6

Damasks and Compound Brocades

DAMASKS

Damasks were originally produced as all silk fabrics. Later, cotton and linen threads were used and in the bleached state the cloths were chiefly employed for table napery. Today cotton and linen are still used to produce the traditional types of damasks but other materials, such as viscose rayon in filament and staple form, polyester and others, find their place in the production of curtainings, fine upholstery cloths and similar fabrics. In a true damask figured fabric, a weft sateen figure is formed upon a warp satin 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 or satin ground, the texture being then known as a one-sided damask. *Figure 6.1* illustrates a sateen figure with warp rib and weft float

Figure 6.1

typical in a one-sided damask upon satin ground. The weaves which are most frequently used are the 5-thread and the 8-thread sateens and satins but other opposite pairs of sateens and satins and warp-faced and weft-faced twills are also occasionally employed.

As the design repeats in finely set damask table cloths and other fabrics are very large, several jacquard systems were developed to increase the figuring scope of the machines and to simplify the design painting and card cutting. The main types of the special systems were the pressure harness, the bannister harness and the self-twilling jacquards which were also sometimes referred to as the scale jacquards. The self-twilling machines are still occasionally used and, therefore, the principle of their operation is described later; however, nowadays most damasks are produced on ordinary, high-capacity, fine pitch jacquards and the use of modern card-cutting machinery permits the design to be painted in simplified or condensed form without the need to introduce any weave binding marks. For such jacquards, apart from the limited number of weaves employed, the designing does not differ from that described with reference to figured fabrics in general in *Watson's Textile Design and Colour.*

As stated above, one of the objects of the special mountings was to increase the figuring capacity of the jacquard and thus to obviate the need for mounting several machines in tandem above the loom or, at least, to reduce the number of jacquard machines per loom. This was achieved by making one needle control (in a variety of ways) two or more consecutive ends and one card to act for two or more successive picks. Thus, a 600s jacquard in which one needle controlled three ends and one card of a set of 400 acted for three picks would produce a design repeating upon 1800 ends and 1200 picks. In addition, a design would need to be painted over an area of 600 × 400 only, thus achieving a considerable saving in the cost of design preparation and, as in the special systems the binding weaves were introduced automatically by the mechanism itself, the most laborious part of design preparation, the insertion of binding weaves, was also saved. In a modern fine pitch machine the above figuring capacity is easily attained and as, instead of paste-board cards, the machine uses a continuous paper roll, the weight and the cost of a long pattern roll is considerably reduced and the operation of card lacing is completely eliminated. This, combined with the higher production rate of fine pitch jacquards and the use of modern card-cutting machinery has resulted in a marked decline in the use of the special mountings some of which, such as the pressure harness, were only suited to handloom weaving.

The self-twilling jacquard

This type of jacquard is still used occasionally in the coarse pitch version and is offered by some jacquard makers also in the fine pitch execution for extra large figuring capacity sometimes necessary for the very wide fabrics favoured presently. Several systems of operation exist but the basic principles in most of them are similar and will be appreciated by reference to the schematic diagrams in *Figure 6.2.*

In *Figure 6.2* the diagram X1 shows the connection in an 8-row machine of three figuring hooks B to each needle A, the capacity of the machine in this case being trebled. Each figuring hook B is made at the lower end in the form of a loop D which is rather longer than the depth of the shed, and when in their lowest position the hooks rest upon bars E, one of which extends right through

each long row of hooks. The bars E offer no obstruction to the lifting of the figuring hooks by the jacquard. At each side of the long row of figuring hooks, a special row of strong twilling hooks H—shown in diagram X2—is provided, each

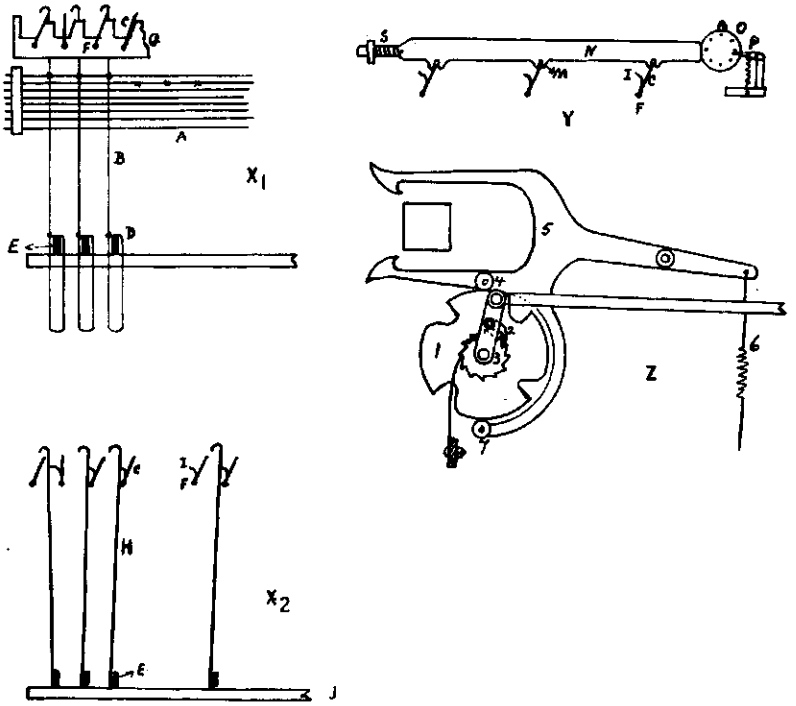


Figure 6.2

of which forms a loop round a bar E so that the bars are supported at both ends. A plate J at each side serves as a rest for the twilling hooks H when the latter are in their lowest position, and the plates are pierced with guide holes through which the straight lower ends of the hooks pass. The heads of the figuring hooks B are turned towards the card cylinder and are over the knives C in the ordinary manner, but those of the twilling hooks H are in the normal position held clear of the knives.

When in their ordinary position the swivelling knives C are inclined towards the figuring hooks B in the usual way. Each knife C, however is capable of being swivelled upon its fulcrum F in such a manner that its upper edge is clear of the corresponding figuring hooks, as shown by the knife 2 in diagrams X1 and X2. At the same time the lip I of the knives which is in line with the twilling hooks, pushes the latter over the preceding knife, as shown by the hook 1 in diagram X2. (It will be noted that the arrangement necessitates the use of one blade more than there are hooks in a short row.)

The rocking movement of the knife C is obtained from a small revolving cylinder O in which projections or studs are fixed, each of the latter acting upon the end of a control bar N, as shown in the diagram Y in *Figure 6.2.* The upper edge of each knife C fits within a recess M formed on the underside of a control

bar N. As many bars are provided as there are threads in a repeat of the binding weave, and each, by means of the recesses M, control every fifth or every eighth knife, according to whether the binding weave repeats upon five or eight threads. The pressure of a stud upon O moves a control bar N (each of which is acted upon for one pick in every five or eight picks as the case may be) so that the knives to which the latter is connected assume the vertical position shown by knife 2 at X1 in *Figure 6.2.* This knife is thus put out of engagement with the corresponding figuring row of hooks, as shown in diagram X1, and into position for engaging the preceding row of twilling hooks, as shown in diagram X2. When the griffe rises on the following pick the figuring hooks in the long row 2 (and every fifth or eighth row) will thus be automatically left down. The twilling hooks 1, and every fifth or eighth twilling hooks, however, will be raised and lift up the corresponding bars E, and as each bar supports a long row of figuring hooks the rows 1 etc., will be automatically lifted. The arrangement causes one long row of figuring hooks to be left down, and one long row to be raised to each repeat of the binding weave, quite independently of the figuring cards; and each hook that is left down is next to a hook that is raised. That is, the jacquard lifts the ends in solid groups in forming the design, except that one in each repeat of the binding weave is left down through the action of the twilling motion, while of the ends that are left down by the jacquard the same proportion is raised. A spiral spring S is used to return each twilling bar to its normal position after the pressure of the stud has been removed.

It will be clear from the foregoing that the increase in the figuring capacity of the machine depends on the number of hooks per needle. This is usually two to four but sometimes the number of hooks controlled by one needle varies so that two consecutive needles control two hooks and the third, three, the fourth, two, and so on.

Apart from a desire to achieve a specific degree of multiplication this may be necessary to obtain a number of long rows of hooks which is a multiple of the binding weave repeat. For example, a machine with eight needles per row in which each needle controls three hooks will result in 24 long rows of hooks which is perfect for the 8-shaft binding weaves but not suited for the 5-shaft binding weaves for which the number of long rows of hooks should be 20, 25, etc., and thus to achieve the required number the needles in a row of eight may control in succession, 3, 2, 2, 3, 3, 2, 3 and 2 hooks.

A reduction from the full capacity of the machine can be effected by taking out of action in each row a number of hooks equal to, or a multiple of, the number of threads in the repeat of the binding weave and the same sets of cards can be used to produce identical designs in different qualities. Smaller reductions, equal to half the size of one repeat of the binding weave, can also be made if necessary by spreading the number of hooks taken out of action between two successive short rows of needles but such fractional changes are rarely required.

The saving of cards and card lacing in machines which do not use continuous paper roll is of some importance and a device which can present the same card several times in succession is illustrated at Z in *Figure 6.2.* The card cylinder can be rotated forwards when the upper catch engages the lantern as the cylinder slides out, or backwards when the lower catch similarly engages the lantern. This is determined by the cord connection 6 which ensures that in the former case bowl 4, and in the latter case bowl 7, acts against the cam face 1. The cylinder

will not turn when either of the bowls act against the projecting segment of the cam 1 but will turn when the bowl falls into a recessed segment, because it is only in this position that either the upper or the lower hook (depending on whether the cards are turning forwards or backwards) of the turning catch 5 can

Figure 6.3

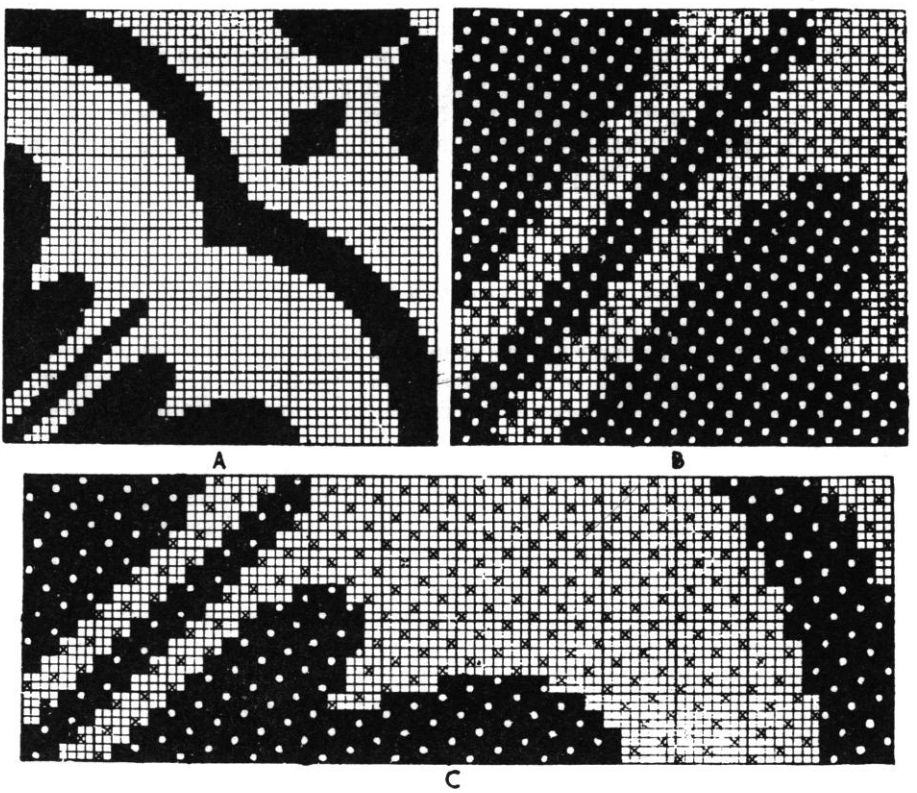


Figure 6.4

engage the cylinder. In the illustration the cam is turned one-twelfth of a revolution each pick by the pawl 2 engaging the ratchet 3 which has 12 teeth. As the projecting segment of the cam 1 acts upon bowl 4 (or 7) for two picks and the recessed segment for one pick the same card will be presented on three picks in succession before turning. To change the number of picks per card the cam must be changed and if each projecting segment, which renders the turning action inoperative, acts for only one pick, the same card will be presented for only two picks in succession, but when it operates for three picks before a recess occurs then four presentations will result before the card is turned.

The designing for this system is very simple and consists of painting the figure solid and leaving the ground blank. If the paint corresponds to the warp-faced portion of the design then it will be cut solid and the special mechanisms will introduce the binding weaves automatically as explained above, also enlarging the design vertically and horizontally according to the number of hooks per needle and picks per card. As each step of the original design is multiplied the figure results in a characteristically steppy outline as shown in *Figure 6.3.*

In the example given at A in *Figure 6.4* the design is painted solid in the usual way, and if the needles are connected to two and three hooks alternately, and the twilling motion produces 5-sateen and satin binding weaves while each card acts for three picks, the full weave of the first 20 vertical and 16 horizontal rows will be as shown at B in *Figure 6.4*. In the same manner, C shows the full weave of 16 horizontal rows of the design A, assuming that each needle is connected to two hooks, the twilling motion produces 8-sateen and satin binding weaves, and each card acts for two picks. Taking the marks to indicate warp, the blanks in the figure represent ends that are left down on account of the knives being made vertical and missing the figuring hooks, while the crosses in the ground indicate the lifts produced by the bars that are raised by the twilling hooks.

Diversification of effect in damasks woven on self-twilling machines

In the twilling jacquard systems the figure and the ground can only be woven in opposite sateen and satin weaves so that no variety of weave development can be produced. It is possible, however, to diversify the ornamentation of a fabric, as shown at D in *Figure 6.5* in which a few shading effects are indicated to illustrate how a figure may be brought up in different tones. The finer the cloth, and the fewer the ends to each needle and picks to a card, the nearer the effects are to those that can be woven in an ordinary jacquard; and it should be kept in mind that very fine lines of figure may be indicated in the solid design, since each small square represents a group of threads. E in *Figure 6.5* shows the full weave of a portion of the design D, assuming that the hooks are connected to the needles in the order of 3, 3, 2; successive cards act for 3, 3, and 2 picks; and 8-shaft binding weaves are formed.

In designing for the twilling jacquard the count of the design paper is in the proportion of–

$$\frac{\text{ends per cm}}{\text{hooks per needle}} : \frac{\text{picks per cm}}{\text{picks per card}}$$

For example, assuming that a cloth contains 38 ends and 56 picks per cm, and that 32 hooks are connected to each short row of 12 needles, and there are 10 picks to three cards–

$$\frac{38 \text{ ends}}{32 \div 12} \qquad \frac{56 \text{ picks}}{10 \div 3} = 12 \times 14 \text{ design paper.}$$

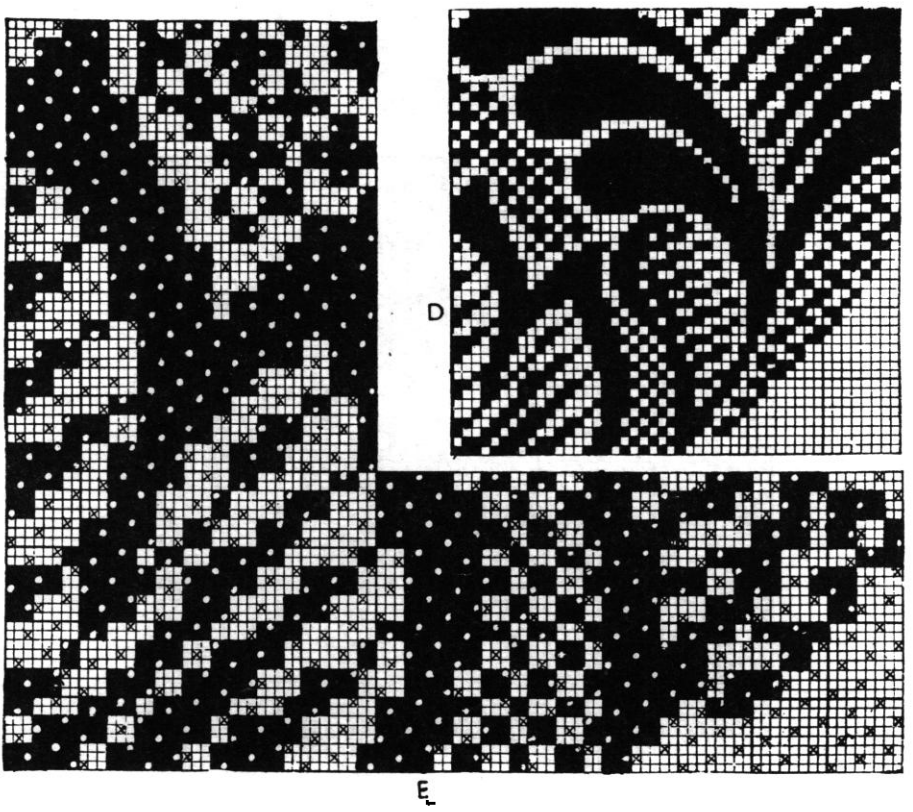


Figure 6.5

The best qualities of damask cloths are generally woven with more picks than ends per unit space, and the following are typical weaving particulars: Warp–33 tex linen, 36 ends per cm; weft–24 tex linen, 52 picks per cm. Five-shaft binding weaves are usually employed in the lower qualities of cloths.

FIGURED WARP RIB BROCADES

The construction of simple warp ribs has been explained in Chapters 3 and 6 of *Watson's Textile Design and Colour.* In figured warp ribs the ends which form the rib are generally composed of a lustrous material, and they are floated on the surface in the manner illustrated by the fabric represented in *Figure 6.6.*

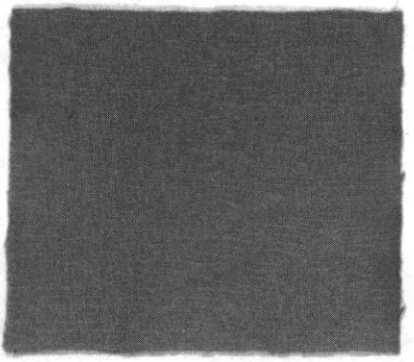


Figure 6.6

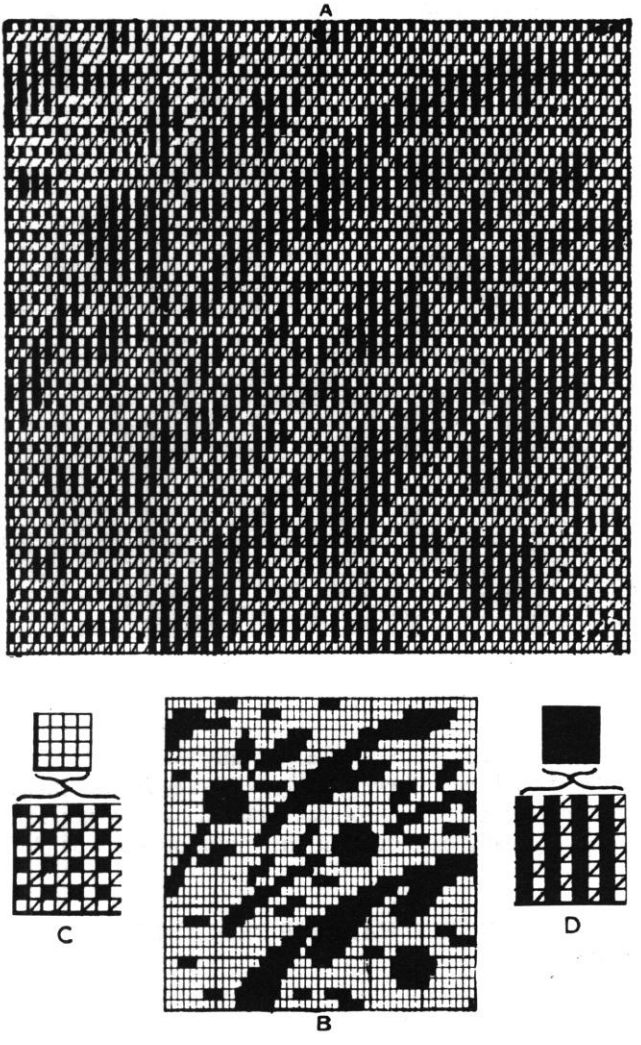
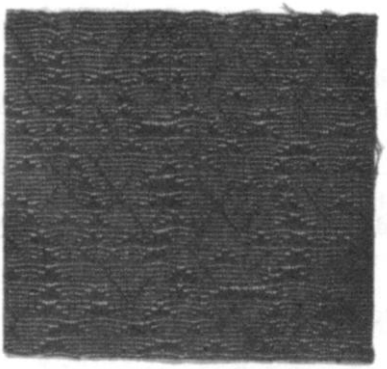


Figure 6.7

The following are suitable weaving particulars: Warp, 2 figuring ends (in a decked mail) of 30/2 tex mercerised cotton, 1 binding end of 20/2 tex cotton, 16 double-figuring ends, and 16 binding ends per cm. Weft 24 tex cotton in the same colour as the binding ends, 22 picks per cm.

A in *Figure 6.7* shows the complete weave of a portion of the design represented in *Figure 6.6*, the solid marks indicating the lifts of the double-figuring ends and the diagonal marks those of the binding ends. The ground of the cloth is plain weave, and the figuring warp floats are arranged to fit with the plain, which, as shown in *Figure 6.6*, causes the figure to appear very prominently, but with a stepped outline. It will be seen in A, *Figure 6.7*, that all the figuring ends are raised on the even picks; the binding ends are raised on the odd picks in the ground, but where the figure is formed they are lifted in alternate order. The figuring lifts of the figuring warp occur on odd picks and it is only these lifts that need to be indicated in simplified designing as shown at B, in *Figure 6.7*. The simplified design is thus condensed by two in each direction as each vertical row equals two ends and each horizontal row two picks. The detailed weave for the ground area, represented by the unpainted paper at B, is given at C, and that for the figure area, represented by the solid marks at B, is shown at D.

Figure 6.8



The combination of weft figure with a warp rib figure is illustrated by the fabric in *Figure 6.8*. The weft effect is indicated in a different colour on the simplified design and when the weft float is short all the ends in the weft figure area are simply left down which is the case in the fabric given in *Figure 6.8*. When, however, the weft floats created in the above manner are too long they may be stitched at intervals by the binding ends in the manner illustrated at E in *Figure 6.13*. As the binding ends are usually of the same colour as the weft, the stitches do not detract from the solidity of the figure produced by the weft.

Rib designs produced in two colours of warp

The design given in *Figure 6.9* illustrates a class of figured warp rib which is different in structure from the foregoing. In this case all the ends are identical in thickness and quality but differ in colour, the arrangement being an end of pink and light green alternately. In the ground differently coloured horizontal tie lines are formed, and both colours are employed in producing the figure.

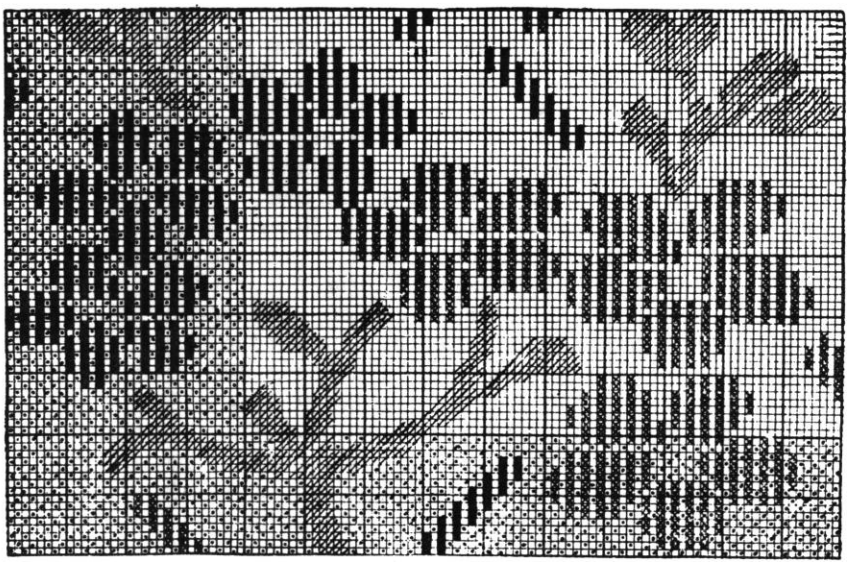


Figure 6.9

In the design the full squares represent the figure produced by the pink warp, and the crosses that formed by the light green warp; while the shaded squares show how a subsidiary effect is obtained by floating both colours of warp together, the intermingling of the colours giving a grey appearance to this portion of figure. Since both colours of warp are used separately for figuring, the warp threads should be finely set, and equally lustrous. The weft requires to be even and smooth, and of a neutral shade, while fewer picks per cm than ends may be inserted–as for example, for plain ground weave 24 picks per cm of 20 tex cotton, and 32 ends per cm of 280 dtex viscose filament rayon.

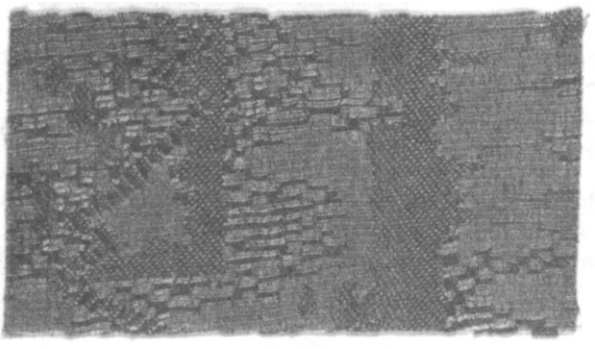


Figure 6.10

In the fabric represented in *Figure 6.10,* the warp threads are arranged alternately in two colours, as in the preceding illustration, but in this example a portion of the figure is formed by the weft, the colour of which is in contrast with the warp colours. Thus, as is shown in the corresponding design given in

Figure 6.11, the figure is formed by floating the odd ends in one section, as represented by the crosses while the weft forms the surface in a number of abstract shapes in the repeat. As the settings in this cloth are comparatively low

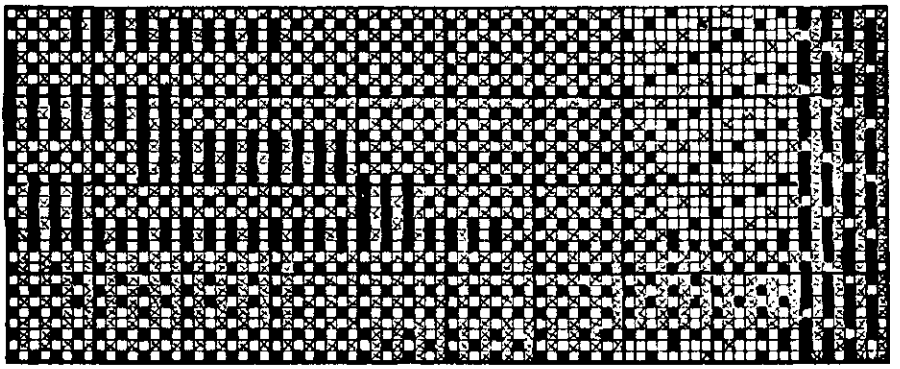


Figure 6.11

the weft areas are bound in a 5-sateen order. Further variety is added by introducing figure areas in which both warps work together and are bound in a 5-shaft warp satin order as shown on the right of *Figure 6.11*.

Methods of ornamenting warp rib structures

In order to further illustrate the diversity of effect that can be produced in the rib structures, a fabric is represented in *Figure 6.12*, which shows a method of figuring by means of brightly coloured weft. Also a number of rib weaves are

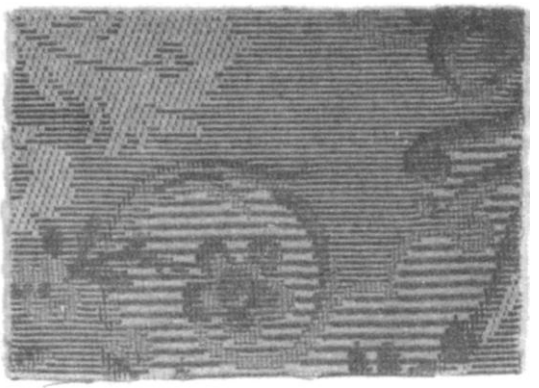


Figure 6.12

shown separately in *Figure 6.13*, two or more of which can be used in combination. It is assumed that in the plans two figuring ends alternate with a fine binding end, and a fine pick with a thick pick, the figuring ends in the ground passing under the former and over the latter, as shown at A. In some cases the rib ground is given a very rich appearance by employing brightly coloured

filament weft for the fine binding picks. Where the filament weft floats over the double-figuring ends, it shows a fine line of bright colour between the ribs forming by the warp.

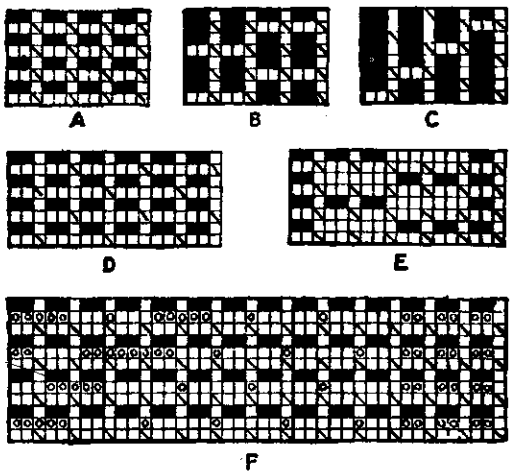


Figure 6.13

A, B, and C in *Figure 6.13* show the weaves that are used in the ground of *Figure 6.12,* and this and other variations of the rib structure can be employed along with, or instead of, the ordinary plain rib. C illustrates the usual method of figuring with the rib ends; each float should be arranged to commence and terminate with a thick pick.

The plan D shows how brightly coloured binding picks can be floated on the surface so as to diversify the form of a design; while, as represented at E, the thick picks can be similarly floated. The plan F illustrates the introduction, between the fine binding and the rib picks, of special figuring picks, the floats of which are represented by the circles. These extra picks can be used to spot the rib ground, as shown on the right of F, and to form a weft figure, as indicated on the left; both of these systems of interweaving are represented in *Figure 6.12.* All the ends are lifted on the extra picks, except where the circles are indicated in F, *Figure 6.13,* and the centre portion of the plan shows how the picks are bound-in on the underside of the cloth.

MULTI-WEFT BROCADES

Very ornate designs are often produced for hangings, corsets, and fine upholstery cloths in which two or three wefts are employed in conjunction with one series of warp threads. There is no special ground weft, as in extra weft fabrics, and all the wefts are floated on the surface as required in producing the figure, but each also assists in making the ground structure.

Two-weft brocades

Figure 6.14 represents a cloth in which the figure is formed in two colours of weft-woven pick-and-pick upon a warp satin ground produced by the two wefts

interweaving with the warp. The following are suitable weaving particulars for an upholstery cloth: Warp and weft, 110 dtex filament polyester; 72 ends and picks per cm.

Figure 6.14

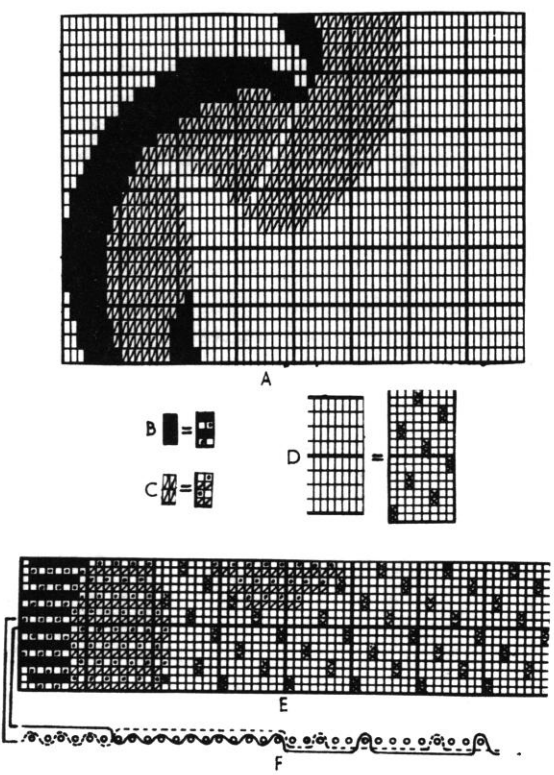


Figure 6.15

A in *Figure 6.15*, which corresponds with a portion of *Figure 6.14*, illustrates the system of constructing the squared paper design. The figure is painted in solid in two colours to represent the different wefts, and the ground is left blank; while it is convenient also to use white in binding the floats of the figure. Each horizontal row corresponds to a pick of each colour, and the count of the design paper is therefore in the proportion of the number of ends per cm to the number of picks per cm of each colour, or 8 × 4 with the foregoing particulars. As the design is condensed by 2 weft-wise, two cards are cut from horizontal row. Assuming that the solid marks represent one colour of weft, say, black and the diagonal marks the other colour of weft, say, grey and that the order of wefting is one grey, one black, the detailed weaves for each differently painted portion of A in *Figure 6.15* will be as indicated at B, C, and D (convention reversed). The effect of the superimposition of the detailed weaves is illustrated at E in *Figure 6.15*, which shows the full weave of the horizontal rows 5 to 12 of A. It will be seen that the ground weave is an 8-shaft satin—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. It will be noted from E that where the plain weave is produced odd lifts are cut for the odd picks of each colour and even lifts for the even picks. The disposition of the two wefts in the different parts of the design is clearly shown at F which is a warp cross-section of the structure cut through picks 8 and 9 of E.

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 detailed weaves remain the same as before for each different portion of the design but are re-arranged to coincide with the 2-and-2 order of wefting.

Two-weft brocade ground weaves

The figure areas in two weft brocades are constructed according to a standard system described above but the ground weaves vary considerably. A number of ground weaves, different from the one shown at D and E in *Figure 6.15*, which

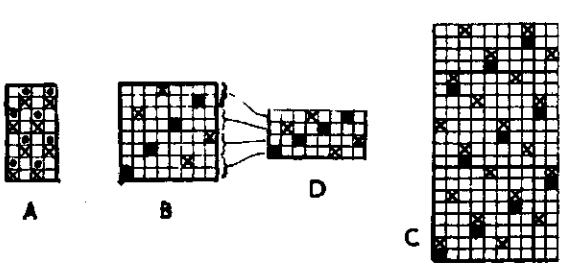


Figure 6.16

are employed in the pick-and-pick brocade fabrics are given, using the reversed convention, at A to C in *Figure 6.16*. A shows a fine 2-and-2 warp rib ground which is occasionally employed in these fabrics. B represents an ordinary 8-shaft

warp satin and this is used extensively in the lower quality fabrics in which the extended satin weaves such as the one represented at D in *Figure 6.15* would result in excessively long warp floats due to a comparatively few picks per cm. At C the ground weave indicates that the successive picks operate alternately in 5-shaft and 10-shaft satin orders, the idea in this case being to interweave one weft more firmly than the other.

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

For the piano card-cutting machines the ground weaves have to be painted and if the design is given in a condensed form ingenious methods of indicating the ground are used so that the weaves are properly reconstituted during cutting. This is shown at D in *Figure 6.16* where the 8-shaft satin ground given at B is shown in a design condensed by 2 weft-wise. Different marks are used to denote the different colours of weft and to achieve the correct satin binding in the cloth the following card cutting instructions are appropriate:

Cut two cards from each horizontal row–

First weft–cut blanks and crosses;

Second weft–cut blanks and solid marks.

The result of this order of cutting is the ordinary satin ground as shown at B. Other ground weaves can be similarly condensed and reconstituted by means of properly formulated instructions. Fortunately, the tedium of painting large areas of ground in an elaborate manner is avoided when modern jacquards and card-cutting machines are used.

Pick-and-pick weave shading

A fabric is represented in *Figure 6.17* 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 blue, while the weft is arranged 1 pick grey, and 1 pick white. Similar weaves to those employed in the cloth are given in full in *Figure 6.18,* in which the solid marks represent the grey weft floats, and the dots the white weft floats. A portion of white weft figure, under which the grey weft interweaves in plain order, is produced by section A. In section B a bluish surface is formed by the white weft interweaving in plain order with the warp, the grey weft floating on the back in 7-and-1 order. Section C is in contrast to section B, as the grey weft interweaves in plain order with the blue warp, so that a different mixed colour surface is formed, under which the white weft floats in 7-and-1 order. In section D, above a plain foundation formed by the interweaving of the white weft with the blue warp, the grey weft is floated in gradually increasing lengths of float, so that the bluish surface gradually merges

Figure 6.17

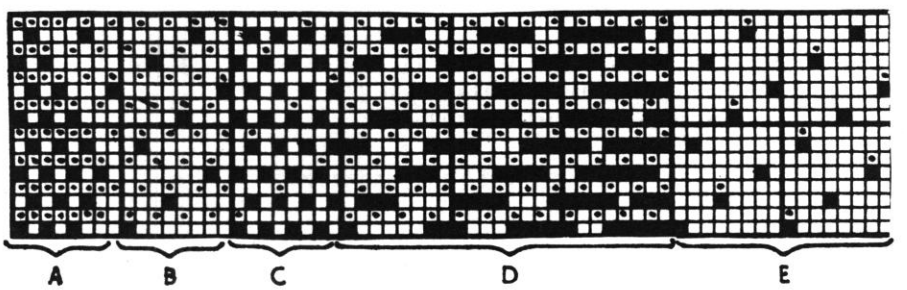


Figure 6.18

into a grey surface. Section E shows the weave which is used in forming a solid blue ground, the blue warp interweaving in 8-satin order with the grey weft and in 16-satin order with the white weft.

Pick-and-pick reversible structures

A perfectly reversible structure can be produced by figuring with the two wefts in such a manner that when one forms a float on the face the other forms a corresponding float on the back. The ground weave which in these structures is usually a warp rib is also the same on both sides. This type of construction is particularly suitable for curtaining fabrics.

Where a weft figure is formed the picks do not interlace and for this reason the floats which are produced must be comparatively short. To keep the length of float of each weft the same, every face float on the right-hand side of the figure is taken down whilst the back weft float is brought up. This is illustrated in *Figure 6.19* which also shows the typical 2-and-2 rib which surrounds the weft figures and the 4-and-4 warp rib in the ground. One weft is represented by the solid marks and the other by the crosses using the reversed convention. The warp section shown below the design has been taken across ends 33 to 64 and shows the operation of the seventh and the eighth picks.

As the warp in the weft figure areas simply lies straight between the face and back floats of the weft without any interlacing it is advisable to break the figure

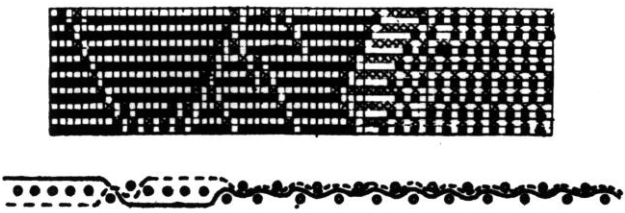


Figure 6.19

in the length by frequent introduction of small areas of ground. Diagonal or horizontal disposition of the figure is particularly helpful in this respect whilst long vertical shapes may lead to the formation of slack ends.

Three-weft brocades

Figure 6.20 represents a fabric in which the figure is produced in three colours of weft which are inserted, a pick of each in succession. Two of the wefts are inserted continuously and the third one is chintzed to add further variety to the design. In this construction when one weft is floating on the surface, the second one weaves plain underneath and the third one floats on the back where it is loosely stitched. The ground is usually a warp satin to the formation of which each of the three wefts contributes although occasionally warp-rib grounds are also used.

Figure 6.20

A in *Figure 6.21* shows a simplified design for this type of structure which has been condensed by 3 weft-wise. A different colour is used to indicate the float of each of the three wefts on the surface and the ground is left blank. The detailed weaves for each differently painted area are shown at B in the corresponding columns.

From an examination of B 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

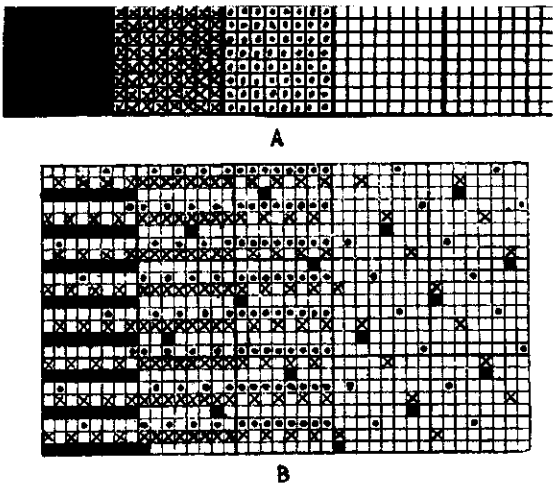
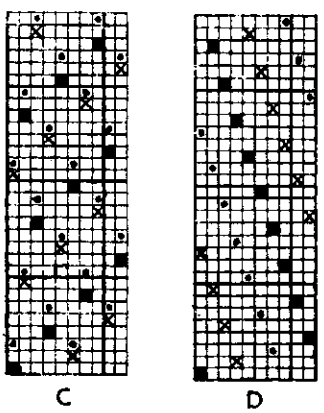


Figure 6.21

Figure 6.22



under the figure formed by the second colour. In the ground 8-satin weave is formed by the second and third colours, and the first colour is stitched on alternate binding points in the same shed as the second colour. This tends to throw the first colour of weft, which is in a strong contrast with the warp, more distinctly to the back thus preventing it from spoiling the solid colour ground effect achieved by the warp satin weave.

Examples of other ground weaves used in conjunction with three weft figuring are given at C and D in *Figure 6.22.* At C the first two wefts operate in a 10-shaft satin order and the third one in a 5-satin order stitching-in together with the second weft on alternate binding points. At D all the three wefts contribute equally to the formation of the ground each making a stitch in succession in a regular 10-satin order.

MULTI-WARP BROCADES

In these constructions two or more different series of warp threads are used to produce a figure in conjunction with a common weft. As opposed to extra warp fabrics in which one warp is specifically allocated to produce the ground structure, in multi-warp brocades all the warps are floated on the face in turn to produce the figure and all of them also assist in the formation of ground weaves.

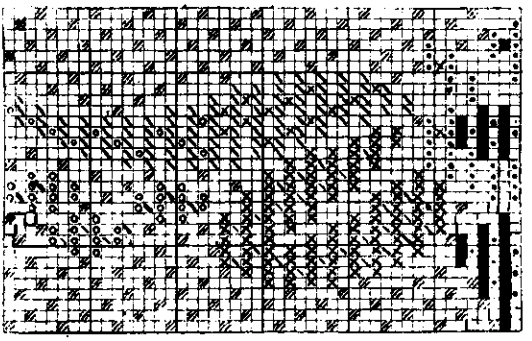


Figure 6.23

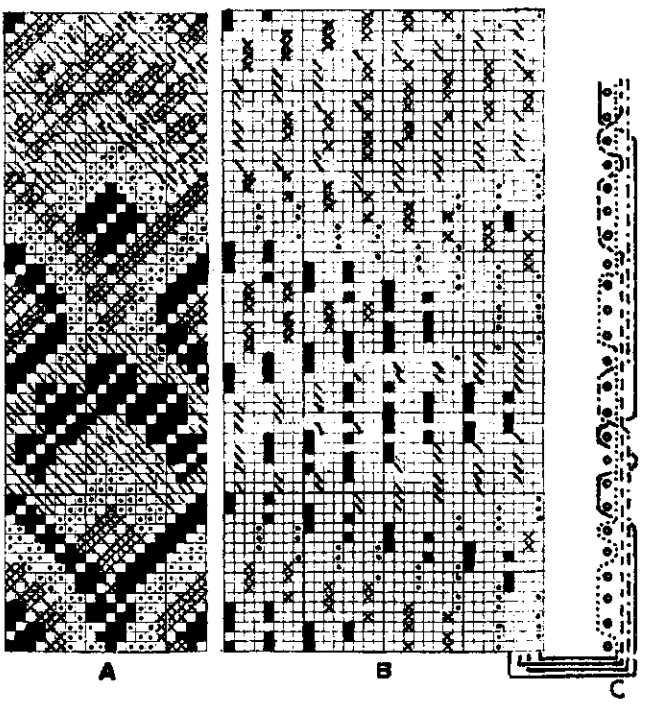


Figure 6.24

The cloths produced in these styles are mainly used for curtainings and are, as a rule, woven in coarse yarns and low settings with the warp frequently entered two ends per mail for better cover.

In *Figure 6.23* a fully worked-out portion of a design suitable for an end-and-end structure is given to show the principle of this construction. In the ground areas, represented by the shaded squares, the weave is a 5-thread weft sateen and as the colour of the weft is usually in considerable contrast with the warp it shows off the brightly coloured warp figure very distinctly. Where one warp floats on the face the other floats on the back where it is loosely stitched with the weft. A feature of this type of construction is the extensive planting (q.v.) in the warp, and in the structure represented in *Figure 6.23* although only two warps are employed per vertical row of design use is made of five different colours of warp, denoted by the different marks, as the original colours are supplanted by other ones in succeeding portions of the design.

A four-colour warp figure is illustrated in *Figure 6.24*, 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 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 *Figure 6.24* shows how the figure may be conveniently indicated by first making the different colours solid, and then inserting the twill marks over the design; while B shows the fully worked-out weave of the first eight vertical rows of A.

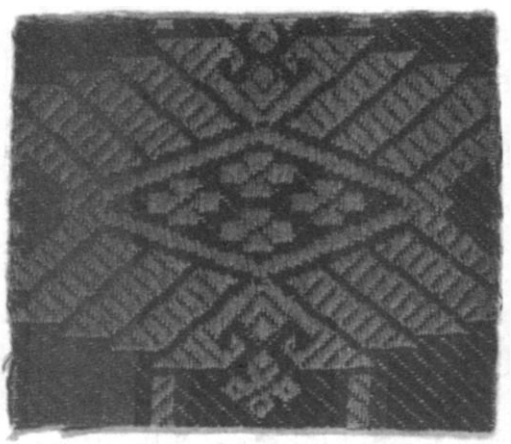


Figure 6.25

Figure 6.25 shows a fabric constructed according to the principles outlined above in which, however, only two series of ends are employed.