

3

Backed Cloths

The backed principles of construction are employed for the purpose of increasing the warmth-retaining qualities of a cloth, and in order to secure greater weight and substance than can be acquired in a single structure which is equally fine on the surface. A heavy single cloth can only be made by using thick yarns, in conjunction with which it is necessary to employ only a comparatively few threads per unit space. A heavy single texture is therefore obliged to be somewhat coarse in appearance. By interweaving threads on the underside of a cloth, it is possible to obtain any desired weight combined with the fine surface appearance of a light single fabric.

When certain threads are inserted solely to give additional weight, the idea is to employ them in forming a back to a face fabric; and one of the advantages of the backed construction is that the extra weight can be obtained in an economical manner, since material which is inferior to the face yarns may be used on the underside. Backed cloths are constructed on both the backed weft and the backed warp principle; a cloth consisting in the former case of two series of weft threads and one series of warp threads, and in the latter case, of two series of warp threads, and one series of weft threads.

The construction of these fabrics on design paper is best carried out methodically in several stages:

- (1) Mark out on design paper face threads and back threads in the order in which they are inserted, e.g. 1 face, 1 back, as shown in *Figure 3.1* at A and B for the warp-backed and weft-backed structures respectively.
- (2) Insert the face weave on face threads only using normal convention for warp backing and reversed convention for weft backing (C and D in *Figure 3.1*).
- (3) Insert the back weave on back threads only—normal and reversed convention as before—taking care to place a mark of the back weave between two long floats of the face weave thus concealing the binding marks of the back weave by the covering float on the face (E and F in *Figure 3.1*).

In reversible structures the binding marks of the face weave should be equally well concealed on the back which is in fact achieved in the examples given in *Figure 3.1* by a suitable choice of the face and the back weaves which are 4 up, 1 down twill face and back, for the warp-backed structure and 1 up, 4 down

twill face and back, for the weft-backed structure. Interlacing diagrams and cross-sectional views which correspond with E and F are given at G and I, and H and J respectively.

Many other weaves can be employed for the purpose of producing backed cloths and several examples of each are given in the succeeding pages. At this

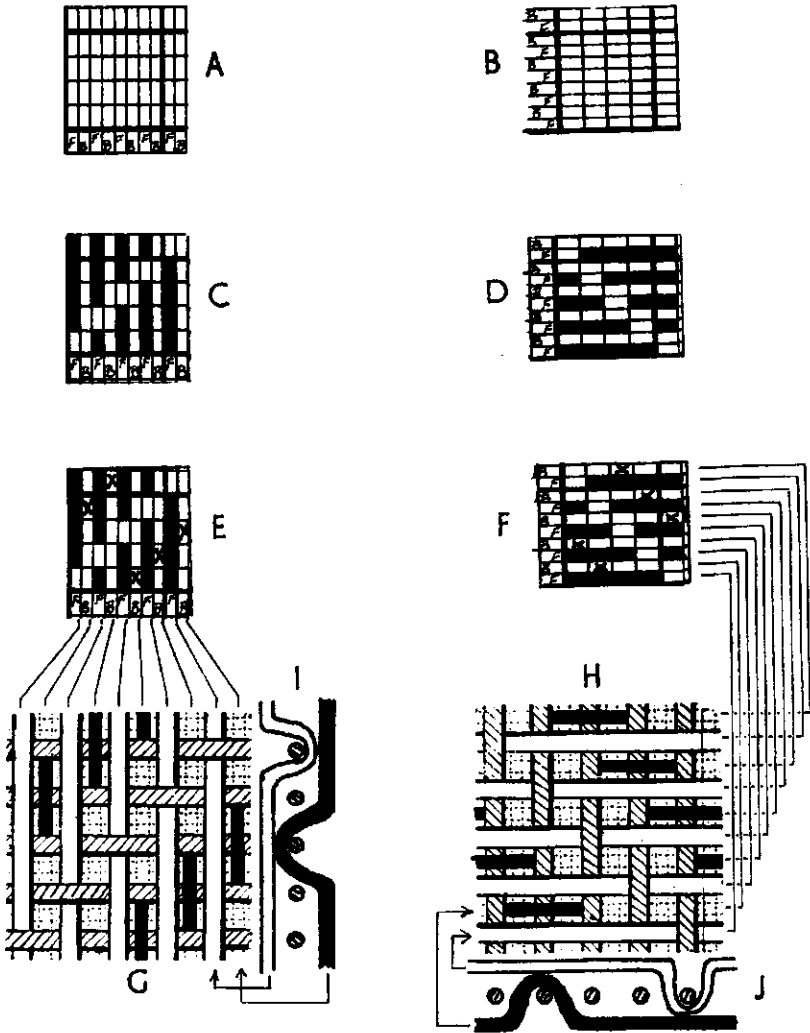


Figure 3.1

point it may be noted that warp-faced weaves are more suitable for warp backing and weft-faced weaves for weft backing whilst certain square-faced weaves can be successfully applied to both structures. In order to achieve a well-covered face in a backed cloth, correct settings are very important as without sufficient density of the face threads the binding marks of the back weave cannot be covered no matter how cleverly they are placed. As most of these fabrics are milled and raised exact rules of setting cannot be given

because the eventual density of thread spacing will depend on the amount of shrinkage achieved during finishing. However, as a general guide it can be stated that in 1 face, 1 back orders of backing the percentage cover of the face yarns could be up to 12 per cent less than in a similar well-constructed single cloth if comparatively short floated weaves are used with firm backing, and about 6 per cent less if longer floated weaves with loose backing are employed. In 2 face, 1 back orders the reduction in the setting compared with a similar single cloth must be less than for 1 face, 1 back orders and under conditions similar to those stated for the latter could be 8 per cent and 4 per cent less respectively.

WEFT-BACKED CLOTHS

Weft-backing is sometimes used in preference to warp backing because a softer and more lofty handling cloth can be obtained owing to the weft containing less twist and being under less tension than the warp. Similar conditions can be obtained in a worsted face cloth by using woollen weft, and, as a weaker yarn can be employed as weft than as warp, the use of cheaper material can compensate to some extent for the increase in the cost of weaving due to the insertion of the backing threads weft way.

The standard orders of arranging the picks in weft-backed cloths are: (1) 1 face to 1 back; (2) 2 face to 1 back; (3) 3 face to 1 back; (4) 2 face to 2 back; (5) 4 face to 2 back. The last two arrangements are used in place of the first two when a different kind of backing weft from face weft has to be inserted in looms with changing boxes at one side only. The first and the second systems are most commonly used, the former being employed for fine cloths in which the face and back wefts are similar in thickness. The latter has the advantage of cheapness of production compared with the first method, as there are only half as many backing picks per cm, so that the cost of weaving is less, and generally the backing yarn is thicker and may be of a lower and cheaper quality. The 2 face, 1 back method of backing, however, produces a less attractive cloth because the underside appears coarser.

Reversible weft-backed weaves

Weft-backed designs, in which the same weft face weave is formed on both sides, as in the example given at F and H in *Figure 3.1*, are a distinct class that is chiefly used for heavily milled cloths which are composed of woollen weft and cotton warp. It is customary to use much thicker weft than warp in this structure, and to insert more picks than ends per unit space, so that the milled and raised finish that is applied to the cloth causes the weft entirely to conceal the warp. A number of designs are given in *Figure 3.2*, which form a weft sateen weave on both sides. The backing weave is shown by crosses placed on the backing picks, and the face weave by solid marks. As sateen weaves form a smoother surface than twills, they are more suitable than the latter for the heavily milled woollen weft and cotton warp structures. The designs A, B, C, and D are arranged in the order of 1 face pick, 1 back pick, and they respectively form the 4, 5, 6, and 8-thread weft sateens on both sides of the cloth. In the

design E in *Figure 3.2*, the 4-thread weft sateen on both sides is arranged to suit a 2-and-2 order of wefting; in the design F the 6-thread weft sateen is similarly arranged with 4 picks face to 2 picks back; whereas the design G shows the 4-thread weft sateen on both sides arranged 2 picks face to 1 pick back. On the

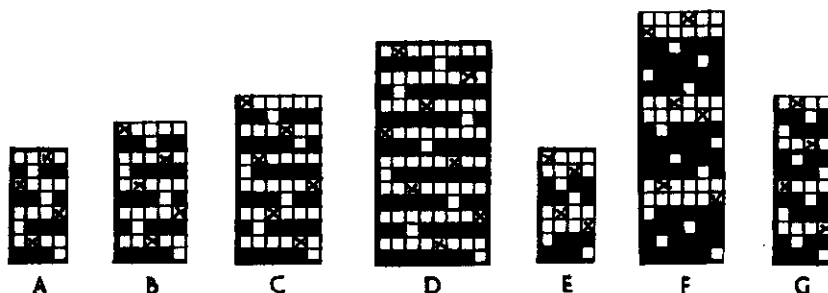


Figure 3.2

same principle certain twill weaves which have floats of more than one end at a place may be made reversible, as for instance, 2 up, 4 down face, 4 up, 2 down back; 2 up, 6 down face, 6 up, 2 down back; 3 up, 5 down face, 5 up, 3 down back etc.

Suitable weaving particulars for the design A are: 38/2 tex cotton warp 16 ends per cm, 160 tex woollen weft, 24 picks per cm; and for the design B; 30/2 tex cotton warp, 22 ends per cm, 120 tex woollen weft, 32 picks per cm. The cloths are shrunk from 20 to 30 per cent in width.

By employing differently coloured wefts for the face and back a cloth is produced in which the two sides are differently coloured, since each weft is retained on one side, or a cloth may be woven coloured on one side and white on the other. In the latter case, in order to avoid the liability of the coloured weft showing through on the white surface, the coloured yarn may be slightly finer than the white yarn. By interchanging two different wefts elaborate designs for dressing gowns, coats, bedspreads, rugs, etc., are woven.

Methods of weft-backing standard twill and hopsack weaves

The examples given in *Figure 3.3* illustrate different methods of weft-backing the 2-and-2 twill. In the design H the picks are arranged 1 face, 1 back, and the weave on the underside is 1-warp and 3-weft twill and the cloth is thus as firm on the back as on the face. The section I in *Figure 3.3* shows how the picks 1 and 2 of H interlace. In the design J the picks are arranged 1 face, 1 back, but the back weave is 8-thread weft sateen. The cloth in this case is looser and softer on the back than on the face, as long weft floats are formed on the underside, as shown at K, which represents how the picks 1 and 2 of the design J interlace. In L and M in *Figure 3.3* there are 2 face picks to 1 backing pick, but each design, although used in practice, is defective in that the back weave stitches occur only on alternate ends, so that the odd and even ends are liable to vary as regards take-up. The design M is additionally defective because the ties occur only on alternate face weft twill lines which show more prominently

than the unstitched twills. In L the stitches produce a very firm back which appears like plain weave. The design N is imperfect, but it shows the best method of weft-backing the 2-and-2 twill when the picks are arranged 2 face and 2 back. In the design O the picks are arranged 3 face to 1 back, and the

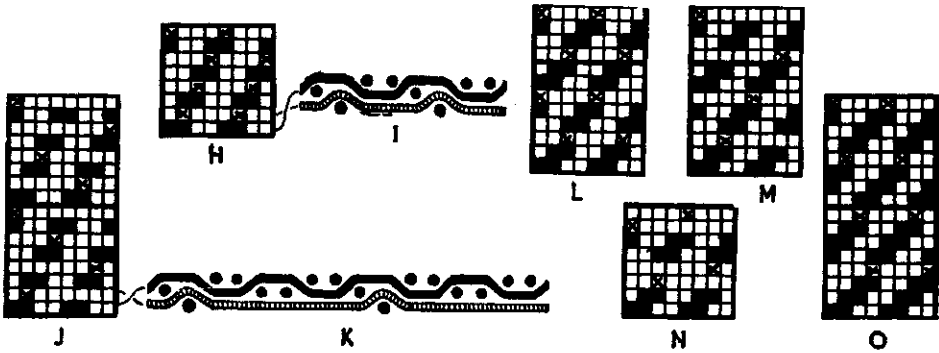


Figure 3.3

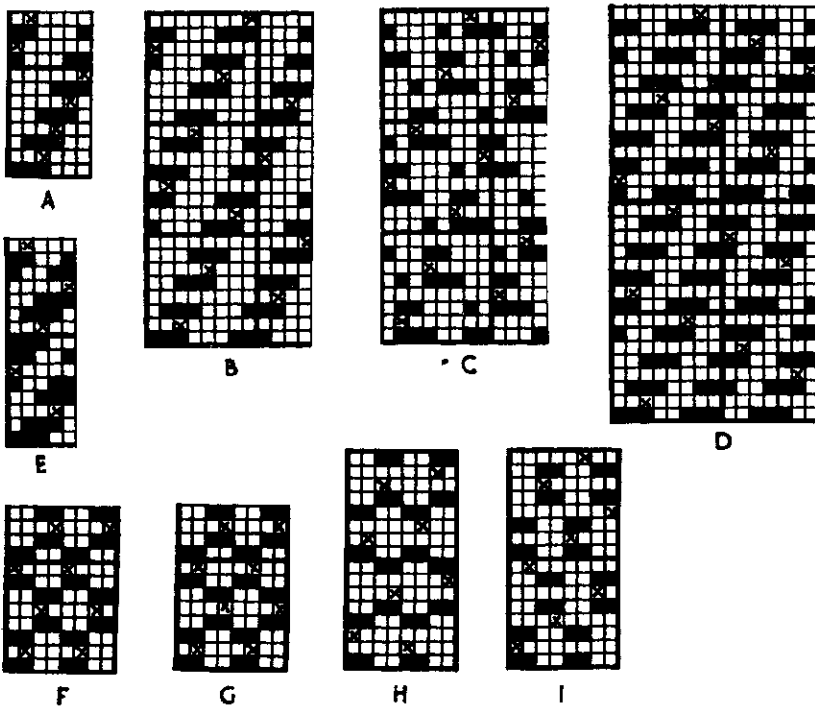


Figure 3.4

stitches are arranged in twill order in the reverse direction to the face twill so that there is a possibility of a cross twill appearing in the cloth. Suitable weaving particulars for design J in worsted yarns are— $37/2$ tex warp, 26 ends per cm, $45/1$ tex weft, 46 picks per cm.

The designs A and B in *Figure 3.4*, which are wefted in the order of 1 pick face, and 1 pick back, show the 3-and-3 twill face weave. In A the backing weave is 1-and-5 twill, and in B 12-thread sateen, and the 3-and-3 twill is extended to two repeats in each direction; each back weave mark in the latter could also have been passed over two ends at a place. In weft-backing the 4-and-4 twill considerable variety of firmness of stitching can be obtained, as each back weave mark may be extended over 1, 2, or 3 ends at a place in either the twill or sateen order of backing. Stitches on these ends can be woven 1 up, 1 down, 1 up, but in twill order this causes the back weave to be much firmer than the face weave. The design C in *Figure 3.4* is wefted 1 pick face, 1 pick back, and shows a 12-thread sateen-derivative face weave backed in corresponding sateen order. The design, D, in which the face weave is 3-and-2 twill, illustrates that in a 1-and-1 arrangement of the threads three repeats each way of a twill on an odd number of threads are required when a sateen back weave is formed. The design E shows the 3-and-2 twill backed with weft in the proportion of 2 face picks to 1 back pick, and this example illustrates that a face weave which repeats on an odd number of threads must be extended to two repeats to fit with a 2-and-1 arrangement. Thus the design contains 10 face picks and 5 back picks, and repeats on 5 ends, and the back weave is 5-thread sateen.

The designs F, G, H, and I in *Figure 3.4* show different methods of weft-backing a 2-and-2 hopsack weave. F and G are wefted in the proportion of 2 face picks to 1 back pick, the backing weave in the design F being in alternate order. In G the stitches are in 4-satinette order, which is a better arrangement, because a smoother and softer back is produced at the same time that a tie is placed on every warp thread. H in *Figure 3.4* is wefted in the proportion of 2 picks face to 2 picks back, and a stitch is placed on each warp thread. Each design F, G, and H, is so arranged that a backing pick is placed between two face picks that are in the same shed, and not between two picks that cut with each other, so that it is possible to place each stitch with a face weft float on both sides. In the design I the 2-and-2 hopsack weave is backed with weft in the order of 1 face, 1 back, and in this case therefore it is only possible to arrange one half the stitches with a face weft float on both sides. A mark, which is covered on one side only by the face weft, should precede the covering pick, as shown in I, because it is better concealed by the subsequent beating up of the covering pick than if the latter preceded the tie. The order of stitching in design I is the 8-thread sateen which yields a soft back, but the regular distribution of the back weave marks is liable to produce a twill effect on the face.

Warp-face weaves backed with weft

The designs given in *Figure 3.5* illustrate warp-face weaves that are backed with weft, in which it is only possible to cover each tie on one side. In each example the face weave is shown alongside with the positions of the back weave marks indicated between the squares, and it will be seen that the back weave is looser than the face weave. The designs A and B both show the 4-thread warp twill backed with 8-thread sateen, but the former, in which the ties follow the face weft floats, is given simply to illustrate incorrect placing of the back weave

marks, the correct method being indicated at B. In the design C the face is 5-thread warp satin, and the back 10-thread weft sateen; the arrangement of the picks is 1 face, 1 back, in each case. The design D is also 5-thread warp satin face, but the picks are in the proportion of 2 face to 1 back, and the backing weave is extended 5-sateen.

The type of design given in *Figure 3.5* is employed for a class of piece-dyed coatings in which a worsted face warp largely predominates in quantity over the face weft, while thick wollen weft is used for the back. The cloth is milled and

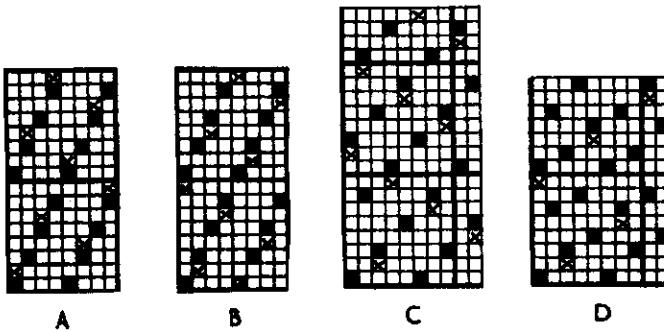


Figure 3.5

raised on the underside, and is therefore soft and full to the feel. Suitable weaving particulars for the design C are: Warp, 35/2 tex worsted, 40 ends per cm; face weft 30/2 tex cotton, backing weft 105 tex woollen, 38 picks per cm. In any weft-backed cloth in which, in order to secure greater weight and substance, thicker backing weft than face weft is used, fewer face picks than ends per cm may be employed with the result that the angle of twill face weave is steeper than 45° , but a very fine twill can be obtained in a heavy cloth.

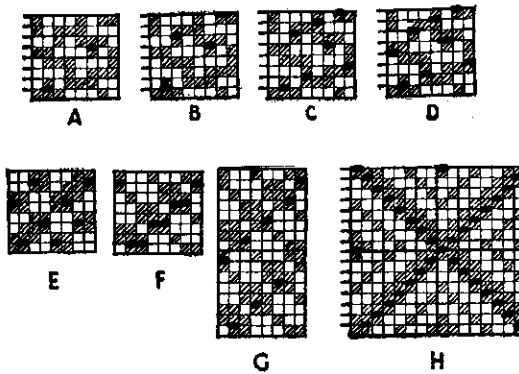


Figure 3.6

The ties for face weaves that are regular in construction are, as a rule, easily arranged, but before constructing a backed design it is convenient, in many cases, to indicate the face weave lightly, and to scheme the distribution of the ties by inserting back weave marks between the squares. The ties for irregular

face weaves are sometimes difficult to arrange, and in *Figure 3.6* a convenient method of working is illustrated in stages at A, B, C, and D. The positions of the backing picks, in the order in which they are inserted with the face picks, are indicated, as shown by the marks alongside the face weave given at A; and the first ties are marked between the face picks where only one tying position is available. Second, the ties are marked on the ends which afford only one suitable tying position, as shown at B on the third and seventh ends. Third, the ties are marked in the remaining positions, care being taken to indicate one for each backing pick, and, if possible, to so distribute them that one tie is placed on each end. In the plan C seven ties are correctly indicated, only that of the fourth backing pick being omitted. This tie can only be covered on both sides by placing it on the second or eighth end, on both of which, however, a tie has already been indicated. In such a case, unless there is a strong contrast in colour between the face and back wefts, it is better to place the stitch with a face weft float on one side only, as shown at D, and thus have the ties properly distributed, than to stitch twice on one of the ends. The complete design may then be readily made, but it is quite convenient to peg the dobbie lags straight from a face plan, constructed as shown at D.

Special examples of weft-backing

As previously shown, in 2 face, 1 back weft-backing it is frequently impossible to place a tie on every warp thread, and it is only in certain weaves that perfect distribution can be obtained. Twill weaves that repeat on an odd number of threads, are examples in which every thread may be stitched, as shown in the design E, *Figure 3.4*. A face weave, such as that given at E in *Figure 3.6*, may be stitched on every end, by placing two ties on each backing pick, as shown; while F is an example in which a similar result is obtained by floating each tie over two consecutive ends. A weave such as F, however, can be stitched on every end by extending it to two repeats, as shown at G. The design H in *Figure 3.6* illustrates the principle of weft-backing a diamond weave with the same number of stitches on each end.

WARP-BACKED CLOTHS

The arrangement of two series of warp threads to one series of weft threads enables a considerable saving in the cost of weaving to be effected, as compared with the weft-backed principle, because of the reduction in the number of picks per cm; a more solid appearance can be given to the cloth by the formation of stripe patterns on the underside, which is impossible in weft-backed textures; while owing to the greater strength warp way the cloths are superior from a structural point of view. On account of the greater strain in weaving, however, such a low quality of backing yarn cannot be used as in weft-backing; drawing in the warp is more costly because there are more ends; the drafts are usually more complicated, and a greater number of healds are required in producing similar effects.

The standard orders of arranging the ends in warp-backed cloths are: 1 face to 1 back, 2 face to 1 back, and 3 face to 1 back (there is no necessity to arrange the ends in even numbers); while in some cases a backed weave is combined in stripe form with a single weave.

Reversible warp-backed weaves

The design A in *Figure 3.7* is a standard reversible weave, in which the face weave and the order of stitching produce a 3 up, 1 down twill on both sides so that the cloth is perfectly reversible except for the difference in the direction of the twill lines, as is illustrated by the corresponding diagrams at E and G. The view, given at E, represents the structure as viewed from the face side, and that shown at G, as viewed from the back, assuming that the cloth has been turned over vertically, while D and F show how the first two ends interlace. The design shown at E in *Figure 3.1* is similar except that it results in a 4 up, 1 down twill on both the face and the back of the cloth. Warp weaves on both sides of the

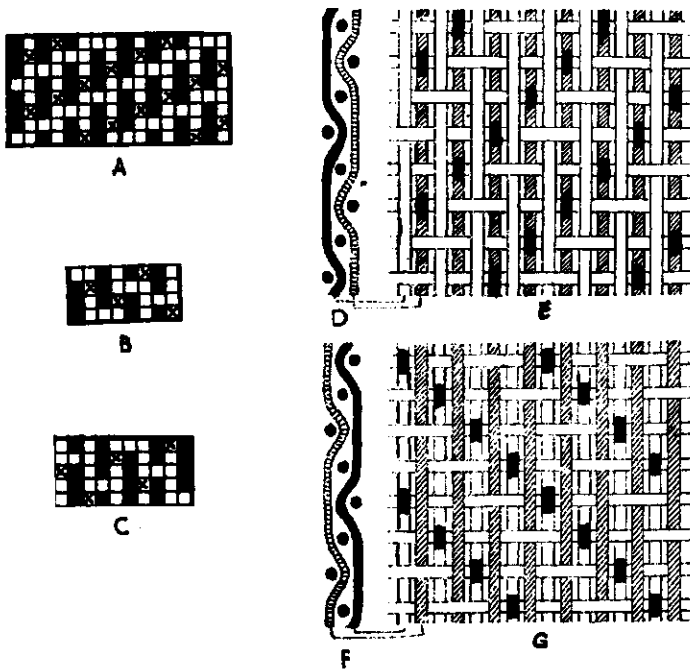


Figure 3.7

cloth are constructed in a similar manner, and B and C in *Figure 3.7* respectively represent the 4-thread and 5-thread satin weaves made reversible. The cloths may also be made reversible as regards the colouring, or different colour patterns may be formed on the two sides by employing different schemes of colouring for the two series of warp threads.

Beaming and drafting warp-backed structures

Figure 3.8 shows various methods backing a 2-and-2 twill face weave, and also illustrates different systems of drafting warp-backed structures. The designs Q and S are arranged 1 face end, 1 backing end. The order of stitching in Q results in a 3-and-1 twill back and R represents the interlacing of the first and second ends of the design. The twill on the underside makes the cloth as firm on the back as on the face. In the design S a loose satin weave is formed on the underside, as shown at T, which indicates how the first and second ends of S interlace.

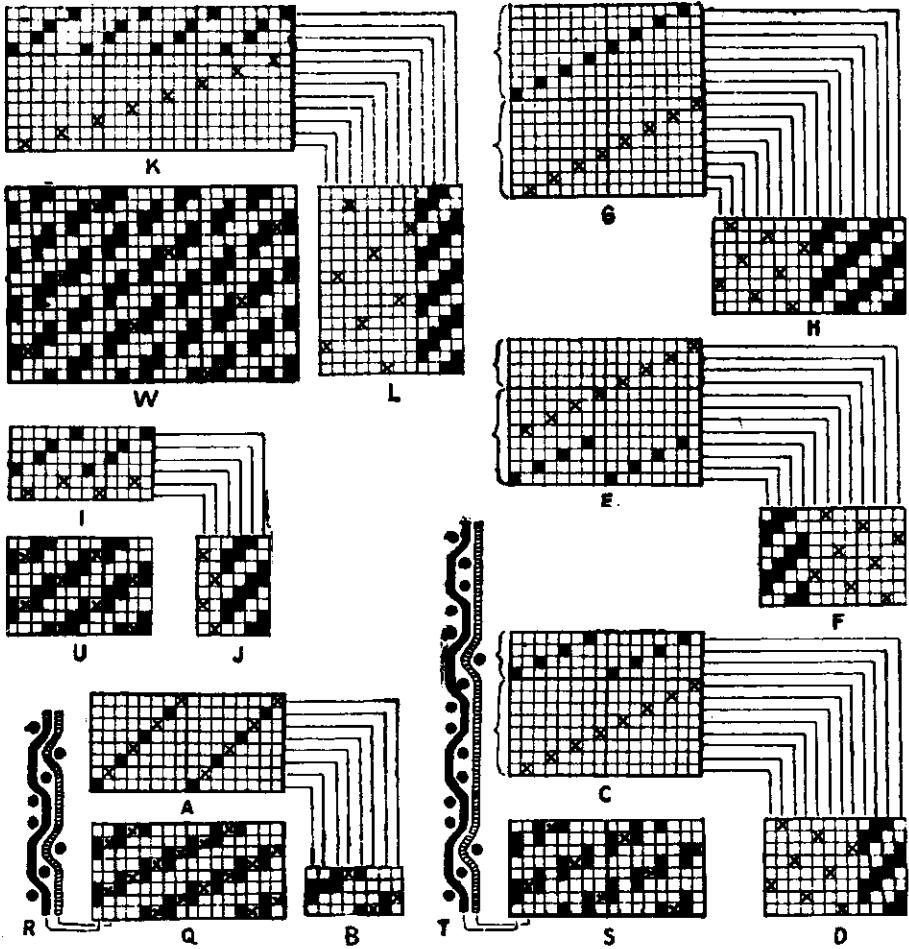


Figure 3.8

In the designs U and W in Figure 3.8 there are two face ends to each backing end, but a commencement is made with one face and in order that the backing ends may be readily dented in the reed with a face end on each side. In the design U an alternate order of stitching on the odd face picks is employed, and

in W a sateen order is similarly arranged, the ties thus occurring on only half the face picks.

For the design S the following are suitable weaving particulars in a worsted cloth: Face and back warp 45/2 tex, 48 ends per cm; weft 45/1 tex, 24 picks per cm. The design U might be woven in a woollen cloth with 66 tex face warp, 96 tex backing warp, 24 ends per cm; weft 66 tex, 16 picks per cm.

In beaming the warp for a warp-backed cloth all the threads may be placed on one warp beam so long as the face and back yarns are similar, and the face and back weaves are equal in firmness, as in the design given at Q in *Figure 3.8*. Preferably however, the two series of threads are placed on separate beams, in order that they may be independently tensioned, and there is then no restriction as to the comparative firmness of the weaves or thickness of the threads. A weave such as that shown at S may require the face warp to be as much as 8 per cent longer than the back warp.

In drafting warp-backed designs simple patterns may be drawn straight over, as shown at A in *Figure 3.8*, which is the draft for the design given at Q, while lifting plan B is exactly the same as Q. In the draft A the healds which carry the backing ends are intermingled with those upon which the face ends are drawn, and a similar order of drafting upon 16 healds can be employed for the design S, the latter then forming the lifting plan. In cases, however, where there is difference in thickness or material between the face and backing ends, or if different warp patterns for the two sides of the cloth are employed, or if the face weave requires a special draft, it is better to draw each series through a separate set of healds. Whether the weaker yarns (usually the backing yarns) should be drawn over the front or the back healds is dependent on the shed geometry of a weaving machine and both methods are employed contingent upon the specific circumstances in operation at a given machine. The two positions of the face and backing healds are illustrated at C and E in *Figure 3.8*, which show two methods of drafting the design S upon the smallest number of healds, while the respective lifting plans are given at D and F. In the draft C the backing healds are shown in front of the face healds, and in E behind them.

The use of only four healds for the face weave as shown at C and E in *Figure 3.8*, gives very little scope for producing different weaves in the same draft, whereas if eight face healds are employed, as shown in the draft given at G, any face weave that repeats on four or eight threads may be woven; also the wires are less crowded on the shafts so that the healds will last longer, and there is less friction on the warp. H shows the corresponding lifting plan for the design S.

The draft and lifting plan for the design U in *Figure 3.8* are given respectively at I and J, and for the design W at K and L; the backing healds in each case being placed in front of the face healds. A comparison of drafts I and K shows that fewer healds are required for a firm back than for a loose back.

Methods of warp-backing standard weaves

The examples in *Figure 3.9* show standard methods of placing back weave ties between the floats of the face structure. The twill order of stitching in A and B coincides with one repeat of the 3-and-3 twill face weave (in the latter design

the backing ends are stitched on two consecutive face picks), whereas the sateen order of stitching in the design C requires that the face weave be extended over two repeats in each direction.

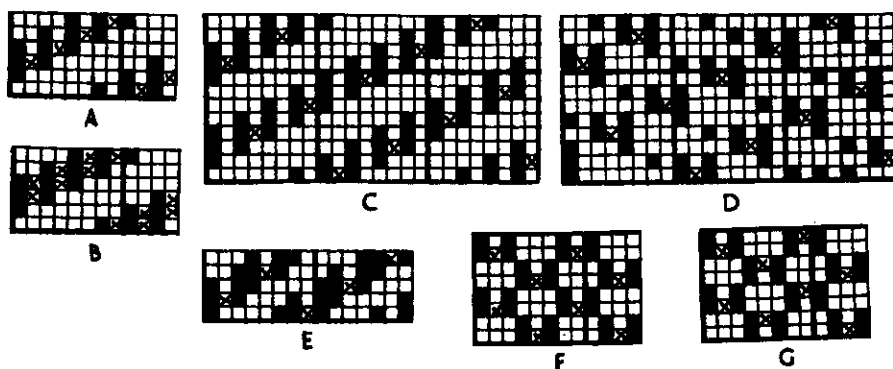


Figure 3.9

The design D in *Figure 3.9* shows a sateen-derivative face weave backed in sateen order. E shows a 5-thread twill extended to two repeats horizontally to fit with a 2 face, 1 back arrangement of the ends. The 2 up, 1 down twill is a standard fine coating weave, and in 1 face, 1 back arrangement the same twill on the back produces a firm structure, and a 9-sateen back a softer handling cloth. In 2 face, 1 back arrangement the 3-thread twill can be formed on both sides running in the same direction when the cloth is turned over. The design F shows the 2-and-2 hopsack face weave and the alternate order of back stitching, while G shows the same weave backed in 4-sateen order, which is a better arrangement than that shown at F. In warp-backing the 2-and-2 hopsack weave in 1 face, 1 back order the back weave may form 4-thread twill or satin, or an 8-thread satin back may be formed, but in each case one-half the stitches are covered by a face float on one side only.

Method of selecting warp ties for irregular weaves

A convenient simplified system of arranging the ties in warp-backing an irregular face weave is illustrated in stages at I, J, and K in *Figure 3.10*. The face weave is marked in, and the positions of the backing ends—in the order in which they are arranged with the face ends—are indicated below the face plan, as shown at I. The ties are first indicated between the face ends in the places where only one tying position is available, as shown by the marks between the squares of J. Then, as shown at K, the remaining ties are indicated in the positions which will give the most regular and uniform distribution. Afterwards, the draft and lifting plan may be constructed directly from the face plan, as shown at L and M.

N in *Figure 3.10* shows a type of design in which, in a 1 face, 1 back order of warp-backing, certain of the stitches of the backing ends—in this case the fourth and eighth—can only be covered on one side by a face warp float. In a 2 face, 1 back order of backing the design, however, it is possible to avoid placing a backing thread between the face threads that cut with each other, so that proper positions for the ties can be readily found, as shown at O.

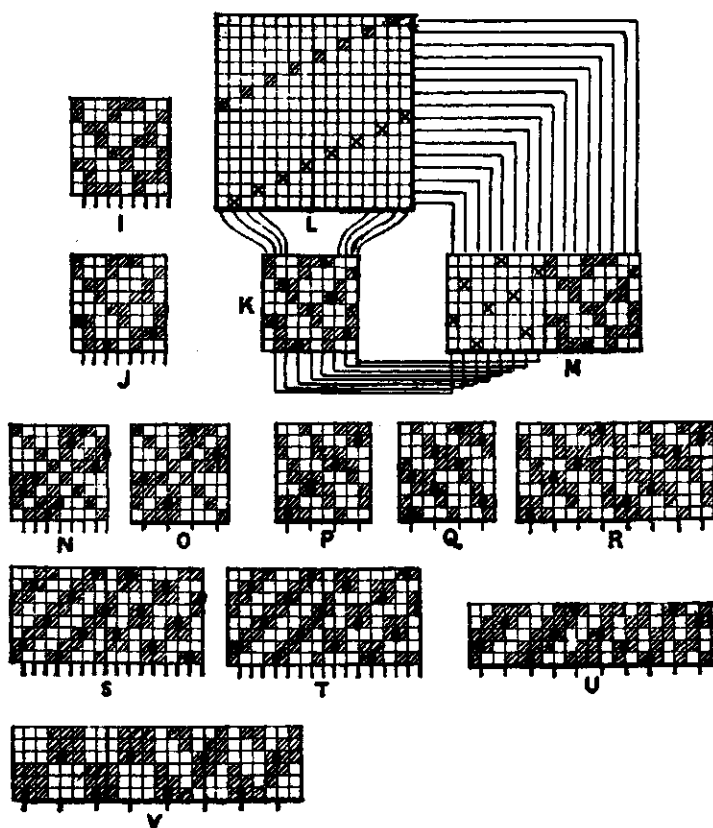


Figure 3.10

P, Q, and R in *Figure 3.10* show different methods of backing the Mayo weave with warp in the proportion of 2 face to 1 back. In the design P the ties are placed on alternate picks only, but Q shows the face weave in a different position relative to the backing ends which permits each to be tied twice so that a stitch is placed on every pick at the same time that the back weave is made much firmer. R shows another method of tying the Mayo weave on every pick; the face weave in this case is extended over two repeats and each backing end is only stitched once, hence the backing weave is as loose as in the design P. The design R, however, requires twice as many backing healds as either P or Q.

The designs S and T in *Figure 3.10* show two arrangements of the stitches in a 1 face, 1 back warp-backed weave, which is composed of 2-and-2 twill and

twilled hopsack. In both designs the stitches are correctly placed as regards being covered on both sides by face warp floats, but in S the distribution is not so good as in T. Further, a complicated draft of the backing ends is required in the former, whereas in the latter the draft of these ends is quite regular.

The design U in *Figure 3.10* shows a stripe face weave, composed of 3 up, 2 down twill and Venetian, which is arranged in 2 face, 1 down order. In the twill section of the face weave the ties are arranged in sateen order with the picks, and in the Venetian section in twill order, so that in this case both the face and the backing threads require to be specially drafted.

The design V in *Figure 3.10* shows a stripe weave composed of 3-and-3 hopsack and 3-and-3 twill derivative that is backed with warp in the proportion of 3 face to 1 back. The 3 face, 1 back arrangement of the threads is particularly suited to the face weave, and the ties are so distributed that only two backing healds are required.

INTERCHANGING FIGURED BACKED FABRICS

Interchanging weft-backed fabrics

These cloths are chiefly used for blankets, dressing-gowns, and rugs. The weave is the same in every part of the cloth, and a weft surface is produced on both sides. The design is due to the manner in which differently coloured wefts are interchanged from one side to the other, a dark figure on a light ground on one side corresponding with a light figure on a dark ground on the other side. This is illustrated by the fabric represented in *Figure 3.11*, in which the reverse side of the cloth is shown in the bottom left-hand corner. A portion of a



Figure 3.11

similar design is given in *Figure 3.12*. Generally, the wefts should be brought about equally to the surface on both sides in order that one side will not appear darker than the other, this being particularly the case when the cloth is seen on both sides at the same time. A raised finish is applied alike to both the back and face, and when woollen weft is used the shrinkage in width ranges from 15 to 30 per cent. The warp is almost invariably cotton, and suitable weaving particulars for a heavy fabric in a 4-thread weave are: 60/2 tex cotton warp, 9 ends per cm, and 350 tex woollen weft, 19 picks per cm; and for a

lighter cloth: 39/2 tex cotton warp, 14 ends per cm and 120 tex woollen weft, 28 picks per cm. The felted and raised finish causes the cotton ends to be entirely concealed, and gives a full soft feel to the cloth. Cheap cloths are made entirely of cotton, the flannelette class of weft being used, which is generally inserted in even picks, and the following weaving particulars are suitable: Warp, 38 tex, 19 ends per cm; weft, 49 tex, 34 picks per cm.

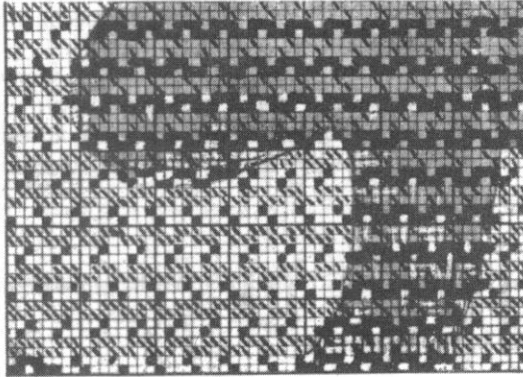


Figure 3.12

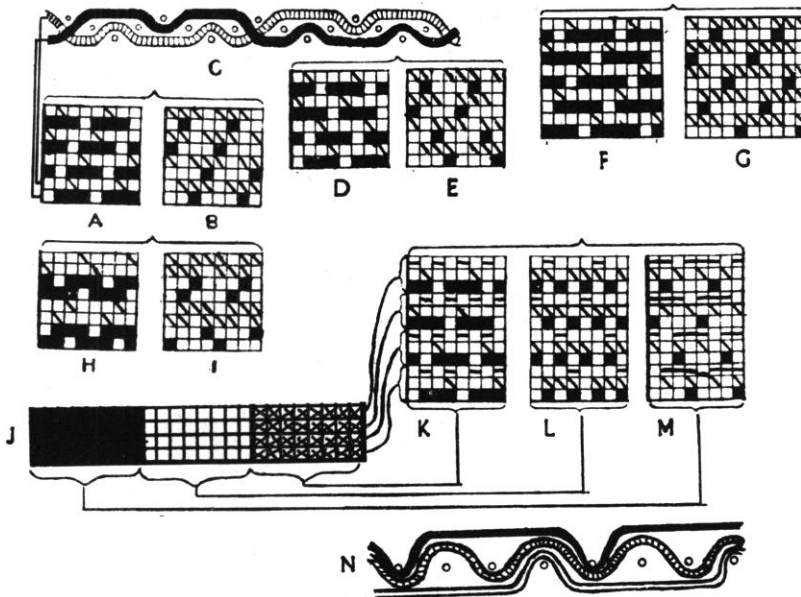


Figure 3.13

The weaves for the figure and ground are constructed upon the same principle as the weft-backed reversible designs illustrated in *Figure 3.2*, and as shown in *Figure 3.13*, in which the most commonly used reversible plans are given. Both

A and B in *Figure 3.13* in which the marks indicate weft, show the double-face 1 up, 3 down weft twill weave, but in A the odd picks are on the surface and the even picks on the back; whereas in B the odd picks are on the back and the even picks on the surface. If, therefore, the picks are arranged 1 dark, 1 light, weave A will produce a dark surface and a light back, and weave B a light surface and a dark back. By combining the two weaves in sections the wefts interchange between the face and back, and a design in two colours is formed, as represented in the diagram C, which shows the interlacing of the picks 1 and 2 of A and B in combination.

D and E in *Figure 3.13* show the 4-thread and F and G the 5-thread weft sateens made reversible in the same manner as A and B, while H and I illustrate the construction of the reversible 4-sateen weave to fit with a 2-and-2 order of wefting. Other weft-face twill and sateen weaves can be similarly arranged, but, as a rule, a sateen produces a smoother surface, and is therefore more suitable for the raised finish than a twill weave upon the same number of threads. As in all weft-backed cloths the chief point to note in each weave of a pair, is that the interlacing points of the back picks occur between face-weft floats.

Figure 3.12 illustrates the method of painting out a design in full. The reversible 4-thread weft sateen weaves are combined; and the order of wefting is 2 dark, 2 light. The figure is indicated lightly in a wash of colour, then, in order to produce a dark figure upon a light ground, the weave H in *Figure 3.13* is indicated in the figured portions, and the weave I in the ground. As the design shows the complete interlacing of the threads, one card is cut from each horizontal space, and the cutting instructions are: Cut all but the weave marks.

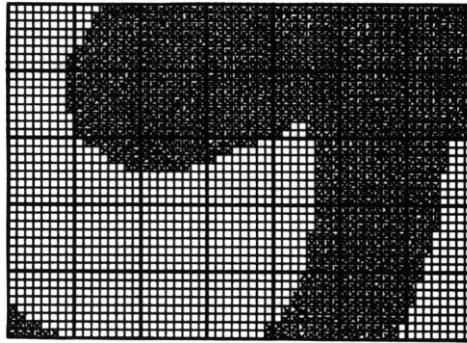


Figure 3.14

It is a tedious process to paint out a design in full, and in most cases a simplified painting would be made in preparation for cutting on one of the advanced card-cutting systems outlined in Chapter 1. Such a design is shown in *Figure 3.14* and corresponds with the fully worked-out design in *Figure 3.12* as far as the shape of the figure is concerned. It will be noted that in simplified designing for interchanging weft-backed structures it is only necessary to paint the figure solid in one colour and then the ground equals paper, i.e. unpainted area. The simplified design would then be programmed into the area selector and

to make the construction identical with that in *Figure 3.12*, weave H from *Figure 3.13* would be placed on the weave selector during the cutting of the paper area, i.e. the unpainted ground, the weave selector pattern would be that represented by I in *Figure 3.13*. Thus, the two areas, i.e. the ground and the figure would be rendered in cloth exactly as shown in *Figure 3.12*. The same design could be produced in other structures if instead of H and I other pairs of weaves shown in *Figure 3.13* were used successively on the weave selector whilst the paint and the paper areas were selected as before on the area selector.

The simplified design in *Figure 3.14* could be easily condensed weft-wise by 2, or even by 4 without an appreciable loss of definition because in these structures, due to the raised finish, only rather solid designs are applicable as any fine design lines are liable to become lost under the surface nap.

In the interchanging weft-backed structures only two colours can be brought to the surface in each horizontal line but more than two colours can be obtained by chintzing in succeeding portions of the design. Even without chintzing it is possible to obtain a third effect by weave 'mixing'. Thus, in a pick-and-pick order of wefting a third effect can be formed by combining two weaves such as D and E in *Figure 3.13* with a third weave, such as H or I, while in a 2-and-2 order of wefting, two weaves, such as H and I, can be combined with a third weave, such as D or E. In each case two of the weaves produce solid effects, whereas in the third the weft colours are intermingled and a subsidiary pattern is formed which can be used to give variety to a design.

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

Treble-wafted interchanging backed fabrics

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

The simplified plan J in *Figure 3.13* illustrates a method of indicating a treble-wafted design, arranged a pick of each alternately, in which each weft interweaves on the face, in the centre, and on the back so as to produce a figure in two colours upon a ground in the other colour, on both sides of the cloth. The weave on the face and back is 4-sateen, and in the centre plain. The design J is condensed by 3 weft-wise, therefore, three cards must be cut from each horizontal row of J. The complete weaves to correspond with different portions

of J are shown separately at K, L and M in *Figure 3.13* in which it will be seen that in K the first weft floats 3-and-1 on the face, the second weft floats 3-and-1 on the back, and the third weft weaves plain in the centre. In L the first weft weaves plain in the centre, the second weft floats 3-and-1 on the face, and the third weft floats 3-and-1 on the back. In M, the first weft floats 3-and-1 on the back, the second weft interweaves plain in the centre, while the third weft floats 3-and-1 on the face. A figure formed by the first and second wefts on the face is similarly formed by the second and third wefts respectively on the back, while the third weft forms the ground on the face and the first weft the ground on the back. The plain centre weave gives the cloth great firmness, and may be too firm for a heavily-wafted cloth, and in such a case another weave may be used, such as 2-and-2 twill, or 2-and-2 weft rib. The floats in the centre require to be shorter than those on the face and back in order that they will be invisible on both sides. The warp section N in *Figure 3.13* shows the interlacing of the first three picks in portion K.

Interchanging warp-backed figured fabrics

This class of structure can be produced in a similar manner to interchanging weft-backed fabrics by employing different colours in the warp. The construction of the weaves that are combined will be illustrated by turning *Figure 3.13* one-quarter round, and taking the marks to indicate warp.

BACKED CLOTHS WITH WADDING THREADS

In this construction the object is to obtain increased weight—as compared with ordinary backed cloths—by introducing a thick cheap yarn between the face texture and the backing threads, with neither of which it is usually interwoven. In weft-backed cloths the wadding threads are introduced in the warp, and in warp-backed cloths in the weft, each type thus consisting of two series of warp and two series of weft threads. The threads may be arranged either 1 ground, 1 wadding or 2 ground, 1 wadding, and each order may be used in conjunction with 1 face, 1 back, or 2 face, 1 back orders of backing. The 2 ground, 1 wadding order allows very thick wadding yarn to be used, and along with 2 face, 1 back order of backing is largely employed for worsted face cloths with low woollen or cotton wadding threads, particularly when the wadding yarn is in the weft.

Weft-backed and warp-wadded designs

The system of constructing weft-backed and warp-wadded designs is illustrated in *Figure 3.15*, in which the weave marks indicate weft. In order that comparisons may be made, the 4-and-4 twill weave is shown arranged on the ordinary weft-backed principle at A, while the construction of a wadded design to correspond is illustrated in stages at B and C. The arrangement of the threads

is 1 face pick, 1 backing pick, and 1 ground end, 1 wadding end. At B the marks of the face weave are inserted where the ground ends and face picks intersect, as shown by the solid marks, while the backing weft stitches, which are represented by the crosses, are indicated on the ground ends between face weft floats. C shows the completion of the design, the wadding ends being marked down, as shown by the dots, on the face picks. On the backing picks the wadding ends are left blank so that they are raised, and therefore lie between the face texture and the backing picks, as shown at D, which represents the interlacing of the picks 1 and 2 of C. E shows the appearance of the design C when only one kind of mark is used to represent weft up. All the wadding ends work alike so that one heald only can operate them.

A different arrangement of the threads is given at F in *Figure 3.15*, which shows the weft-backed 2-and-2 hopsack weave, wadded with warp in the proportion of 2 ground to 1 wadding end, while the picks are in the proportion of 2 face to 1 back. As before, the weave marks on the face ends are exactly the same as in the ordinary weft-backed design, and the wadding ends are marked down on the face picks. The section through the weft given at F, which represents the interlacing of the first two ends of F, shows how the wadding ends lie between the face fabric and the backing weft.

Warp-backed and weft-wadded designs

The system of constructing warp-backed and weft-wadded designs is illustrated by the examples given at H to M in *Figure 3.15* in which the weave marks indicate warp up. The design H in *Figure 3.15* shows the 4-and-4 twill arranged on the ordinary warp-backed principle, while I represents the construction of the wadded design in the same structure. The arrangement of the threads is 1 face, 1 back in the warp, and 1 ground, 1 wadding in the weft, the positions of the backing ends and wadding picks being indicated by the lines on the fringe of I. The face and back weaves are shown by the solid marks and crosses, then the face ends are lifted on the wadding picks, as shown by the dots, whereas the backing ends are left down. The wadding picks therefore lie between the face and the backing ends, as shown in the diagram given at J, which represents the interlacing of the first and second ends of I. K represents the appearance of the design I assuming that only one kind of mark is used to indicate warp up. The drafting of the design is the same as for the warp-backed design H.

The design L in *Figure 3.15* shows a 2-and-2 twill backed with warp in sateen order and illustrates a method of interweaving the wadding picks with the backing ends, which is sometimes practised, in order to produce a firmer cloth. The diagonal strokes which precede the crosses in L indicate the lifts of the backing ends over the wadding picks; it is necessary for these lifts to be made either immediately before or immediately after the backing-warp stitches (the former, which is shown at L, being preferable), in order to avoid breaking the backing-warp floats on the underside of the cloth. Diagram M represents the interlacing of picks 2 and 3 of L and shows how the wadding picks lie between the face and the backing ends, except where they pass under the latter at a

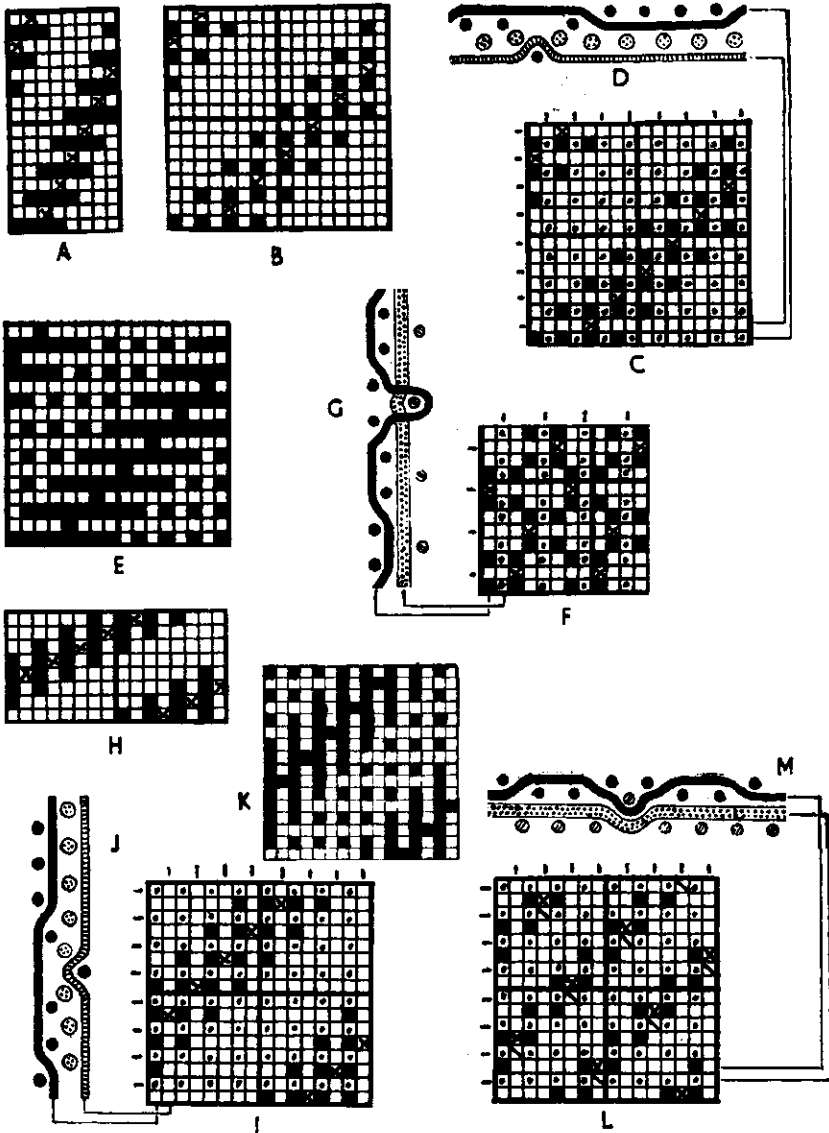


Figure 3.15

stitching place. In the design L the wadding picks and backing ends interweave in 8-sateen order with each other and really form a loosely-woven wadding fabric in the centre of the cloth.

IMITATION BACKED CLOTHS

Nearly any ordinary weave can be so modified as to produce a structure which very closely resembles a weft or a warp-backed texture, but in which each

thread interweaves regularly on both sides of the cloth. The system has the advantages that a heavy single cloth is produced which has a fine surface appearance, and is elastic and soft in the handle, while the threads sustain an equal amount of friction in the manufacture and wear of the cloth, and in imitation warp-backing only one warp beam is required. An inferior quality of yarn cannot, however, be introduced on the back, since each end and pick is interwoven on both sides, while colours cannot be so effectively applied to the surface as in proper backed cloths. The principle of construction is, however, very useful, particularly for piece-dyed fabrics. The designs may be made in imitation of either the 1 face, 1 back, or the 2 face, 1 back order of backing.

Imitation weft-backing

The method of constructing imitation weft-backed designs is illustrated in *Figure 3.16*, in which the marks indicate weft up. In modifying the 2-and-2 twill weave, given at A, to imitate a 1 face, 1 back order of wefting, the repeat of the imitation weave is made one thread less, or one thread more than twice

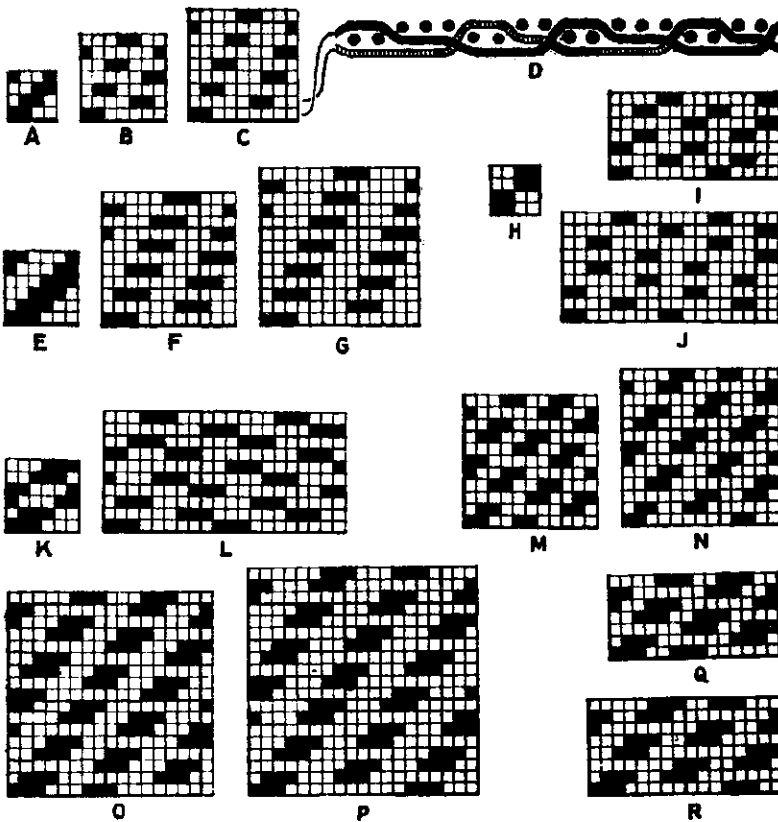


Figure 3.16

the number of threads in the repeat of the twill. Thus, in B and C, both of which are imitations of a weft-backed 2-and-2 twill, the respective repeats are on 7 and 9 ends and picks. In constructing the weaves a line of marks of the original twill is inserted on alternate horizontal spaces of B and C, but as the repeats contain an odd number of picks the twill marks fall first on the odd and then on the even horizontal spaces. Diagram D represents the interlacing of picks 1 and 2 of C, and shows that the odd and even picks form separate twill lines behind which the even and odd picks respectively float. The design should be woven with about twice as many picks as ends per unit space in order that the picks will be beaten up very close together, and so cause the twill lines to appear as solid as in an ordinary single cloth. The long weft floats on the underside give the appearance of a loose or sateen back weave, and complete the resemblance to a weft-backed structure.

E, F, and G in *Figure 3.16* illustrate the modification of a 3-and-3 twill on the imitation 1 face, 1 back principle; the larger weave, of course allowing of finer setting than the smaller. In the same manner, H, I, and J in *Figure 3.16* illustrate the modification of 2-and-2 hopsack weave, and K and L of a 3-and-3 twill derivative. In constructing imitation designs that are not twill weaves, a series of floats of the original weave is inserted on the odd horizontal spaces, then a second series is run in on the even spaces, at such a distance from the first series as will give the nearest resemblance to the weave when the picks are beaten close together. In some cases, as shown at J and L it is necessary to insert several lines of the floats in order to complete the design, each line being placed in the same relative position to its neighbours as the first two lines are to each other.

In re-arranging twill weaves in imitation of the 2 face, 1 back order of weft-backing, the repeat is made one thread less or one more than three times the number of threads in the repeat of the twill. For instance, a 2-and-2 twill imitation weave may be made on 11 or 13 threads as shown at M and N respectively in *Figure 3.16*; and a 3-and-3 twill imitation weave on 17 or 19 threads, as represented at O and P respectively. A design in imitation of a twill that repeats on an odd number of threads is complete on twice as many threads in one direction as the other, as shown at Q and R in *Figure 3.16*. These are weft-backed imitations of a 3-and-2 twill and repeat respectively on 14 ends by 7 picks, and 16 ends by 8 picks. Assuming that the 3-and-3 twill modifications given at G and P are woven in 50/2 tex worsted warp and weft—25 ends and 50 picks per cm will be suitable for the former, and 25 ends and 38 picks per cm for the latter, and in each case the face twill will run at 45° angle. Sometimes a firm back is produced by stitching the weft on the underside between weft-face floats; thus the first pick of weaves G and P may be stitched on the ninth end, and the other picks in corresponding positions to the twill lines of marks.

Imitation warp-backing

Imitation warp-backed designs are constructed on the same principle as imitation weft-backed effects, and if *Figure 3.16* is turned one-quarter round and the marks are taken to indicate warp up, the example will illustrate imitation warp-backed structures. In the designs given in *Figure 3.17*, the marks indicate warp, and in order that comparison may be made, the construction of an

imitation warp-backed 2-and-2 twill is illustrated at A, B, C, and D, which correspond with the examples similarly lettered in *Figure 3.16*. In this case a line of marks of the original twill is inserted alternately on the odd and even vertical spaces of B and C, so that the odd and even ends form separate twill lines with long floats at the back, as represented in the diagram given at D.

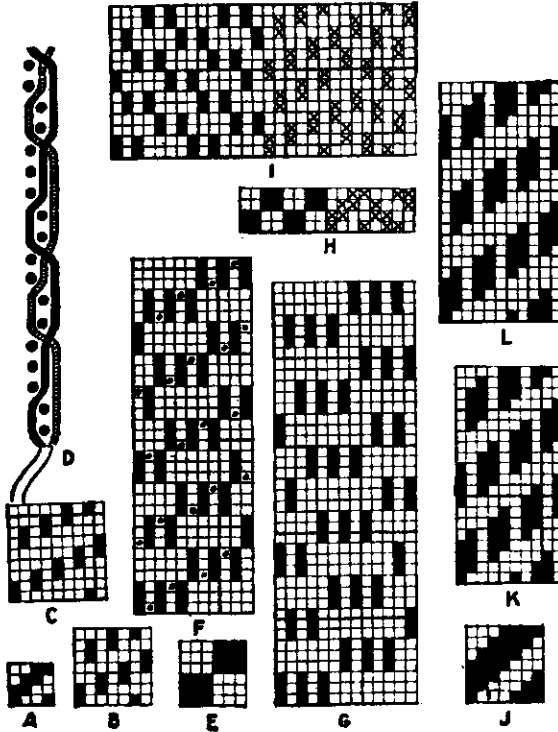


Figure 3.17

F and G in *Figure 3.17* illustrate the arrangement in two ways of the 3-and-3 hopsack weave E in imitation of 1 face, 1 back warp backing; while I shows a 1 face, 1 back imitation of the stripe weave given at H.

The designs K and L in *Figure 3.17* show 2 face, 1 back imitation warp-backed modifications of the 4-and-3 twill given at J, the former containing one pick less, and the latter one pick more than three times the number of picks in the twill.

The 1 face, 1 back imitation warp effects should have about twice as many ends as picks per unit space, while in the 2 face 1 back styles the proportion of ends to picks should be about 3 to 2. The warp on the underside may be stitched between face warp floats so as to produce a firm back, as shown by the dots in weave F.