extra weft principle :—

Advantages : (1) The productiveness of a loom is greater because only one series of picks is inserted, and a quicker running loom can be used. (2) No special picking, box, and uptake motions are required. (3) There is practically no limit to the number of colours that can be introduced. (4) In an intermittent arrangement of the extra ends either spotted or stripe patterns can be formed, whereas a similar arrangement in the weft can only be used to form spots (except in special cases) because of the objectionable appearance of horizontal lines.

Disadvantages : (1) Two or more warp beams may be required instead of one. (2) If an ordinary jacquard and harness are employed the point-paper designing

is more difficult ; and a less width of repeat is produced by a given size of machine, because the sett of the harness requires to be increased in proportion to the number of extra ends that are introduced in a design. (3) In dobby weaving the drafts are usually more complicated. (4) Stronger yarn is required for the figure, and the threads are not so soft, full, and lustrous ; extra ends are subjected to greater tension during weaving than extra picks, and, as a rule, there is less contraction in length than in width, and the result is that extra warp effects usually show less prominently than

Fig. 145.

extra weft figures. (5) If the extra threads have to be removed from the underside of the cloth, it is more difficult and costly to cut away extra ends than extra picks. The chief advantage of the warp method is in productiveness, but in order that elaborate designs may be designed and woven conveniently and economically, a more complicated jacquard mount is required than in extra weft figuring.

Continuous Figuring in One Extra Warp.—Fig. 145 represents an extra warp figured fabric, in which the ends are arranged continuously in the order of 1 extra,

1 ground. The example is a style in which the extra ends are floated on the back during weaving, but are cut away in the finishing processes, and the figure is therefore stitched at the edges. The stitches, however, are so arranged that they soften the

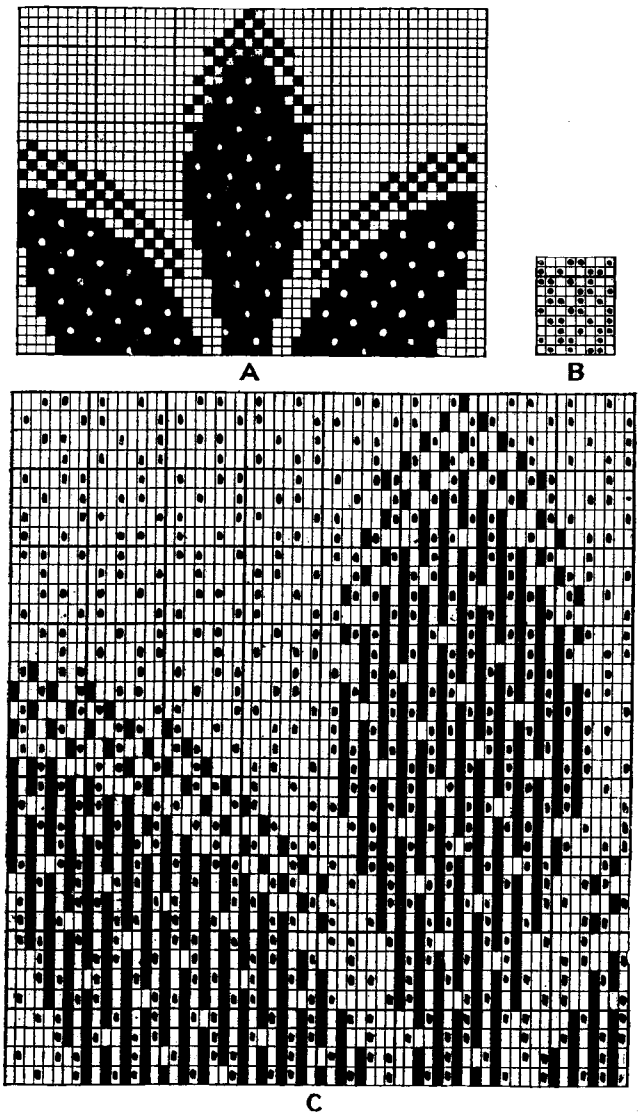


Fig. 146.

outline of the figure, and do not detract from its appearance. A in Fig. 146 shows a portion of the extra warp figure, and B the weave of the ground ends, while C illustrates the method of constructing a point-paper draft of the figure and ground in full for an ordinary jacquard and harness mount. The solid marks indicate the

lifts of the extra ends which are drawn on the odd harness mails, while the lifts of the ground ends are represented by the dots, a crêpe ground weave being formed.

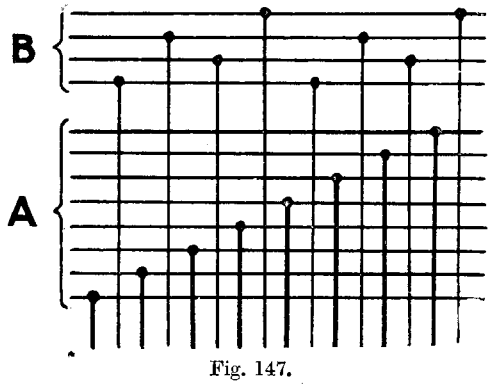


Fig. 147.

The hollow circles in A show a sateen binding weave which is inserted on the figure

Fig. 148.

to stop the long warp floats. In the cloth the ground ends and picks per unit space are equal, so that, including the extra ends, there are twice as many ends as picks

per unit space, and 8 × 4 design paper is therefore suitable in constructing the design in full, as shown at C in Fig. 146.

Heald and Harness Mounting.—One of the simplest modifications of an ordinary jacquard and harness, used in weaving extra warp-figured cloths, consists of mounting healds in front of, or behind, the harness. The figuring ends are drawn on the harness, and the ground ends on the healds, but the method is, of course, only suitable for ground weaves that require a small number of healds. Fig. 147 shows a draft in which four healds B are placed behind the harness A, and can be used for 2 or 4-thread ground weaves. The extra ends can be raised in any desired order by the jacquard, but the use of healds for the ground ends restricts the order in which the latter can be operated; and the foundation weave must be the same under the figure as in the ground spaces. The system, however, enables all the hooks, except a few that may be utilised to lift the healds, to be employed for figuring; while a great advantage is the simplification of the point-paper design, since no regard need be taken of the ground weave. (See also p. 163.)

Alhambra Quilts.—A simple application of the combined harness-and-heald draft is in the manufacture of Alhambra Quilts, in which, as shown in the fabric represented in Fig. 148, a figure is formed in extra warp upon a ground that is ornamented by the extra ends. The figuring ends, which are much thicker than the ground ends (or are woven 2 or 3 per mail), are floated boldly on the surface in forming the figure, while the ground ends interweave in plain order. Substance is given to the cloth by the weft which is very thick and soft spun. The following are suitable weaving particulars of a medium quality of cloth :—

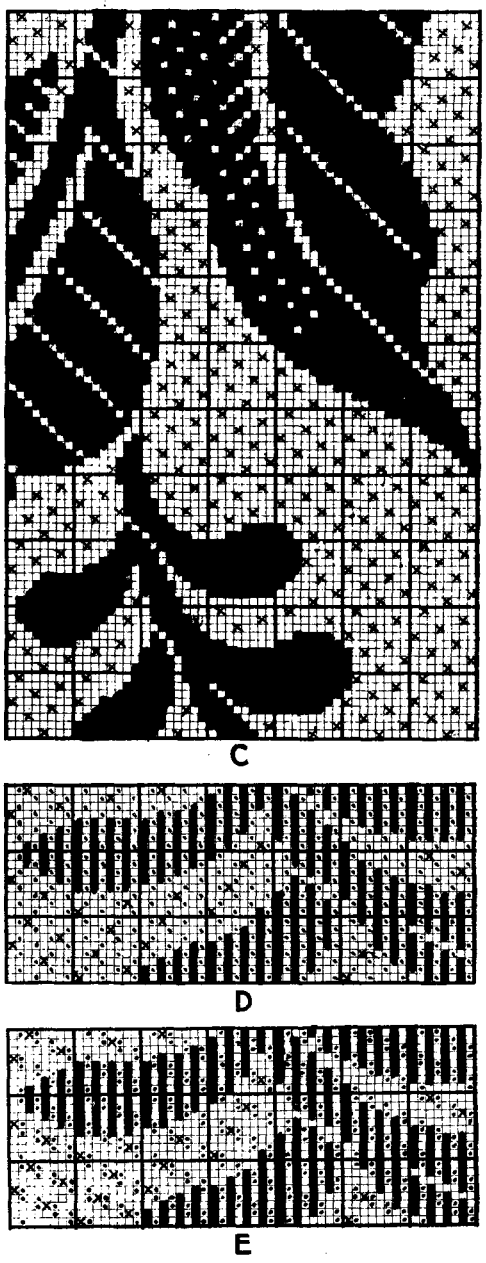


Fig. 149.

Warp : two-ply 16's cotton extra, 20's cotton ground, 29 two-ply, and 29 ground ends per inch.

Weft : 160 yards per ounce bleached cotton, 30 picks per inch.

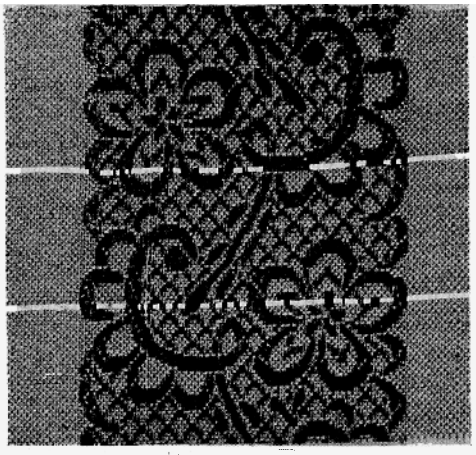


Fig. 150.

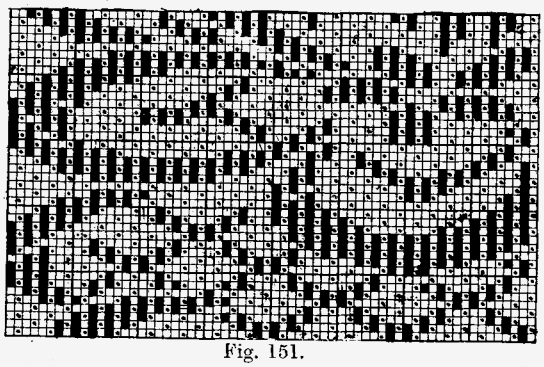


Fig. 151.

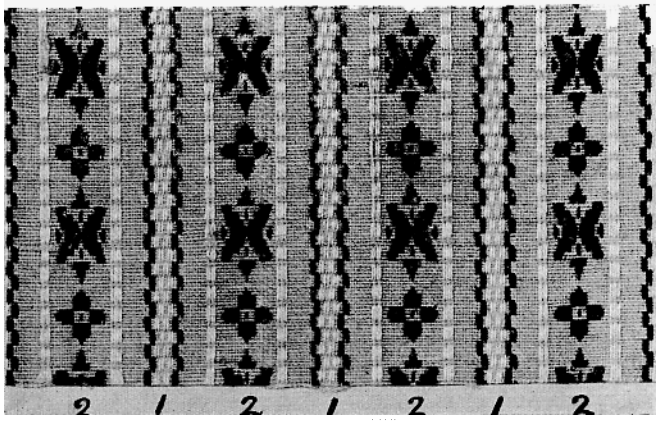


Fig. 152.

From 120 to 125 yards of ground warp, and 106 to 108 yards of figuring warp are required for 100 yards of cloth, while the shrinkage in width is about 5 per cent.

The method of constructing the point-paper design, to correspond with Fig. 148, is illustrated at C in Fig. 149, in which the marks indicate the lifts of the extra ends. After the figure has been painted in solid and suitably developed, a weave is inserted in the ground which may be twill, hopsack, a fancy effect, or, as is shown in the example, a sateen. Every lift of the thick extra warp over the thick weft shows clearly in the ground, and a rich and full appearance is given to what would otherwise be a bare and dull ground. The weight of the extra material is retained in the cloth without the presence of long floats on the back. D in Fig. 149 shows the structure of a portion of C with the plain ground ends included.

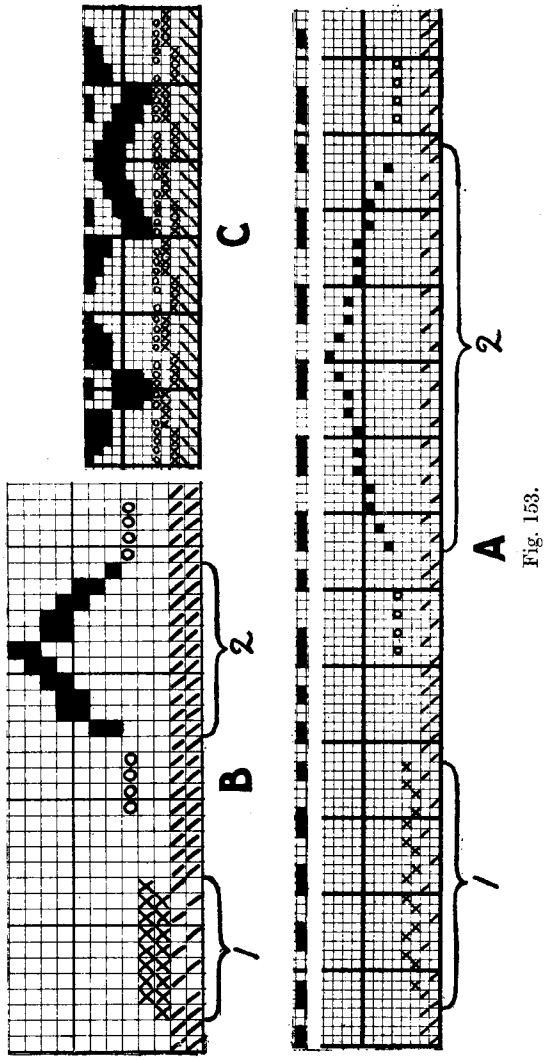


Fig. 153.

Binding in Extra Ends between Face Floats. — In the ground of ordinary extra warp figured fabrics, it is usually necessary for the extra threads to be invisible from the face side, and they can be floated loosely on the back, or if the ground weave is suitable, be bound in between corresponding warp floats. Thus, assuming that 2-and-2 twill ground is formed, the complete structure of the lower portion of C in Fig. 149 will be as indicated at E. With a heald and harness draft, as indicated in Fig. 147, the method of designing, shown at C, can be employed, but care requires to be taken that the healds lift the ground ends in the proper positions in relation to the extra warp stitches.

Intermittent Figuring in One Extra Warp.—The cloths represented in Figs. 150, 152, 154, 155, and 156 illustrate the introduction of one series of extra ends intermittently, and show various ways of forming either stripes or detached figures. In Fig. 150 the stripe figure is due to the continuous manner in which the extra ends

are floated. In Fig. 152 the extra figure is not continuous, but the parts are so near together that the figure has a striped appearance which is enhanced by the stripiness of the other parts of the design. In Fig. 154 the extra warp spots are quite separate but are near enough together to show in stripe form, whereas in Fig. 155, the spots are so far apart that the stripe appearance is chiefly due to the introduction of the gauze effect. In Fig. 156, the ornament is entirely due to the extra warp, which is brought up at intervals so as to form detached figures.

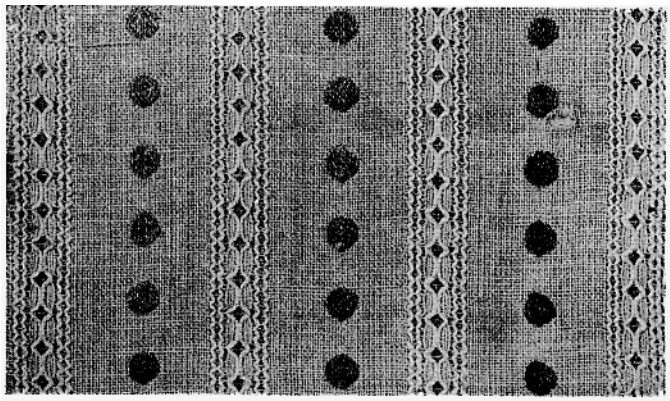


Fig. 154.

Fig. 151 corresponds with a portion of Fig. 150, and shows the method of constructing the design in full, with plain ground, for an ordinary harness mount.

Drafting and Denting Extra Warp Stripes.—Fig. 152 is a dobby style, and the complete design is not given, but A in Fig. 153 shows the draft, with the order of

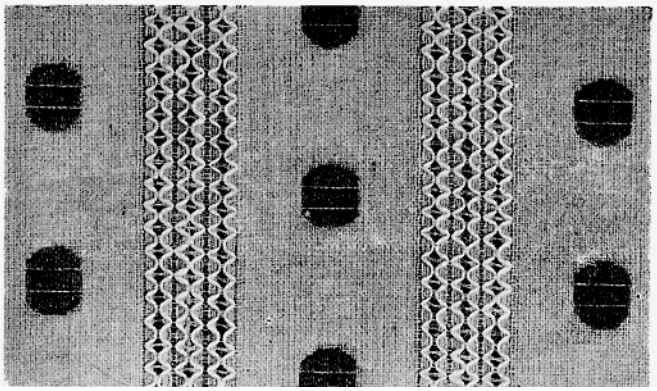


Fig. 155.

denting indicated above, while C is the pegging plan. For the purpose of illustration the order in which the healds will require to be knitted—assuming that ordinary twine healds are used—is indicated at B. (The method of constructing a heald-knitting plan is described in reference to Figs. 273 and 274.) The stripes numbered 1 and 2 in Figs. 152 and 153 correspond, and if the healds are knitted at the rate of

the splits per inch of the reed, the marks and blanks of B in Fig. 153, taken horizontally, indicate the order of knitting and missing.

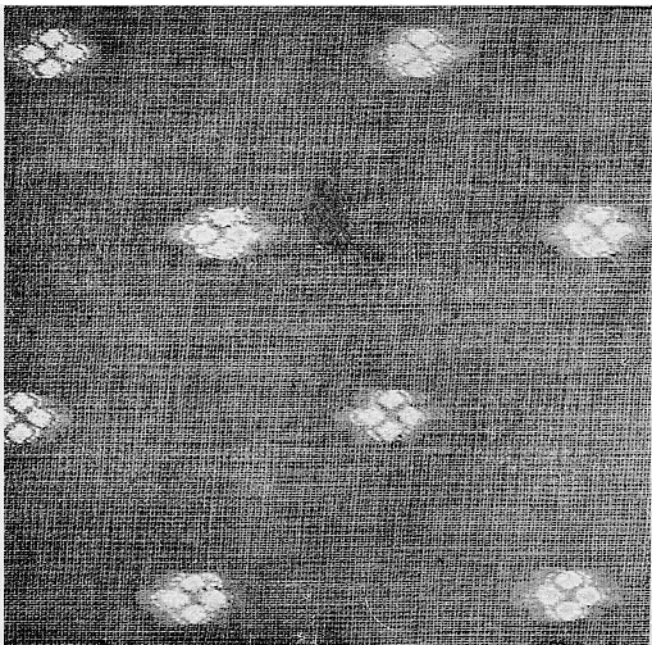


Fig. 156.

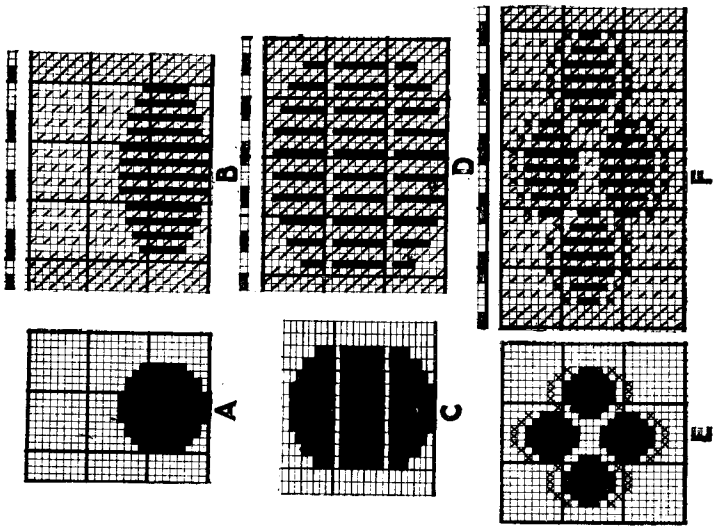


Fig. 157.

The solid plans to correspond with the extra warp spots given in Figs. 154, 155, and 156, are respectively shown at A, C, and E in Fig. 157 ; while the complete

structures, with the orders of denting above, are indicated at B, D, and F. In B and F the order of arrangement where the figure occurs, is 1 extra to 1 ground; and in D 1 extra to 2 ground. In each case the ground ends are 2 per split, therefore in B and F the denting in the figure is 4 per split, and in D 3 per split, each extra end in D being placed in a split with a ground end on both sides.

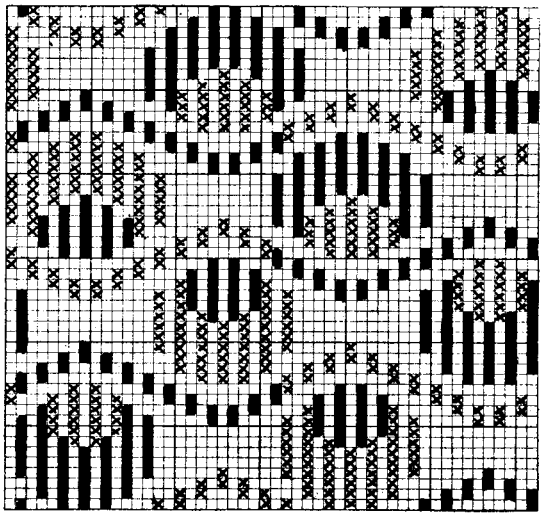


Fig. 158.

In the example represented in Fig. 156 the extra ends between the spots are cut away from the back of the cloth, and, as the figure is in loose float on the surface, in order to prevent the threads from fraying out, they are stitched in at the edges of the figure, as shown by the crosses in the plans E and F in Fig. 157. It will be noted in Fig. 156 that the stitching gives a blurred appearance to the outline so that the spots are not clearly defined.

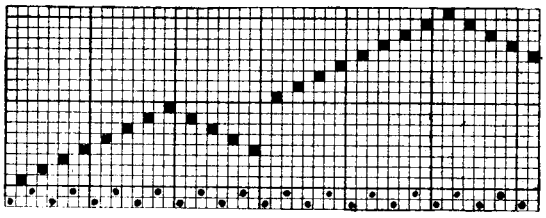


Fig. 159.

From an examination of the denting plans, given in conjunction with the foregoing examples of intermittent extra warp figures, it will be seen that the ground ends are uniformly distributed, which is a very important matter

Figuring with Two Extra Warps.—Fig. 158 shows a style in which two series of extra ends are introduced continuously. A feature of the example is that the

complete design extends over 50 extra ends, whereas the order of interlacing repeats upon 25 ends. This is due to the figure having been designed upon an odd number of ends, which causes the colours to change positions in succeeding repeats. The warp colours are also interchanged in the direction of the length of the design. The half-repeat in width of Fig. 158 shows the card-cutting plan for a heald-and-harness draft; and in weaving jacquard designs the method can be employed to obtain a width of repeat that appears to require twice as many needles as are actually necessary—*e.g.*, a figure repeating upon 399 extra ends will produce an effect

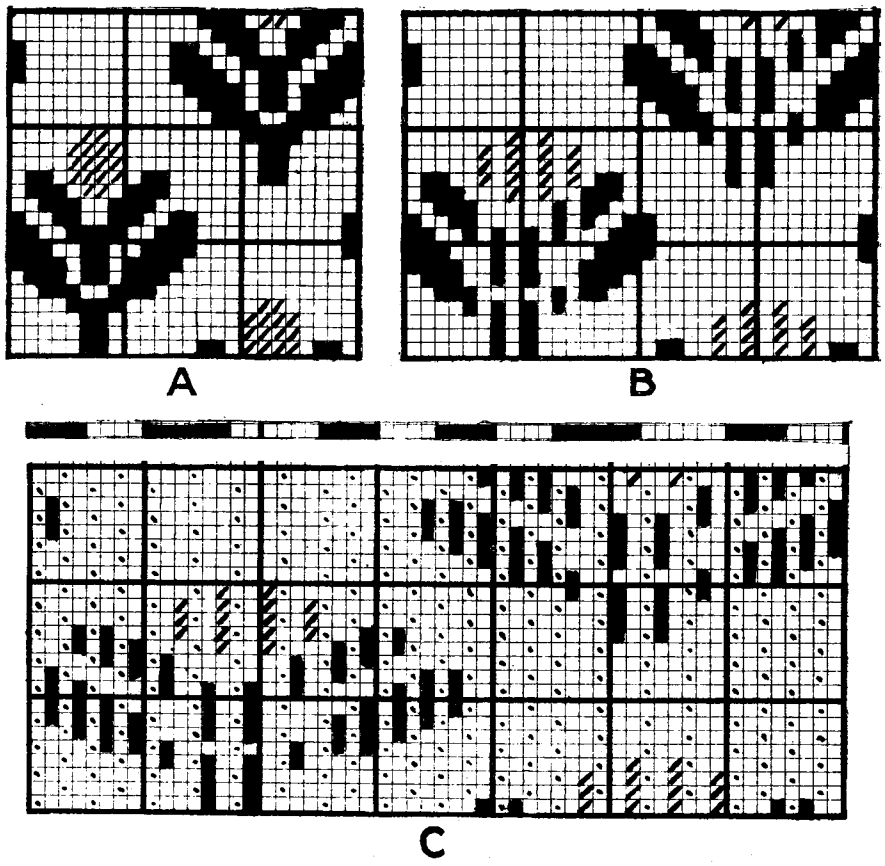


Fig. 160.

extending over 798 extra ends. The system can be also used to produce a large repeat in dobby weaving, and in Fig. 159 the complete draft is given for the design shown in Fig. 158, assuming that the ground weave is plain.

Fig. 160 illustrates a simple arrangement (which is applicable to elaborate designs) in which one extra is introduced continuously, as shown by the solid marks, and a second extra intermittently, as indicated by the strokes, the former being used to form what may be termed the ground pattern, while the latter assists the first in producing a figure in two colours. The intermittent extra can also be

used to form detached spots, etc., independent of the other. A shows a convenient method of first indicating the figure on design paper; at B the complete plan for the card-cutting is given, assuming that healds are employed in producing a plain ground texture; while C represents the complete structure, and also the card-cutting plan for a full-harness mount.

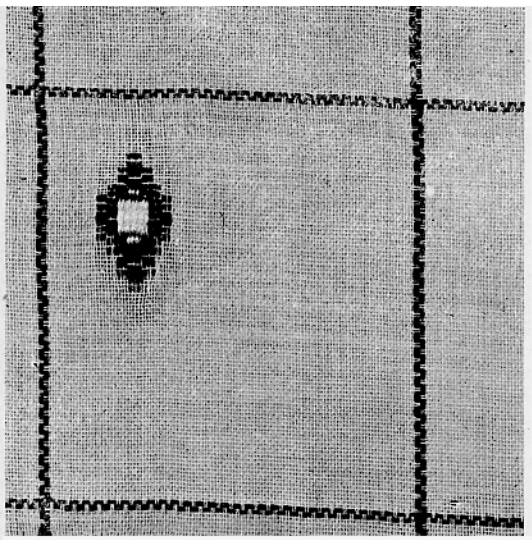


Fig. 161.

The fabric represented in Fig. 161 shows a detached spot figure, which is formed in two extra warps both of which are cut away between the spots. The firm interweaving of the extra ends at the edges of the figure, in this case, forms part of the effect. The spot is formed of coloured and bleached white mercerised cotton on a natural coloured cotton ground, and there is an overcheck of coloured mercerised cotton, which is not extra, but simply crammed. A portion of the complete design is given in Fig. 162, the full squares representing the coloured mercerised, the diagonal marks the white mercerised, and the dots the ground. The denting order is indicated above, and it will be noted that within the overcheck there

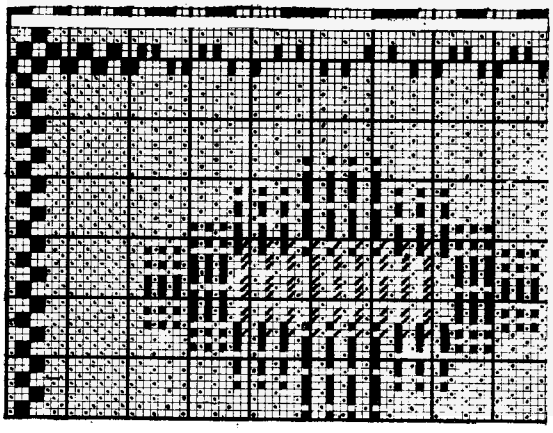


Fig. 162.

Fig. 163.

are two ground ends to each split, giving four ends per split where one extra only is employed, and six ends per split where both extras are introduced.

In Fig. 163 an extra warp stripe in two colours—arranged one of each to each

ground end—is shown combined with a 5-and-1 mock leno effect, while plans to correspond are given in Fig. 164. In designing an effect in more than one extra, it is convenient to first paint the figure solid in different colours on the point-paper, as shown at A in Fig. 164, in which different marks are used to represent the colours. For the card-cutting, if the ground texture is produced by healds, the figure under

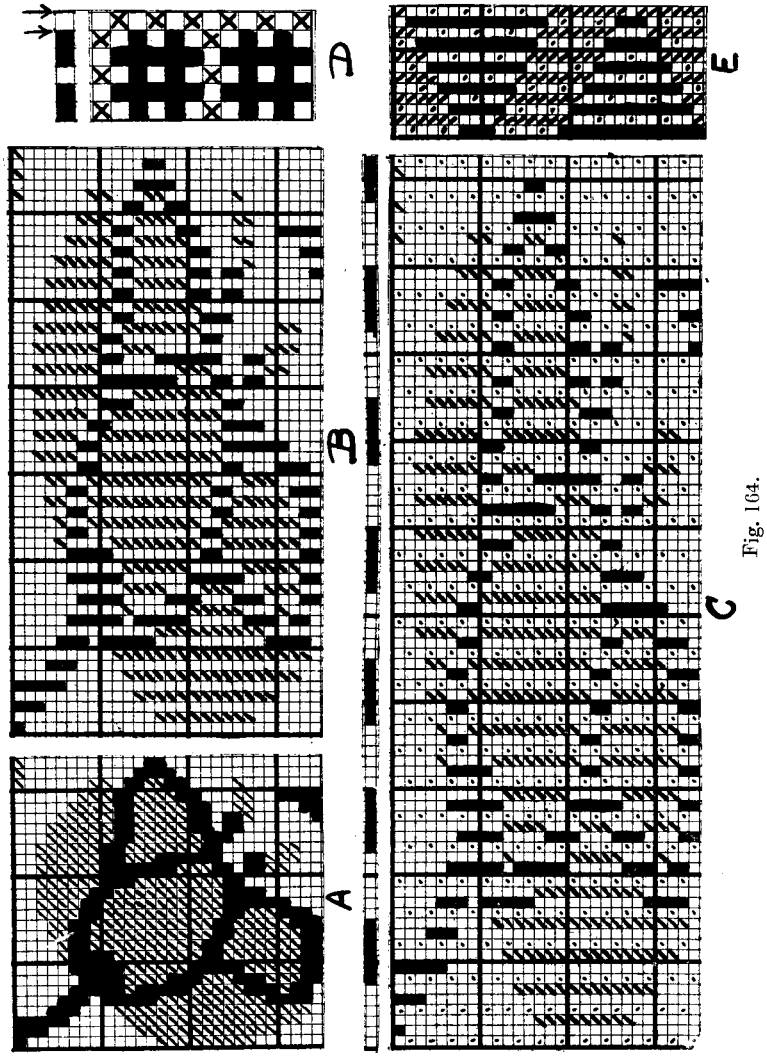


Fig. 164.

ordinary circumstances, will require to be extended, as shown at B; and for a full-harness mount, as indicated at C. The mock leno weave is given at D, for which a suitable order of denting is: 5 ends in 3 splits, 1 split missed, 1 end in 1 split, 1 split missed, as indicated above the plan D. E shows the weave of the fancy corkscrew effect which is formed on each side of the extra warp stripe in Fig. 163.

Fig. 165 also shows a combination of an extra warp figure in two colours with imitation gauze, but in this case there are two ground ends to each colour of extra, while the mock leno weave is 3-and-3. The corresponding sectional plans are given in Fig. 166, A showing the figure marked solid, and B the extension of a portion without the ground ends. The complete structure is indicated at C in which the ends are arranged in the order of: ground, first extra; ground, second extra. D shows the imitation gauze weave, which is dented 3 per split, 1 split missed. In B and C the long floats of one extra on the back are shown stitched between the surface floats of the other extra. (Combinations of extra warp figures with true gauze effects are illustrated in Chapter XII.)

Stitching by means of Special Picks.—When it is desired to retain the extra ends on the under side of a cloth without leaving them to float loosely between the figures, and when the ordinary method of stitching them between face floats of the ground ends is not feasible, the system, illustrated in Figs. 167 and 168, may be employed. The method is the same in principle

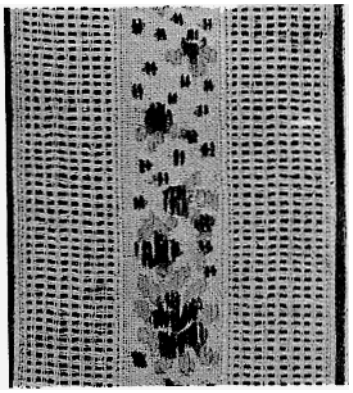


Fig. 165.

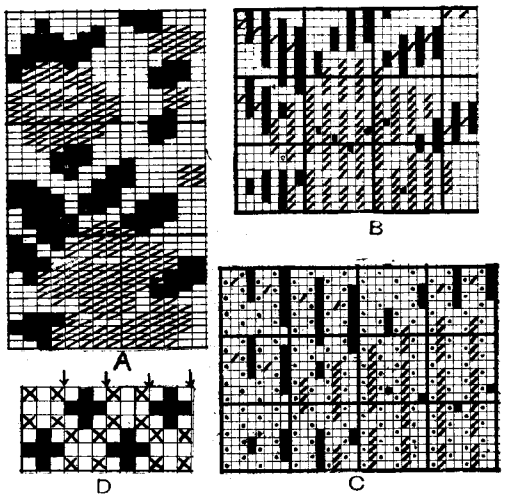


Fig. 166.

as that illustrated in reference to extra weft figures in Fig. 126 (p. 118), but in this case special binding picks are employed to stitch the extra ends on the underside. The arrangement is applicable to any number of extras, and to either continuous or intermittent orders.

The upper portion of Fig. 167 shows the face of the cloth, and it will be noted that the ground, which is plain weave, is quite free from the extra ends, yet, as shown in the lower portion of the figure, on the underside they are firmly bound in. F in Fig. 168 illustrates the method of indicating the figure on design paper for a heald-and-harness mount; G shows how the ground ends interweave with the picks; H is the heald draft for the ground ends, and I the lifting plan for the healds; while at J the complete weave of a portion of J is indicated. The weft is the same throughout, but every fifth pick is used as an extra binding pick which floats under 9 and over 1 ground end, as shown at G. On the binding picks all the extra ends are raised where figure is formed, but in the ground portions of the cloth they are lifted alternately. Really, the binding picks form a plain back cloth with the

extra ends where the latter are not required to form the figure, but the alternate interweaving of the binding picks in 9-and-1 order with the ground ends, as shown by the fifth and tenth picks in G, firmly unites the back to the face. The interweaving of the binding picks with the ground ends, however, causes slight indentations to show in the face of the cloth. For a heald and harness mount a card is cut from each horizontal space of the design F to correspond with a ground pick, and an extra card from every fourth space for the binding picks. The card cutting particulars of F are: Cut the figure on the ground picks, and the figure and the blanks plain on the binding picks. In addition, the lifts of the healds, indicated at I, will require to be cut opposite the needles that are used to operate them.

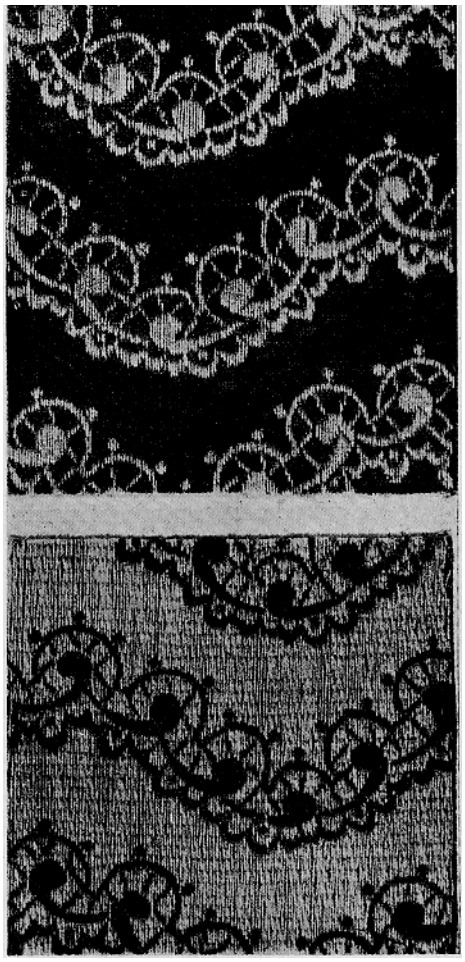


Fig. 167.

In K, Fig. 168, the solid line shows how the tenth pick of J interlaces, and the dotted line the ninth pick, the extra ends being represented as larger in diameter than the ground ends; while L shows the interweaving of the last three ends of J, the solid line representing end 38, the dotted line end 40, and the thicker shaded line the extra end between them.

Extra Warp Planting.—The design A in Fig. 169 illustrates a system of arrangement termed "planting," which enables a figure to be formed in a large number of colours without an addition being actually made to the series of extra threads. (The method corresponds to "chintzing" the weft, previously referred to—p. 126). In the example 5 colours (represented by different marks) are employed, but it will be noted that two colours only are introduced in any vertical line of the design. So far as regards the number of extra threads the arrangement is thus equivalent to a two-colour extra. The order in which the colours replace each other can be observed by following the spaces horizontally in the "gamut" indicated above A.

End-and-End Figuring.—In some Eastern styles, in which a figure is formed in two or more colours of warp, no ground ends are introduced, but a dark weft is employed which interweaves in a simple order with the figuring ends. B in Fig. 169 shows a portion of the design A thus arranged, the ground weave (represented by the

shaded squares) being 5-thread weft sateen, in contrast with the dark surface of which the brightly coloured warp figure shows very distinctly.

A four-colour warp figure is illustrated in Fig. 170, in which there are two features to note—viz., (1) The surface of the cloth is entirely covered by the warp figure, and there are no ground ends, the necessary firmness of structure being

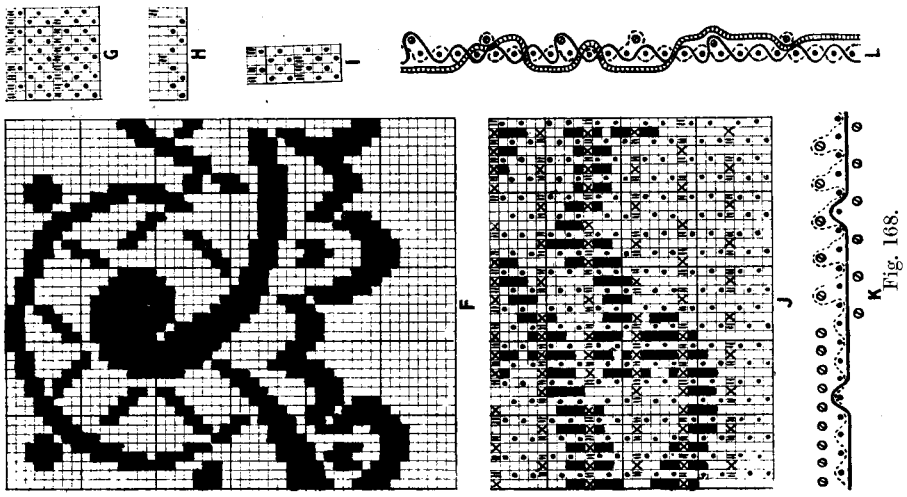


Fig. 168.

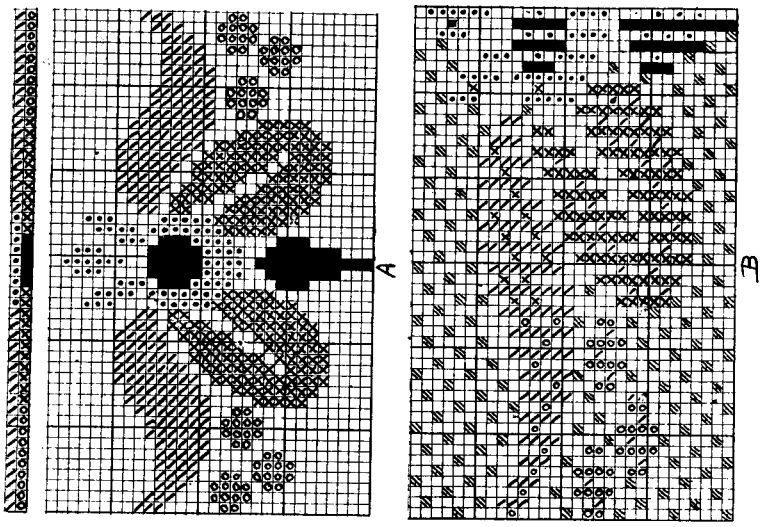


Fig. 169.

obtained by interweaving each colour, where forming figure, in 3-and-1 twill order; (2) Variety of effect is obtained by the interchange of the colours in succeeding repeats. Thus, an examination will show that, while the complete design is on 64 picks, the figure in the upper half is exactly like that in the lower half, except that the colours, represented by the full squares and crosses, interchange. A in Fig. 170 shows how the figure may be conveniently indicated by first marking the different

colours solid, and then inserting 1-and-3 twill entirely over the design; while B shows the complete structure of the first eight ends of A.

Reversible Warp-Face Figured Fabrics.—This class of structure can be produced in a similar manner to reversible weft-face fabrics by employing different colours

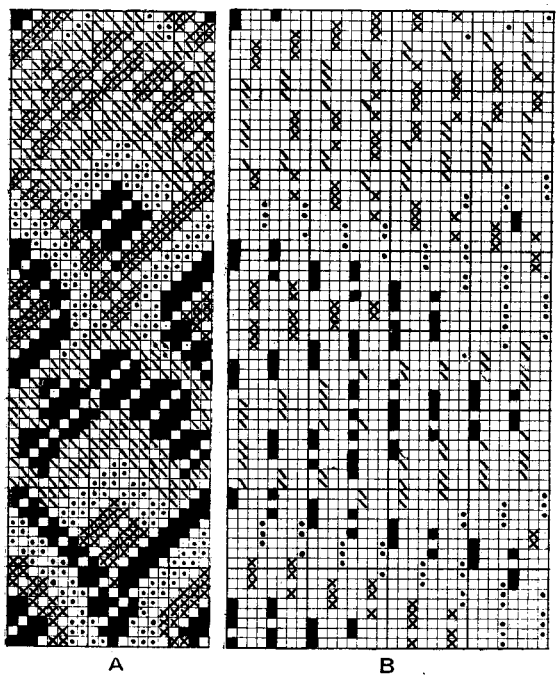


Fig. 170.

in the warp. The construction of the weaves that are combined will be illustrated by turning Fig. 143 (p. 129) one-quarter round, and taking the marks to indicate warp. The designing of reversible warp effects and extra warp styles in which more than one series of extra ends are employed is very much simplified if a sectional harness arrangement, such as is illustrated in Fig. 183 or Fig. 184, is used.

CHAPTER VII

FIGURING WITH EXTRA WEFT AND EXTRA WARP

Economical Use of Extra Materials—Extra Warp and Extra Weft Spotting. DOUBLE WEAVE COMBINATIONS—Designs Produced in Double-Plain Weaves—Double Twill Weaves—Combination of Fine and Coarse Fabrics—*Combinations of Double Weaves and Warp and Weft Float*—Crepon Structures—Double Weave and Weft Figure on Warp-Rib Ground.

Economical Use of Extra Materials.—The combination of extra weft and extra warp threads gives very great scope in the development of designs, and for certain styles of ornament is more economical than when only one of the series of threads is employed. For instance, a fabric is represented in Fig. 171, in which an all-over figure has been produced in extra weft and extra warp with comparatively a small consumption of extra material. In the corresponding design given in Fig. 172, in which the marks represent warp, the full squares indicate the positions of the extra threads, which are arranged in warp and weft in the order of 1-and-6 with the ground threads. A special feature of the example is that the surface of the cloth is made perfectly plain by allowing each extra end and pick respectively to inter-

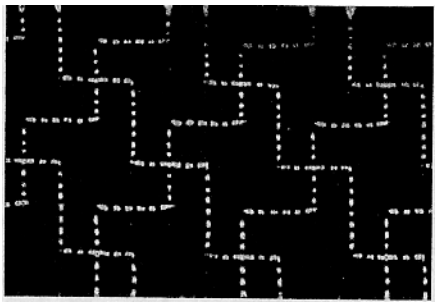


Fig. 171.

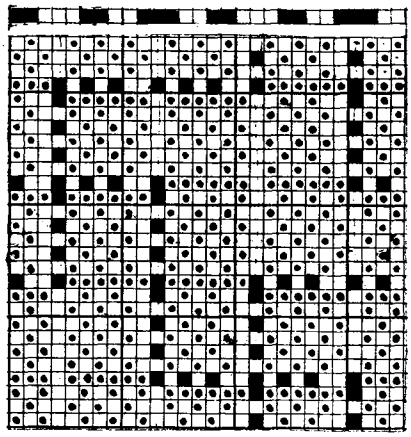


Fig. 172.

change with the preceding ground end and pick. Thus it will be seen that where an extra thread interweaves plain on the surface, as indicated by the solid marks, the ground thread which precedes it floats on the back, while where an extra thread floats on the back the ground thread is brought to the surface in plain order. If the ground threads had been interwoven in plain order throughout, the plain weave of the extra threads would have been the same as the preceding ground threads, and the former would have been partly concealed by the latter.

Extra Warp and Extra Weft Spotting.—A muslin fabric is represented in Fig. 173, which shows detached figures formed by floating extra warp and extra weft threads in combination, and small spots produced by the extra warp alone. A convenient method of first indicating the combined weft and warp effect is illustrated at A in Fig. 174, in which the solid marks indicate the weft figure and the dots the warp figure. The surplus warp and weft threads are sheared off the underside of the cloth,

but the weft is so firmly interwoven in the figure that no stitches are required at the edges. In the warp figure, however, the ends are loosely interwoven, and they are therefore stitched with the ground picks, as shown by the circles in A, above and below the warp floats. Each horizontal space of A represents a ground pick, and where weft figure is indicated, also an extra pick, while each vertical space represents a ground end, and where the warp figure is shown, an extra end also. The ratio of ground ends to ground picks per inch—in this case 64 to 48—gives the proper

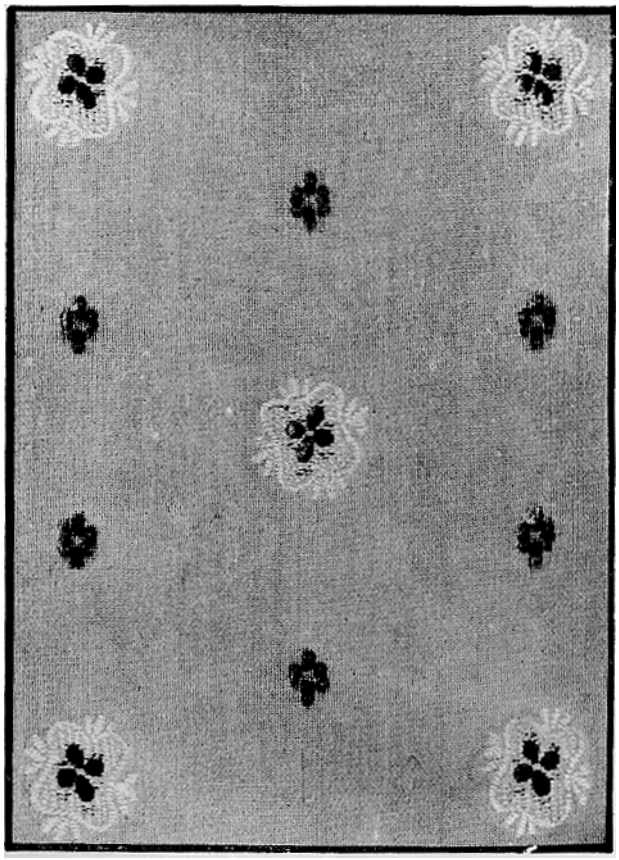


Fig. 173.

counts of point-paper in designing the figure solid, and 8 × 6 paper is therefore shown at A.

With a sectional harness arrangement (see p. 156) the cards could readily be cut from the solid design given at A, but if an ordinary harness mount is used, it is necessary for the design to be extended, as indicated at B, in order to show the working of the extra ends. B is the same as A except for the inclusion of the extra ends which are marked down in places where they are not lifted to form figure or for stitching. The order of denting is indicated above B, in which it will be seen

that twice as many ends are placed in each split where the extra warp is introduced, as in the remaining parts of the design.

In the extra weft figured portions of the design a figuring and a ground card are cut from each horizontal space, and in the remaining portions a ground card

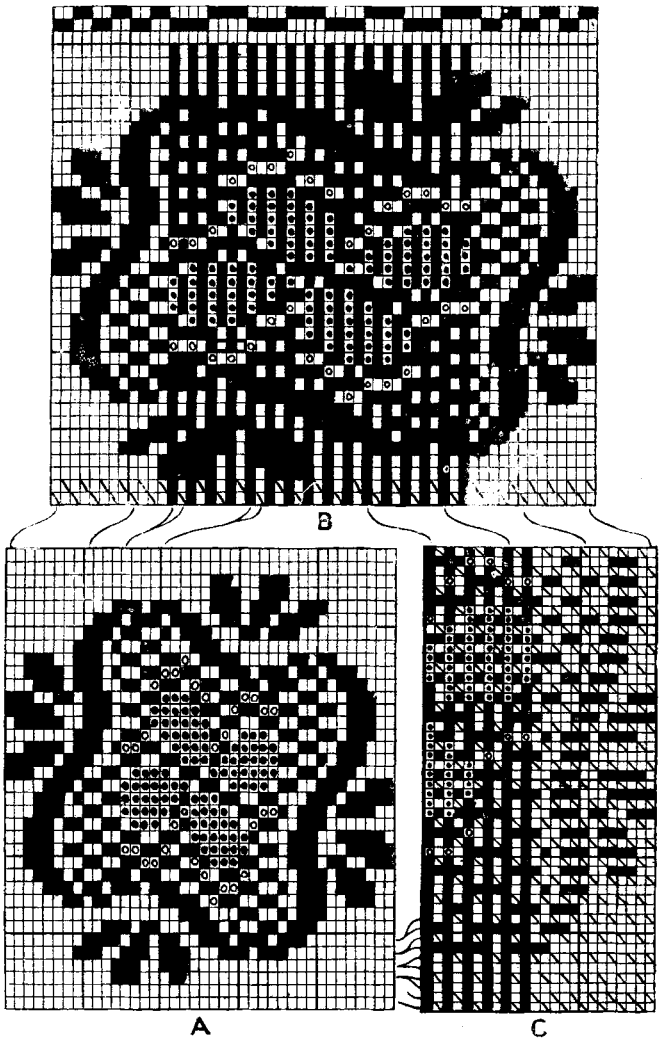


Fig. 174.

only. On the first two picks of B in Fig. 174, the diagonal marks indicate the order of cutting by which the ground ends and picks are interwoven in plain order. The odd ground cards are cut like the first pick of B, and the even ground cards like the second pick ; but in addition, the extra warp lifts are cut where the latter are indicated by the dots and circles. On the extra weft figuring cards, all but

the solid marks and circles are cut. The complete weave of the first 24 picks and the last 24 ends of B is represented at C in Fig. 174. (The circles in C, which indicate the extra warp stitches, should be situated one pick later.) The ground ends and picks form plain weave throughout the cloth, and a feature to note is that where the extra warp figure is formed the extra weft lies between the plain foundation and the warp floats, the latter being thereby shown up very prominently.

DOUBLE-WEAVE COMBINATIONS

In their simplest form figured double cloths are a development of the interchanging double-weave effects described and illustrated in Chapter III., in which two separate fabrics are formed one above the other in every part of the cloth. The threads of one fabric require to be different from those of the other, in respect to either thickness, material, or colour, in order that the design will be visible, while the number of threads in the two fabrics may be in either equal or unequal proportions. The appearance of a double-weave texture is represented in Fig. 175, in which a dark figure is formed in silk yarns upon a light worsted foundation. When the two fabrics are alike except as regards colour, the cloth is generally reversible; a dark figure on a light ground on one side corresponding with a light figure on a dark ground on the other side. This is illustrated at E and F in Fig. 1. Figured double cloths, as produced in special jacquards and harnesses, are fully dealt with in subsequent chapters, therefore only the method of designing the styles for ordinary machines is considered here.

Fig. 175.

The double weaves that are chiefly combined are illustrated in Fig. 176, in which the marks indicate warp. The order of arranging the threads, as to colour or material, is shown by different marks along the bottom and at the side of the examples; the positions of the backing ends and picks are indicated by the shaded spaces, above which the complete double weave is given.

Designs Produced in Double-Plain Weaves.—Double-plain weaves are largely employed in combination, and a number of plans are given at A to H in Fig. 176, which illustrate various effects that can be formed in a 1-and-1 order of warping and wefting. Two methods of arranging the threads are shown, however, viz.: (1) the weft and the warp in the same two colours—represented by the solid marks and shaded squares; and (2) the warp in two colours—represented by the solid marks and shaded squares, and the weft in two different colours—represented by the crosses and dots. Above each double weave A to H, and linked with the order of colouring, the colour effect that is produced on the surface is represented by

corresponding marks; the lower row of plans showing the effects formed with the warp and weft in the same two colours, and the upper row with the two warp colours different from the two weft colours. The threads on the surface in the respective weaves are as follows:—A, odd ends and odd picks; B, even ends and even picks; C, odd ends and even picks; D, even ends and odd picks; E, odd ends and first and second picks; F, even ends and third and fourth picks; G, second

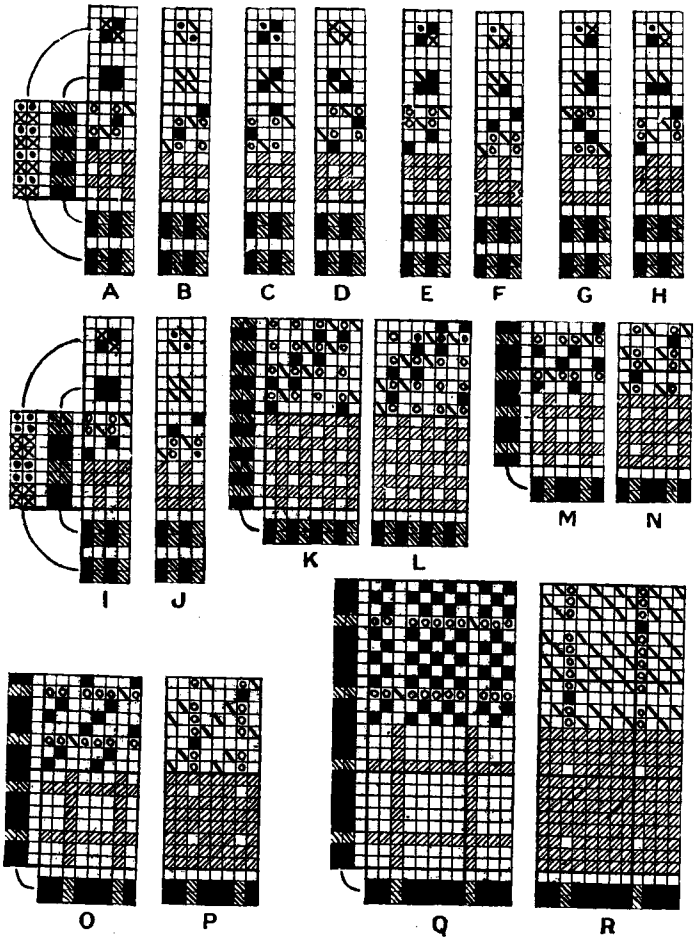


Fig. 176.

and third ends, and second and third picks; H, first and fourth ends and first and fourth picks. (Figs. 185 and 218 show special methods of forming double plain weaves.)

The plans I and J in Fig. 176 produce similar effects to A and B, with the weft arranged in 2-and-2 order to suit a loom with changing boxes at one end only. It will be seen that the weaves I and J are respectively the same as E and F, and the other weaves A, B, C, D, G, and H can be used in combination in the 2-and-2 order of wefting to obtain diversity of effect.

Each weave A to J produces two separate plain fabrics, and in designing a figured style two or more of the weaves are combined. After the outline of the figure has been drawn on the design paper, the different effects are lightly indicated in different colours of paint, and then the proper weaves are inserted in the respective sections and in the ground. The method is illustrated by the example given at N in Fig. 70 (p. 74), in which the weave marks indicate weft. Also a simple geometric style, suitable for a vesting fabric, is shown in Fig. 177, in which the weave marks indicate warp. A method of producing neat, unpronounced effects, in such cloths as vestings, consists of using a twist yarn for the figure, in which one of the threads is the same colour as the ground threads—*e.g.*, a combination of black with black-and-white twist threads.

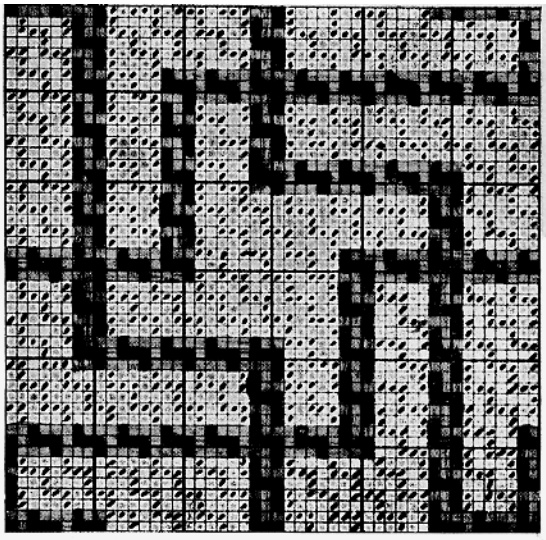


Fig. 177.

Double-Twill Weaves.—Double-twill weaves can be readily arranged and combined in the same manner as the double-plain. The double 2-and-2 twill is shown at K and L in Fig. 176, the former bringing the odd ends and picks to the face and producing a dark surface, and the latter the even ends and picks which produce a light surface.

Fig. 178.

Combination of Fine and Coarse Fabrics.—Figured effects are also formed by interchanging a fine fabric with an open, or coarse fabric. Thus M and N in Fig. 176 show two opposite double-plain weaves, in which the threads are arranged in the proportion of two to one. M brings the fine ends and picks to the surface, and N the coarser ends and picks, so that by combining the two weaves a figure in thick yarns may be formed upon a fine foundation, or *vice versa*. The plans O and P are opposite

double weaves in which the threads are arranged in 3-and-1 order; the threads of the fine fabric forming 2-and-1 twill, and those of the coarse fabric plain weave. Q and R are opposite double-plain weaves in which the threads are arranged in 5-and-1 order; the open fabric in this case should be composed of very much thicker threads than the fine fabric.

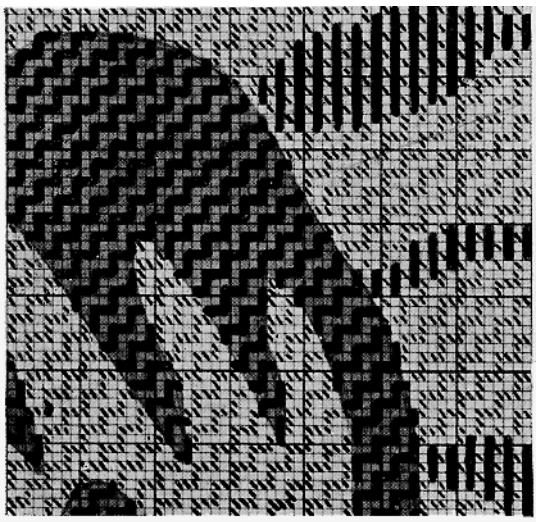


Fig. 179.

Combinations of Double Weaves and Warp and Weft Float.—In addition to forming figure by interchanging the fabrics variety of effect can be produced by floating the warp or weft threads loosely on the surface. Fig. 178 represents a texture in which a figure is formed in coloured silk yarns upon a black worsted foundation, the particulars of the cloth being: 1 thread 2/60's botany, 1 thread three-ply 60/2 spun silk in warp and weft; 72 ends and picks per inch. As shown in the corresponding sectional design given in Fig. 179, in which the marks indicate warp, the cloth is chiefly double plain, but additional interest is given to the design by forming the waved horizontal lines in floats of the silk warp. The worsted and silk picks interweave plain with the worsted ends underneath the warp figure. (See also p. 190.)

Fig. 180.

The fabric represented in Fig. 180, and the corresponding sectional design given in Fig. 181, illustrate the combination of a double-plain weave with an extra warp figure effect. The particulars of the cloth are: 1 end 2/40's mohair worsted, 1 end 2/40's cotton, 76 ends per inch; weft, all 40's cotton, 60 picks per inch. The mohair ends are on the surface in the double-plain portions of the cloth, and they produce an extra warp figure and a fancy diamond effect upon a plain foundation that is formed by the cotton ends and picks.

Crepon Structures.—Fig. 180 illustrates the figured " crepon " class of texture in which a waved or cockled surface is produced. The effect is due partly to the weave structure and partly to the combination in the cloth of yarns which have different shrinking properties. Hard-twisted botany worsted threads readily shrink when scoured, as also do cotton yarns when they are immersed in a solution of caustic soda, but neither process has much effect upon the length of mohair and silk threads. In a cloth in which an unbound effect in mohair or silk is formed upon a foundation of hard-twisted botany or cotton, the conditions are favourable for giving full play to the different shrinking properties of the materials. The result is that as the foundation yarns shrink, the non-shrinking threads, which are floated loosely, tend to form curls or loops on the surface, while in the double-weave portions of the cloth the slack upper fabric forms ridges and hollows. The crepon effect, shown in Fig. 180, has been produced by the caustic soda treatment, which caused the cloth to shrink 21 per cent in width and length.

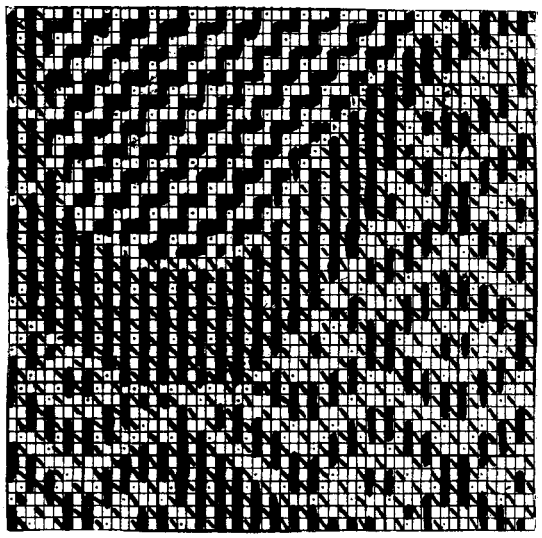


Fig. 181.

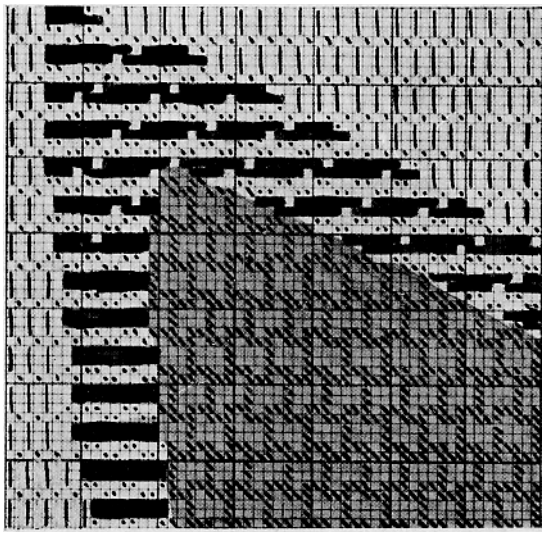


Fig. 182.

Double-Weave and Weft Figure on Warp-Rib Ground.—Fig. 182, in which the marks indicate weft, shows the combination of a double-weave, weft figure, and 3-and-1 warp-rib ground. In the warp the arrangement is 1 end of two-ply spun silk, and 1 end worsted, and in the weft, 2 picks of two-ply spun silk, and 2 picks of worsted; the plan in Fig. 182 commences with one pick of silk. In the rib ground the worsted ends are chiefly on the surface, the two worsted picks and one silk pick going into the same shed. In the double weave

the silk warp and weft form a plain upper fabric, and the worsted warp and weft a 2-and-2 rib under fabric. The double-weave figure is surrounded by floats of the worsted weft.

CHAPTER VIII

SPECIAL JACQUARD AND HARNESS MOUNTINGS AND SYSTEMS OF DESIGNING

Comparison with Ordinary Jacquard and Harness Mounts. *Sectional Jacquard and Harness Arrangements*—Sectional Harness Ties—Special Connection of Hooks and Needles—Special Draft of the Warp Threads—Designing and Card-Cutting for Sectional Arrangements. *Methods of Increasing the Figuring Capacity of Jacquards*—Inverted Hook Jacquards—Combinations of Healds with Harnesses—Combinations of Lifting Rods or Bars with Jacquard Machines. *The Split Harness or Shaft Monture*—Operation of the Lifting Rods—System of Designing. *Working Comber-Boards.*

Comparison with Ordinary Jacquard and Harness Mounts.—The chief advantage of the ordinary type of jacquard and harness *—usually termed a full or thread harness—is that any desired weave may be employed in both the figure and ground of a cloth, because every end in the repeat can be operated independently in any order. The system has the disadvantage that the size of the repeat is limited, because each card only corresponds to one pick, and each needle to one end, the weaving of very large designs thus being both inconvenient and costly. Also, the full harness system, except in a few cases—*e.g.*, extra weft-figured fabrics—necessitates the complete working of every end and pick to be indicated upon the point-paper design, which for complex cloths is a very long and tedious process. Special modifications of the ordinary jacquard and harness arrangements have therefore been devised, each of which has one or more of the following objects chiefly in view : (*a*) To simplify the painting-out of designs ; (*b*) to reduce the cost of cards and card-cutting ; and (*c*) to obtain a large repeat from a comparatively small jacquard. In most special mountings, however, one or more limitations are imposed which are not common to an ordinary machine, and which vary according to the form of the mounting.

SECTIONAL JACQUARD AND HARNESS ARRANGEMENTS

Sectional systems of mounting are used in the manufacture of cloths which are composed of two or more different kinds of warp threads—arranged alternately, or in 2-and-1 order, etc., with one another—each of which has a separate function in forming the design or the structure of the fabric. Except when employed in conjunction with a special harness mount (*e.g.*, working comber-boards), the object of a sectional arrangement is solely to simplify the processes, and reduce the cost of painting-out designs and card-cutting. There is no saving, as compared with an ordinary form of jacquard and harness, in either the number of hooks, or the number of cards required for a design.

* The ordinary forms of jacquard and harness, ordinary and special harness ties, and jacquard, harness, and design calculations are described and illustrated in the accompanying book : TEXTILE DESIGN AND COLOUR—ELEMENTARY WEAVES AND FIGURED FABRICS.

The different kinds of warp threads must follow each other in the harness in the order in which they are required in the cloth ; the sectional arrangement enables each kind of warp to be governed by a separate section of the needles, so that the lifts of each warp can be cut independently upon a corresponding section of the cards. Three methods of accomplishing the result are illustrated in Figs. 183 and 184.

Sectional Harness Ties.—In the method shown in Fig. 183, the hooks and needles are connected in the ordinary manner, but a special system of tying up the harness is employed. A separate transverse section of the hooks is allotted to each kind of warp, the number of hooks in the respective sections being in the same proportion as the threads of each kind. From each section of hooks the harness cords are passed through a separate *longitudinal* section of the comber-board to correspond, and each kind of warp is drawn through the harness mails of the section allotted to it. The system is illustrated in Fig. 183 which shows in the upper portion a sectional tie for two kinds of warp arranged in 1-and-1 order. The hooks are divided into two equal parts, A and B, and the harness cords that are tied to the hooks A are passed through the front longitudinal section A of the comber-board, while those tied to the hooks B are passed through the back section B of the comber-board. In the warp draft, which is represented in the lower portion of Fig. 183 the even ends are shown drawn through the harness mails of the front section A, and the odd ends through the mails of the back section B. One half of the needles, taken consecutively, thus governs the even ends, the lifts of which are cut on the corresponding half of each card, while the other half of the needles governs the odd ends, the lifts of which are similarly cut on the other half of each card. In weaving designs, which are so large that two machines placed side by side are required (a twin jacquard), one machine will govern one series of ends, and the other machine the other series ; the two machines being operated as one. This is very convenient for the card-cutting, as the provision of two separate sets of cards enables one warp to be cut for quite independently of the other.

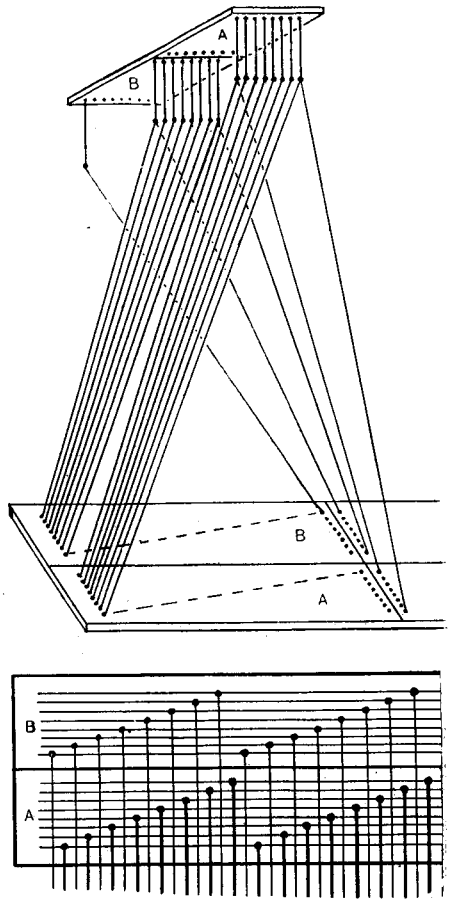


Fig. 183.

Other proportions of the warp threads are arranged in the same manner as the foregoing. Thus, if two series of threads are arranged in the proportion of two

to one, the hooks of a 600-machine will be tied up in two sections of 1-400 and 401-600 to correspond, and the harness cords will be passed through longitudinal sections of the comber-board which are respectively 12 holes and 6 holes deep, or 8 and 4. For a three-thread arrangement in 1-and-1 order, the hooks and needles of a 600-machine will be in three equal sections—viz., 1-200, 201-400, and 401-600; but if there are two threads of one to one of each of the others the sections will be arranged 1-300, 301-450, and 451-600, and so on; and the respective sections of harness cords will be passed through longitudinal sections of the comber-board to

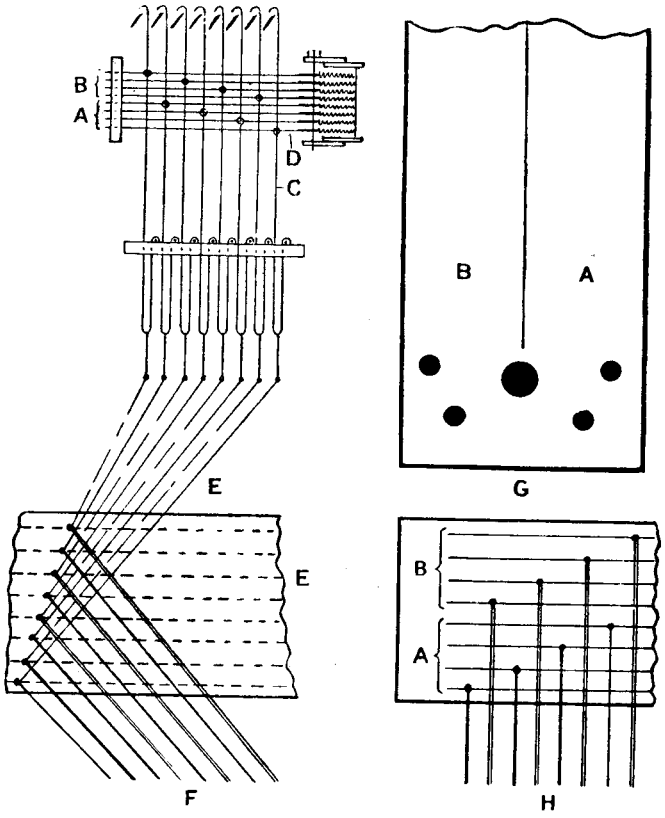


Fig. 184.

correspond. The lay-over, pointed, mixed, or bordered principle of tie-up may be employed, the sectional arrangement in each case enabling each series of warp threads to be separately controlled by its own section of the cards, needles, hooks, and harness. The tie is more conveniently arranged when the card cylinder is over one side of the loom (the London system) than when it is over the front or rear (the Norwich system), but it can be employed with the cylinder in any of the positions.

Special Connection of Hooks and Needles.—Two methods are illustrated in Fig. 184, either of which may be employed in place of a sectional harness tie for achieving the same results as regards the simplification of the designing. In the method

illustrated by the diagram on the left of Fig. 184 the hooks C and needles D are so arranged that the four bottom needles A are connected to the odd hooks, and the four top needles B to the even hooks. The harness tie and the draft of the warp threads, which are represented at E and F respectively, are exactly the same as in an ordinary machine, and it will be seen that the odd threads are controlled by the four bottom needles in each row and the even threads by the four top needles. In this system each card is divided into two longitudinal sections, as shown at G in Fig. 184, and the lifts of the odd threads are cut on the section A which presses against the four bottom needles, and of the even threads on the section B which presses against the four top needles.

Special Draft of the Warp Threads.—This method consists simply of drawing in the warp threads in such a manner that one series passes through the front half A of each short row of harness mails, as represented at H in Fig. 184, and the other

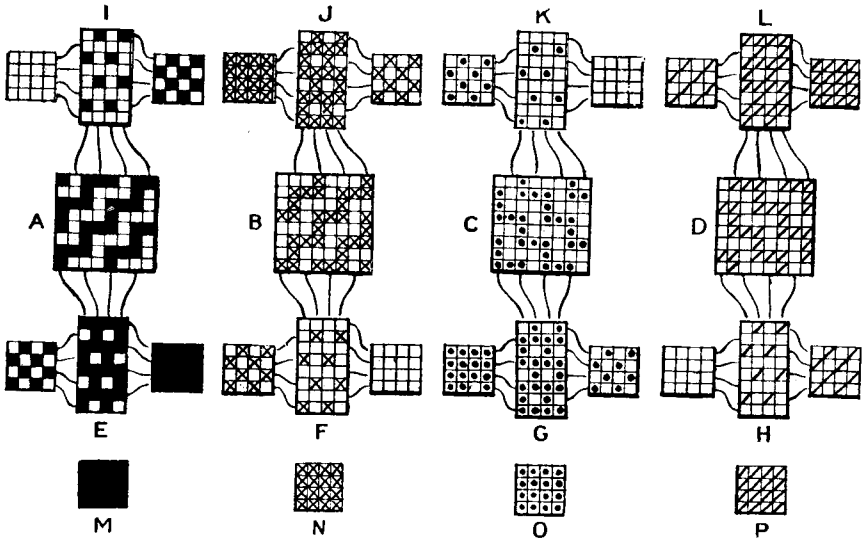


Fig. 185.

series through the back half B. With the needles and hooks and the harness tie arranged in the ordinary manner, the lower half of each row of needles controls one kind of warp, and the upper half the other kind, so that the system of card-cutting is exactly the same as in the previous method. An advantage of the last method is that the usual form of jacquard and harness can be adapted to the special system of designing by drawing in the warp to suit the arrangement of the ends.

In Fig. 184 the arrangement of two kinds of warp in 1-and-1 order, only, is illustrated, but either of the methods may be applied when more than two series of ends are used. Thus, at B in Fig. 445, a warp is shown drafted in five sections to conform with a 5-colour arrangement of the warp threads.

Designing and Card-Cutting for Sectional Arrangements.—The examples given in Fig. 185 show how the painting out of a design is simplified by means of a sectional arrangement, and also illustrate a method of ascertaining the card-cutting particulars by which the desired structural effects will be produced in the cloth. Four different

double-plain weaves are given in full at A, B, C, and D (these correspond with the examples similarly lettered in Fig. 176, p. 152), which, it may be assumed, are required to be combined in a design. Two series of ends and picks, in the order of a thread of each alternately, are employed, and a jacquard and harness arrangement in two equal sections, as illustrated in Fig. 183 or Fig. 184, is therefore suitable for the arrangement in the warp. The lifts of the odd ends of the respective double-plain weaves, which are shown separately at E, F, G, and H in Fig. 185, will be cut on one section of the cards, and those of the even ends, which are shown separately at I, J, K, and L on the other section of the cards. On the left of each plan E to L the lifts of the odd picks are shown apart, and on the right the lifts of the even picks. The small plans on the left and right of the examples lettered E to L thus indicate the interweaving of each kind of warp with each kind of weft in the respective weaves A, B, C, and D.

To represent the effects shown at A, B, C, and D a design would be painted solid in four different colours (or in three colours, the fourth effect being represented by the paper), as indicated by the different marks shown at M, N, O, and P in Fig. 185. As there are two series of threads in both warp and weft, each vertical space in the design then corresponds to two ends, and each horizontal space to two picks. Two cards are therefore cut from each horizontal space, and further, the design is cut twice—first, for the section governing the odd ends, and then for the section that governs the even ends. The plans on the left and right of the examples E to L indicate the exact order in which the cards require to be cut from the plans M, N, O, and P, and in order to enable comparisons to be readily made, bracketed references are made to the respective plans in the following list in which the card-cutting particulars are given.

	Section governing odd ends.	Section governing even ends.
First Card	Cut M plain (left of E) Cut N plain (left of F) Cut O solid (left of G) Blank P (left of H)	Blank M (left of I) Cut N solid (left of J) Cut O plain (left of K) Cut P plain (left of L)
Second Card	Cut M solid (right of E) Blank N (right of F) Cut O plain (right of G) Cut P plain (right of H)	Cut M plain (right of I) Cut N plain (right of J) Blank O (right of K) Cut P solid (right of L)

If the cards are in longitudinal sections, as shown at G in Fig. 184, for convenience in the card-cutting, the design paper should be ruled in fours vertically for an 8-row machine, and in sixes if the machine is 6-rowed.

As each vertical space of a design corresponds to two or more ends (according to the number of sections) the number of spaces over which a design requires to be extended is only equal to one-half, or one-third, etc., the number of ends in the repeat. Also, as shown in Fig. 185, the arrangement frequently enables the painting-out to be done in such a manner that more than one card can be cut from each horizontal space, so that the design is simplified in length as well as in width; and, further in most cases the weave structure need not be indicated. In a 2-and-1 proportion of the ends, however, it is sometimes found very difficult to cut the smaller section of the cards from the design of the larger section, as two vertical spaces of the latter correspond to one of the former. In such a case it is advisable to paint out both

sections separately, one on half as many vertical spaces as the other. Numerous examples are given in the following pages which show the application of the sectional system to different classes of cloths.

METHODS OF INCREASING THE FIGURING CAPACITY OF JACQUARDS

To increase the figuring capacity of a jacquard it is necessary to employ parts which are additional to the ordinary form of mount, and the machine in its modified form may also include a sectional harness tie, a special connection of the hooks and needles, or a special draft of the ends, such as are illustrated in Figs. 183 and 184. The additions to and modifications of the ordinary form of machine are chiefly as follows :—

(1) Inverted hooks, each of which is connected to the same needle as an ordinary hook.
(2) Ordinary healds combined with a harness.
(3) Pressure healds combined with a harness.
(4) Lifting rods or bars.
(5) Working combei-boards.

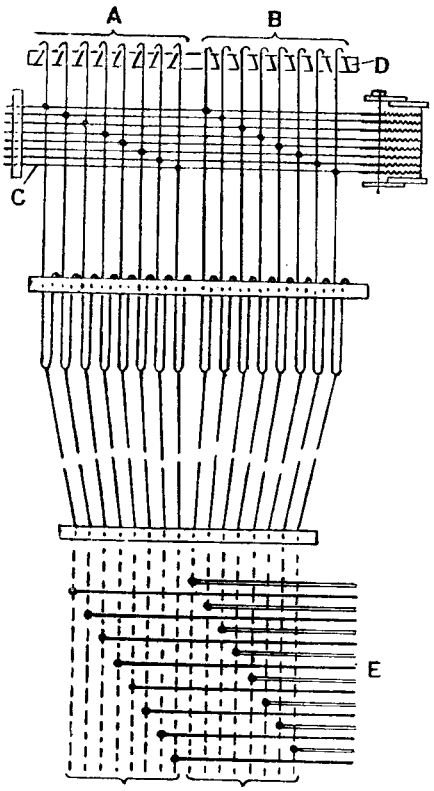


Fig. 186.

In the first modification the ends are controlled entirely by the jacquard; in the second, some of the ends are controlled by the jacquard and others by the healds; while in the third, fourth and fifth systems, the same ends are operated from two sources—viz., by the jacquard for forming the design, and by the additional parts for producing the structure. In some mountings, two or more of the special systems are used in combination. For every needle in the jacquard the cloth may contain two, three, or more consecutive warp threads, and compared with an ordinary mounting, the time occupied in cutting the cards and the weight of card paper required are correspondingly reduced. In addition many of the special modifications are devised so as to enable one card to act for two, three, or more consecutive picks, by which a further great saving in cards and card-cutting is effected. One card is made to act for two or more picks in two ways—viz. (*a*) both the jacquard and the card-cylinder remain stationary for a period during which the additional parts go on working; (*b*) both the jacquard and the additional parts continue in work all the time, but the sneck, which turns the card-cylinder, is put out of action as required so that the same card is pressed against the needles a number of times.

Inverted-hook Jacquards.—This type of machine is used with great advantage in weaving large designs in which two series of ends, arranged in 1-and-1 order,

work exactly opposite to each other. As shown in Fig. 186 the jacquard is made with two sets of hooks, A and B, to correspond with the two series of ends. The hooks A have their bent upper ends turned towards the card-cylinder in the ordinary manner, whereas those of B are turned towards the spring-box. One griffe D is employed carrying 16 lifting blades in two sets of 8 blades each, which are inclined towards the hooks that they govern. When in the normal position the hooks A are over their lifting blades, whereas the hooks B are clear of the other set of blades.

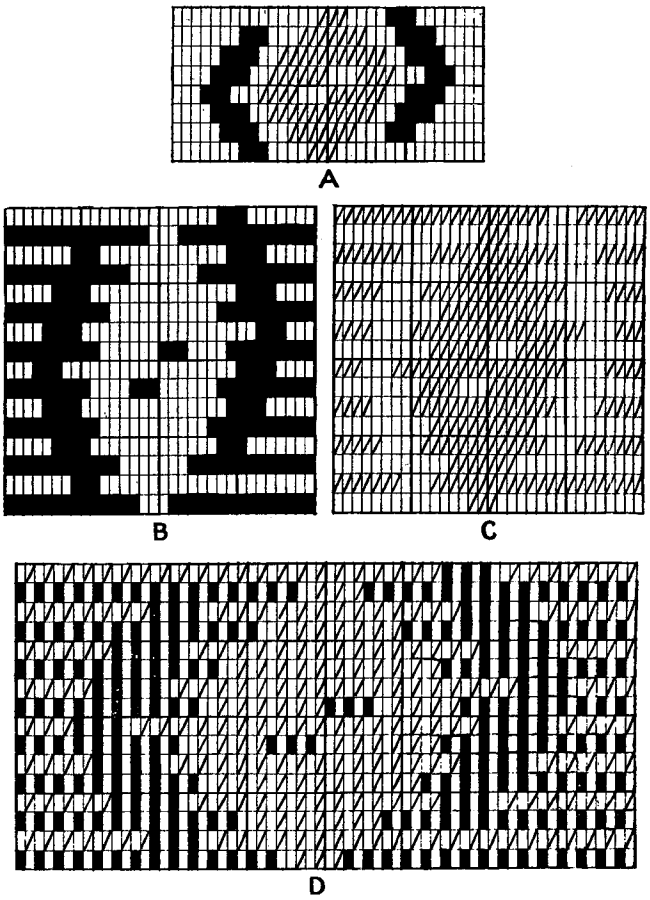


Fig. 187.

The harness cords are tied up in the ordinary manner, but in the warp draft, which is represented at E, one series of ends is drawn upon the harness cords connected to the hooks A, and the other series upon the cords connected to the hooks B. Only one set of needles is used, but each needle is connected to a hook of each set, and thus controls an end of each series. A blank in a card presses a hook A away from the path of its lifting blade, and places the corresponding hook B in position for being raised, while a hole in a card leaves a hook A in position for

being lifted, and a hook B out of action. Therefore, where ends of one series are raised, corresponding ends of the other series are left down, and *vice versa*.

A class of fabric for which the arrangement is particularly useful is a reversible warp rib structure, in which a warp figure is produced in two colours upon plain or rib ground on both sides of the cloth. In order to show the special use of an inverted hook jacquard plans are given at A, B, C, and D in Fig. 187, which illustrate the development of a portion of a design from the solid system of marking to the complete reversible rib structure. The figure formed by each colour of warp is painted solid, as shown by the different marks in A, each vertical space of which represents an end of both series, and each horizontal space two picks. Assuming that the dark figure is required to be produced by the ends which are controlled by the ordinary hooks, two cards are cut from each horizontal space, as follows :—

First Card.—Cut all except the marks of the light figure.
Second Card.—Cut only the marks of the dark figure.

B in Fig. 187 shows the lifts that are cut on the cards and are formed by the ordinary hooks, while C, which is exactly opposite to B, shows how the other threads are raised by the inverted hooks. As the ends are drawn through the harness in 1-and-1 order, an end of B is followed by an end of C, and the complete weave is, therefore, as indicated at D.

The inverted hook arrangement, illustrated in Fig. 186, not only enables a very simple method of designing to be employed, but a design is produced that repeats upon twice as many ends as there are needles in the machine. If, however, an increase in the figuring capacity of the jacquard is not desired, one of the sectional arrangements, previously described, will enable the same method of designing to be employed for a reversible warp rib cloth, two cards being cut from each horizontal space of the design A in Fig. 187, as follows :—

Dark Warp Section.—First card, cut blanks and solid marks ; second card, cut solid marks.
Light Warp Section.—First card, cut diagonal marks ; second card, cut blanks and diagonal marks.

To correspond with the design A in Fig. 187, B then shows the lifts cut on the dark warp section, and C those cut on the light warp section.

Combination of Healds with Harnesses.—When ordinary healds are employed in conjunction with a jacquard harness the threads which they operate in regular order are not passed through the harness mails, but are in addition to the figuring threads. The position of the healds—at the back or front of the harness—is largely a matter of convenience as regards space and depth of shed, but a determining factor is the relative strength of the threads, as the weaker yarn should be operated by the shedding mechanism at the front. Certain of the jacquard hooks may be used in raising the healds, but this prevents a card from acting for more than one pick. Either tappets or a dobby may be employed to work the healds independently of the jacquard (positive shedding motions being most serviceable when the threads controlled by the healds are heavily tensioned), and these motions enable each card to act for any desired number of picks.

A heald-and-harness mount has been previously referred to in connection with extra warp figuring (see Fig. 147), and in the following pages different classes of cloths are illustrated for which the system is employed. One-half, two-thirds,

etc., of the warp threads are drawn upon the healds, so that the figuring capacity of the jacquard is increased two or three-fold, etc. The limitation in the arrangement is in the weave of the ends that are operated by the healds, but it will be understood that the ends controlled by the jacquard may be operated as desired.

In the "pressure-harness" system (see Fig. 201) the healds that are used in conjunction with the harness are special in form, and in this case the same ends are drawn through both the harness and the healds, and are operated from the two sources, which results in the weave being limited in both the figure and the ground.

Combinations of Lifting Rods or Bars with Jacquard Machines.—This system enables the harness cords to be operated in longitudinal rows quite independently of the figuring hooks, and at the same time does not prevent the cords from being operated by the jacquard. The method is employed, on the one hand, in order that each needle of the jacquard may control two, three, or more consecutive warp threads, as in the split-harness mounting (described in the following), and the twilling jacquard (see Fig. 204); and, on the other hand, it is used for the purpose of enabling warp threads to be lifted in a definite order without the lifts being cut on the figuring cards, as in certain classes of tapestry (see Fig. 216).

THE SPLIT HARNESS OR SHAFT MONTURE

The split harness or shaft monture (also known as the scale or bannister harness) is used in weaving fabrics which are very finely set in the warp in order to double, treble, or quadruple the width of repeat of the jacquard. Rich silk fabrics, of the non-reversible damask and other types, are frequently woven with only a comparatively few picks per inch, but contain a very large number of ends per inch (400 and upwards in some cases), so that with an ordinary full harness mount a very large machine is required in weaving a wide repeat. In the most common form of split harness, which is illustrated in Fig. 188, an ordinary single-lift jacquard is used, but some distance above the comber-board C each single cord D from the neck cords is connected to two or more double harness cords E, each of which is passed through a separate hole in the comber-board. A knot F is tied in each double harness cord, so as to form, above the mail, a loop G which is sufficiently long to allow the proper depth of shed to be made. Also, the comber-board is placed high enough above the knots F to permit the cords to be lifted the proper height without obstruction. The diagram on the left of Fig. 188 represents an 8-row machine, in which the scale is doubled—*i.e.*, two looped harness cords are connected to each single cord D, giving 16 rows of harness cords in the comber-board C. On the right of Fig. 188 three looped harness cords are shown connected do each single cord, which, in an 8-row machine, gives 24 rows in the comber-board.

Operation of the Lifting Rods.—A bannister shaft or rod H (Fig. 188), which is rather longer than the width of the harness, is passed loosely through the loops of each long row of harness cords, so that each rod is capable of lifting one end in every sixteen or every twenty-four, etc., according to the number of rods employed, quite independently of the figuring cards. The arrangement does not prevent the jacquard from lifting the ends in forming the desired figure, but they are necessarily raised by the hooks in groups of two or more to correspond with the scale of the harness. By lifting the rods, the ends that are left down by the jacquard may be raised singly and produce any ground weave (plain, twill, sateen, etc.), which repeats upon a number of ends that is a measure of the number of rods

employed. Thus, in the diagram on the left of Fig. 188, the hooks 1 to 4, which are shown raised by the jacquard, lift up the harness mails 1 to 8, but the rods are raised in 1-and-3 order, and lift up one-fourth of the mails—viz., the twelfth and sixteenth—which are left down by the jacquard. Only warp figures can be formed on the surface as the cloth is woven, and a weft figure is therefore produced by weaving the texture wrong side up.

As a general rule, as the cloths do not contain a large number of picks, each card acts for only one pick. The rods H may be operated by means of a dobby, but it is generally found convenient to use a number of specially strong hooks in the jacquard, cords from which are passed through guide holes in the comber-board to near each end of the rods. If the card cylinder is at the back or front of the loom a row of special hooks should be used at both sides of the figuring hooks, in order that the weight will be evenly distributed on the machine. In some cases the needles and hooks, by which the lifting of the rods is governed, are situated a sufficient distance from the figuring needles and hooks to enable them to be operated by a separate small set of cards. This method has the advantage that a design may be woven in different ground weaves simply by changing the small cards.

The split mounting is sometimes arranged with two neck-cords (which pass separately through a board) to each hook, and with the loops, through which the rods are passed, formed in the neck-cords. It is claimed for the arrangement that the rods are situated where there is most space and are out of the way of the weaver. The double neck-cord system is also used in conjunction with a double-lift single-cylinder jacquard machine.

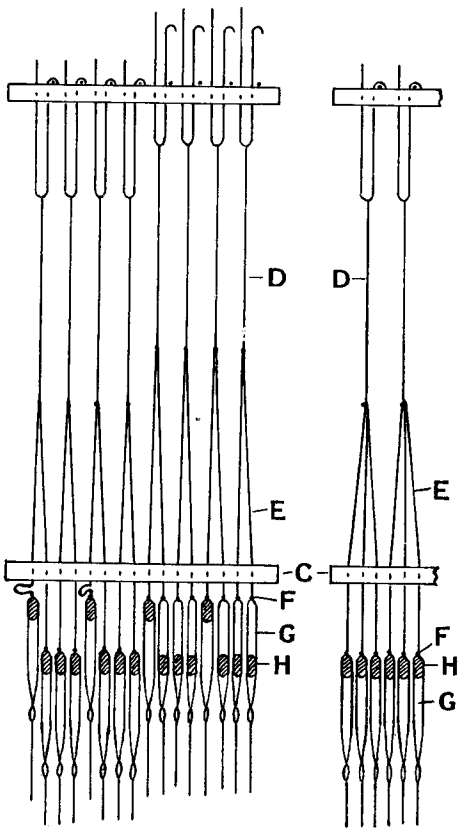


Fig. 188.

System of Designing.—In painting out designs no ground weave requires to be filled in, as this is produced by the lifting of the rods, but the long floats of the figure require to be stopped in the ordinary manner. Thus, A in Fig. 189 illustrates the method of preparing a design for the card-cutting, the particulars of which are :—Cut marks. Assuming that the rods are raised in 1-and-3 twill order, as indicated at B, the full design will be as shown at C in a double-scale mounting, and as represented at D in a treble-scale mounting. At the edge of the figure each step of one end in A corresponds to a step of two ends in C, and three ends in D ;

while, similarly, each single binding point in the figure represents two ends in C and three ends in D. In the ground, however, the ends are operated singly, as shown by the dots.

It is necessary to take into account that the lifts produced by the rods are liable to occur where ends have been left down by the jacquard for the purpose of binding the figure. The dots inside the figure in B and C indicate such lifts, and it will be seen that the binding of a warp float is neutralised at each place.

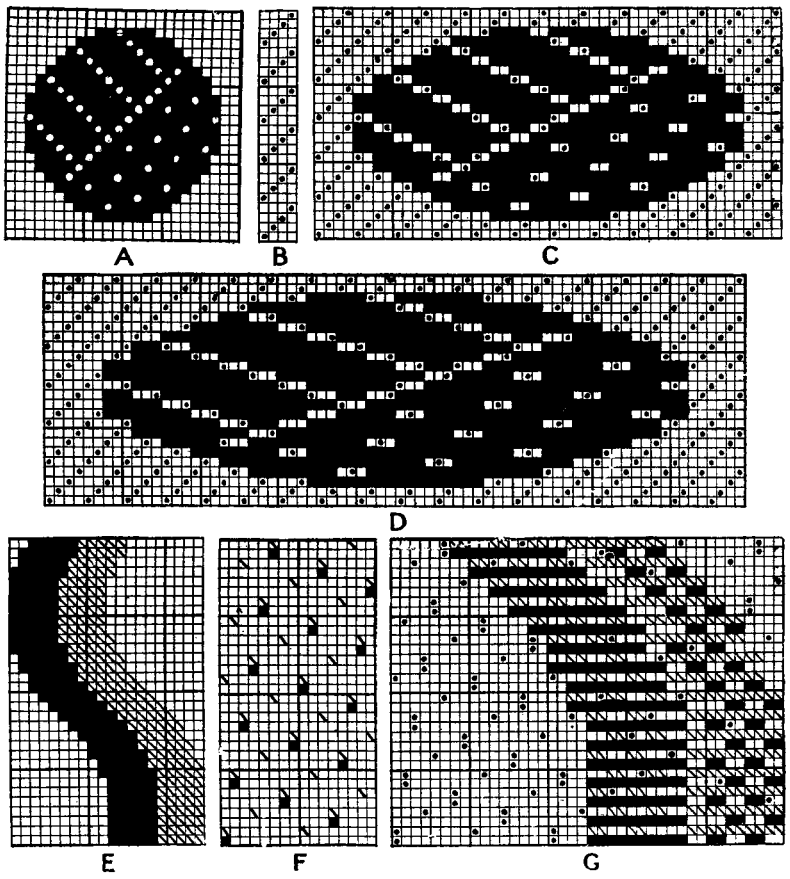


Fig. 189.

In fine cloths which have a weft figure upon a warp sateen ground (produced by weaving the cloths wrong side up), the defective warp float is on the wrong side, and the fault is considered of such little importance that it is generally ignored in painting out designs. However, the defect can usually be avoided by inserting each binding place in the figure upon two consecutive vertical spaces, but this is liable to break up the figuring weft floats on the right side of the cloth, particularly in sateen binding weaves, in such a manner that the remedy is worse than the defect.

The split harness system greatly simplifies the processes of drafting and cutting designs, and there is scarcely any limit to the diversity of weave development that can be obtained in a design, nor to the variety of ground weave that may be used. The outline and binding lines of a figure, however, are rather steppy, but the figure shows up very bold and clear upon the fine ground effect that is generally formed. The system is readily applied to elaborately-figured multiple-weft fabrics, and E in Fig. 189 illustrates the method of designing a figure in two wefts, which are inserted in pick-and-pick order. Two cards are cut from each horizontal space of E as follows .—

First Card.—Cut the marks of the first colour and those of the second colour plain.

Second Card.—Cut the marks of the second colour and those of the first colour plain.

Assuming that the scale of the harness is doubled, and that the rods are raised in the order indicated at F (by which one of the wefts is interwoven in 8-sateen and the other in 16-sateen order in the ground), the full weave to correspond with the lower portion of E will be as indicated at G. It will be seen that the plain cutting of the figure produces a 2-and-2 weft rib weave under each kind of weft float. This example may be compared with that given in Fig. 132 (p. 121).

WORKING COMBER-BOARDS

In this system each harness cord is knotted in such a position that the knot rests on the comber-board when the harness mail is at the bottom line of the shed. The knots do not prevent the cords from being raised individually by the jacquard in the ordinary manner, whereas by lifting the comber-board all the cords, whose knots rest upon it, are raised together. In the manufacture of Brussels and Wilton carpets (see Fig. 445) only one board is employed, but for Marseilles quilts (see Figs. 230 and 231) and satin quilts (Fig. 234) the board is in two longitudinal sections, and for Kidderminster carpets (Fig. 218) in four longitudinal sections, which enable the ends to be raised in groups separately.

In weaving Marseilles and satin quilts, working comber-boards are used in conjunction with ordinary healds, and in Fig. 190 a form of the mounting (as made by Messrs. Robert Hall & Sons) is illustrated. There are two knotted comber-boards A, and two healds B (one of each is shown partly raised), which are operated by means of four tappets C. Cords D, straps E, levers F, and cords G, connect the tappets with the top of the comber-boards and healds, while through levers H similar connections are made with the bottom staves of the healds. Spiral springs I are employed to assist the downward movement of the comber-boards. The tappets C are rotated at the proper speed by the wheel J on the end of the crank shaft gearing into the wheel K connected to the tappets. The jacquard is operated once in every group of picks by means of a positive tappet L, which is driven by a wheel on the crank shaft. Through connecting levers the vertical rod M, which is connected to the jacquard griffe, is made to fall and rise and remain stationary as required, by the tappet L.

Special forms of jacquard and harness mounts are further described and illustrated in the following pages, along with the particular classes of cloths for which they are used. They include the book-harness mounting, pressure harness, self-

twilling jacquard, tapestry mounting, double-plain cloth jacquard, special gauze jacquard, Madras gauze mounting, and pile carpet jacquards, and in addition lappet and swivel mechanisms are dealt with.

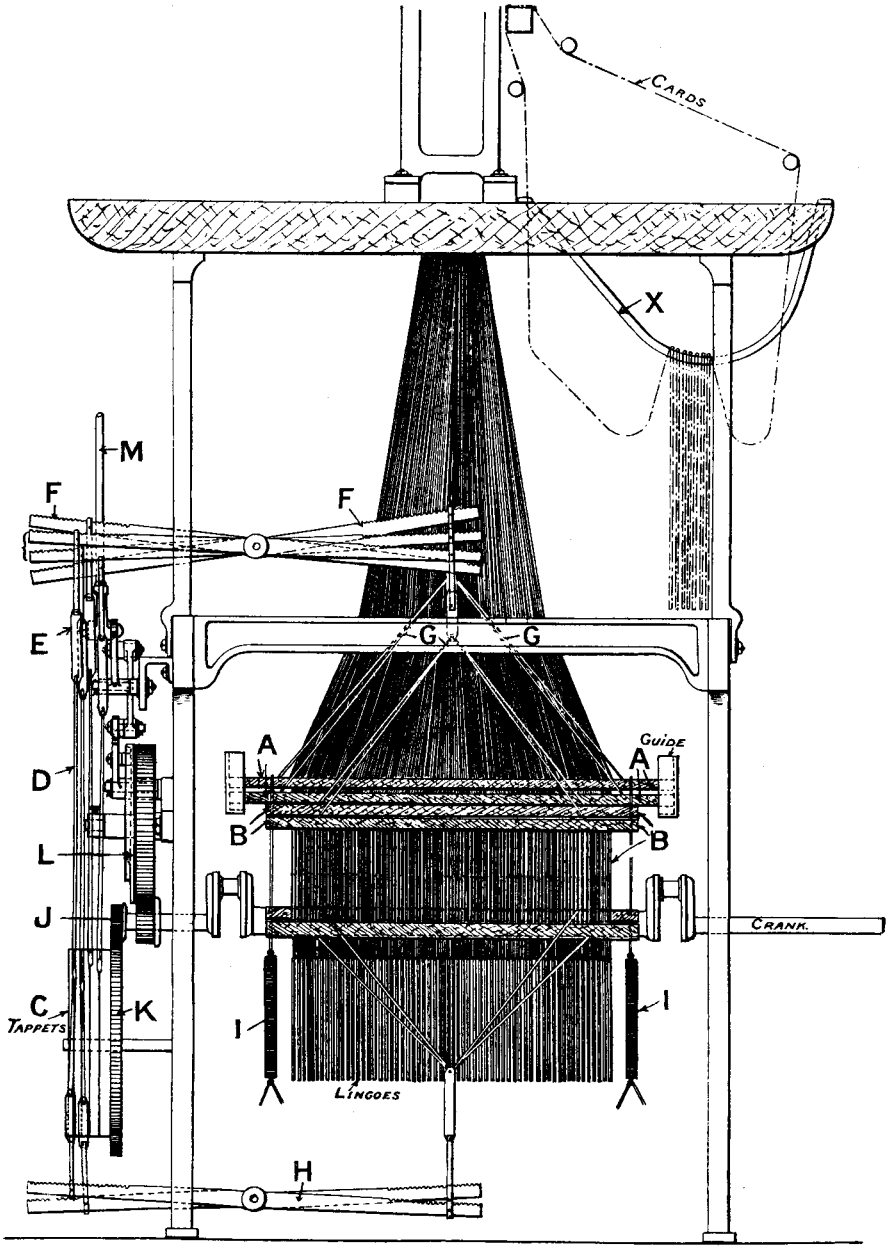


Fig. 190.

CHAPTER IX

FIGURED MUSLIN AND DAMASK FABRICS

Figured Muslin Fabrics. FIGURED BOOK MUSLIN FABRICS—System of Loom Mounting and Structure of the Cloth—Features in Painting-out Designs—Ground Weave Variation —Introduction of Ground-Weft Cords—Weaving Particulars of Book-Muslins—Book-Muslin Loom. DAMASK FABRICS—Reversible and Non-Reversible Damasks—*The Pressure Harness*—Form of the Healds—Operation of the Harness and Healds—Method of Designing —*The Self-Twilling Jacquard*—Arrangement of Needles, Hooks, and Lifting Bars—Operation of Twilling Needles—Proportions of Hooks to Needles—Operation of Card Cylinder—Changing the Capacity and Sett—System of Designing—Production of Diversity of Effect.

FIGURED MUSLIN FABRICS

AN essential feature of a figured muslin fabric is the formation of a light semi-transparent foundation texture, and ground yarns are used which range in fineness from 70's to 120's cotton in warp and weft. The ground texture is most frequently white or cream, and upon it an opaque figure is produced by means of extra threads, which may be either white or coloured. The extra threads are only retained in the cloth where the figure is formed, and when all the yarns are white the design is chiefly apparent because of the difference in density between the figure and the ground. The cloths are woven in the thread or full-harness system by inserting the figuring threads, as extra weft or warp, in the ordinary manner; and in Fig. 116 (p. 112) an illustration of an extra weft style is given; Fig. 156 (p. 139) and Fig. 161 (p. 142) represent extra warp muslin fabrics; while Fig. 173 (p. 149) shows figuring with both extra weft and extra warp. Special methods of producing particular forms of the cloth also are employed, which include Madras, lappet, and swivel weaving (subsequently described and illustrated under their respective titles), and an important class, termed book-harness muslins, is described and illustrated in the following :—

FIGURED BOOK MUSLIN FABRICS

In the " book-harness " muslin structure a light plain foundation texture is ornamented with extra weft, in the manner represented in Fig. 191, which shows the appearance of a typical fabric as viewed from opposite sides. The extra weft is thick and soft spun, and in the figured portions of a cloth it is, as a rule, inserted in 2-and-2 order with the plain ground picks. As the cloth is woven, the figuring picks are floated loosely on the surface between the parts of the ornament that are detached from each other horizontally; but in the finishing process the loose floats are cut away so that an opaque figure appears upon a semi-transparent ground. The cloths are practically reversible, but, as shown in Fig. 191, the uncut side—represented in the lower portion of the figure—is neater in appearance than the cut side, which is shown in the upper portion, as on the latter side the severed ends of the figuring picks impart a rough edge to the figure. The textures are

used as window curtains, and in small designs for skirtings and blouse and dress fabrics.

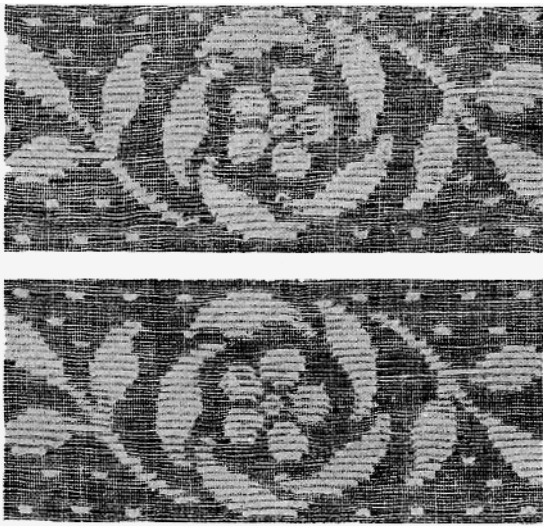


Fig. 191

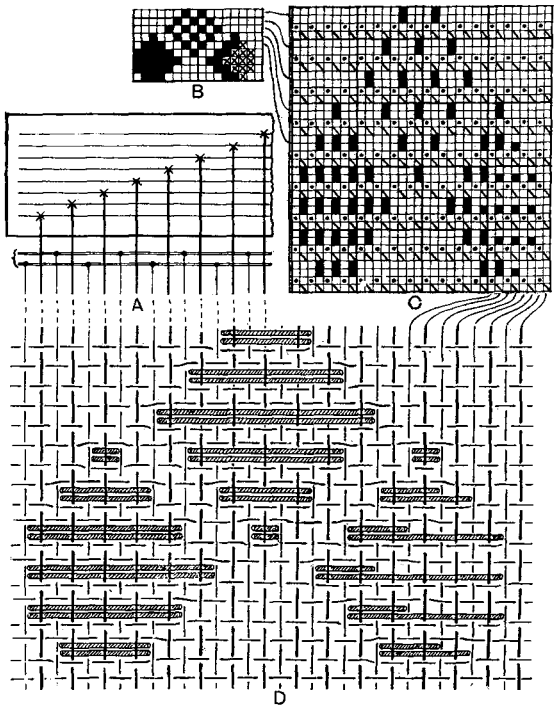


Fig. 192.

System of Loom Mounting and Structure of the Cloth.—In Fig. 192, A shows the heald-and-harness draft that is commonly used, and B a sectional design which is represented in full at C, whilst D illustrates the interlacing of the threads to correspond with C, as viewed from the cut side (the face side as the cloth is woven). The odd warp threads are drawn upon two healds (which work together as one), and the even threads upon the harness, the arrangement enabling designs to be woven which repeat upon twice as many threads as there are hooks of the jacquard tied up. By comparison it will be seen that each horizontal space of the plan B in Fig. 192 is equivalent to four horizontal spaces of C, and each vertical space of B to two vertical spaces of C. Further, a comparison of the draft A with the flat view D will show that the plain foundation results from lifting the full harness on the first pick of each pair of ground picks (represented by the diagonal marks in C), and the two healds on the second pick (represented by the dots in C). On the extra picks the healds are left down, but the harness is raised where figure is required to be formed—that is, the marks in the plan B in Fig. 192 indicate warp up.

In the most usual structure of the figure the extra picks float over only one end at a place on both sides of the cloth, as shown in the spot on the left

of C and D in Fig. 192. On the uncut side of a cloth a longer float than over one end cannot be produced, because alternate ends are depressed by the healds on the figuring picks. On the cut side the harness ends may be operated in any desired order by the jacquard, but if long figuring floats are made they are liable to be cut away in the shearing process along with the floats which extend between the figures. It is, therefore, customary in a figure to leave down not more than one harness end at a place, which gives a float of three ends in the cloth on the cut side, as shown in the central spot in C and D, Fig. 192. The weave development of a figure is thus limited to floats of one and three in the cloth, but a further variation of the structure is made by interweaving both figuring picks of a pair in one portion and only one pick in another portion, as shown in the spot on the right of C and D in Fig. 192. An effect is obtained which, being between the semi-transparent ground and the opaque figure, is useful in shading a design; and the card-cutting particulars of the plan B to obtain the result are: Cut the solid marks on both figuring picks of a pair, and the crosses only on the odd picks.

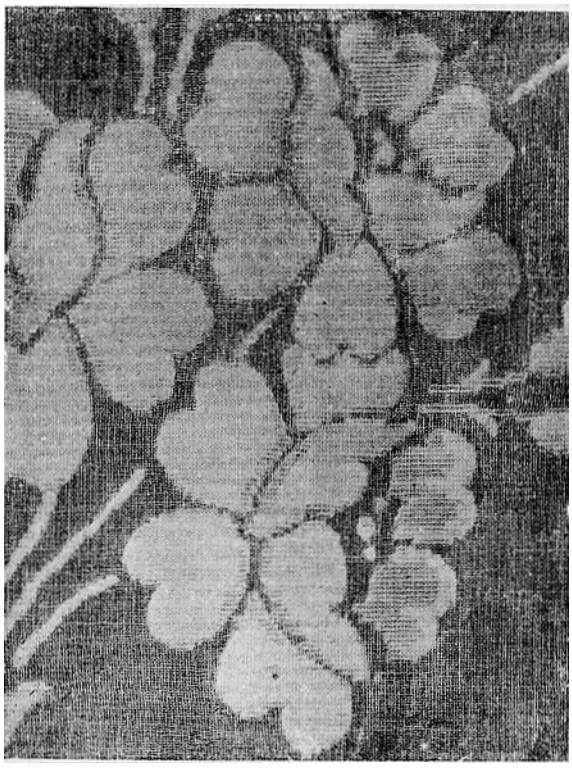


Fig. 193.

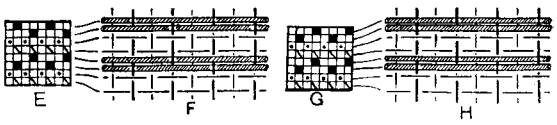


Fig. 194.

The three methods of interweaving the figuring picks, illustrated at C and D in Fig. 192, are largely used, but as both picks of a pair are inserted into the same shed, adjacent pairs are distinctly separated from each other by the plain ground picks. The running of the figuring picks in pairs is clearly shown in Fig. 191, and, generally, this is considered a feature of the structure. Sometimes, however, this formation is avoided as much as possible, and in Fig. 193 a fabric is represented in which a fuller and more solid figure is obtained by floating the picks of each pair alternately in 3-and-1 order. The 3-and-1 floats may be arranged as shown at E and F in Fig. 194, in which the last figuring pick of one pair is in the same

shed as the first pick of the next pair, or as indicated at G and H, in which they run continuously in alternate order.

Features in Painting-out Designs.—The plan given at K in Fig. 195, which corresponds with a portion of the design represented in Fig. 193, will serve to illus-

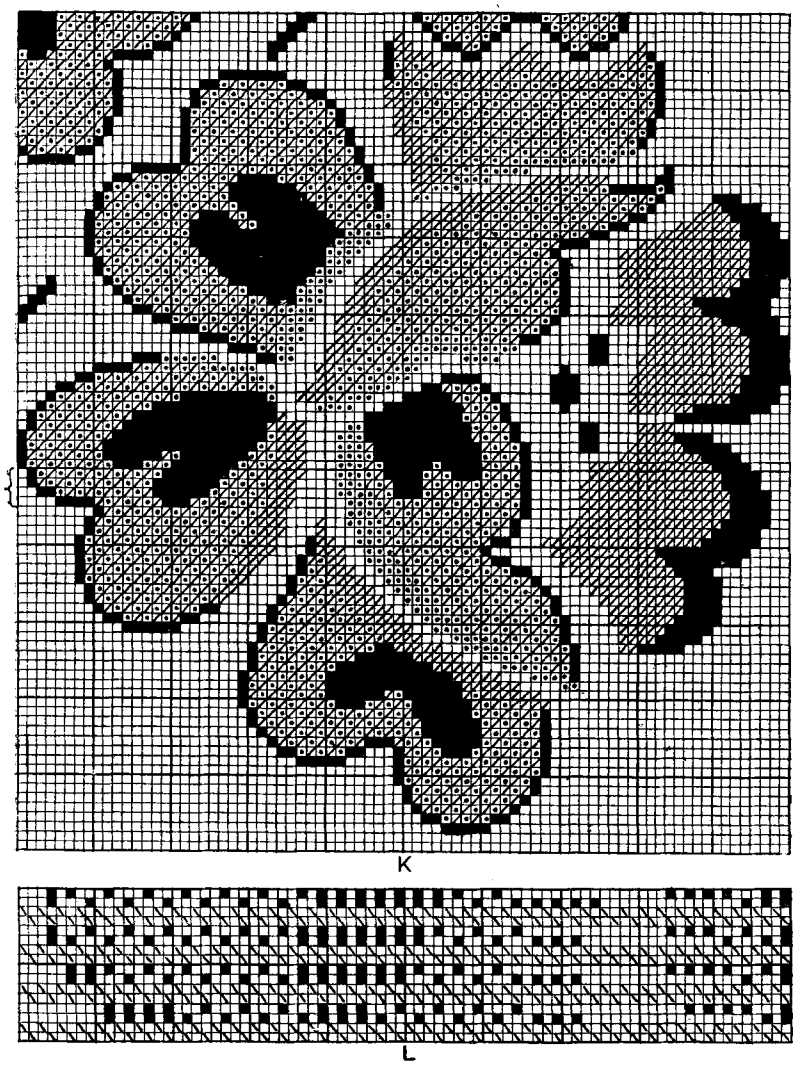


Fig. 195.

trate several features in the painting-out of designs for these fabrics. It is a rule to separate two portions of figure—between which the light ground texture is required to show distinctly—by at least two horizontal spaces of the design paper. Otherwise the weft floats between the parts will not be long enough to be engaged by the shears, and by being retained in the cloth will make the two portions of

figure appear to join up. Frequently, in the finer set cloths three consecutive spaces are left blank horizontally, in order to ensure that the light ground texture will show clearly between the separate parts of a figure. The card-cutting particulars of the design K are :—First figuring card of each pair—cut the full squares and the diagonal strokes ; second figuring card—cut the full squares and the dots. In the bulk of the figure the diagonal marks and dots are inserted in alternate order, which, in the foregoing order of cutting, results in 3-and-1 floats being formed alternately, as shown at F in Fig. 194 ; while by reversing the cards of alternate pairs the structure represented at H in Fig. 194 will be produced. Floats of one thread only are made in the remaining portions of the design —by both figuring picks where the solid marks are indicated ; by the odd figuring picks where the diagonal marks only are shown ; and by the even figuring picks where only the dots are inserted. The two last orders of marking are for shading the figure, and it will be seen that where two shaded effects are made close together, one is formed by the odd picks (the diagonal marks) and the other by the even picks (the dots). The object of this is to get as great a length of float as possible between the separate parts of the figure, so that the floats will be effectively cut away ; while the arrangement also tends to equalise the lifts of the harness threads. In order that comparisons may be made, the complete weave of the picks 37 to 40 (indicated by the bracket at the side of K) and the ends 1 to 40 is given at L in Fig. 195, assuming that the preceding order of cutting is employed.

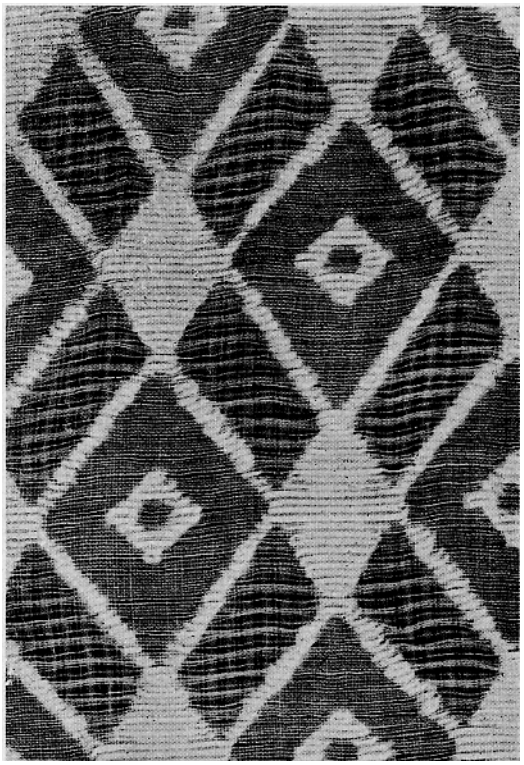


Fig. 196.

Ground Weave Variation.—In the cloth shown in Fig. 196 a useful variation of the plain ground texture is illustrated in the form of a 5-and-1 imitation gauze weave, which is used in these fabrics to a considerable extent. The corresponding complete card-cutting plan is given at M in Fig. 197 ; the full squares are cut on the figuring picks (two cards alike from each horizontal space), and the diagonal marks on the cards which are employed in raising the healds. The complete weave of the picks 12, 13, and 14 (indicated by a bracket), and the ends 1 to 25, is given at N, while the plan O, which corresponds with the last six ends of N, with the figuring picks omitted, shows the imitation gauze weave that is formed in the ground.

Introduction of Ground-Weft Cords.—The fabric represented in Fig. 198 illustrates a style in which thick cord ends are used to supplement the effect produced by the extra weft. The cord ends are interwoven in the cloth in the space between two massive portions of figure which occur at intervals, but where the massive figures are formed they are floated loosely on the surface (the cut side) and are afterwards sheared off. The extra weft is introduced only to a small extent where the cord ends are woven in, but the latter give the cloth the appearance of having the extra weft inserted continuously. The complete design of the fabric—the last sixteen picks enclosed by the bracket Q being repeated five times—is given in Fig. 199, in which the crosses represent the cord ends The card-cutting particulars are :—Cut the full squares and the crosses on the figuring picks, and the crosses on the cards that are used for the heald sheds. In order to show the effect of the cutting, the full weave of the four picks and eight ends, with which it is shown connected, is inset at P. The cord ends are extra (there are three ends per split at each place), and where each is interwoven it works along with the accompanying harness end. Previous to the shearing process the cord ends are cut by hand by means of a knife which is run across the cloth at the places where the ends are floated, the free threads then being sheared off at the same time as the floating picks.

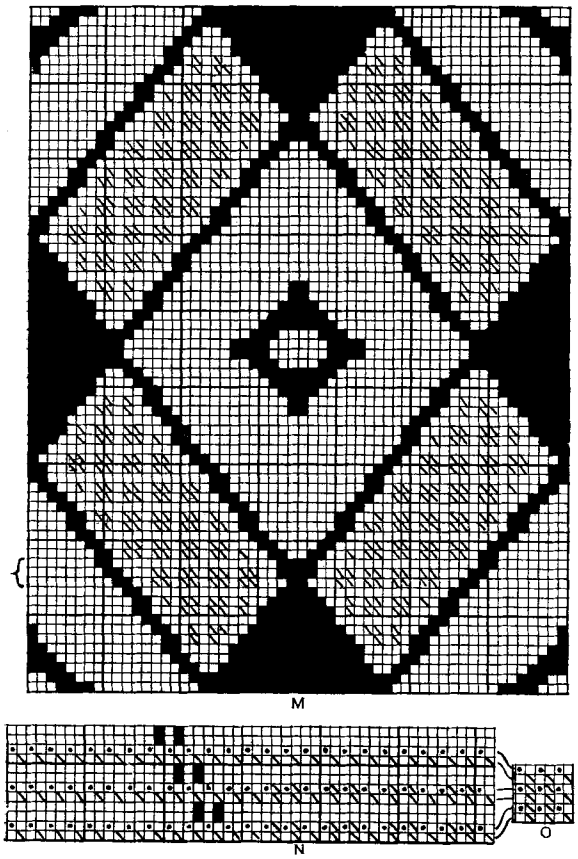


Fig. 197.

Weaving Particulars of Book Muslins.—The number of ends per inch with which the cloths are woven usually ranges from 48 to 60, and the number of ground picks from 40 to 56 ; the warp yarns range from 60's to 80's cotton, and the ground weft yarns from 70's to 100's cotton ; while from 16's to 20's soft spun figuring weft is used. The average number of figuring picks per inch varies according to the order in which they are inserted, and the cloths are classed as " full cover," in which the extra picks are inserted continuously with the ground picks, or one-half, two-thirds, two-fifths cover, etc., in which the extra picks are inserted inter-

mittently. The proportion of the cover can be obtained by finding the number of horizontal spaces of the design upon which the extra figuring picks are indicated in relation to the total number of horizontal spaces in the repeat. Thus, in Fig. 199 there are 50 figuring spaces and six blank spaces, then two figuring spaces and six blank spaces repeated eleven times, giving a total of 72 figuring spaces in a repeat of 144 spaces, which is equal to a " half-cover." The design paper should be ruled in the same proportion as the ends per unit space are to the ground picks. Thus, for a cloth that counts 63 ends $\times$ 55 ground picks per inch 8 $\times$ 7 paper is suitable. In most cases the yarns are white, but occasionally a coloured figure is made upon a white ground, and sometimes, by chintzing, a figure is woven in white and a colour, or in two colours.

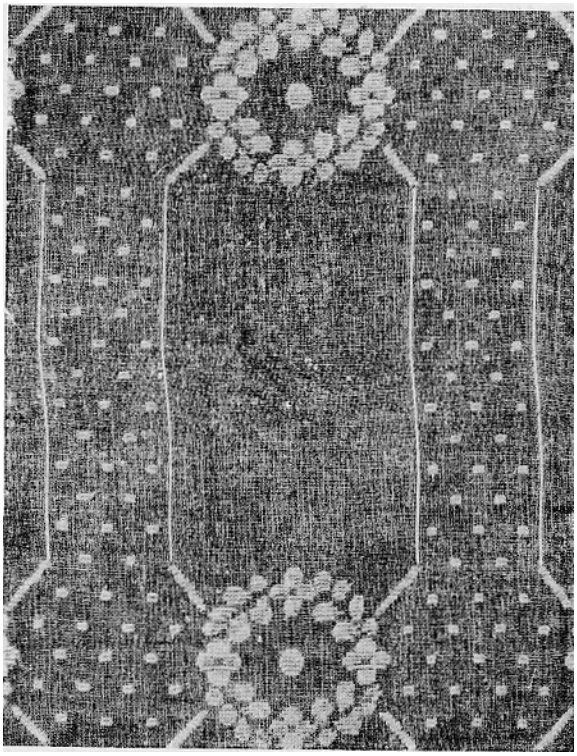


Fig. 198.

Book-Muslin Loom.—Usually, the book-muslin loom is made with a very simple box motion, two boxes being provided at one side which are brought into operation in turn by means of special hooks in the jacquard. The extra picks are not woven into the selvages, but are bound at each side by a strong catch cord which is raised by a special hook on both ground picks and one of the extra picks. A special hook is also set aside for bringing the healds into operation. If an ordinary form of jacquard is employed, four cards are required for each group of four picks—viz., a fully punched card for the full harness ground shed; a blank card for the heald shed (except that holes are cut for operating the healds and the boxes, and to lift certain harness ends when a special effect is woven); and two figuring cards for the two extra picks. Frequently, however, a card-saving mechanism is applied, which, in order that the formation of the different effects previously described will not be interfered with, is devised so as to dispense only with the cards for the full harness ground sheds. One-fourth of the cards are saved in the figured portions of the cloth, and one-half where no extra weft is inserted—that is, one card is saved to correspond with each horizontal space of a design.

In one system, in which a double-lift, single-cylinder jacquard is used, the card

cylinder is brought into operation only when a certain hook, which is set aside for the purpose, has been raised on the preceding pick. The card which precedes the full harness lift (the first ground pick of each pair) always causes the particular hook to be left down, so that on the full harness lift the card cylinder is left away

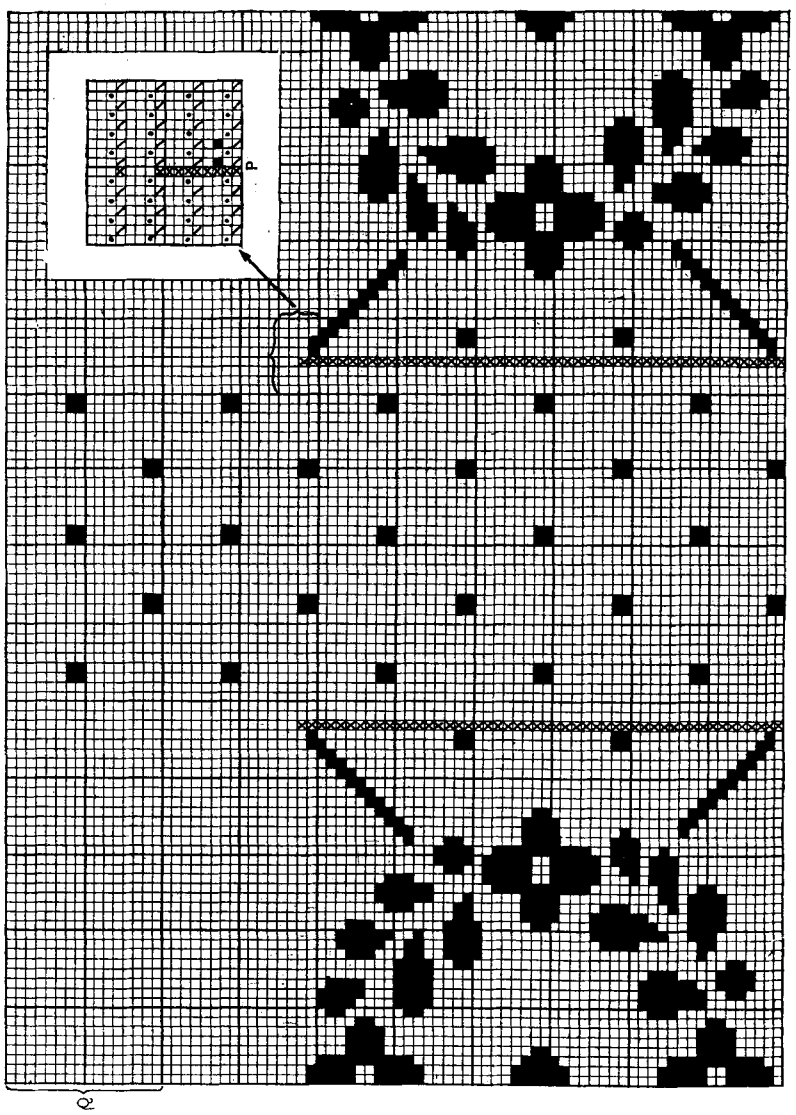


Fig. 199

from the needles, and thus produces the same result as a fully punched card. On the latter lift the special hook is automatically raised, so that the card cylinder is brought into action on the following pick. In the figured portion of a cloth the cylinder is put out of action by the second figuring pick of each pair, and where no extra weft is inserted, by each card that is used for a heald shed. In order that

the full harness lift will not interfere with the position of the boxes, by raising the hooks by which the boxes are controlled, each of these hooks is single, and is operated by the opposite griffe to that which rises on the full harness shed.

DAMASK FABRICS

Reversible and Non-Reversible Damasks.—In a true damask figured fabric, a weft sateen figure is formed upon a warp sateen ground, or *vice versa*, and the structure is described as reversible. The term damask, however, is also applied to cloths in which the figured portions are developed in diverse ways upon a sateen ground, the texture being then known as a one-sided damask. Fig. 200 illustrates a method of developing a figure as a one-sided damask upon 5-sateen ground, Cotton and linen damasks are used in the white state for table napery; cotton or linen warps are crossed with worsted weft, and in the dyed condition the cloths (termed union-damask) are used for table-cloths, hangings, etc., while fine silk damasks are used for a variety of purposes.

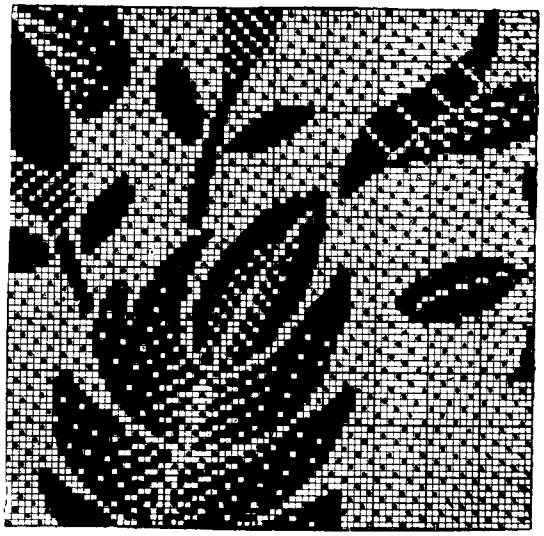


Fig. 200.

Designs in which diverse weaves are employed in the figure are woven in ordinary or full-harness mountings. Small reversible damask designs are also frequently woven in a similar manner, in which case it is necessary for the binding weaves of the figure and ground to be cut upon the cards since each end in the repeat is controlled by a separate needle and a card used for each pick. Very large designs, which are extensively woven in the finer qualities of table-cloths, napkins, etc., require for economical and practical reasons the use of special machines, and of these there are two chief types—viz., the Pressure Harness, and the Twilling Jacquard. The objects of each arrangement are to enable each needle of the jacquard to control two or more consecutive ends, and each card to act for two or more successive picks; and to simplify and reduce the cost of painting out designs and card-cutting. In each mounting the ends are controlled both by and independently of the figuring cards.

The Pressure Harness.—The jacquard is generally an ordinary single-lift machine in which each needle controls one hook and one harness cord in the repeat, but two or more ends are drawn through each harness mail. In order to prevent the ends from twisting round each other "decked" harness mails are used, each mail being provided with several eyes through which the ends are drawn individually. In Fig. 201, A and B show two forms of decked mails, the former being constructed