13

Weft Pile Fabrics

In pile fabrics a proportion of the threads, either warp or weft, are made to project at right angles from a foundation texture and form a pile on the surface. The projecting threads may be cut or uncut thus resulting in tufted or looped pile. A different form of pile surface is produced by raising and cropping during fabric finishing operations but in this case the surface is formed of projecting fibres and not of projecting threads and the term nap rather than pile is more appropriate for cloths of this type. Weft pile fabrics are composed of one series of warp threads and two series of weft threads, the ground and the pile. The pile weft is cut in a separate operation after weaving resulting in a surface consisting of short and very dense tufts. A feature of weft pile structures, also termed velveteens, is very high density of shotting which in the finest fabrics may reach 200 picks per cm. In order to reach such weft densities the warp setts should be comparatively low and the warp yarn has to be kept very taut; also, the weaves must be so selected that successive picks can be beaten-up one on top of another. Due to the high warp tension positive shedding mechanisms are used and the highest qualities of cloth require specially constructed, heavy weaving machinery which cannot operate at high speeds and, therefore, aggravates further the already low production rates arising out of the high densities of shotting. For this reason the quantities of the top quality of velveteen produced at present are insignificant. On the other hand the low and the medium quality cloth in some constructions is very popular and can be produced on standard, high-speed automatic weaving machinery using reeds with special deep dent wires. The shottings at which such fabrics are produced range from 60 to 110 picks per cm.

The pile effect in the velveteens is not produced during weaving but is a result of a cutting operation during cloth finishing. The structure is so arranged that the surface of the cloth is covered by weft floats; these floats are severed by knife action and form the cut pile surface. The ground cloth, usually plain or twill, is unaffected by the knife action and forms a solid base from which the cut tufts project and in which they are anchored. The cutting method differs for the different classes of structures and is described together with the appropriate constructions. Before cutting the cloth is prepared for the operation by stiffening the surface float in order to define the cutting races more precisely and to ensure crisper cutting. The back of the cloth is also treated by an application of

an adhesive, usually starch, to ensure that the tufts during cutting are not plucked out from the ground structure. The fabrics after cutting undergo a crosswise brushing operation and are then singed and dyed. If pastel shades are required the cloth may require to be bleached after singeing.

The yarns employed in these structures are mainly cotton although filament rayon pile velveteens are also sometimes produced. For furnishing purposes worsted or mohair pile yarns have also been occasionally used. Structurally, the velveteens may be classified as follows:

(1) All-over or plain velveteens in which the surface is uniformly covered by the pile.
(2) Weft plushes–similar to above but arranged to produce much longer tufts and used mainly for upholstery purposes.
(3) Corded velveteens–also known as corduroys and fustians in which the pile runs in orderly vertical cords of varying width.
(4) Figured velveteens in which pile figure is produced on bare ground.

All the above groups may be further sub-divided into plain back or twill back structures depending on the type of weave in which the ground picks interlace with the warp.

ALL-OVER OR PLAIN VELVETEENS

This class of velveteen has a perfectly uniform surface, the foundation texture being entirely covered by a short pile in which the projecting fibres are of equal length. In constructing designs for the fabrics the chief points to note are: (1) The weaves that are used for the ground and pile respectively; and (2) the ratio of pile picks to ground picks. These factors, together with the ends and picks per cm of the cloth, influence the length, density, and fastness of the pile.

The ground weaves mostly used are plain, 2-and-1 twill and 2-and-2 twill, the last weave being employed for very heavy structures. The interlacing of the pile is almost invariably based either on the plain weave, a simple twill, a sateen, or a sateen derivative. The pile and ground picks may be arranged in any reasonable proportion, but generally a particular ratio is most suitable for a given weave.

Plain-back velveteens

Examples A, B, C, D, and E in *Figure 13.1* are designs for standard velveteens, with the plain foundation weave. The latter is represented by the crosses, and the base weaves for the pile interlacings are shown at the left of the plans. In each design the number of pile picks to each ground pick is equal to the number of picks in the repeat of the pile base weave. This is a convenient ratio, but other proportions of pile to ground picks are quite easily arranged in the same weave.

A distinct feature to be noted in the designs is that the pile base weaves are indicated only on alternate ends; thus each plan is on twice as many ends as the base weave. Design A is arranged 2 pile picks to 1 ground pick, and the pile weave is based on the plain weave which yields a weft float of three. In a finely

set cloth the pile from this design is short and poor, but at low warp settings a fairly good result is obtained.

In design B, the pile weave is based on the 1-and-2 twill which yields a weft float of five, and there are three pile picks to each ground pick. This design produces a fine and rich effect, and is extensively employed. Designs C and D are each arranged 4 pile picks to 1 ground pick, but whereas in design C the pile interlacing is based on the 1-and-3 twill, in design D it is based on the satinette weave. Both of these yield a float of seven, and produce identical results in the finished cloth. Design E is arranged 5 pile to 1 ground, and the base for the pile interlacing is 1-and-4 sateen, which gives a float of nine.

In order to produce a dense pile, a very large number of picks per cm are required to be inserted, the number varying from about 120 in 15 tex cotton weft for the design B in *Figure 13.1* to about 200 in 10 tex weft for the design E. There are two reasons why it is possible to insert such a large number of picks. First the warp is held under great tension, and the ends lie almost straight in the cloth, which causes the picks to do most of the bending. This results in the ground texture being formed on the weft rib principle, hence a comparatively large number of ground picks can be inserted. Second, the system in which the pile interlacing is arranged enables the pile picks to be beaten over one another, so that each group occupies not more than the space of one ground pick. Also, in the plain-back structures, all the pile picks go into the same shed as the first ground pick, but are in the opposite shed to the second ground pick. Therefore, so far as regards the space occupied by the picks, the structural effect of each design A to E in *Figure 13.1*, is somewhat as represented at F—i.e, the total number of picks in the repeat of each design go into the space of four picks, of which three are in the same shed.

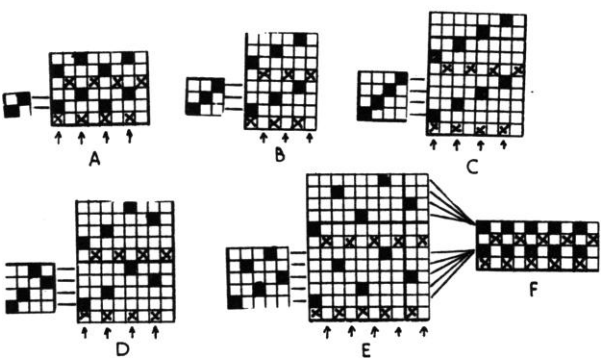


Figure 13.1

The diagrams given in *Figure 13.2*, in which design G is similar to the plan B in *Figure 13.1*, will enable various features of the velveteen structures to be noted. The flat view given at H, which corresponds with G, will serve to show somewhat how the pile picks crowd over each other in the cloth. This, however, is only a convenient representation of the structure, as in the actual fabric the ground picks are entirely concealed by the floating pile picks.

The purpose of binding in the pile picks only by the alternate ends (lettered A in H, *Figure 13.2*) is to enable the cutting to be more easily accomplished.

This will be understood from an examination of the cross-sectional drawing given at I in *Figure 13.2*, which represents how the picks 2,3,4, and 5 in the plan G interweave. Each pile float stands out furthest from the foundation cloth at

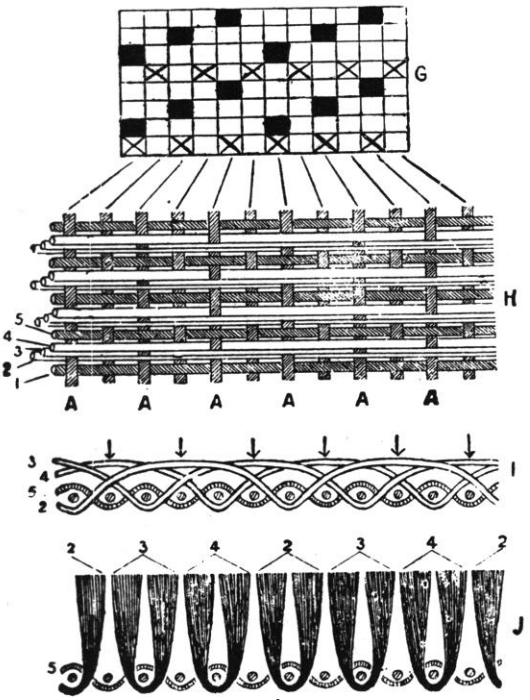


Figure 13.2

its centre, and the guide of the cutting knife is so adjusted that only those floats are engaged whose centres are in line with the longitudinal movement of the knife. The method of binding the pile picks causes the centres of the floats (indicated by the arrows above diagram I) to occur only on alternate ends, therefore only half as many longitudinal traverses of the knife are required as would be the case if the pile picks were bound in by every end.

An important feature, moreover, is that the alternate binding causes regular courses or races to be formed in the foundation texture, which are readily followed by the knife guide. Arrows are indicated below the designs in *Figure 13.1* to show where the cutting races occur.

After the cutting process, the twist runs out of the free ends of the weft threads which then project vertically from the foundation in the form of tufts of fibres, in the manner represented at J in *Figure 13.2*. Each repeat of the pile weaves produces one horizontal row of tufts, and in the plans A to E in *Figure 13.1* a complete row of tufts is formed to each ground pick.

Length of the pile

The length of the pile varies according to the ends per cm of the cloth and the number of ends over which the pile weft floats. An increased length of pile is

obtained either by reducing the ends per cm or by increasing the number of ends over which the pile weft passes; and conversely, a decreased length results from increasing the ends per cm or from reducing the pile float. With the same number of ends per cm the designs A,B,C, or D, and E in *Figure 13.1* give successively an increased length of pile. For example, with 12 ends per cm in the cloth the approximate lengths are respectively 1·25, 2·1, 2·9 and 3·75 mm.

Density of the pile

The density of the pile varies according to the thickness of the weft, the length of the pile, and the number of tufts in a given space. An increase in the thickness of the weft tends to make the pile coarser, but other things being equal the density is increased. A long pile causes the surface of the cloth to be better covered, and thus gives a fuller handle than a short pile. The greater the length the pile is, however, the fewer are the number of tufts formed by each pile pick, and with the same number of pile picks per cm, an increase in density, due to increased length, will be counteracted by a reduction in the number of tufts. It is, therefore, customary for an increase in the length of the pile weft float to be accompanied by an increase in the number of pile picks per cm.

In each of the plans in *Figure 13.1*, the same number of tufts per cm^2 will result by employing the same number of ground picks per cm. Assuming that the warp is 20/2 tex cotton with 28 ends per cm, and the weft is 12 tex cotton, 32 ground picks per cm will be suitable, which will give the following number of pile picks and total picks per cm for the designs.

Design A.–64 pile picks and 96 total picks per cm
Design B.–96 pile picks and 128 total picks per cm
Designs C and D.–128 pile picks and 160 total picks per cm
Design E.–160 pile picks and 192 total picks per cm.

Comparisons of the number of tufts in different structures can be made by means of the following formula, which gives the number of tufts per cm^2:

$$\frac{\text{Ends per cm} \times \text{pile picks per cm}}{\text{Ends in repeat of pile weave}}$$

For example, with the foregoing particulars, the design B will produce–

$$\frac{28 \times 96}{6} = 448 \text{ tufts per cm}^2.$$

It will be found in the same manner that the other designs with the particulars indicated will give exactly the same number of tufts per cm^2.

Changing the density of the pile

There are different way of changing the density of the pile, and in the same design and sett, alterations are frequently made simply by varying the number of picks per cm, or the thickness of the weft. Alternatively the design may be changed

in order to obtain a different proportion of pile to ground picks. This is illustrated in *Figure 13.3* where the design K has the same base weave as B in *Figure 13.1*, but there are six pile picks, instead of three, to each ground pick. L and M are

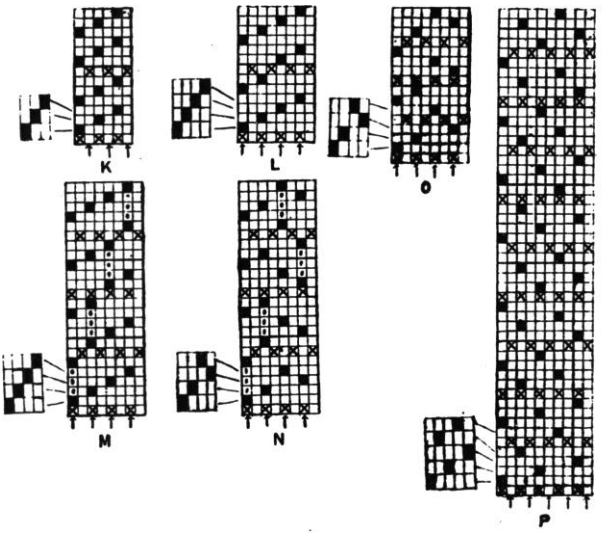


Figure 13.3

similar to C in *Figure 13.1* except that they have six and five pile picks respectively instead of four to each ground pick. In the same manner the designs N and O correspond with D, but have respectively five and three pile picks to each ground pick; while the design P is similar to E except that there are four instead of five pile picks to each ground pick.

The pile is most evenly distributed when, between each pair of ground picks, every binding end holds the same number of tufts, as shown at K in *Figure 13.3*. When the modified arrangement makes it necessary for the pile weave to be extended over two or more repeats of the ground weave, a sateen base is better for the pile interlacing than a twill base. The reason for this will be understood from a comparison of the plans M and N, both of which are arranged on a 4-thread base with 5 pile picks to 1 ground pick. Between each pair of pile picks two tufts occur on one end in the positions where the dots connect the full squares. In the plan M on account of the pile interlacing being based on a twill weave, these positions run in twill order, which may result in a slight twilled effect appearing in the finished cloth. In N, however, the positions occur in satinette order and the liability of twill lines being formed is avoided. Also, in the designs O and P, between each pair of ground picks, there is one end on which there are no tufts, and if these positions were to run in twill order there would be a similar liability of twill lines being formed in the cloth. This may be avoided by using a satinette base for the pile interlacing, as shown in the two examples.

In changing the proportion of pile picks to ground picks in a design the effect of the alteration should be considered in relation to the number of picks that it is proposed to insert under the new conditions. The alteration may be for the purpose of changing the density of the pile while retaining approximately

Table 2

	Design	*Ratio of pile picks to ground picks*	*Ground picks per cm*	*Pile picks per cm*	*Total picks per cm*	*Tufts per cm*	*Remarks*
Original structure	D	4 to 1	32	128	160	448	Original structure
To retain same total picks as original structure	N	5 to 1	27	135	162	473	Density of pile increased. Ground texture less firm.
	0	3 to 1	40	120	160	420	Density of pile reduced. Ground texture firmer
To retain same density of pile as original structure	N	5 to 1	26	130	156	455	Total picks reduced. Ground texture less firm.
	0	3 to 1	43	129	172	452	Total picks increased. Ground texture firmer.
To retain same ground texture as original structure	N	5 to 1	32	160	192	560	Density of pile increased. Total picks increased
	0	3 to 1	32	96	128	336	Density of pile reduced. Total picks reduced.

the same total number of picks per cm as the original structure; or of changing the density while retaining a similar ground structure; or the idea may be to obtain approximately the same density as before, but with a different ground structure. Table 2 shows the result which will occur under the different conditions named, assuming that the weave D in *Figure 13.1*—which has 4 pile picks to 1 ground pick—is changed to five and three pile picks respectively to each ground pick, as shown at N and O in *Figure 13.3*. The total picks of the original structure are taken as 160 per cm, giving 32 ground and 128 pile picks per cm; and the tufts per cm^2 are based on the cloth having 28 ends per cm.

Fast pile structures

A very important feature of these fabrics is the proper securing of the pile to the foundation cloth so that there will be no tendency of the tufts fraying out. In the examples given in *Figure 13.1* to *13.3*, the tufts are bound in by one end only at a place, and the fastness of the pile is chiefly dependent upon the pressure of the picks upon one another. It is therefore necessary, particularly in the longer piles for a very large number of picks to be inserted in order to keep the pile firm. If it is desired to introduce fewer picks per cm, or to make a very long pile, the necessary firmness can be secured by interweaving the pile picks more frequently and thus making what is termed a 'fast' pile. The examples Q,R, and S, given in *Figure 13.4*, respectively show how the plans C,D, and E in *Figure 13.1* may be made firmer. The section shown at T, illustrates how the tufts

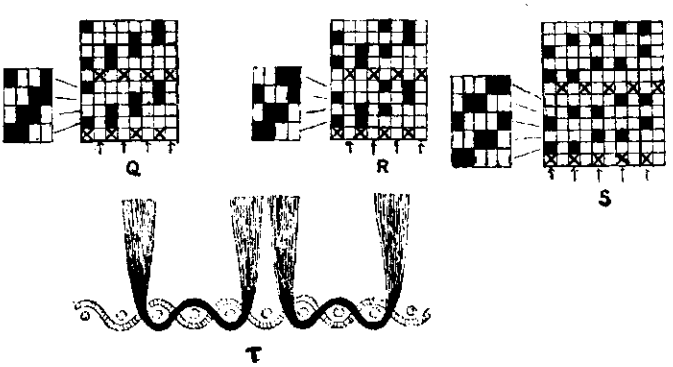


Figure 13.4

formed by the picks 5 and 6 of the design S, are bound in. By comparing the designs given in *Figures 13.1* and *13.4* it will be seen that with the same number of ends per cm Q and R will each produce the same length of pile as B, and S, as C or D. The firmer interweaving renders it more difficult to insert a larger amount of weft, and it is generally recognised that in a fast pile the richness of the cloth will suffer, but there is the advantage that the greater firmness gives the cloth better wearing qualities.

Twill back velveteens

Examples of velveteens with a twill foundation are given in *Figure 13.5* A, B, and C having a 1-and-2 twill or 'Genoa' back, while the ground weave of D and E is 2-and-2 twill. A twill foundation weave is looser than a plain, and therefore, not only permits, but, in order to maintain the same firmness of pile, requires a large number of ground picks to be inserted. Hence, with the same ratio of pile to ground picks, more pile picks can be put in and a denser pile formed. Also, a cloth with a twill ground is softer and more flexible than a similar cloth with plain ground; the latter ground, when very heavily wefted, tending to make the cloth handle somewhat hard and stiff.

In A,B, and C in *Figure 13.5* the pile weave is based on 1-and-2 twill, which, as before, is marked on alternate ends; the pile picks are arranged in the proportion respectively of two, three, and four, to each ground pick.

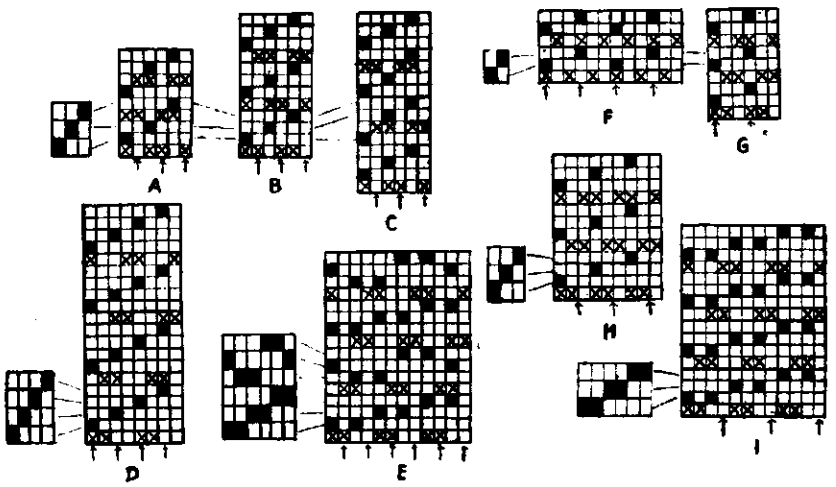


Figure 13.5

It may be noted that A in *Figure 13.5* is the standard design for the moleskin class of fabric, which is usually made in coarse cotton yarns. This is not a pile fabric, as the floating picks are not cut but remain in the condition they are after weaving. The cloth is very strong and leathery, and is, in fact, used as the 'leather' side in imitation sheepskin overcoats and car coats.

A 2-and-2 twill foundation weave enables a very large number of ground picks to be readily inserted, and is therefore used for the heaviest and densest velveteens. In the design D, *Figure 13.5*, the pile weave is based upon 1-and-3 twill, and there are four pile picks to each ground pick, while in E, a 6-thread sateen pile base weave is employed with the pile made fast, and there are three pile picks to each ground pick.

Designs which simplify the cutting operation

The designs F to I given in *Figure 13.5* illustrate a method of arranging the pile interlacing that is sometimes employed with the object of reducing the time

occupied in the pile cutting. In F, G, and H, the pile base weaves are indicated only on every third end, therefore, only one-third as many longitudinal traverses of the cutting knife are required as there are ends in the width of the cloth. Compared with the examples in which the binding of the pile picks occurs on alternate ends, the number of cutting races is reduced by one-third. The distribution of the pile, however, is not so perfect, and the surface of the cloth has a coarser appearance. I in *Figure 13.5* shows a fast pile effect in which the pile interlacing is based on a 1-and-2 twill weave doubled; and as indicated by the arrows below the design, the cutting races occur only on every fourth end.

Cutting of all-over velveteens

The cutting of all-over or plain velveteens is a slow and costly process which adds considerably to the already high cost of production due to the great density of wefting. The finer qualities of velveteens can only be cut one cutting race at a time even with modern machinery. In a cloth of standard construction with 28 ends per cm there are 14 cutting races per cm which means that a length of fabric 60 cm wide requires 840 passages through the machine before it is fully cut.

The cloth, having been prepared for cutting in the manner described earlier, is stretched lengthwise and is guided with precision so that a knife guide enters a cutting race or 'tunnel' formed by the floats of the pile weft. The races are indicated by the arrows at I in *Figure 13.2*. The guide slides over the ground structure and expands slightly the pile weft floats which are above it. A razor-edge knife fits into a slot of the guide and as the cloth runs forwards the floats of the pile weft climb upon the inclined knife blade and are thus severed.

Qualities of all-over velveteens

Quality of any velveteen construction can be varied considerably by changing the warp and the weft yarn settings and counts. Reduction in the number of picks per cm is usually compensated for by the increase in the number of ends per cm if similar density of pile is required. As this results, however, in the increase in the number of cutting races the more favoured practice is to employ heavier yarns. This permits the reduction of the settings in both directions which reduces the costs of weaving and finishing whilst weight and density of pile cover is maintained. The height of pile can then be controlled by a suitable choice of the pile float length.

A feature to be noted in these fabrics is the considerable shrinkage in the width from the reed to the cloth which varies from 12½ per cent in the lighter velveteens to 20 per cent in the heavy ones. This explains why the pile floats are forced into a tunnel formation which permits the insertion of guides and makes cutting possible. The contraction in length is negligible and amounts to between 2½ to 4 per cent.

In the list which follows, ends per cm in the reed, and picks per cm in the loom are quoted. The settings represent a top quality all-cotton cloth in each of the selected weaves and yarn counts.

1. Weave B, *Figure 13.1*–Warp; 20/2 tex, 28 ends per cm; weft: 15 tex, 120 picks per cm; 420 tufts per cm^2; weft contraction 12½ per cent.
2. Weaves C and D, *Figure 13.1*–Warp: 17/2 tex, 28 ends per cm; weft: 10 tex, 176 picks per cm; 496 tufts per cm^2; weft contraction 15 per cent.
3. Weave A, *Figure 13.5*–Warp: 60/2 tex, 15 ends per cm; weft: 38 tex, 96 picks per cm; 160 tufts per cm^2; weft contraction 17 per cent.
4. Weave C, *Figure 13.5*–Warp: 17/2 tex, 28 ends per cm; weft: 10 tex, 208 picks per cm; 740 tufts per cm^2; weft contraction 17 per cent.

WEFT PLUSHES

These constructions are similar in principle to the ordinary all-over velveteens but are made with longer pile floats and in heavier weights, being chiefly employed as upholstery cloths. They are produced in insignificant quantities as most of the pile upholstery cloths are at present made on the warp pile principles (see Chapter 15) in which similar effects can be woven faster and without the need for the separate costly cutting operation after weaving.

Due to the use of the cloth and the length of pile the pile weft is invariably anchored to the ground cloth on the fast pile principle. The pile consists usually of woollen, mohair, or acrylic yarns although other materials have also been used.

In the plain-back velveteen structures previously given, all the pile picks go into the same shed as one ground pick, and in the opposite shed to the other ground pick. This causes a slight irregularity in the lower picked cloths, which, however, is quite imperceptible in the finer fabrics when finished. In some of the long and coarse weft pile structures, the irregularity is got over in the manner illustrated by the design A in *Figure 13.6* in which the plain ground texture is modified, so that each group of two pile picks is in the same shed as the preceding ground pick, and in the opposite shed to the ground pick that follows. Suitable weaving particulars for the design are: Warp, 38/2 tex cotton, 20 ends per cm; weft, 1 pick 72 tex woollen, 2 picks 56 tex mohair, 60 picks per cm.

The design B in *Figure 13.6* is arranged 2 ground to 1 pile pick and the pile interlacing is based on an irregular 8-sateen weave. This structure is used for a heavy type of weft plush termed 'dogskin' in which a long mohair pile is developed with the following weaving particulars: Warp, 50/2 tex cotton, 16 ends per cm; weft, 2 picks, 60/2 tex cotton, 1 pick, 300 tex mohair, 24 picks per cm.

In the design C the pile interlacing is based on a 5-sateen weave, and to each ground pick there are two pile picks. One pile pick, however, has a longer float than the other, so that two different lengths of pile are formed in the cloth. Variety of effect can also be obtained by having the pile picks alternately in different colours or different materials. The following are suitable weaving particulars: Warp 30/2 tex cotton, 19 ends per cm; weft, 1 pick 24 tex cotton, 1 pick 32 tex acrylic yarn (shade 1), 1 pick 32 tex acrylic yarn (shade 2), 84 picks per cm.

The construction D illustrates an effective method of developing the pile in different materials or colours. The pile interlacing is based on an irregular 8-sateen weave, but the binding of the odd pile picks, shown by the full squares,

occurs on one-half of the plan, while that of the even pile picks, represented by the dots, occurs on the other half. By arranging the pile picks alternately in different colours or materials, stripes of pile are formed on the surface.

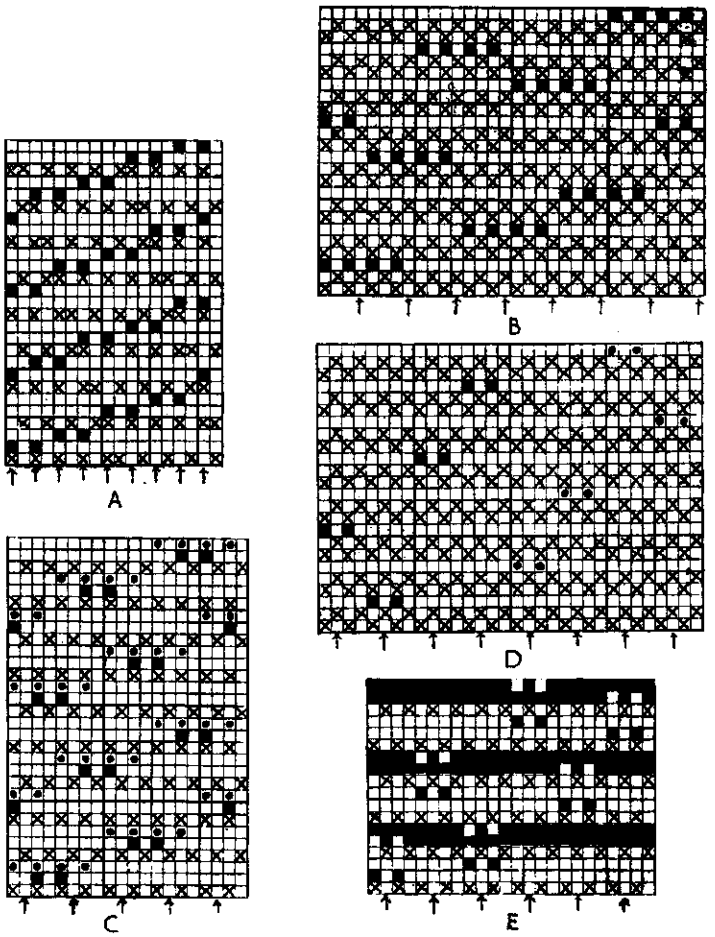


Figure 13.6

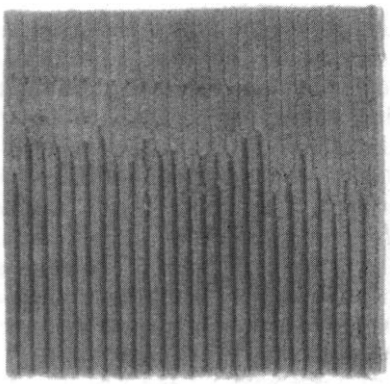
The design E in *Figure 13.6* shows the arrangement of a reversible weft plush, a structure that is sometimes used for luxurious rugs. The cloth has a plain ground, and the pile binding places are arranged in 6-sateen order on both sides. The following weaving particulars are suitable: Warp, 40/2 tex cotton, 19 ends per cm; weft 1 pick 66 tex woollen, 2 picks 74 tex mohair (face), 1 pick 66 tex woollen, 2 picks 74 tex mohair (back), 57 picks per cm. The pile on the back may be developed in a different colour from that on the face.

CORDED VELVETEENS

In these structures the pile picks are bound in, at intervals, in a striaght line. The cuts are made right up the centre of the space between the pile binding points,

with the result that the tufts of fibres project from the foundation in the form of cords or ribs running lengthwise of the fabric. An illustration of a cloth is given in *Figure 13.7*, which shows in the upper and lower portions respectively, the appearance of a corduroy before and after the operation of cutting.

Figure 13.7



The finer classes of cords, such as are used for dress fabrics, are largely made in fine yarns with a plain back. The corduroys used for men's clothing, are made sometimes heavier, in which case a twill ground weave is employed. In the heavier cloths thicker weft is used, and consequently fewer pile picks to each ground pick are necessary, usually not more than two being employed.

In the simplest cord designs, the pile picks are bound in plain order on two consecutive ends. J, K, L, and M in *Figure 13.8* are examples with a plain back which, in the same sett, yield successively an increased width of cord. Thus, with 24 ends per cm in the finished cloth the number of cords per 10 cm will be

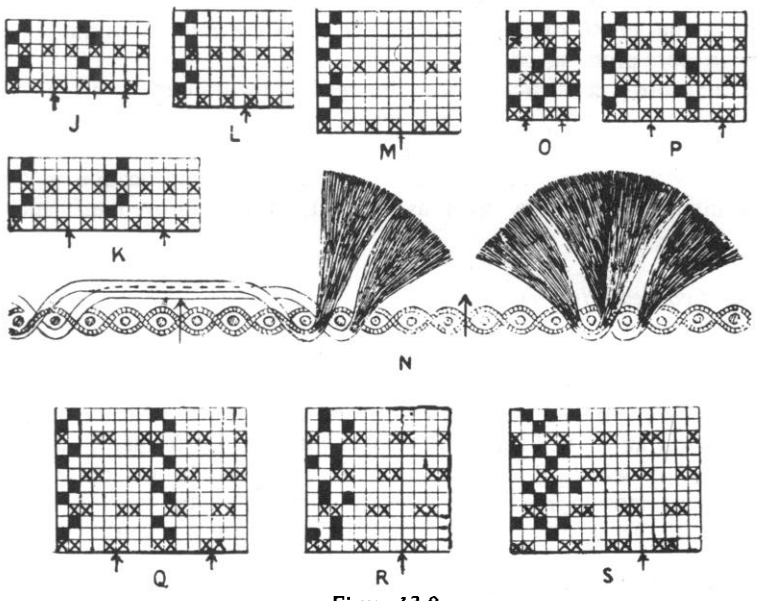


Figure 13.8

J-40, K-30, L-24, M-20. Designs may be constructed to produce other widths of cords simply by varying the space between the binding ends.

The plain binding weave of the pile picks may be reversed in alternate cords, as shown at J, in which case the design extends over the width of two cords, and each pile pick forms alternately a long and a short float. On the other hand, the pile binding may be the same in each cord, as shown at K, and in this case all the pile floats are equal. The result is practically the same whichever method of binding is adopted, because the floats are cut in the middle of the space between the pile binding points; consequently, in either case, one side of each tuft is longer than the other side. The difference in the lengths causes the ribs to have a rounded formation, as the long side of the tufts forms the centre, and the short side the outer parts of the cords. This is illustrated by the warp section given at N in *Figure 13.8*, which shows on the left how the picks of the plan K interlace, while on the right the appearance of the cord, after the cutting, is represented. The arrows indicate the position of the cutting races. Similar effects are produced by the designs L and M, but here there are three and four pile picks respectively to each ground pick.

Examples of cords with a 2-and-1 twill back are given at O and P in *Figure 13.8*, and with a 2-and-2 twill back at Q, R, and S. These are arranged two pile picks to each ground pick, and in producing very heavy structures they are woven with comparatively few ends per cm, the number varying from about 13 to 15.

The cords, produced by the design O in *Figure 13.8* are only three ends wide, and both sides of the tufts are of equal length, therefore, the ribs are not rounded, and a poor and bare structure results. P is similar to J except for the difference in the ground weave, the pile floats being of different sizes, and the complete design extending over the width of two cords. Q is similarly arranged, but in R and S (which are used for specially heavy and wide cords), alternate pile picks are interwoven more frequently with the object of producing greater variety in the length of the tufts, and so cause the rounded formation of the ribs to be more pronounced.

All the above constructions can be readily re-arranged to produce in the same cloth cords of different width which results in more interesting textures. Sometimes, alternate cords are left uncut so that a stripe of tufted cord alternates with a stripe of float construction. This modification is useful in fabrics intended for heavy wear as it results in an improved tuft anchorage.

Cutting of corded velveteens

Due to the distance between the cutting races corded velveteens can be cut in a single passage of the cloth through the cutting machine. All the cords are cut at the same time by means of circular knives, one to each cord, placed upon a revolving shaft. Each knife rotates within a slot formed in a guide, the pointed end of which is inserted under the pile floats in the centre of a cord. By means of tension rollers the cloth is drawn forward towards the knives, but at about the point of contact with the latter, it is taken downward over the edge of a transverse bar. The floating pile picks are brought by the guides into the path of the revolving knives and are cut, while the cloth passes downward and is either wound on a beam or is plaited down.

Qualities of corded velveteens

Quality of corduroy fabrics can be varied considerably by the changes in the density of weft shotting. Once the width of the cord has been determined the end setting has to remain unchanged but the scope for changes in the weft yarn counts and settings is sufficiently extensive to permit the construction of widely differing qualities of cloth within each structure. The examples which follow represent a good quality all-cotton fabric in each of the selected weaves.

1. Weave L, *Figure 13.8*–Warp: 20/2 tex, 28 ends per cm; weft: 12 tex, 140 picks per cm; 294 tufts per cm^2; weft contraction 19 per cent.
2. Weave P, *Figure 13.8*–Warp: 60/2 tex, 12 ends per cm; weft: 32 tex, 168 picks per cm; 224 tufts per cm^2; weft contraction 20 per cent.
3. Weave R, *Figure 13.8*–Warp: 74/2 tex, 13 ends per cm; weft: 32 tex, 172 picks per cm; 124 tufts per cm^2; weft contraction 25 per cent.

FIGURED WEFT PILE FABRICS

These structures are not produced at present on account of very high costs of weaving and finishing and an example is given here merely for the sake of completeness. Similar effects can be produced much more economically on the principle of warp pile (see Chapters 15 and 16) and although, using the latter principle, the same density of pile population per area cannot be achieved the necessary hard wearing properties are obtained by the use of modern, strong, and resilient materials such as polyamides, acrylics or polypropylene.

Figured velveteens

In figured pile structures most of the surface is occupied by a massive pile figure this being the most ornamental part of the design, and the bare ground is exposed only to separate the parts of the ornament. Practically any velveteen weave can be used for the figure, but in the ground the structure is varied according to the method in which the pile weft is prevented from showing on the surface. There are two chief methods of disposing of the surplus weft in the ground: (1) It is bound in on the underside in the same manner as on the face. (2) It is floated loosely on the back of the foundation texture, and after the cutting operation is brushed away as waste.

The velveteen weaves that are chiefly used for the pile figure are given at A and C in *Figure 13.9*. If the pile picks are bound in on the back, corresponding methods of interlacing, as shown at B and D respectively are employed in the ground but the pile binding points are placed in different relative positions to the face binding points. The design is painted as indicated at E, i.e. by painting-in the ground which occupies far less space than the figure. Full scale is retained warp-wise but weft-wise the design is condensed, the degree of condensation depending on the weave used. It is usual to condense so that the number of horizontal rows in the design correspond to the number of ground picks in the repeat, thus in the case of weave A the condensation would be by four and in the case of C, by five. The detailed weaves which are cut for the blank and the

painted portions are shown at F. From each horizontal row of the condensed design a number of cards is cut which equals the number of pile picks to each ground pick; in addition, a ground weave card is cut (plain or twill) and inserted

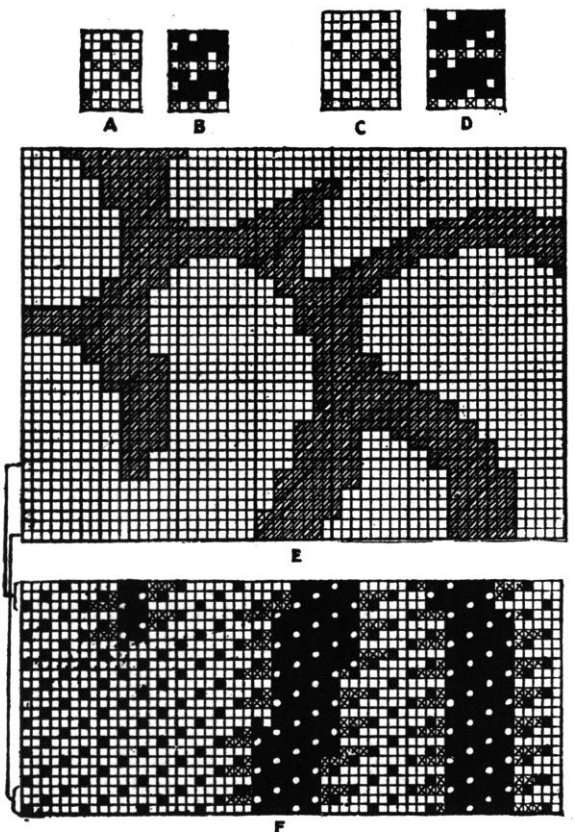


Figure 13.9

between each group of pile cards. The edge of the figure is modified to overcome a difficulty which may arise during cutting on account of the liability of the knife guide leaving the races between the separate parts of the figure. It has been found that the best results, as regards the pile cutting, are secured, first, by starting and finishing the outer edges of the ground portions on the bound or odd ends; and, second, by making each pile weft float pass over at least five ends at the edges of the figure. It will be seen in E, *Figure 13.9*, that the edges of the ground effect are indicated on the odd ends, i.e. the bound ends in the plan F, while the outline is worked in steps of two ends. The crosses in F illustrate the method of taking out all pile floats of less than five at the edges of the figure. The marks in the plan F are cut.

The method of indicating a design, shown at F, may be employed when the pile weft is not bound in the ground, except that no binding marks are indicated in the ground portion of the design. It has to be taken into account, however, that the removal of the surplus weft from the underside causes a half tuft formed

by each pile pick to be drawn away on both sides of every portion of figure. The latter method, as compared with the former, therefore increases the ground space, and if care is not taken in indicating the cutting marks of a design, a narrow portion of figure may be eliminated. In order to preserve the full mass of the figure, instead of throwing all the small floats to the back, as shown by the crosses in F, the three floats may be extended to floats of five on the surface by taking out marks in the ground.

Figured cords

Any standard cord weave may be employed as the basis of the structure in producing a figured velveteen cord, but as it is necessary for the outline of the figure to fit with the vertical cord lines, more elaborate ornamentation can be produced in narrow than in broad cord effects. In any case the steppy character of the lines makes it necessary for the design to be simple and massive, and, as a general rule, the styles are limited to simple geometrical figures. The ground effect is produced by floating the pile weft on the back between the binding ends, but there is the exception that in check patterns the horizontal lines can be formed simply by discontinuing the pile weave and inserting the required number of ground picks consecutively.