10

Figured Double and Treble Cloths

Figured double and treble cloths represent a principle of construction which is widely employed to produce considerable ranges of ornamental fabrics in different materials and weights for such divergent uses as dress fabrics, fancy waistcoats, overcoatings, curtainings, upholstery materials and rugs. An inexhaustible structural variety is possible and in this chapter it is intended to show only the main classes and to establish the principles of construction involved.

Most of the structures of the above type are a development of the cloth interchange principle dealt with in Chapter 8 in which a number of simple figured effects falling within the scope of the dobby shedding mechanisms were given. The basic principle of layer interchange remains the same and whether a dobby or a jacquard is employed the separating lift is the governing factor determining which layers at any given part of the construction shall occupy the top and the bottom positions. A treble interchanging cloth is only slightly more complex as it involves interchange at three different levels but these are as much under the control of the separating lifts as are the two layers in a double cloth.

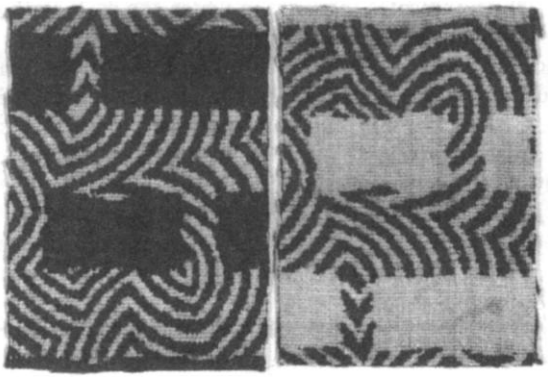

Figure 10.1

To produce a distinctive design the threads of one fabric require to be different from those of the other in respect of colour, material or thickness whilst the number of threads in each layer may be in either equal or unequal

proportions. Many interchanging fabrics are produced in reversible styles, as shown in the fabric in *Figure 10.1*, in which a light figure on a dark ground on one side corresponds with a dark figure on a light ground on the other side.

At one time the figured interchanging cloths were extensively produced in special jacquard harnesses and mountings designed to increase the figuring scope of the coarse pitch machines or to simplify the painting of the designs and the card cutting. The traditional mountings applicable to the manufacture of the interchanging cloths such as the sectional harness tie are described together with the other special jacquards in Appendix I. In this chapter it is assumed that the fabrics are produced on fine pitch ordinary jacquards using condensed and simplified painting and modern card-cutting machinery as outlined in Chapter 1.

FIGURED INTERCHANGING DOUBLE CLOTHS

Simple interchanging structures

The least complex structures in this group consist of two layers which differ in colour and which, by alternating between the face and the back according to a predetermined plan, produce a reversible design in two colours. An example of this type of construction is given in *Figure 10.1* which shows both sides of the cloth side by side. The weaves employed in each layer in that particular cloth are plain and this, in fact, is the most frequently used weave as it permits the production of a compact and serviceable fabric at lower settings than any other weave. However, apart from the question of the economics of production, there is no limitation as to the type of weave which could be employed in the interchanging double cloth and many other interlacings are used. It is also possible to have one layer constructed in one weave and the other in a different weave.

The construction of the simple interchanging cloths on design paper is illustrated in stages in *Figure 10.2*. At A a simple motif is shown in a condensed and simplified form which indicates the areas in which the dark cloth (solid squares), or the light cloth (blank squares), is displayed on the surface. The degree of condensation adopted here is by 2 in both directions so that each vertical row equals two ends, one dark and one light, and likewise, each horizontal row corresponds to two picks, one dark and one light. In finely set fabrics it is possible to condense the design by 4 in each direction without losing too much detail, especially when plain weave is used in both layers. It will be appreciated that in normal jacquard designs much more ornate figures will be produced than the dice effect given at A, but whatever the effect the motif is as representative of the constructional features of an interchanging double cloth as the most elaborate figured design.

If it is required to produce the design A in plain weave then each 2 X 2 area of the solid squares is representative of the detailed weave shown at B in *Figure 10.2*, and each 2 X 2 area of blank squares is representative of C. It will be noted that at both B and C the dark ends weave plain with the dark picks and the light ends weave plain with the light picks, the only difference between the two being the occurrence of the separating lifts. Thus, at B, dark ends are raised over light picks ensuring that the dark cloth occupies the top or face

position, and at C, light ends are raised over dark picks which makes the light coloured cloth layer assume the surface position with the dark layer underneath it. The interchange is shown clearly by the warp section D which represents the first horizontal row of A, and by the fully worked-out design E. Referring to the fabric given in *Figure 10.1* it will be appreciated that despite the complexity of the figure each dark portion of the cloth is produced exactly as at B, and each light coloured portion exactly as at C in *Figure 10.2.*

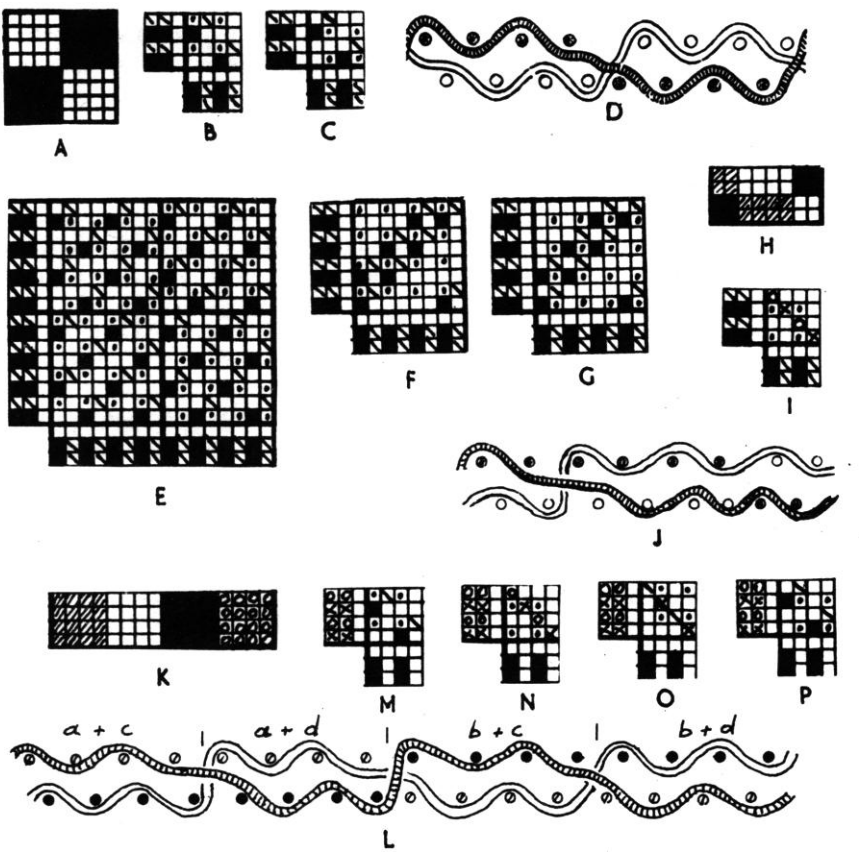

Figure 10.2

As the motif A is representative only of the disposition of the two differently coloured layers between the face and the back of the cloth and not of any specific interlacing it can be used also to illustrate the construction of interchanging twill weave fabrics. Thus, if it is required to produce the design A in a 2-and-2 twill weave, then each 4 × 4 area of solid squares in the motif is representative of the detailed weave given at F, and each 4 × 4 area of blank squares equals to that at G in *Figure 10.2.* It will be noted that, again, the only difference between F and G is in the positions of the separating lifts which are as at B and C respectively.

Apart from varying the weaves in the fabric as a whole, it is also possible to produce interchanging constructions in which different weaves are used in each

cloth layer. If, for example, it is intended to have the dark layer in plain weave and the light coloured layer in 2-and-2 twill then the solid portions of A will be representative of B, and the blank portions of A will correspond to G in *Figure 10.2.* Although, theoretically, any two weaves could be combined in the manner suggested above, in practice it is necessary to consider the possibility of cloth distortion if the two weaves have considerably different frequencies of interlacing. In such situations, and particularly when all the ends come from the same beam, there is a tendency of one layer becoming much slacker thus forming distinctly puckered areas. This, when not wanted, as in overcoatings, represents a fault; however, there are many other ornamental structures in which the puckering of one layer in respect of the other is deliberately magnified as a special feature.

In the foregoing examples solid two-coloured effects were produced by interweaving dark with dark and light with light ends and picks. Using the same colour arrangement it is, however, possible to obtain a three-coloured effect in the cloth by interweaving in selected areas dark ends with light picks and *vice versa.* Thus, in addition to the solid dark and solid light coloured areas, mixed colour areas can be formed which, due to the close juxtaposition of the differently coloured threads, assume a hue intermediate between the one and the other. This is indicated by the motif H in *Figure 10.2,* in which the cross-hatched portion represents the mixed colour area of the design. Assuming that the weave is plain throughout, the solid portions of H will weave as B, the blank portions as C and the cross-hatched portions as I in which the plain weave is produced between the dark ends and the light picks. As the dark ends are lifted on dark picks the top cloth layer in this portion will, therefore, consist of a plain weave composed of dark ends and light picks whilst a similar bottom layer consists of light ends and dark picks as shown clearly by the warp section J which corresponds to the first horizontal row of the condensed design H.

As a further elaboration of the simple interchanging cloth, designs in four different hues can be obtained if the two colours of weft are different from the two colours of warp. Thus, assuming that the warp colours are a and b, and the weft colours c and d the four-colour effect is due to the combination of a + c, a + d, b + c, and b + d as indicated by the motif K and the warp section L in *Figure 10.2.* The fully worked-out constructions to correspond with the different portions of K are given at M, N, O and P respectively. Although the different areas are not as clearly defined as when they are composed of solid colour they often produce pleasingly subdued effects. The colour range in this form of construction and also in the preceding ones can be considerably extended, if desired, by planting and chintzing.

Combination of fine and coarse fabrics

Figured effects can also be formed by interchanging a fine fabric layer with a coarse one as illustrated by the cloth in *Figure 10.3.* The design is given in a condensed form at A in *Figure 10.4* in which the blank areas represent the portions in which the fine cotton/polyester blend yarn fabric forms the surface, whilst the cross-hatched areas indicate where the coarser worsted cloth is displayed on the face. Plain weave is used for both layers and the threads are

arranged in the proportion of 2 fine to 1 coarse in both the warp and the weft directions. For this reason the degree of condensation used in the design A is 1 : 3, i.e. each vertical and horizontal row in the design equals three threads—two fine and one coarse. The fully worked-out weave representative of a 2 × 2 area of the blanks is given at B, whilst that for a similar area of cross-hatched squares is shown at C. The warp cross-section at D corresponds to the beginning of the sixth horizontal row of A.

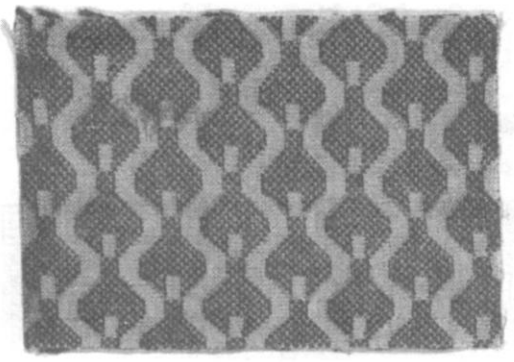

Figure 10.3

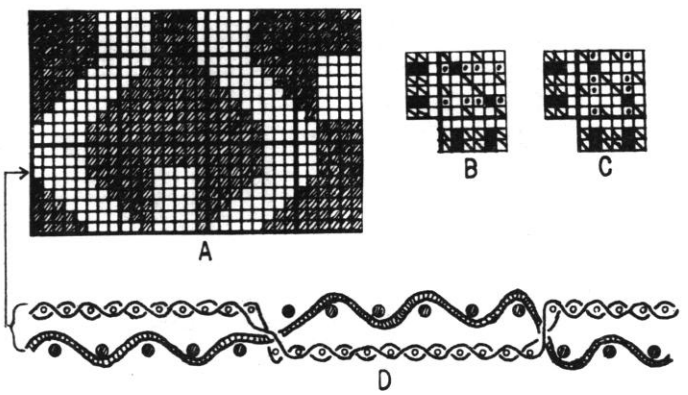

Figure 10.4

In constructions in which there is a very considerable disparity in the thickness of the fine and the coarse threads the ratios between the two sets of yarns can be increased to 3 : 1, 4 : 1, or even 5 : 1. However, as the very coarse layer tends to distort the threads of the very fine layer at the point of interchange the uses of such extreme combinations are confined to a very small range of effects verging on the bizarre.

Combination of double weaves with warp and weft float

In addition to forming figure by interchanging the fabric layers, as described in the foregoing, the cloths can be further embellished by floating the weft or

Figure 10.5

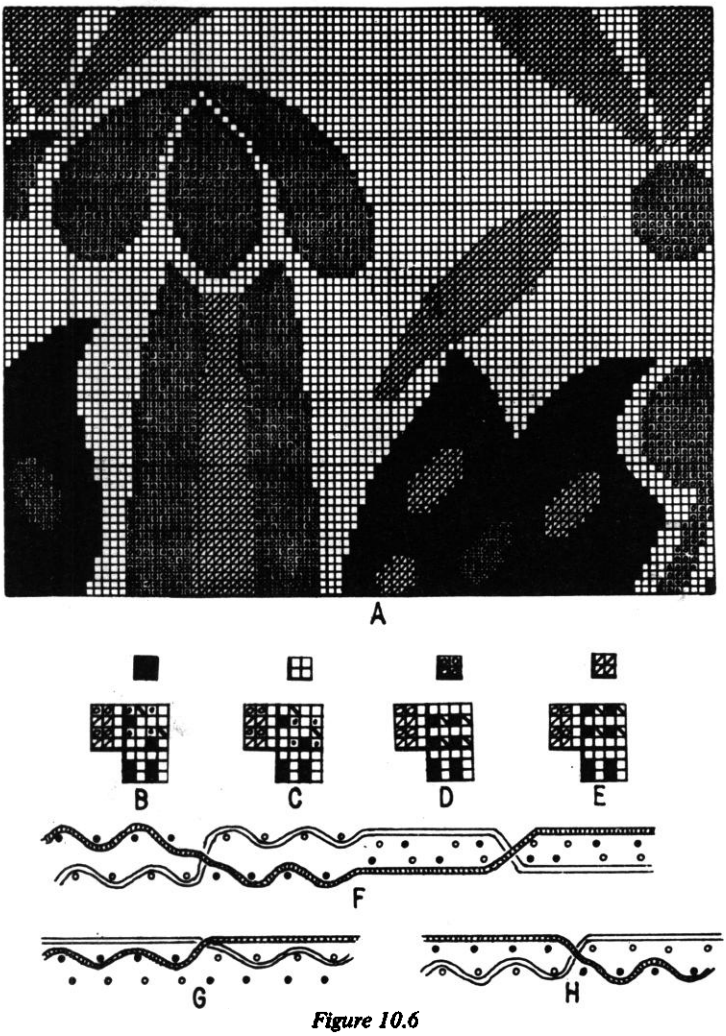

Figure 10.6

warp threads. In *Figure 10.5* a cloth is represented in which two colours of warp combine with two different colours of weft to form two interchanging plain cloths each in a mixed colour effect and, additionally, each weft is floated in places to form a solid coloured figure on its own. When one weft floats on the surface the other makes a corresponding float on the back, the two warps being contained in between the weft floats.

A portion of a simplified design (condensed by 2) is given at A in *Figure 10.6* with the detailed weaves for the four different structural areas of the cloth worked out at B, C, D and E. The warp cross-section at F shows the order of thread interlacing in each of the four areas.

At G and H in *Figure 10.6* two different sections are provided to show alternative methods of construction which may be adopted for the float portions of the figure. At G one weft floats on the surface supported by the plain weave cloth produced by the interweaving of the second warp and weft whilst the first warp forms a corresponding warp float area on the back. This method produces a firmer construction than that used at A and may be more suitable for upholstery fabrics whilst the former may be preferred for curtainings. At H yet another possibility is presented in which the weft float is supported by a corresponding float of its own warp whilst the other warp and weft weave plain underneath. This method offers the advantage of utilising the warp placed directly below the floating weft for stitching the pick in on the surface should the weft float be judged excessively long. When the floating warp is placed in the position indicated in the section H the occasional stitching-in is carried out without disturbing the plain foundation cloth.

Although in the foregoing examples only the weft float was considered it will be appreciated upon the examination of the sections F, G and H in *Figure 10.6* that in each case additional ornamental features could be readily produced by reversing the positions of the warp and weft floats to obtain warp float figures on the face of the cloth.

The cloth represented in *Figure 10.5* has been made for a heavy curtaining fabric to the following particulars: 1 thread 30/2 tex cotton, 1 thread 28 tex filament rayon in warp and weft; 28 ends and picks per cm.

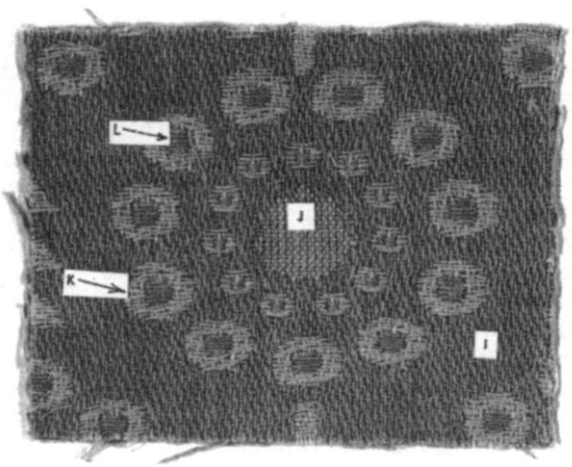

Figure 10.7

In *Figure 10.7* an entirely different curtaining fabric is shown which is produced in the, so-called, folk weave style which is characterised by a comparatively open construction. It also incorporates weft float figure areas which are produced exactly as in the cloth given in *Figure 10.5* but its main interest lies in the rather unusual combination of weaves. Thus, the ground, marked I in *Figure 10.7,* is produced by the darker ends and picks in a 5-shaft satin weave with the reverse of that in the lighter ends and picks in the bottom layer; portions of the figure designated J are produced in plain weave with the lighter threads forming the face cloth and the darker ones the back cloth; other portions, K, weave in a 5-shaft sateen in light threads on the face with the reverse weave in the dark threads on the back, and at L the dark weft floats on the face whilst the light weft floats on the back with both warps in between.

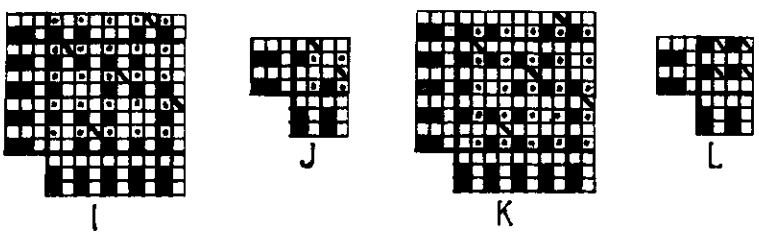

Figure 10.8

A perfectly reversible fabric is produced for which the detailed weaves are given in *Figure 10.8* designated I to L to correspond with the lettering in *Figure 10.7.* The two sets of threads are exactly the same in thickness and differ only as to colour, the arrangement being 1 dark, 1 light in both directions. The warp and the weft consist of identical 74/2 tex cotton yarns and the settings are 26 ends and 22 picks per cm.

Cloque or crepon effects

In *Figure 10.9* the face and the back of two different fabrics are shown, illustrating the appearance of a cloque texture in which a waved or cockled surface is produced. The effect may be due to the weave structure, or the use of yarns with different shrinkage properties, or to both. The possibility of using the difference in contraction between the two layers, due to the employment of tightly and slackly interlaced weaves, to create distortion has been mentioned earlier. The effect which causes cockling of the slack fabric layer can be magnified if the warp in the tightly interlaced cloth layer is drawn from a heavily tensioned beam and the warp in the slack cloth is placed on a lightly tensioned beam. Where only a slight degree of cockling is required in the layer containing the excess length of yarn this method may be sufficient in itself. Where, however, a pronounced cockle is desired the utilisation of differential shrinkage properties in yarns is necessary, the shrunk cloth layer remaining straight whilst the one not subject to shrinking becomes corrugated or cockled due to the excess length in its yarns compared with the first one. This is illustrated by the schematic diagram at A in *Figure 10.10.*

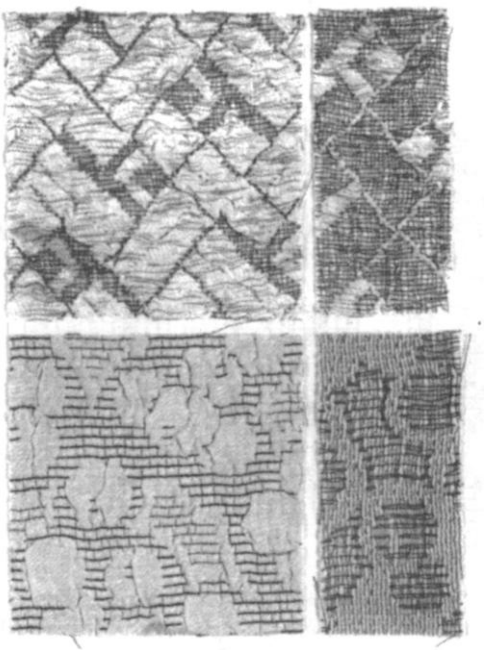

Figure 10.9

The differential shrinkage properties are best considered in connection with pairs of materials one member of which is affected and the other unaffected by a particular agency. Thus, if one layer in an interchanging double cloth consists of woollen yarns and the other of cotton then in a milling process the woollen layer shrinks and the cotton one cockles as it is less affected by the milling action than the former layer. Similarly, a cotton and a polyamide layer when immersed in a caustic soda solution will result in the shrinkage of the cotton component and cockling or wrinkling of the polyamide one. In another method of achieving differential shrinkage one layer composed of crepe twisted yarns will shrink more than the second layer consisting of low twist yarns. In addition, it is also possible to utilise in a similar manner the heat sensitive properties of some synthetic materials which have the capacity to shrink appreciably when exposed to heat whilst making the other cloth layer from materials which remain unaffected by exposure to higher temperatures.

All of the above methods can be employed for the production of cloque effects and the choice frequently depends on what particular pairings of materials are the most desirable for any specific purpose. The two fabrics represented in *Figure 10.9* are both of the light dress type in which the cockled appearance was achieved by the use of high twist yarns in one layer and low twist yarns in the other. The high twist fabrics are in both cases very open and form a net-like construction through which the finely set structure composed of the low twist yarns is clearly visible. The open structure is achieved by the special arrangement of the threads which in the upper fabric in *Figure 10.9* is: 3 low twist, 1 high twist in the warp and 4 low twist, 1 high twist in the weft; and in the lower: 4 low twist, 1 high twist in the warp and 6 low twist, 2 high twist in the weft.

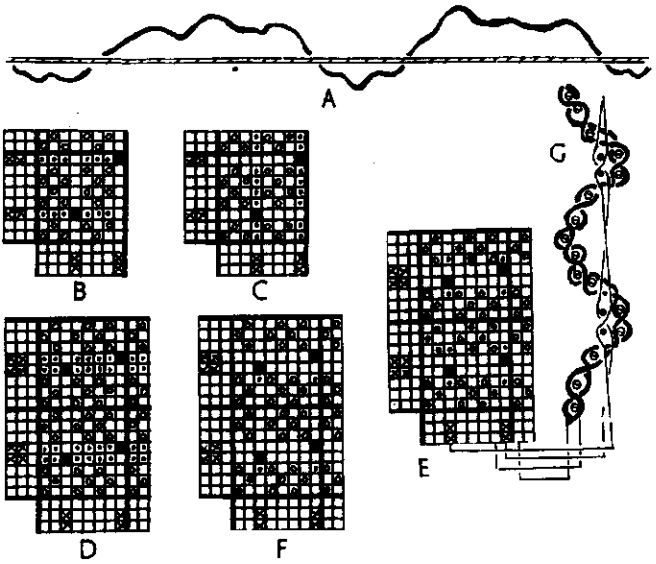

Figure 10.10

Plain weave is used throughout in each layer. Fully worked-out weaves are shown in *Figure 10.10*, those at B and C referring to the upper and those at D, E and F to the lower fabric in *Figure 10.9*. In each of the detailed weaves the high twist threads are indicated by the crosses at the margins of the designs. At B the construction is shown in which the finely set low twist yarns weave plain on the face with the high twist yarn producing the open plain weave structure on the back. C shows the reverse situation. At D and E the constructions in the second cloth are shown which correspond respectively with B and C in the first cloth except that at E the cloth made from the high twist yarns is brought to the face in only narrow horizontal portions. This is done in order to create a ground consisting of a series of wefts as an added feature illustrated clearly in the weft section at G. At F in *Figure 10.10* another effect is given which forms a secondary feature in the lower cloth in *Figure 10.9* and which consists of an even thinner band of high twist yarns on the face, this band being only one pick wide on the surface. Thus, two grades of welt are formed in the ground areas, a pronounced one at E and a discreet one at F.

Combination of double cloth with warp or weft float on single cloth ground

The fabric illustrated in *Figure 10.11* shows a compact upholstery fabric of very rich appearance which embodies five different constructional areas. The ends are all the same consisting of 17/2 tex filament viscose rayon, 84 ends per cm; in the weft arrangement is 1 pick 34 tex filament viscose rayon, 1 pick 140 tex condenser spun cotton, 29 picks per cm.

The ground is composed of a single cloth produced in a warp-faced rib structure indicated at B, and also in the weft section at A in *Figure 10.12*. In the design B the coarse cotton picks are indicated by the solid marks at the margin

of the repeat. It will be noted that the rib weave is such that it splits the weft into two layers the top layer consisting of the fine rayon and the back layer, of the coarse cotton picks. The back is comparatively loosely bound as the warp

Figure 10.11

makes only half the number of interlacings on the back compared with the face which, due to the density of end spacing, is completely covered by the warp. The section A shows the interlacing of the first and the second ends which indicate clearly the manner in which the warp is made to separate the weft into layers.

In constructions which involve the combination of single cloth with double cloth areas the warp-faced rib is the weave commonly employed for the single

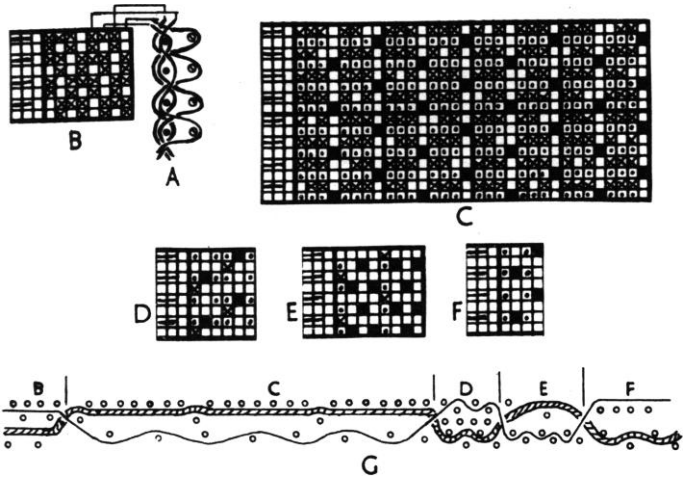

Figure 10.12

cloth areas because it can easily accommodate the large number of ends per unit space without distortion. The weave also provides a very hard wearing surface and can be adapted to produce attractive ground structures when the warp is arranged in two-colour combinations in almost any proportion such as 1 and 1, 2 and 1, 3 and 1, etc. A number of rib weaves which could be usefully employed for this purpose are given in Chapter 6.

The figured portions in the cloth given in *Figure 10.11* are all constructed on the double cloth principle. The main effect is produced in a warp satin construction in which three out of four ends act as face ends and produce the face satin in conjunction with the coarse weft whilst the fine weft weaves plain underneath with the remaining ends as indicated at C in *Figure 10.12.* Auxiliary features in the figure are produced in (1) a plain weave on the face in which one-third of the ends weave plain with the fine picks whilst another third weave plain with the coarse picks on the back and the remainder act as wadding ends in the middle, as shown at D; (2) another plain weave on the face in which only a quarter of the ends weave plain with the coarse weft on the face thus permitting this weft due to low warp cover to show clearly through, whilst the remaining ends weave plain with the fine picks on the back, as given at E; and (3) a weft float where the fine filament weft floats on the surface supported by half the ends directly underneath it, whilst the other half makes a plain structure with the coarse picks on the back, as indicated at F. All the five structural areas of this fabric are shown also by means of a warp section at G in which two picks are given and each different area is lettered to correspond with the fully worked-out designs B to F.

Combination of double cloth with extra threads for wadding or figuring purposes

In interchanging double cloths extra threads are sometimes used for the sole purpose of adding bulk. As the incorporation of such threads in a fabric,

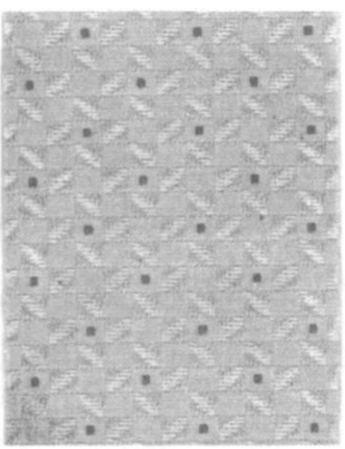

Figure 10.13

however, invariably results in additional costs it is normal to utilise them in a dual capacity, both as wadding and also in a figuring capacity. In jacquard weaving the extra material is usually introduced in the form of weft to avoid the

inconvenience of re-tying the harness or the need for elaborate casting-out schemes. In dobby styles it is frequently preferable to use extra warp yarns which permits higher rate of production.

The latter style is represented by a fancy waistcoat fabric in *Figure 10.13* in which the extra warp forms a simple spot effect by floating on the face of a fine plain weave layer when it occupies the top position. The double cloth consists of a fine plain weave layer which alternates with a coarser twill layer. Where the extra warp is not required to form a spot on the face it is made to float on the back. Apart from showing one method of combining a double cloth with extra warp figuring threads the fabric in *Figure 10.13* is also representative of a combination of a fine with a coarse cloth layer. A complete repeat of the construction is shown in the simplified and condensed motif at A in *Figure 10.14* in which the solid squares represent the extra warp spots. Where the fine yarns weave plain on the face the coarse yarns also weave plain on the back as indicated

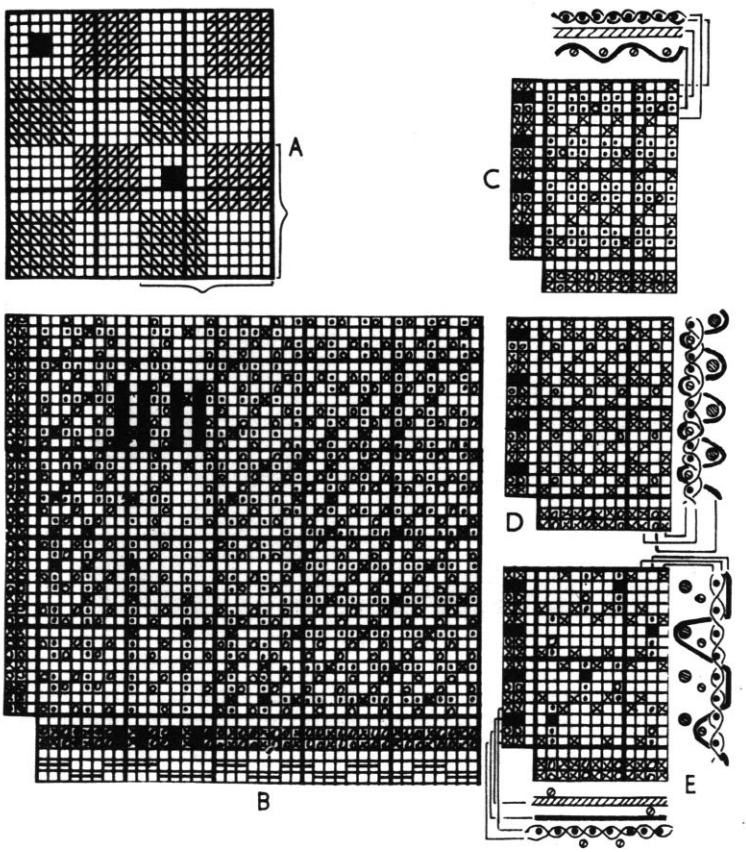

Figure 10.14

by the blanks at A. The diagonal marks show the areas in which the coarse yarns produce a 6-end twill on the face. The direction of inclination of the diagonal marks is representative of the direction of the twill which in either

variant is backed by the fine plain cloth. One quarter of the repeat, as marked by the brackets at A, is given in full at B in which the fine ends and picks correspond to the circles, the coarse ends and picks to the crosses, and the extra ends to the solid marks at the margins of the design. It will be noted that the warp is sleyed-in three ends/dent except where the extra ends are introduced, these being additional to the two fine and one coarse ends which are combined within each split. The extra ends are raised over both the face and the back picks when required to form the figure on the face but remain down on all the picks in between.

In *Figure 10.15* a heavy non-reversible curtaining fabric is shown in which extra weft yarns are used for wadding and, at intervals, also for figuring purposes. The warp in this fabric is arranged–2 ends of filament rayon, 28 tex, to one end of two-fold cotton, 33/2 tex, 40 ends per cm; and the weft–2 picks of filament rayon (same as warp) to 1 pick of two-fold cotton 50/2 tex, and 1 pick of condenser spun cotton 150 tex, 32 picks per cm. The ground consists of a double plain cloth in which the rayon yarns produce the face, the two-fold cotton yarns the back, the heavy condenser cotton yarns acting as the wadding materials between the two layers. The figure is composed of two structurally different areas. In the first, a sunk effect is formed by interweaving the yarns in a single cloth warp rib weave, and in the second, the wadding weft is brought to the surface where it is loosely stitched where required by the cotton warp whilst the fine rayon yarns weave plain underneath. The detailed weaves for each of the

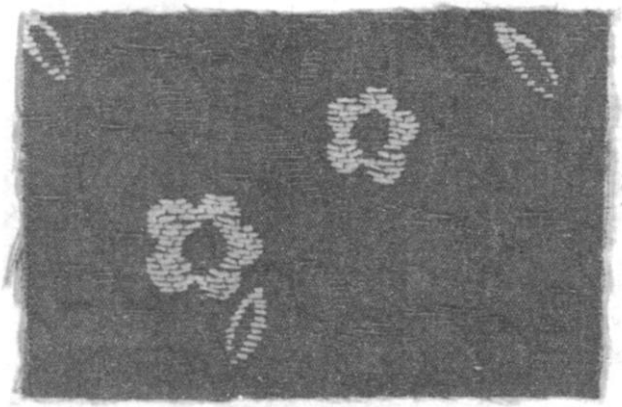

Figure 10.15

three different areas are shown respectively at C, D and E in *Figure 10.14* with the salient features of each structure clearly indicated in similarly lettered cross-sectional diagrams. The filament yarns are indicated by the crosses, the two-fold cotton yarns by the circles and the heavy condenser weft by the solid marks at the margins of the designs. All marks in the designs represent warp up.

FIGURED INTERCHANGING TREBLE CLOTHS

More elaborate cloths of a similar character to the double plain styles are woven with three series in one direction and two series in the other direction, or with

Figure 10.16

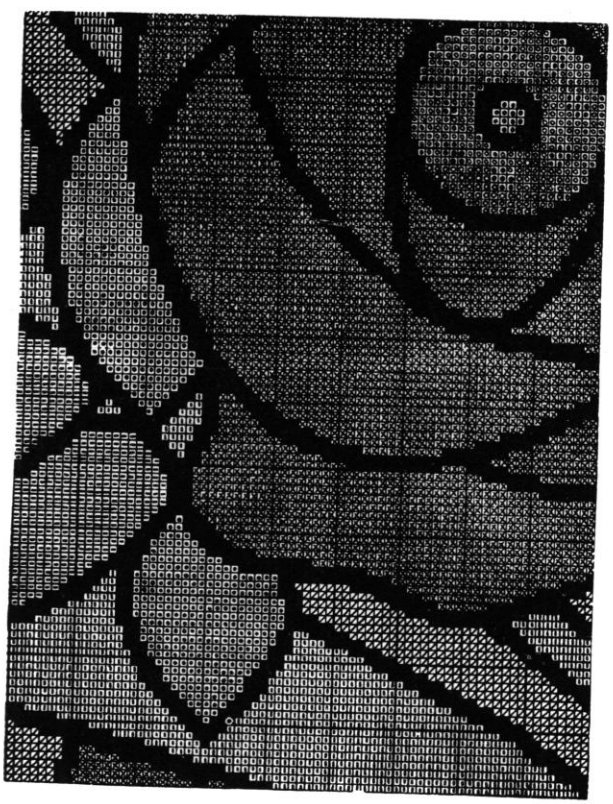

Figure 10.17

three series in both directions. *Figure 10.16* illustrates a curtaining fabric of the last type in which the weft is arranged 1 pick yellow, 1 pick blue, and 1 pick white; and the warp, 1 end red, 1 end green, and 1 end white, all staple viscose rayon. Seven effects are formed in the design, as indicated by the different marks in the corresponding condensed plan given in *Figure 10.17*, which illustrates the method of designing for the texture. The weaves are so arranged that the yellow and blue wefts are frequently brought to the surface, full use thus being made of the contrasting colours.

The various weaves that are combined are illustrated in full at A to G in *Figure 10.18* in which the weave marks indicate warp. Linked with the face threads of the weaves a plan on 2 × 2 squares is shown in which the marks coincide with the corresponding effect in *Figure 10.17*. The positions which the threads occupy in the different sections of the cloth, represented by the respective weaves A to G in *Figure 10.18* are indicated in the following list:

Table 1

Weave	*Face*	*Back*	*Centre*
A.	First weft and first warp	Second weft and third warp	Third weft and second warp
B.	Second weft and second warp	Third weft and third warp	First weft and first warp
C.	Third weft and third warp	Second weft and first warp	First weft and second warp
D.	First weft and third warp	Second weft and first warp	Third weft and second warp
E.	Second weft and third warp	First weft and first warp	Third weft and second warp
F.	First and second wefts and first warp	Third weft and third warp	Second warp
G.	First and second wefts and second warp	Third weft and third warp	First warp

Plain weave is produced on both sides of the cloth, but in F and G two wefts are intermingled on the face, so that there are no weft threads in the centre. In

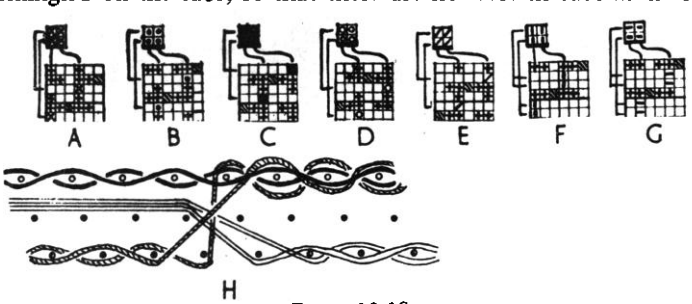

Figure 10.18

A, B, C, D and E there are both weft and warp threads in the centre which, however, do not interlace with each other, but simply serve as wadding threads, the picks passing over the ends. The warp section H shows, on the left, the effect A, to which areas B to E are structurally similar, and, on the right, the effect F which is similar to G.