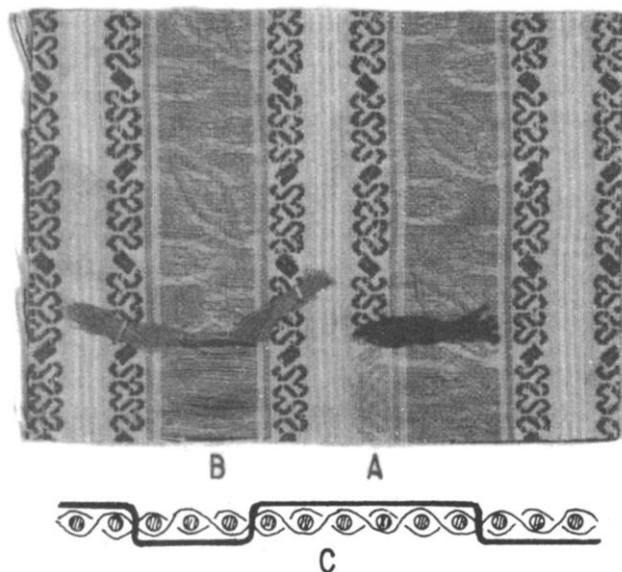


## 2

# Figuring with Extra Threads

### 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 ground structure under the figure. This is illustrated in *Figure 2.1*, 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 principle of this type of structure is also shown diagrammatically at *C* where an extra thread figuring float is made on the face of a plain ground weave. The figuring ends in stripe *B*



*Figure 2.1*

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 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.

#### *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. When the extra material is introduced as warp then a separate beam is required for each warp on account of the different take-up rates between the extra and the ground ends. For extra weft figuring the weaving machine must have the capacity to insert more than one colour or kind of weft. 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 side 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, when the ground is dense and when the fabric is used in situations that do not render the long floats on the back objectionable. It is 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 if the extra threads 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 yarns 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 form of small auxiliary figures or floats thus adding to the fullness of the texture.

#### *Comparison of extra warp 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 productivity of a loom is greater because only one series of picks is inserted, and a faster running loom can be used. (2) No special picking, box, and uptake motions are required. (3) There is theoretically 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 a smaller 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 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.

### EXTRA WARP FIGURING

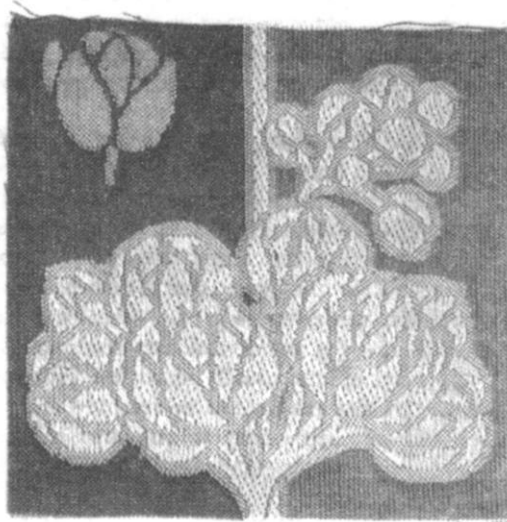
The chief advantage of the extra warp method is in productivity but at present it is mostly utilised for continuous styles arranged one end of ground, one of extra, except dobby effects which are still produced in a considerable variety of intermittent figuring arrangements. The reason for the decline of the fancier jacquard stripe styles lies in the fact that each different design frequently requires the harness to be re-tied or otherwise modified which is costly in itself and which often leads to further costs by increasing the length of the weaving machine downtime. Additional costs are incurred by the need to draw-in new warps into the newly re-tied harness which is more expensive than knotting-in, a procedure used when standard harness setts remain unchanged between one warp and another. Many elaborate styles similar in appearance to extra warp

can be produced by means of extra weft figuring using standard harness setts and achieving the necessary variety by weft pattern changes. The higher actual weaving cost due to the lower rate of cloth production may be partially or entirely offset by the use of weaker and, therefore, often cheaper materials for the figuring yarns.

The above argument does not apply quite so strongly in dobby styles where draft changes only necessitate the change in the number of slider wires per heald frame although the economics of the drawing-in of new warps as opposed to knotting-in have to be taken into account despite the fact that both can be in dobbies performed by machines.

*Continuous figuring in one extra warp*

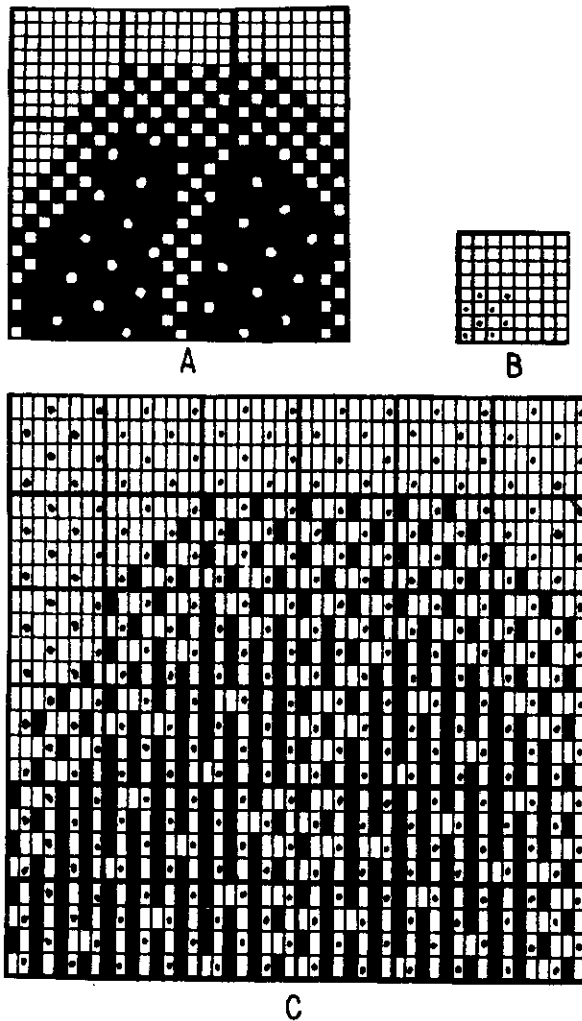
*Figure 2.2* represents an extra warp figured fabric, in which the ends are arranged continuously in the order of 1 extra, 1 ground. The example is a style



*Figure 2.2*

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 outline of the figure, and do not detract from its appearance. A in *Figure 2.3* shows a portion of the extra warp figure, and B the weave of the ground ends, while C illustrates the method of constructing a squared paper design of the figure and ground in full. 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 crepe ground weave being formed. The blank circles in A show a sateen binding weave which is inserted on the figure 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  $8 \times 4$  design paper is therefore suitable in constructing the design in full, as shown at C in *Figure 2.3*.



*Figure 2.3*

A typical continuous 1 extra, 1 ground style is represented by the Alhambra quilt structure used mainly for bed covers and consisting of plain ground weave worked between fine ends and coarse, soft spun picks. The extra figuring ends are thicker than the ground ends, or they may be woven two or three per mail in decked mail eyes (B, *Figure 2.4*) to produce distinct floats as illustrated at A, in *Figure 2.4*. A wide variety of qualities is produced in this structure and the following are suitable particulars for a medium quality cloth: Ground warp—30 tex, 12 ends per cm, 20 to 25 per cent crimp; extra warp—38

tex, 2 ends per mail, 12 double ends per cm, 6 to 8 per cent crimp; weft—190 tex, 12 picks per cm.

Cotton yarns are normally used throughout although good effects have been obtained with two-fold viscose rayon staple yarns for the figuring ends. This is a

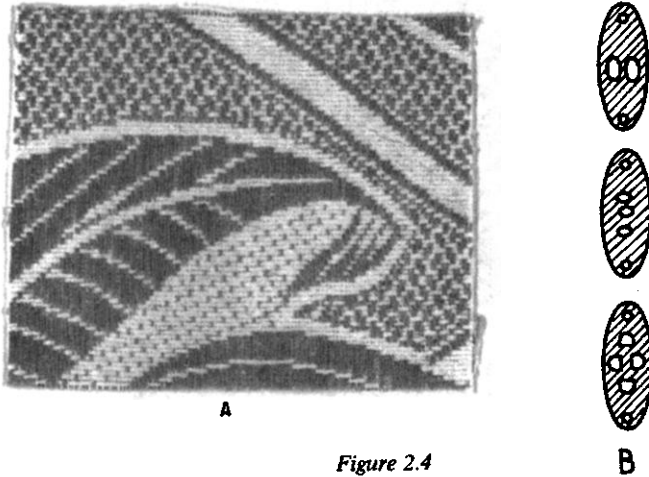
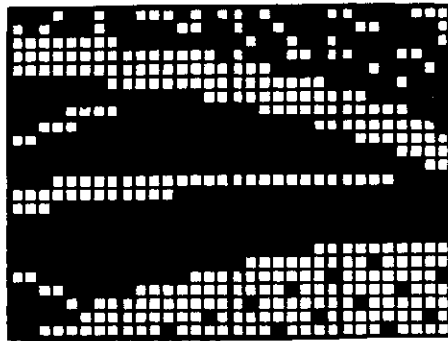


Figure 2.4



C

D

E

Figure 2.5

structure which at one time was extensively woven on a heald and harness mounting to increase the figuring scope of the jacquard and to simplify the design painting and card cutting (see Appendix I).

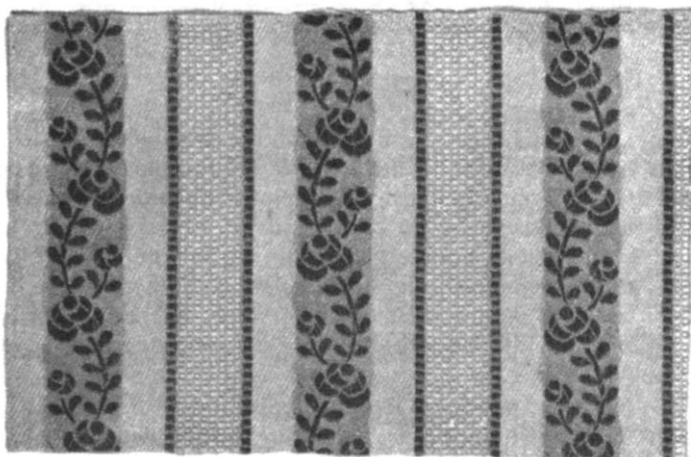
A portion of the fabric illustrated in *Figure 2.4* is shown in *Figure 2.5* where at C a simplified design showing only the lifts of the extra figuring ends is given. This shows the bold floats of the extra warp and contrasting ground areas. Where the ground area is very large the extra warp is stitched-in in sateen order to reduce the length of the extra warp float on the back. Weaves other than sateen can also be employed for this purpose and a broken weave is used in the ground area above the leaf in *Figure 2.4A*. At D, in *Figure 2.5*, a small portion of the simplified design is worked out in full, showing the plain weaving ground ends and using the technique already fully described in connection with *Figure 2.3*.

#### *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 structure represented at E in *Figure 2.5* shows how the binding lifts of the extra warp can be concealed on the surface by placing them between two long floats of the ground structure.

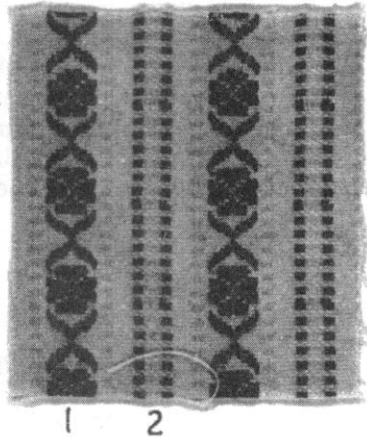
#### *Intermittent figuring in one extra warp*

The cloths represented in *Figures 2.6, 2.7, 2.9* and *2.10* illustrate the introduction of one series of extra ends intermittently, and show various ways of forming either stripes or detached figures. In *Figure 2.6* the stripe figure is due

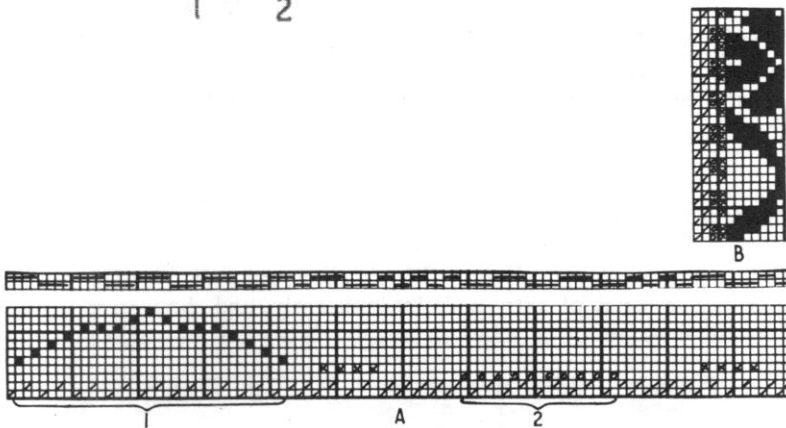


*Figure 2.6*

to the continuous manner in which the extra ends are floated. In *Figure 2.7* 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.



*Figure 2.7*



*Figure 2.8*

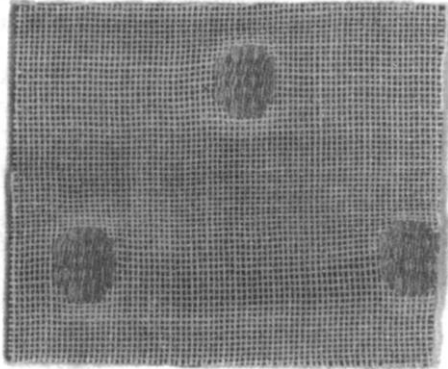
In *Figure 2.9* the spots are set out in full-drop style and are quite separate. In *Figure 2.10* the spots are also quite detached but this time they are combined with a small brocade figure forming distinct stems to the brocaded leaves.

The cloth represented in *Figure 2.6* consists of viscose rayon ground with the extra warp in cellulose acetate thus permitting the use of the cross-dyeing technique to achieve coloured figure on white ground. Where the extra warp is present it is drawn-in on the basis of one extra to one ground end and the designing technique in the extra thread stripe is exactly the same as explained in connection with *Figure 2.3*.

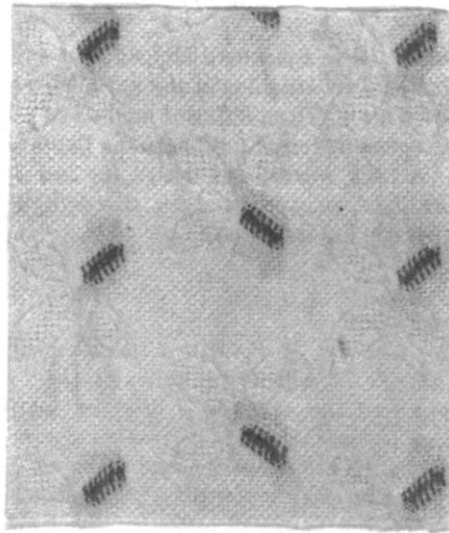
The cloth illustrated in *Figure 2.7* is a typical dobby stripe which can be produced on only 11 healds. The full draft for this design is given at A, *Figure 2.8*, with the order of denting indicated above it. Corresponding parts of the design in *Figure 2.7* and in the draft are marked 1 and 2. It will be noted



from the denting plan that the ground ends are dented regularly two per dent with the figuring ends being added to some dents as they occur so that in some splits there may be four ends, in some three and in some others only the two ground ends. Regular order of denting for the ground ends is, of course, essential to maintain even spacing of the ends across the cloth. At B, in *Figure 2.8*, the lifting plan appropriate to the draft A is given from which the full design can be easily constructed.



*Figure 2.9*



*Figure 2.10*

The fabric in *Figure 2.9* represents a dobby style clipped spot on an open ground cloth. As the extra yarn is cut away on the back of the fabric it could be easily plucked from the surface if it was insecurely anchored to the cloth. The necessary anchorage is achieved in this cloth in a two-fold way. Firstly, the ground ends are dented one per dent and where the extra ends occur they are crammed three per dent together with the ground end so that they are in effect

nipped fast between two adjacent ground ends and this in itself provides a secure hold. Secondly, the extra ends are not permitted to float continuously on the surface but are bound-in at intervals in such a manner that the discontinuity of the extra end float is not noticeable.

This is illustrated clearly in *Figure 2.11*, where at A full construction of one spot is given with the denting order indicated above. B shows a weft section through the structure illustrating the manner in which the longest extra warp floats are bound-in. Due to the considerable degree of cramming of the extra warp the binding points are invisible on the face and the spot appears quite solid.

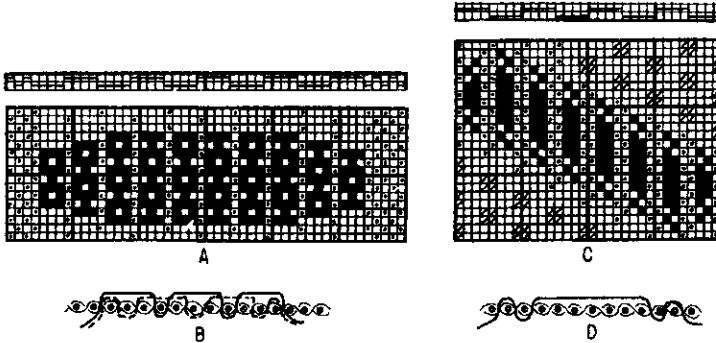


Figure 2.11

The cloth in *Figure 2.10* is a jacquard clipped spot and secure hold on the extra warp is provided here by stitching-in the extra yarn in plain weave order at the edge of the spot. This is also an efficient method of preventing the threads from fraying out but it gives a blurred outline to the figure with some loss of the clarity of definition. A fully worked-out design for one spot in this fabric is given at C, in *Figure 2.11*, accompanied by the denting plan, with a weft section at D showing clearly the fast bound float edge.

#### Figuring with two extra warps

*Figure 2.12* 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. 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 extending over 798 extra ends. The system can be also used to produce a large repeat in dobby weaving, and in *Figure 2.13* the complete draft is given for the design shown in *Figure 2.12*, assuming that the ground weave is plain.

*Figure 2.14* illustrates a simple arrangement (which is applicable to elaborate designs) in which one extra is introduced continuously, as shown by

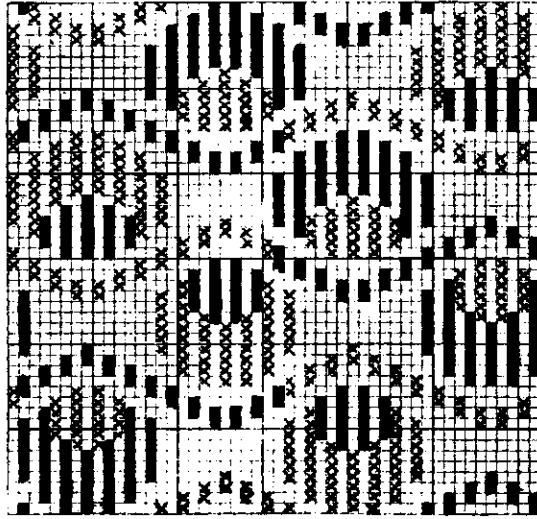


Figure 2.12

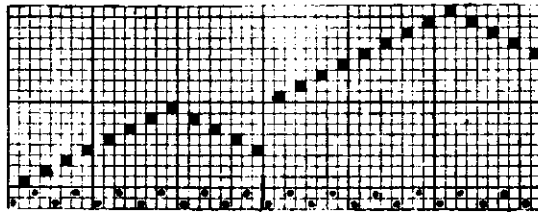


Figure 2.13

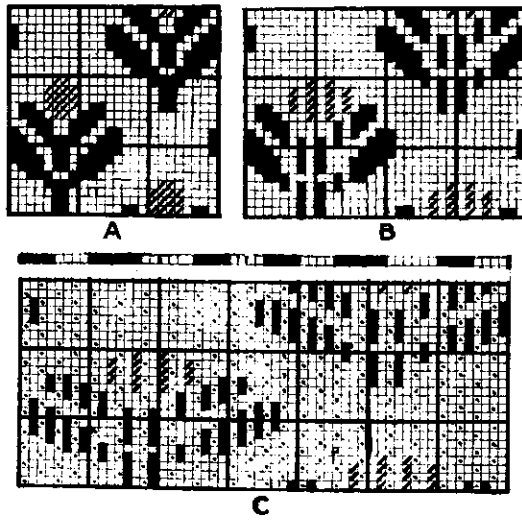


Figure 2.14

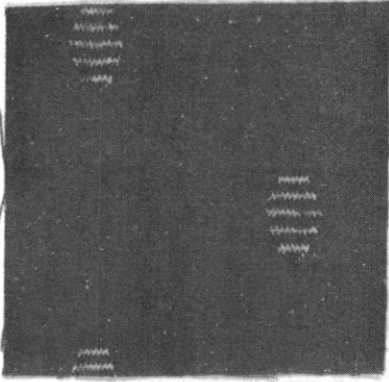


Figure 2.15

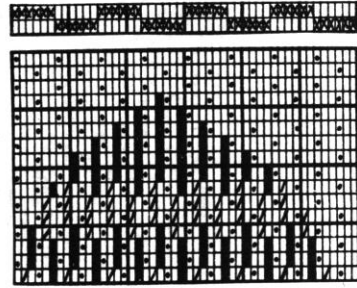


Figure 2.16

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 distribution of the extra ends is given; while C represents the full structure.

The fabric represented in *Figure 2.15* 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 in the figure, in this case, forms part of the effect. The spot is formed of coloured and white mercerised cotton on a self coloured woollen ground. A portion of the fully worked-out design for one spot is given in *Figure 2.16*, the full squares representing the coloured, the diagonal marks the white extra warp, and the dots the ground. The denting order is indicated above.

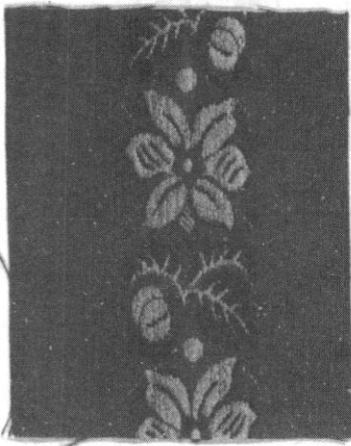


Figure 2.17

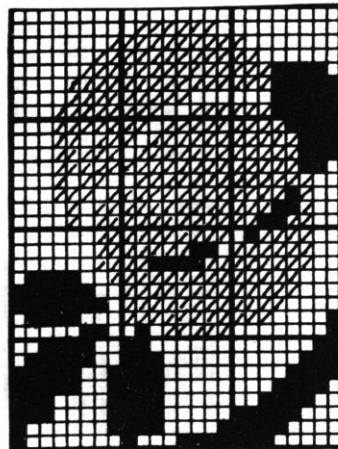
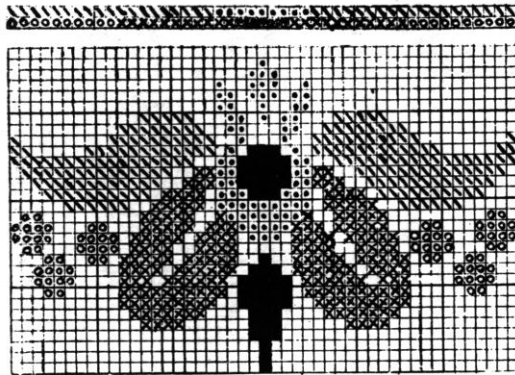


Figure 2.18

A more elaborate extra warp stripe in two colours is given in *Figure 2.17* for which a portion of the simplified design is shown in *Figure 2.18*. This cloth is also arranged on the basis of 1 ground end, 2 extra ends, which is the usual arrangement of the warp in two-colour extra warp structures. However, other orders of arrangement can also be employed such as for example: (a) 1 ground, first extra, 1 ground, second extra; or, (b) 2 ground, 2 extra. A two-colour extra warp fabric arranged on the basis of (a) is illustrated in *Figure 2.20*.

### *Extra warp planting*

The design in *Figure 2.19* 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. In the example five colours (represented by different marks) are employed, but it will be noted that



*Figure 2.19*

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 the design.

### *Stitching by means of special picks*

When it is desired to retain the extra ends on the underside 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 *Figures 2.20* and *2.21* may be employed. The arrangement is applicable to any number of extras, and to either continuous or intermittent orders.

*Figure 2.20* shows the face of the cloth, and it will be noted that the ground, which is plain weave, is at intervals quite free from the extra ends, yet, as shown at B, on the underside they are firmly bound-in.

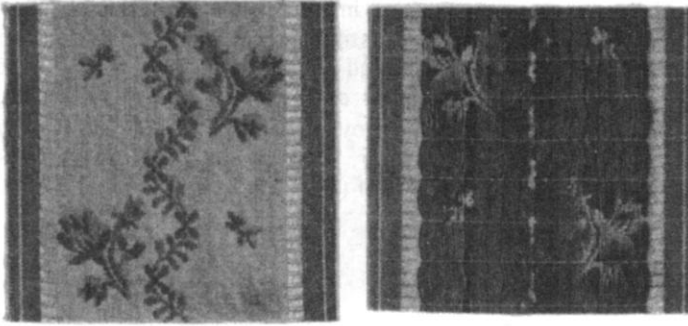


Figure 2.20

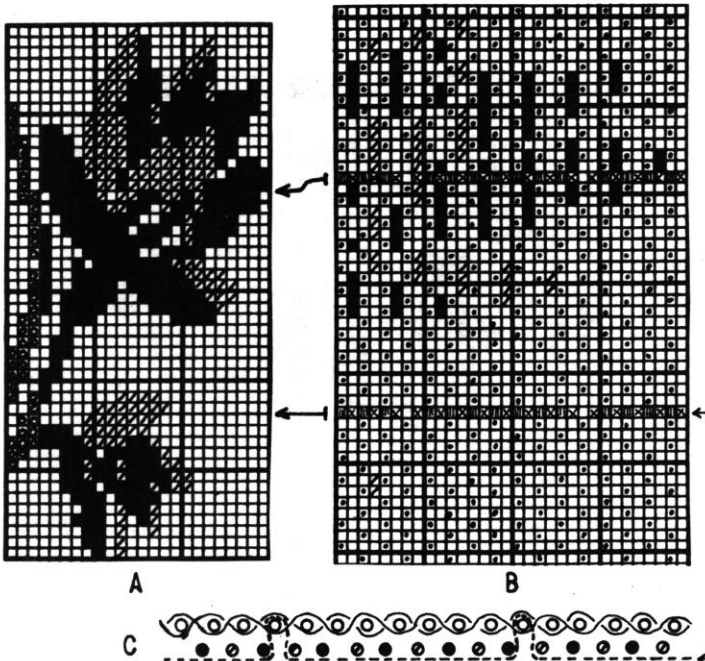


Figure 2.21

In *Figure 2.21* at A, a portion of the design, which is an extensively planted two-colour extra warp structure, is shown in a condensed form. The different marks indicate different extra warp colours and the arrows indicate the positions at which the special stitching picks are introduced. The last eight vertical rows of A are expanded into a fully worked-out design at B, which shows how the stitching picks operate. In this example the special picks are introduced after every 20 ordinary picks and if so desired they could be introduced more frequently. Whenever they are introduced the take-up motion must be rendered inoperative but unless the ordinary weft is very coarse they do not require to be different from the remainder of the weft. In most instances

they are, in fact, the same as the ordinary weft and only perform a different function. It will be seen from B, in *Figure 2.21* and also from the warp section at C that on the stitching pick all the extra ends are raised, as are also the ground ends with the exception of those which are deliberately left down to provide a binding point for the special weft. In the example illustrated every eighth ground end is left down so that the stitching pick floats under eight extra and seven ground ends at a time. In the fully worked-out design the solid and the diagonal marks indicate the figuring lifts of the extra ends whilst crosses indicate the lifts of the extra ends on stitching picks; the ground weave is shown dotted and the lifts of the ground ends on stitching picks are represented by the vertically shaded squares.

In other forms of stitching alternate extra ends may be raised on alternate stitching picks so that the first special pick binds-in only the odd extra ends and the second only the even ones. The float of the stitching weft on the underside may also be made longer or shorter as required. Frequency of the stitching must not be too great, however, as in such cases indentations are liable to show on the face of the cloth.

### EXTRA WEFT FIGURING

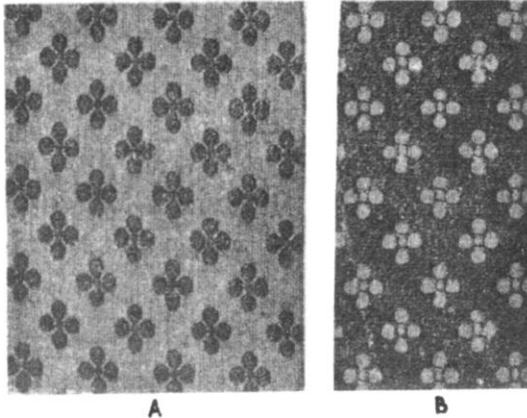
Extra weft-figured fabrics may be formed with one, two, or more extra weft picks in addition to the ground weft. Only one series of warp threads is used and the effect is obtained by floating the extra weft where desired on the face of the ground cloth produced by the interlacing of the warp with the ground weft in plain or in some other simple weave order. As already stated, weaving machines used for this purpose must have the capacity to insert more than one kind of weft.

When the extra weft is inserted continuously the take-up speed of the cloth is calculated in terms of ground picks only and the take-up mechanism can run continuously. When, as happens most frequently, the extra weft is introduced intermittently, i.e. when there are bands across the cloth where no extra material is required followed by bands where extra picks are inserted then an intermittent take-up motion is necessary. This, in effect, means that on extra picks the take-up device must be rendered inoperative.

#### *Continuous figuring in one extra weft*

A simple example is shown in *Figure 2.22* 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 *Figure 2.22*, 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 condensed method of designing for the style is very simple since it is only necessary for the weft figure to be indicated on the paper (convention reversed), as shown in the corresponding design given at C in *Figure 2.23*. The card-cutting instructions are—cut two cards from each horizontal row, cut blanks for the extra picks, and cut the ground cards plain. The

complete structure given at D in *Figure 2.23* 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 warp section is given at D in *Figure 2.24*, which shows how the picks 2, 3, and 4 of D in *Figure 2.23* interweave with the ends 1 to 20. It will be appreciated that in all the designs in *Figure 2.23* the design convention has been reversed so that the marks indicate warp down and the blanks warp up. The reversal of the convention helps the designer to visualise better the shape of the figures formed on design paper.



*Figure 2.22*

E in *Figure 2.23* shows the full development of the design C, assuming that it is produced in a loom with changing boxes at one side 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 section given at E in *Figure 2.24*, 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. Two cards are cut from each horizontal row, the card-cutting instructions being—on extra picks cut all blanks solid; on ground picks, cut the marks, and cut the blanks plain.

Suitable weaving particulars for the fabric represented in *Figure 2.22* are— $15\frac{1}{2}$  tex cotton warp, 32 ends per cm; and 15 tex cotton ground weft with 32 ground picks per cm; while the counts of the extra weft may be varied from the equivalent of 15 to 30 tex according to the desired prominence of the figure. In designing an extra weft figure in simplified form the count of the design paper is decided by the relative number of ends per cm to figuring picks per cm. In the 1-and-1 and 2-and-2 arrangements the number of extra



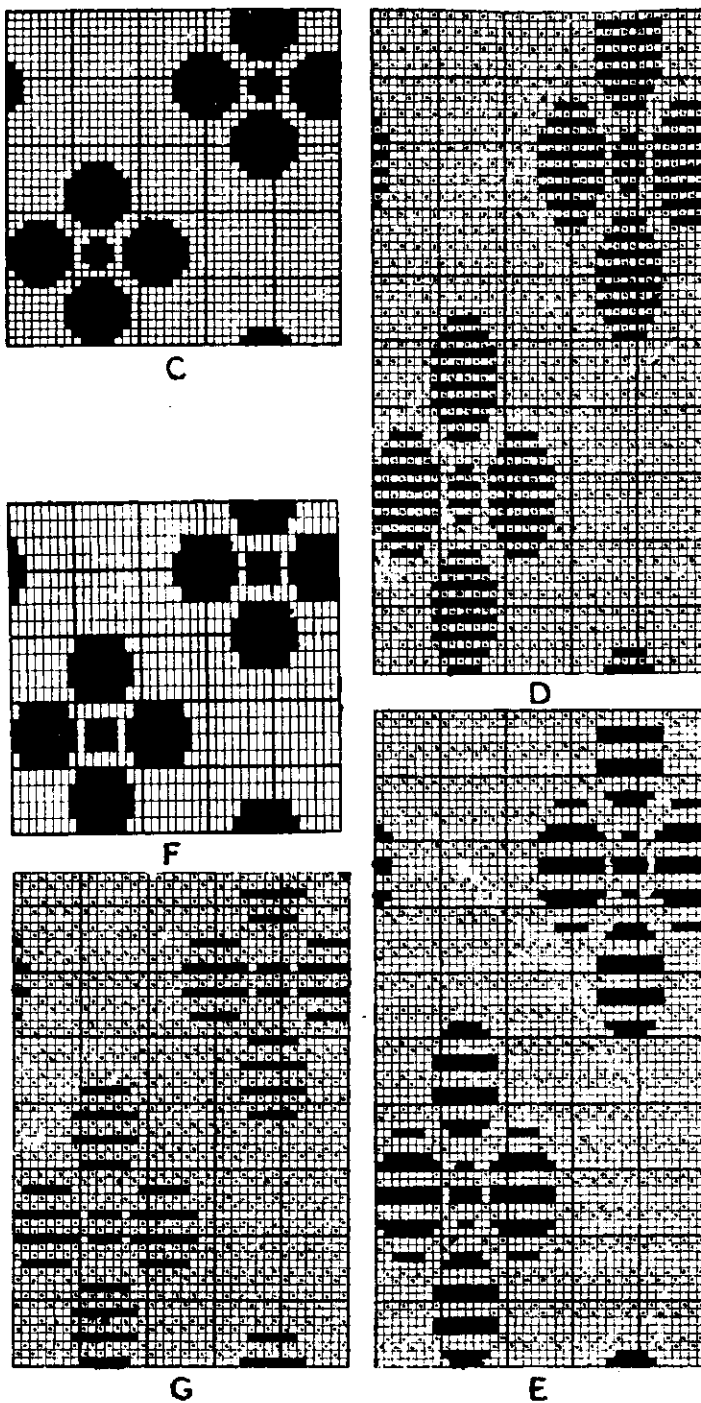


Figure 2.23

picks per cm are the same, therefore the count of design paper for the design C, with the foregoing particulars, is as 80 ends: 80 picks =  $8 \times 8$ .

The 1 extra, 2 ground order of introducing the extra weft is more economical than the 1-and-1, but with the same number of ground threads per cm the

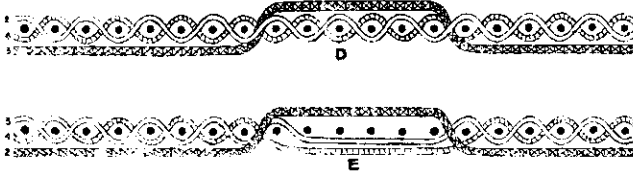


Figure 2.24

extra weft requires to be thicker, and the figure should usually be more massive. Assuming that the figure given at C in *Figure 2.23* is required to be produced in the 1 extra, 2 ground order, and that the ground threads per cm are as before, the extra picks per cm will be 40, and the count of the design 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 *Figure 2.23*.

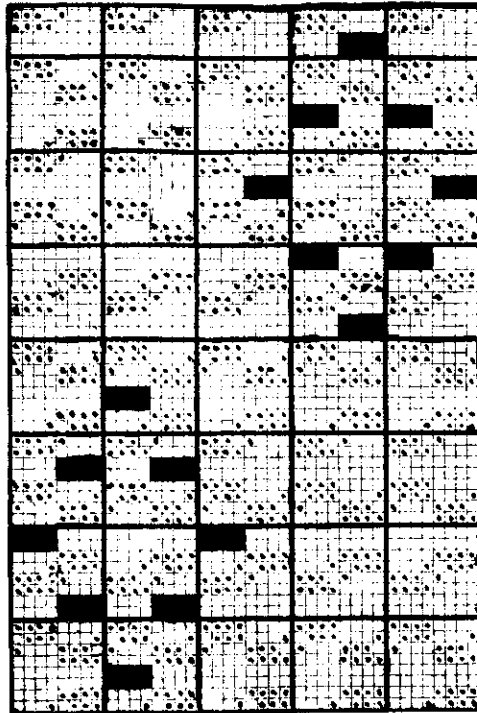


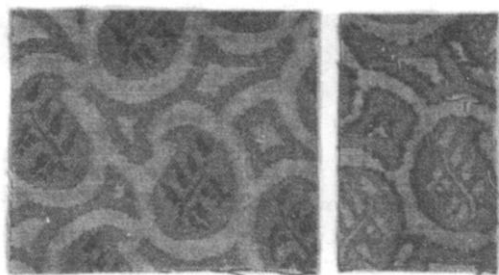
Figure 2.25

In the 2 extra, 4 ground order of wefting, a similar appearance could not be given to the figure shown at F in *Figure 2.23*, 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 arrangement is employed it is preferable to adapt the form of the figure to the weaving order, in the manner illustrated by the design in *Figure 2.25* in which the full squares show where the extra weft floats on the surface, while the dots represent the ground weave, which is a modified hopsack. *Figure 2.25* 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 design 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.

### *Clipped spot effects*

In the example given in *Figure 2.26* 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 *Figure 2.26*. In order to avoid the possibility 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 used 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.



*Figure 2.26*

The condensed plan in *Figure 2.27* illustrates the method of indicating the design upon design paper. The figure is first painted in solid, then marks are inserted to stop excessively long weft floats, after which the plain binding is indicated round the figure. The complete structure of the portion indicated

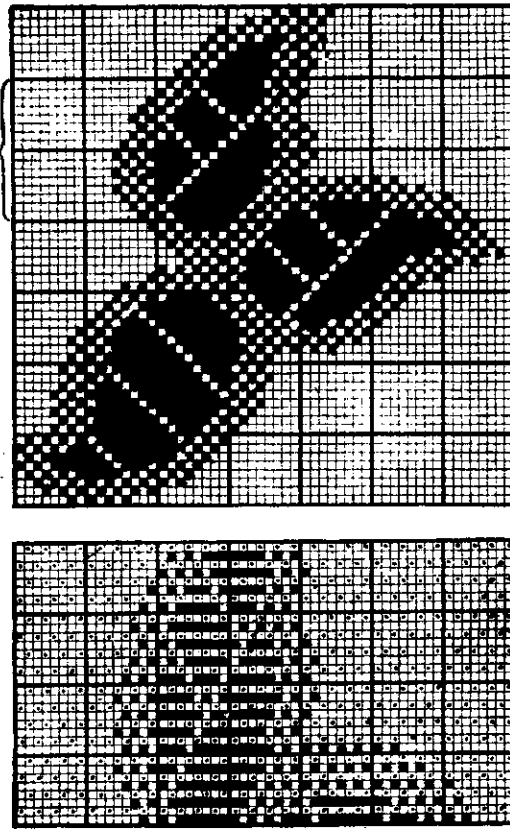


Figure 2.27



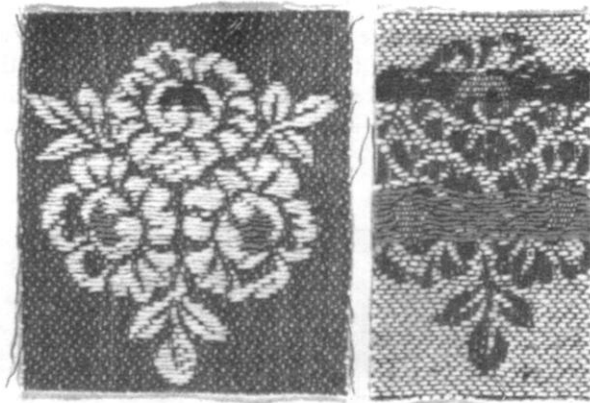
Figure 2.28

between brackets is shown below the condensed design in *Figure 2.27*; while *Figure 2.28* shows how the last extra pick of the fully worked-out portion of the design and the ground pick on each side interweave with the ends 15 to 34.

#### *Intermittent extra weft figuring*

The fabric represented in *Figure 2.29* illustrates the principle of introducing the extra weft in intermittent order with the ground weft, for the purpose of producing a detached spot effect.

In this cloth an intermittent extra weft figure is combined with a figure formed by the ground weft—a useful method of obtaining an additional embellishment without adding to the production costs. In *Figure 2.30* at A, a portion of the fully worked-out design (convention reversed) for this fabric is given in which the ground weft float is indicated by the shaded squares and the dots whilst the extra weft float is depicted by the solid marks and the crosses. The background consists of an irregular 6-shaft warp satin upon which the coarse ground weft figure shows prominently. The dots indicate that the ground weft weaves plain with the warp under the extra weft figure area as shown by the warp section given at C. The plain weave interlacing of the ground elements under the extra weft figure is used often in an otherwise loosely bound cloth to achieve a reasonable degree of firmness in areas which without it would be very poorly bound. The extra weft figure is rendered in comparatively long floats as indicated by the solid marks, and as considerable distance separates one extra weft figure from another and the extra yarn is not cut away from the back of the cloth it has to be stitched in on the reverse side to prevent excessive floating—this is shown by the crosses and is also seen clearly in the warp section at C.



*Figure 2.29*

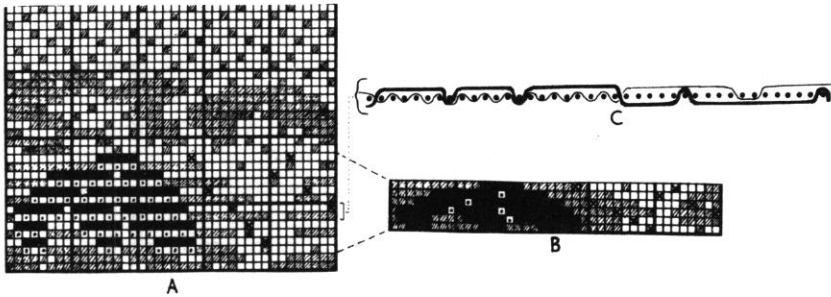
Generally the ground weft floats will close together and effectively conceal the binding points, but if the figuring weft is much thicker than the ground weft there is a liability of the stitches forcing the ground picks apart and showing on the surface, particularly if there is a strong colour contrast between the figuring weft and the ground. In such a case the stitches should be as infrequent as possible. In the example given the extra weft is bound-in in the 12-shaft irregular satin order, i.e. half as frequently as the ground weft. Where the stitch falls between two long floats of the ground weft it is concealed effectively as shown at C in *Figure 2.30*, but where it occurs at the point in which the ground weft float is short (as it will in the warp-faced background area) it may show on the face. If this is objectionable then the frequency of the extra weft stitching on the underside may be further reduced to, say, one third of the ground, thus binding it in the 18-shaft satin order.

At B, in *Figure 2.30* a condensed form of design is indicated for a portion of A. To achieve correct cloth construction from this the following card-cutting instructions would have to be given:

Cut two cards from each horizontal row;

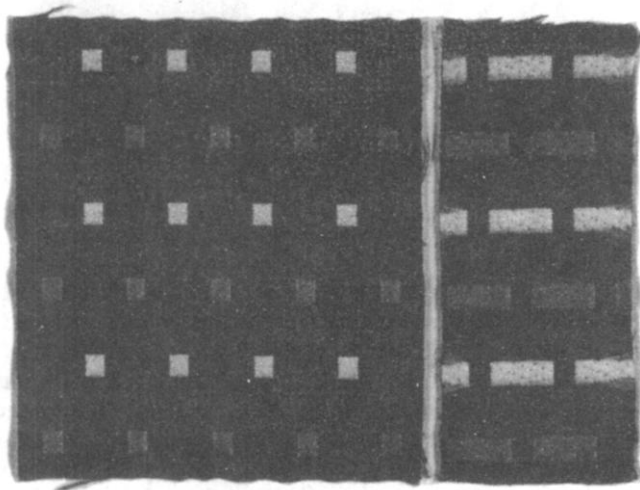
1. Ground weft card—cut all blanks, cut solid marks and dots plain.

2. Extra weft card—cut all dots, blanks and shaded marks.



*Figure 2.30*

In *Figure 2.31* another example of an intermittent extra weft fabric is given. This is a fine tie cloth produced in polyester filament yarns to the following specification: Warp—120 dtex, 86 ends per cm; ground weft—170 dtex, 43 picks per cm; extra weft—same count as ground weft, inserted 1 extra, 1 ground where it occurs.



*Figure 2.31*

A portion of the design is worked out in full in *Figure 2.32* (convention reversed) showing the cord ground weave in dots, the extra weft float on the face in solid marks and the stitch marks of the extra weft on the reverse side in

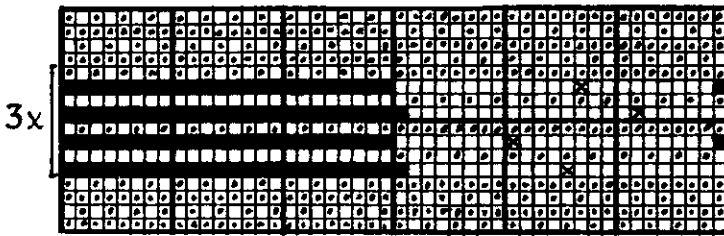


Figure 2.32

crosses. Each spot consists of 12 extra picks floating over the full width of the cord which is 24 ends wide. On the back, the extra weft floats under three cords before it again appears on the surface and is stitched in an irregular order.

#### *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 in Figure 2.32 where the ground weft instead of floating on the face, as it does in the ground weave area, is made to float on the back under the extra weft spot. The warp float, thus created, shows up the figuring spot distinctly.

#### *Stitching by means of special ends*

In fabrics in which the extra weft is considerably thicker than the ground elements and also of different colour, using the ordinary method of binding

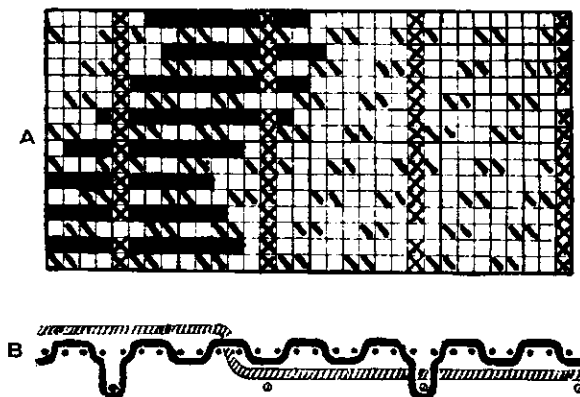


Figure 2.33

the float, as illustrated in the two preceding examples, is unsuitable because the stitches would be liable to force the finer ground picks apart and show on the surface. The binding is therefore effected by the warp and in the example shown in *Figure 2.33* every ninth thread of which is employed as an extra thread for the purpose, as shown in the design given at A in *Figure 2.33*. 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 *Figure 2.33* 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.

The method is similar in principle to that illustrated in *Figures 2.20* and *2.21* in respect of extra warp fabrics but in this case warp instead of weft stitchers are employed.

### *Chintzing*

In *Figures 2.29* and *2.31* two different colours of extra weft were used in forming different parts of the figure. The structure, however, was not changed in principle by this fact and would still be considered a one extra weft construction. Replacement of one colour of extra weft by another in succeeding horizontal rows of design is known as 'chintzing' and is simply a function of pattern change in the weft insertion and corresponds with planting in the warp direction (q.v.). It adds considerably to the variety of effect achieved without appreciably increasing the cost of production. Chintzing is often used also in true 2-thread extra weft styles, where two distinct series of extra threads are inserted and two differently coloured extra weft figures can, therefore, exist side by side. The differences between ordinary and chintzed effects are shown schematically in *Figure 2.34* in which at A, an ordinary extra weft effect is represented, at B a similar single extra weft effect is shown chintzed, with the green extra thread replacing the red one in a succeeding spot. C and D show two-colour extra weft figures, the former not being chintzed and in the latter, one of the two series of extra wefts is continuous (the grey) whilst the other is chintzed, the green threads being replaced by the pink ones in succeeding horizontal rows.

### *Continuous figuring with two extra wefts*

*Figure 2.35* shows the designing 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 cm is the same as the number of ground ends, the figure may



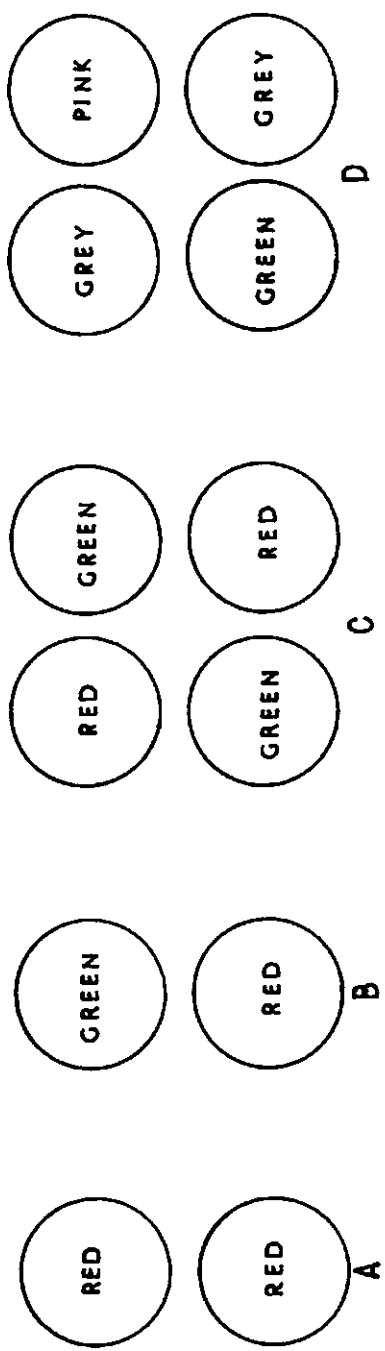
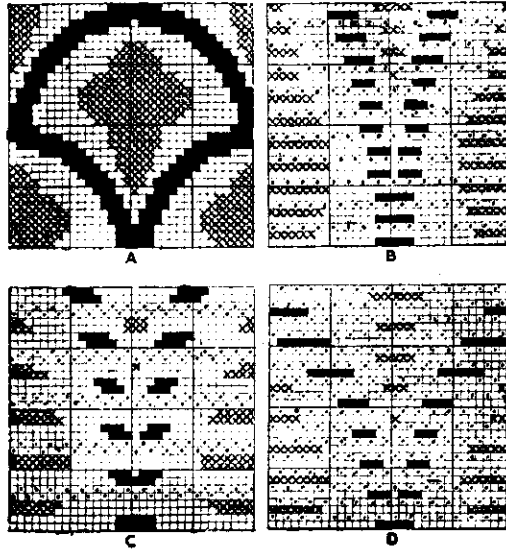


Figure 2.34

be painted solid in two colours on  $8 \times 8$  design paper, as indicated at A. 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 *Figure 2.35*, 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 weave right across disregarding the marks. 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.



*Figure 2.35*

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 *Figure 2.35*. The figure, however, is not so solid, and it is necessary to note that with an equal number of ground ends and picks per cm,  $8 \times 4$  paper will be required in painting the design solid, since there are two ground picks to each double pick of each colour.

#### FIGURING WITH EXTRA WARP AND EXTRA WEFT

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 *Figure 2.36*, in which an all-over figure has been produced in extra weft and extra warp with a comparatively small consumption of extra material. In the corresponding design given in *Figure 2.37*, in which the marks represent warp, the lines below and at the side of the plan indicate the

positions of the extra threads, which are arranged in warp and weft in the order of 1 extra and 6 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

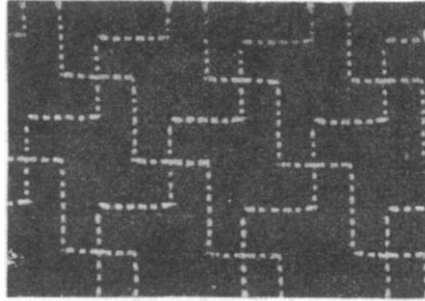


Figure 2.36

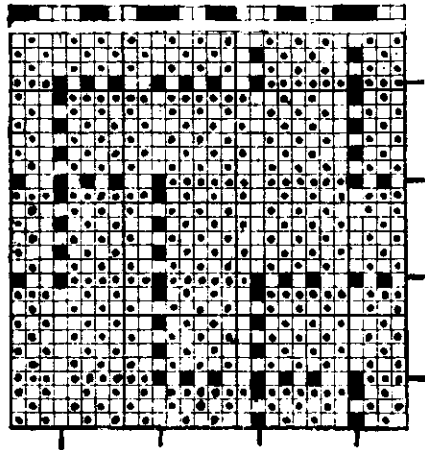


Figure 2.37

respectively to interchange 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 spot effects*

A muslin fabric is represented in *Figure 2.38*, 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

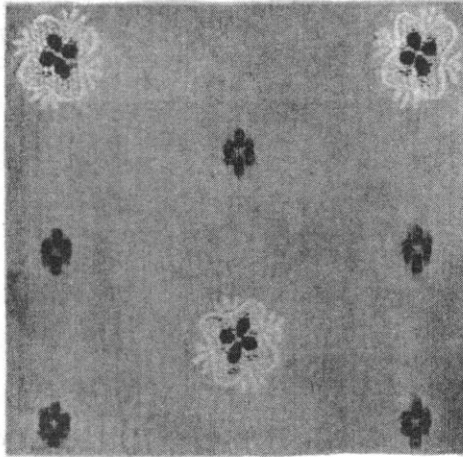


Figure 2.38

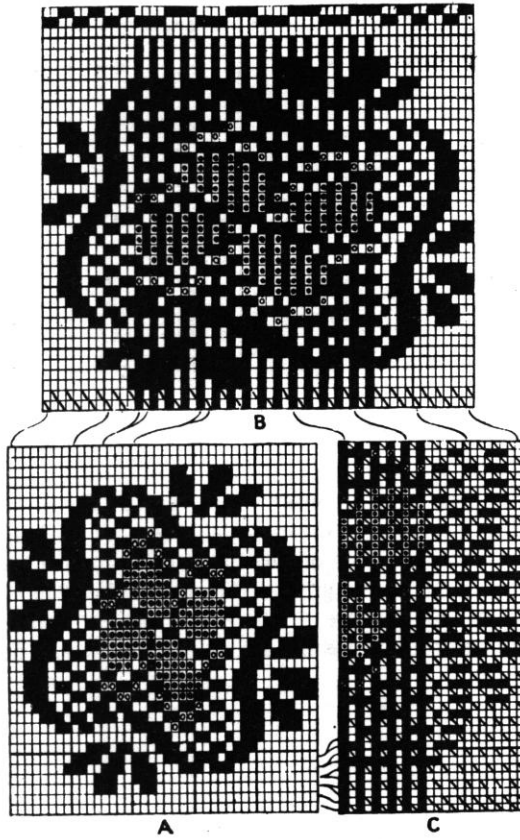


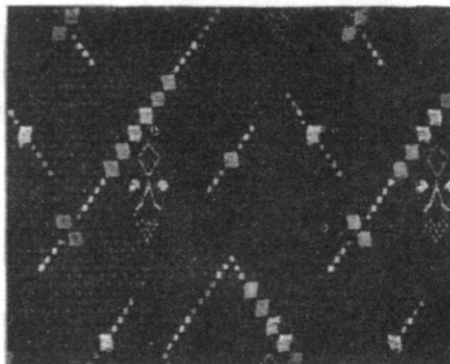
Figure 2.39

the combined weft and warp effect is illustrated at A in *Figure 2.39*, 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 cm—in this case 24 to 18—gives the proper counts of squared paper in designing the simplified figure, and  $8 \times 6$  paper is therefore shown at A. B is the same as A except for the inclusion of the extra ends which are 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 only. On the first two picks of B in *Figure 2.39*, 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 (solid marks = weft up); 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 horizontal rows and the last 24 vertical rows of B is represented at C in *Figure 2.39*. (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.

#### IMITATION EXTRA THREAD EFFECTS

By careful and judicious arrangement special materials can be employed in such a manner in developing a design as to give the impression that extra threads are

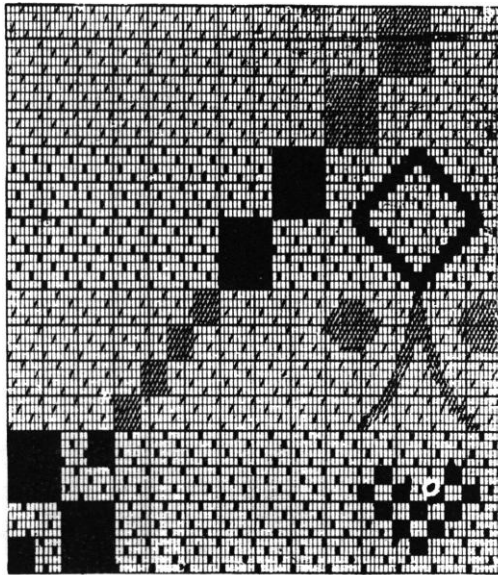


*Figure 2.40*

included in the cloth thus imitating successfully the more expensive extra warp or extra weft structures. The special figuring threads may be introduced, either in the weft or the warp, the latter method being usually the more convenient. In intermittent figured fabrics bright lustrous threads, either warp or weft, may be inserted where the figure is formed, and an ordinary class of yarn in the spaces between, both classes of threads being interwoven in the same manner in the ground portions of the cloth. Under certain conditions the difference between the yarns is scarcely observable in the ground, and a bright lustrous figure is produced with a minimum use of the more expensive yarn.

#### *Imitation extra weft figures*

The fabric represented in *Figure 2.40* and the corresponding design given in *Figure 2.41*, show how an ordinary fabric may be made to appear as if figured with extra weft. The figure and the order of wefting are arranged to coincide, and in the example the picks are inserted in the order of 16 dark and 16 light, to correspond with the arrangement of the figure, which in *Figure 2.41* is indicated in the same order by different marks (convention reversed). In order to produce the imitation extra weft effect, it is necessary for the ground of the cloth to be warp surface, in strong colour contrast with both wefts, and very

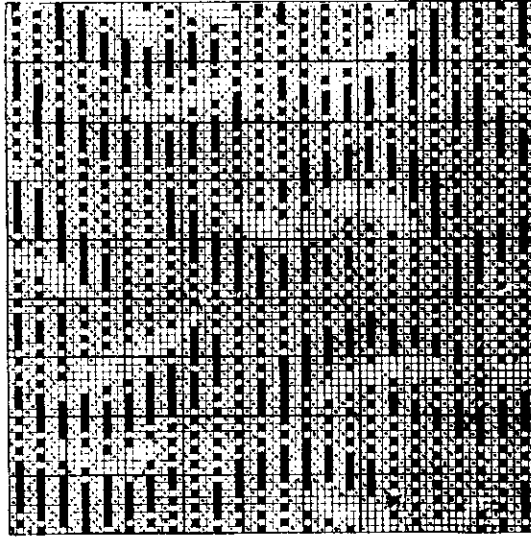


*Figure 2.41*

finely set; as for example, for the 8-thread satin ground weave—64 ends per cm of 15/2 tex cotton. Except for a slight shadiness, the weft intersections in the ground are concealed by the fine setting of the warp, and the figure is developed in two distinct colours on what is practically a solid-coloured ground.

*Imitation extra warp figures*

The foregoing principle can be employed in producing an imitation extra warp effect by using coloured ends in sections to correspond with the form of the design.



*Figure 2.42*

A method of figuring with special warp threads is illustrated in the design given in *Figure 2.42*, in which the marks indicate warp. The arrangement in the warp is 2 threads of 20/2 tex cotton to 1 special thread of 120/2 tex mercerised cotton, 20 threads per cm; while the weft is 30 tex cotton in the same colour as the ground warp, 22 picks per cm. The cloth is chiefly ornamented by floating the thick warp threads, as indicated by the solid marks, but weft figure is also formed as shown by the blank spaces in the design. Similar styles are woven in which the warp threads are arranged in the proportion of 3 ground to 1 special, or 4 ground to 1 special etc., the decrease in the proportion of the effect threads being usually compensated for by an increase in their thickness.