LECTURE NOTE

SUB: TEXTILE DESIGN -II

BRANCH:- TEXTILE ENGG.

SEMESTER:5th

NAME OF FACULTY: PUJA MEHER (GF textile engg.)

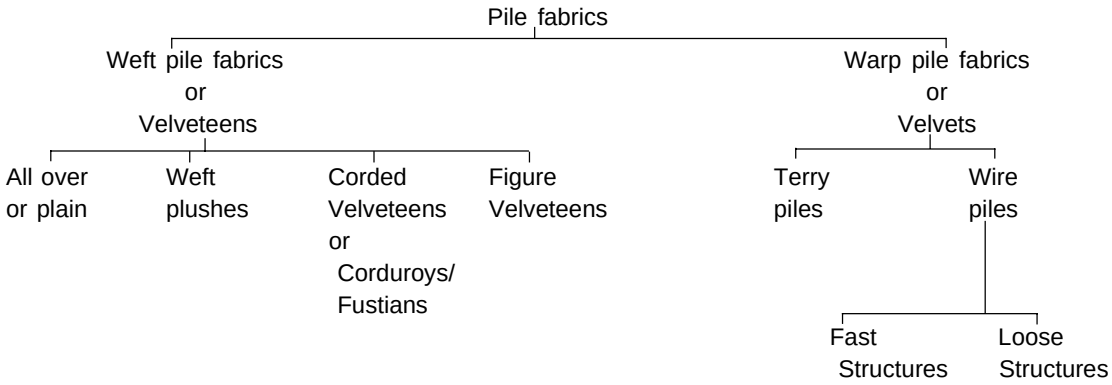
GOVERNMENT POLYTECHNIC, BHADRAK

PILE FABRIC

Pile fabrics are characterized by the brush like surface formed by tufts of warp or weft cut threads. The brush like surface is formed by a set of threads which project at right angles from a foundation or ground structure and form a pile or loop on the surface. Cutting the looped threads can be done either on the loom or on the machines of the fabric finishing department. Such fabrics should be distinguished from the others which become a pile after passing through a raising machine or after electrical flocking.

12.1 CLASSIFICATION OF PILE FABRICS

The classification of pile fabrics is given below :



12.2 WEFT PILE FABRICS

These fabrics incorporate two systems of weft threads and one system of warp threads. A drop box is necessary, if the pile weft differs in count or colour from the ground weft. Weft pile fabrics usually contain a much greater proportion of weft threads as compared to the warp threads. Weft pile fabrics are also known as velveteens. A feature of weft pile structures is the very high density of weft picks which in the finest fabrics may reach 200 picks per cm. The high weft thread density is possible by having a low warp sett with higher tension of warp. Due to the high warp tension positive shedding mechanisms

are used and the highest qualities of cloth require specially constructed heavy weaving machinery that have to be used with a compromise in production. Low and medium quality cloth can be produced on high speed automatic looms using reeds with special deep dent wires. The pick densities for these fabrics range from 50 to 100 picks per cm.

Weft piles unlike the warp piles do not have loops of yarn. Instead they have long floats of weft which may be cut or uncut. The method of cutting the weft floats depends on the structure of the piles.

Cotton is mainly employed in the weft pile structures. In some cases rayon , worsted and mohair may be used for special purposes.

12.3 TYPES OF VELVETEENS

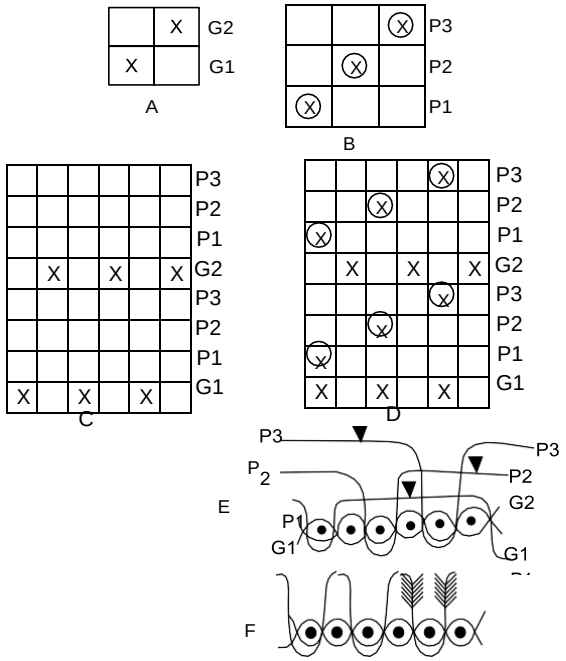
(i) Plain velveteens
(ii) Weft plushes
(iii) Corded velveteens
(iv) Figured velveteens.

12.4 PLAIN VELVETEENS

These are also known as all over velveteens. They are characterized by an uniform surface consisting of

protruding fibres that are of equal length. Generally the ground weave is plain. However, weaves such as 2/1 and 2/2 twill are also employed for producing heavier fabrics. The ratio of the ground to pile threads is selected according to the nature of the weave.

The design of a plain back velveteen is shown in Fig. 12.1 below :



The standard particulars for a typical plain back velveteen is given below.

Warp count - 2/30s
cottonEnds/inch - 72

Weft count - 50s cotton
Picks/inch of ground weft -
82 Tufts/sq.inch - 1060

Weft contraction - 12.5%

12.5 CUTTING AND 8UALITY ASPECTS OF PLAIN VELVETEENS

One major draw back of the velveteens is the cutting process. This is time consuming and expensive. Before the cutting operation, the cloth is longitudinally stretched and positioned such that a special knife enters and cuts the floats of pile weft threads. This is accomplished as the fabric runs forward and the knife severes the pile weft.

The thread densities and yarn count determine the quality of velveteens. The pile height can be variedby adjusting the float length of the pile weft suitably. Generally the width wise shrinkage ranges from 12.5% to 20%, depending upon the weight of the velveteen. The length wise contraction is ranging from 2.5% to 4%.

12.6 WEFT PLUSHES

Weft plushes are characterized by longer pile floats and heavier weight. They are mainly employed as upholstery cloths. Due to the long length of the pile weft, the pile yarn is anchored to the ground cloth,which gives it firmness. The type of material used for the pile yarn are woolen, mohair or acrylic yarns. Sometimes other materials are also used.

12.7 CORDED VELVETEENS

These structures are variously known as corduroys or fustians . The tufts of fibres from the cut piles project from the foundation in the form of cords or ribs that run longitudinally (warp way) in the fabric. The ground weave may be plain or twill. The finer class of the cords are constructed employing a plain ground with finer yarns. In heavier varieties of corduroys, a twill ground is used with coarser yarns. Thus fewer pile picks to each ground pick are necessary. The common ratio of the pile to ground weft

12.1 CUTTING AND 8UALITY ASPECTS OF CORDUROYS

Just as in the previous case the cloth is prepared by stretching the cloth longitudinally. The cloth is then properly positioned and drawn forward in the path of a cutter blade which is usually circular in shape. The weft floats forming the cords are severed by the rotating cutter blade. The cloth is subsequently wound suitably.

The quality of corded velveteens is largely influenced by the weft pick density. For a given cord width and warp thread density, the quality of the cord can be varied by changing the weft count and weft thread density.

12.8 FIGURED VELVETEENS

In these structures the pile forms an ornamental design and the bare ground is exposed only to separate the parts of the figure. Any velveteen weave is suitable for the figure, but the ground structure is varied according to the method in which the pile weft is prevented from showing on the surface. The figuring threads can be avoided at places where they are not required. There are two methods for doing this:

(i) The figuring threads are tucked in on the underside in the same manner as on the face.
(ii) The figuring threads are floated loosely on the back of the foundation texture, and brushed away after the cutting operation.

Figured velveteens are not produced owing to the very high costs of weaving and finishing. Similar effects can be produced much more economically on the principle of warp pile.

12.9 LENGTH AND DENSITY OF THE PILE IN VELVETEENS

The length of pile float depends on two factors :

(i) The warp thread density, and
(ii) Number of warp ends over which the pile weft floats.

Thus the pile length increases with reduced warp thread density per cm or with increase in the number of warp threads over which the pile weft passes.

The density of the pile float depends on the following factors:

Count of the weft yarn
The pile length, and
The pile density per cm.

By using a coarser weft and maintaining the other two parameters constant, the pile becomes coarser and its density is increased. Longer the pile length, better is the cover and handle of the fabric. It is advantageous to have longer pile float length with higher weft thread densities.

12.10 END USES OF VELVETEENS

Velveteens find many uses. Some of these are dress materials for children and gents, suitings, furnishing, bed covers, pillow covers, fancy dresses, artificial fur cloth, upholstery, interlining cloth etc.

12.11 WARP PILE FABRICS

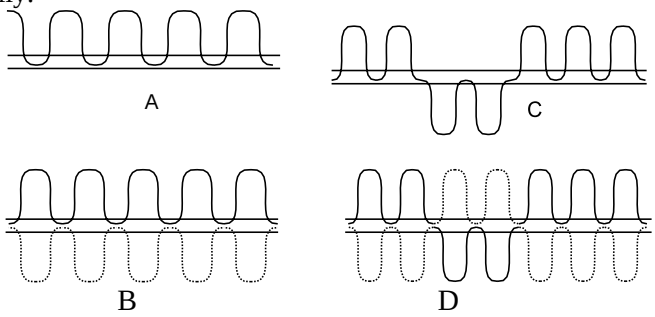
These fabrics consist of piles or loops of warp yarn running lengthwise along the fabric. Two systems of warp threads are necessary for weaving warp pile fabrics i.e. pile and ground warp, and one system of weft. The pile warp is supplied from a special weaver's beam. The length of the pile yarn is considerably greater than that of the ground yarn. When the pile fabrics are produced with cut short dense pile they are known as velvets. There are two methods of producing warp pile fabrics.

(i) The first method produces terry fabrics by using two or three warp beams and a single weft system or two weft systems. The pile is not cut, but left as it is. This class is exclusively used for manufacture of towels .

(ii) The second method is known as wire pile method. In this method, besides ordinary picks inserted by means of a shuttle, wires are inserted in a certain sequence by a special motion into the shed formed by lifting the pile warp only. The same motion pulls these wires out of the fabric after several revolutions of the main shaft, forming the warp pile on fabric. This method can produce cut or uncut pile.

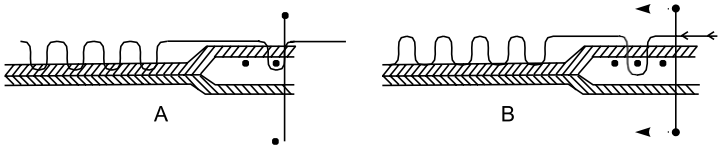
12.12 TURKISH OR TERRY PILES

These belong to a certain class of warp pile structure in which certain warp ends are made to form loops on the surface of the cloth. Terry structures are constructed by using one series of weft threads and two series of warp threads; one for the ground and the other for the pile. The ground warp interlaces with the ground weft to form the ground cloth from which the loops formed by the pile ends project. The loops may be single sided (face) or double sided (face and back). Fig. 12.6 shows the different types of terry structures, schematically.



12.1 PILE FORMATION IN TERRY

The terry pile is formed normally on 3 picks. This is done by creating a gap between the fell of the cloth and two successive picks. The pile is formed in two stages. In the first stage a false fell of cloth is formed by beating up loosely two successive picks a little away from the fell of the cloth. When the next pick is inserted, the lastly laid pick along with the previous picks are beaten to the true fell of the cloth. The formation of a terry pile on 3 picks is shown in Fig. 12.7.



At A is shown the formation of a false or temporary fell. On the third pick of the group full beat up takes place, the three picks being pushed forward together to the true fell position. During this action the three picks are capable of sliding between the ground ends, which are kept very taut, firstly, because they are structurally locked with them and , secondly, because the pile warp at that moment is slack. Therefore, as they are pushed forward after the third pick they pull a length of pile warp from the beam and at the same time force the excess length of pile yarn in front of them into a loop. If the pile warp float

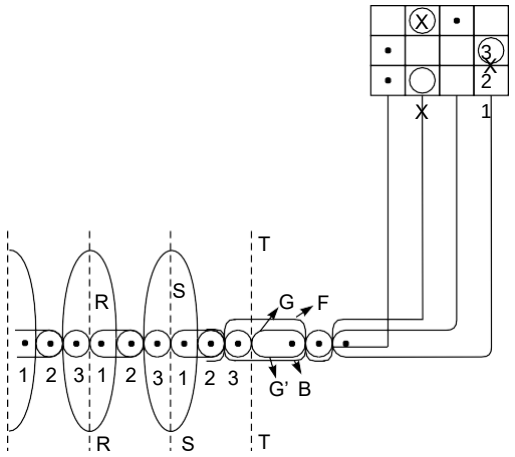
is formed on the surface a loop is made on the face and if the float is on the back of the cloth a back loop results. From the description it will be obvious that in this construction two beams are necessary. The ground beam is very heavily tensioned while the pile beam is only under slight tension and in some systems it is, in fact, rotated forward positively during the full beat up, i.e. after the insertion of the third pick of the group, to deliver exactly the length of yarn required for a loop.

The gap is created by a variety of devices which can be divided into two main classes, viz.

(i) Those in which the reed is drawn back the required distance before reaching the fell on the two picks in question, and

(ii) Those in which the fell of the cloth itself is made to recede away from the oncoming reed during the insertion of the two succeeding picks.

The exact relation of the weft to the two warps and the principle of loop formation is shown by means of the weft section in Fig. 12.8



The broken vertical lines RR, SS and TT divide the picks 1, 2 and 3 into repeating groups of three, line TT indicating the position of the fell of the cloth. On the right of the diagram, a group of three picks, which compose a repeat, is represented previous to being beaten up to the fell of the cloth. The ground threads G¢ and the face and back pile threads F and B are shown connected by lines with the respective spaces in the corresponding weave given at P. In weaving the cloth the group warp beam carrying the threads G and G¢, is heavily tensioned, so that these threads are held tight all the time.

The picks 1 and 2 are first woven into the proper sheds, but are not beaten fully up to the fell of the cloth at the time of insertion in their sheds; but when the pick no.3 is inserted the mechanisms are so operated that the three picks are driven together into the cloth at the fell TT. During the beating up of the third pick the pile warp threads F and B are either given in slack, or are placed under very slight tension.

The picks 1 and 2 are in the same shed made by the tight ground threads G and G¢, which, therefore, offer no obstruction to the two picks being driven forward at the same time with the third pick. The pile threads F and B, on the other hand, change from one side of the cloth to the other between the picks 1 and 2, and they are, therefore, gripped at the point of contact with the two picks. As the three picks are beaten up this point of contact and is moved forward to the fell of the cloth, with the result that the slack pile warp threads are drawn forward and two horizontal rows of loops are formed one projecting from the upper and the other from the lower surface of the cloth in the manner shown in Fig. 12.8.

In order to produce the loops on the three picks during the insertion of which the terry motion is in operation, the pile and ground threads must be interwoven with the weft in the exact order represented in Fig. 12.8. The 3 pick terry structure is employed most extensively, but sometimes four, five and even six picks are inserted in making each horizontal tow of loops. The interweaving of the threads on the

subsequent picks, is however, of little consequence so long as the cloth has the necessary firmness, and a natural connection is made with the weave of the three picks particularly referred to.

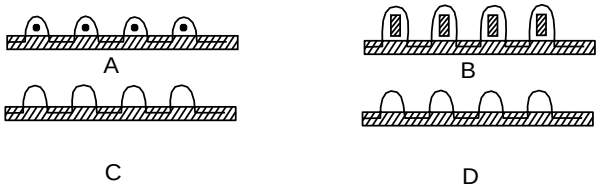
12.13 VARIOUS TYPES OF TERRY PILE DESIGNS

The various designs are given so that a ready comparison can be made. The circles in the designs represent the interlacings of the ground warp threads, and the crosses (uncircled and circled) show the interweaving of the face pile threads and back pile threads. Figs. 12.9 A, D, G and J show designs which form loops on one side only. In A, D, G and J, the warp threads are arranged ground pile, and in B, E, H and K the warp threads are arranged one ground, one face pile, one ground and one back pile. The weaves C, F, J and L are arranged one ground, one face pile, one back pile and one ground.

12.14 WIRE PILE STRUCTURE

These are also known as positive warp pile structures. In these constructions, a single series of weft and two series of warp are required.

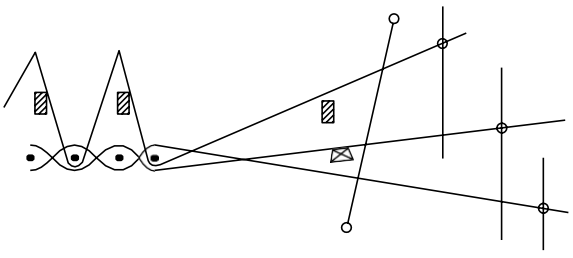
The pile is produced by a wire which is inserted across the width of the warp into a shed formed by the pile ends. When the pile ends are subsequently brought into the bottom shed and interlaced with the weft they remain draped over the wires as shown in Fig. 12.12.



At A is shown a small loop and at B is shown the bigger loop. C and D show the corresponding loops resulting from removal of wires. Thus it can be seen that the cross sectional dimensions of the wire determine the height of the pile. After the insertion of a number of picks (and wires) the wire is furthest away from the cloth fell and is withdrawn leaving the loops which were formed over its shank as a surface feature in the cloth as shown at C and D. The withdrawn wire is reinserted at the front there being between 12 to 50 wires between the point of withdrawal and insertion. The special mechanism which controls the wire movement is designed to insert the wire rapidly, as fast as it takes to insert a pick of weft, and to withdraw it slowly. The large number of wires between the two points is necessary mainly to prevent the loops being pulled back by the tension on the pile yarn. The difference between the actual number of wires depends primarily on the weight of the fabric, and on the frictional characteristics of the pile warp. Fewer wires are required in lighter fabrics.

The type of wires used may be plain or bladed. If plain wires are used, the pile may be looped, and if bladed wires are used a cut pile results.

The cross sectional shed diagram of a wire pile structure is shown in Fig. 12.13 below.



The figure above shows the normal shedding arrangements used in the manufacture of wire pile fabrics. It is to be noted that the wire is inserted into a special high shed formed by the pile yarn

simultaneously with the shuttle which inserts the weft into a low shed formed by the ground yarns.

The wires are available in a wide variety of shapes and sizes. Fig. 12.14 shows the commonly used types of wires.

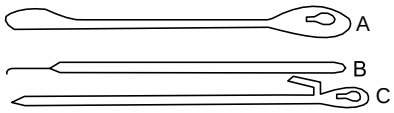


Fig 12.14 *Types of Drop Wires*

The wire at A is used for cutting the loops and B and C give uncut loops. The depth of the wires differ considerably and ranges from 1.5 mm for the short pile fabrics to as much as 25 mm for imitation fur fabrics and carpetings.

12.15 CLASSIFICATION OF WIRE PILE FABRICS

The wire pile fabrics can be grouped in three main classes depending on the surface effect formed

(a) All over or continuous pile effects
(b) Figured effects with one series of pile threads which may consist of loop and cut pile figuring or pile and ground figuring.
(c) Figured constructions with up to five series of differently coloured threads in which the ornament is chiefly due to colour.

12.16 ALL OVER OR CONTINUOUS PILE STRUCTURES

The majority of cut pile effects produced for the apparel and upholstery fabrics in the all over structures are at present made on the face to face principle. Fig. 12.15 shows the design of an ordinary wire pile structure

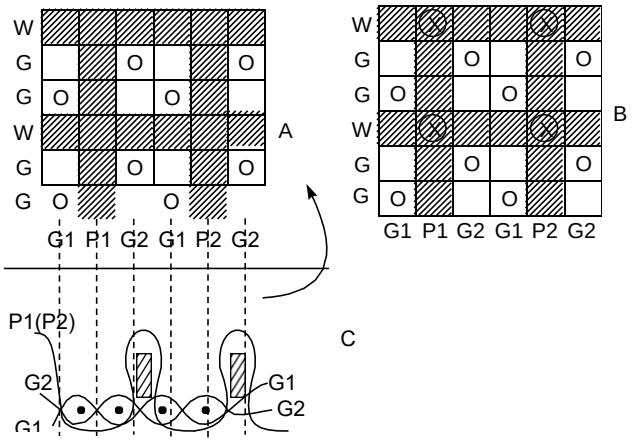
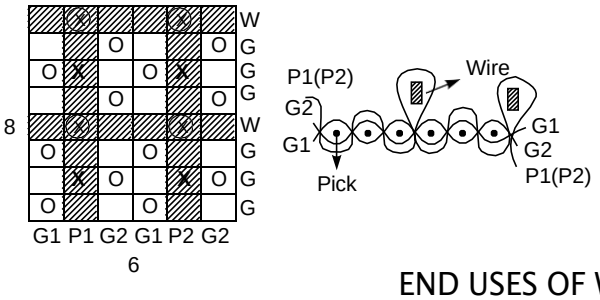


Fig 12.15 *Design of Ordinary Warp Pile Structures*

The figure above shows a wire pile structure constructed on a repeat size of 6 ¥ 6. The ratio of ground ends to pile ends is 2:1. At A is shown the insertion of ground weave and at B is shown the insertion of wire picks. The shaded portion along warp indicates the pile warp and along the weft indicates insertion of wire. C shows the weft way cross section of the pile fabric.

12.17 FAST WIRE PILE STRUCTURE

On observing the cross section of the fabric in Fig. 12.15, the pile foundation is not firm. This form of binding is known as ordinary 'U' binding and is suitable when short, dense pile is produced. This type of binding may be further improved by using the alternate tight and slack ends. But when the cloth is expected to be subjected to a degree of rubbing and particularly when long pile is produced a superior 'W' binding is used in which each pile is additionally inserted with the weft between the wires. A plain or similar tight interlacing is used to anchor each tuft firmly in the ground structure so that it cannot be easily pulled out. A typical design is shown in Fig. 12.16.



END USES OF WARP PILE FABRICS

Warp pile fabrics find a wide range of enuse applications. Both the types of pile fabrics have different end uses some of which are mentioned below

(a) Terry pile structures find uses as mats, curtains, over coats, dressing gowns, towels etc

(b) Wire pile structures are used in upholstery (uncut mocquettes), carpetings (Brussels, cord or boucle) in loop form. The cut pile effects find use in apparel wear, curtainings and upholsteries and are known as velvets, plushes and cut mocquettes, and also for carpets of the wilton or velvetpile class.

DOUBLE CLOTH

Double cloths are those fabrics which consist of two layers of threads that are woven one above the other and stitched together. These fabrics consist of a minimum of two series of warp threads, and two series of weft threads, face and back. They are also known as two ply fabrics. The upper layer is formed by interlacing the face warp threads with the face weft threads, and lower layer by interlacing the back warp threads with the back weft threads. There are two objectives in producing double cloths :

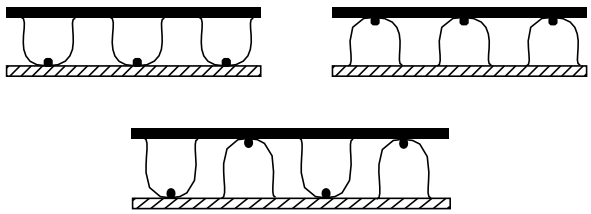
(a) To enhance the thermal resistance value of the fabric, and
(b) To give a good appearance and feel.

14.2 CLASSIFICATION OF DOUBLE CLOTHS

Double cloths are classified into the following categories

14.2.1 Double cloths constructed on the principle of self thread stitching

In these type of cloths the face fabric is formed by the interlacement of the face warp and weft threads and the back fabric is formed by the interlacement of the back warp and weft threads. The two fabric layers are stitched at intermediate points by either face/back warp or face/back weft or both. A typical structure with the different possible methods of stitching is shown in Fig.14.1A.



14.2.2 Double cloths constructed on the principle of centre thread stitching

In these types of cloths, besides the face and back series of threads, a third series of threads are introduced as stitching threads at intervals. The stitching can be warp or weft way or both. The stitching threads lie between the face and back layers of the cloth and are visible on the face or back at the stitching points. Fig. 14.1B shows a centre stitched double cloth.

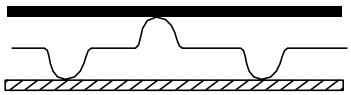


Fig. 14.1B *Center stitched double cloth*

14.2.3 Double cloths constructed on the principle of stitching by thread inter-change

These cloths resemble the self stitched double cloths as the stitching is by means of either the face or the back threads themselves. However the difference lies in the fact that a group of face threads interlace or stitch with another group of back threads at regular intervals. A typical structure is shown in Fig. 14.1C.

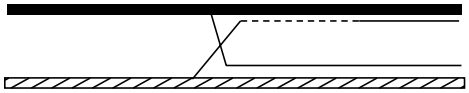


Fig. 14.1C *Double cloths constructed by thread interchange*

14.2.4 Double cloths constructed on the principle of cloth interchange

In these types of cloths, unlike the previous ones, the cloth layers change places at intervals. The firmness of this type of structure depends on the frequency of the exchange of the face and back layers of the cloth. This type of structure is shown in Fig. 14.1 D.

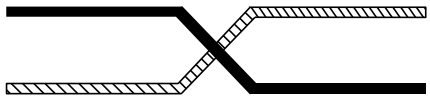


Fig. 14.1D *Double cloth stitched by cloth interchange*

14.2.5 Double cloths constructed alternately as single and double cloths

In these types of cloths, the group of threads forming the face are merged together with those of the back to form a single layer at intervals. The face layer is separated from the back wherever a figure is formed. A structure of this kind is shown in Fig. 14.1 E.

Figs. 14.1 F and G show double cloths produced without stitching threads. These cloths become single cloths after their removal from the loom. At F is shown a double width cloth and at G is shown a tubular.

Fig. 14.1E *Double cloth based on alternate single ply and double ply construction*

Fig 14.1F and G *Double cloths without stitching threads*

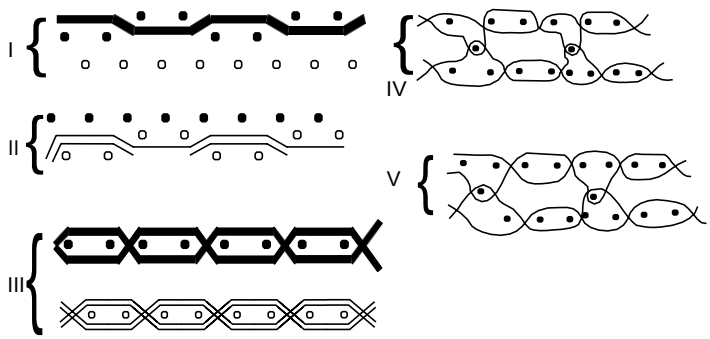
14.3 SELF STITCHED DOUBLE CLOTHS

In a self stitched double cloth, one series of warp and weft interlace to form the face fabric and the other series of warp and weft interlace to form the back fabric. The face and back threads have to be arranged in a suitable order depending on the fabric to be woven. Generally separate weaves are chosen for the face and back fabrics. Sometimes the weaves may be similar. By the interlacement of the corresponding face threads the face fabric is formed and so also is the back fabric. The self stitched double cloths are constructed on the following principles:

(a) Stitching face to back - the face thread is lowered below the back thread, and

(b) Stitching back to face - the back thread is raised above the face warp thread.

Fig. 14.2 shows the formation of the self stitched double cloth and the methods of stitching.



The face and back threads are arranged in the ratio of 1:1, and the weave for both sets of threads is an oxford (2 and 2 weft rib). The dots represent the warp threads and the lines represent the weft picks. Fig. I shows that the first face pick is inserted. It can be seen that all the back warp threads are below the face pick. It can also be seen that half of the face warp threads are raised above the face pick to form the face weave. Fig. II shows the insertion of the first back pick. It can clearly be seen that all the face warp threads are well above the first inserted back pick. Also half of the back warp threads are floating above the back weft to form the back weave. Fig. III shows that when each set of warp threads is allowed to interlace with its corresponding weft, two layers of fabrics result. These fabrics are separate and detached from one another. Fig. IV shows the stitching together of the two layers of the fabrics by causing the back weft to stitch over the face warp. Fig. V shows the stitching together of the two layers of the fabrics by causing the face weft to stitch over the back warp. Thus the last two diagrams represent the two principles of stitching self stitched double cloths.

14.3.1 Method of stitching

The face and back cloths have to be joined or stitched together in such a way that the appearance of either of the fabrics does not get affected. When the face warp is lowered below the back pick, then it must be well below the face weft and above the back warp threads and vice versa. The manner of stitching depends on the character of the weave. For warp faced weaves stitching by means of the back warp over the face weft is suitable. In the case of weft faced weaves, the face ends can be brought below the back picks. In some cases both the methods of stitching can be combined together.

14.4 CONSTRUCTION OF SELF STITCHED DOUBLE CLOTHS

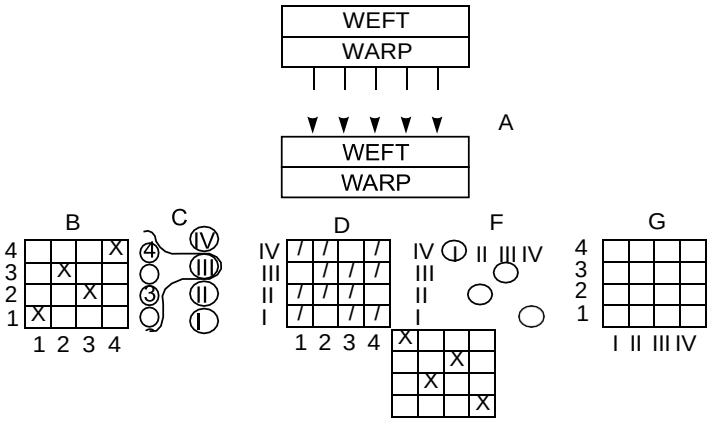
Self stitched double cloths are constructed by the following methods:

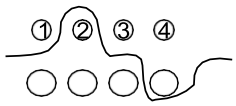
(a) Stitching from face to back
(b) Stitching from back to face
(c) Combination stitching.

14.4.2

14.4.3 Stitching from face to back

In this method the face and back fabrics are stitched together by lowering the face warp below the back weft. The various stages of constructing the design



E 

The stitching of the two layers of fabrics is shown at A. The arrow marks denote the stitching of face warp with back weft. Since the face warp is stitching with the back weft the warp should have long overlap on the back side. Hence it is necessary to use weft faced weaves with long warp floats at the back. The back fabric also should have weft faced weave. This is because the long weft floats on the upper side of the back fabric can be used for stitching with the warp threads of the face fabric.

The face and back fabrics have been constructed by using a 4 end irregular sateen weave. The design of the face and back fabrics are shown at B and F respectively. The design at B is denoted by arabic numerals and that of the design at F is denoted by roman numerals. This has been done for the purpose of clarity. The weft way cross section of the double fabric is shown at C, with the first warp thread of the design as the reference. The first warp thread of the face fabric stitches with the third pick of the back fabric. This is considered as the most suitable stitching point because it is in the middle of the warp float. In other words the first face warp is lowered below the third back weft (III). The other stitching points are selected on the same basis. Fig. D shows the interlacement of all the face warp threads with the back weft threads. This method of choosing the intersections allows uniform distribution of the binding points. Fig. E shows the arrangement of warp overlaps on the back weave. This depends on the position of the binding points at D. From Fig. B and F it is clear that long warp floats are placed on the backside of the two fabrics. On observing the Fig. A, it can be seen that the face weft threads are above the back warp threads. Thus the interlacement of the face weft with the back warp is shown at G, which is blank, indicating no interlacement.

The final design of the double fabric is shown at H. The ratio of the face and back threads (warp and weft) is 1:1. The face and back picks are inserted alternately. The warp floats at B, D and F are incorporated at H. Figure I shows the warp way cross section of the double fabric. The first face and back weft of the design are shown for reference. Fig. J shows the weft way cross section in which the first face and back warp threads of the design are shown for reference. The final design shown at H will require 8 heald shafts using a divided draft.

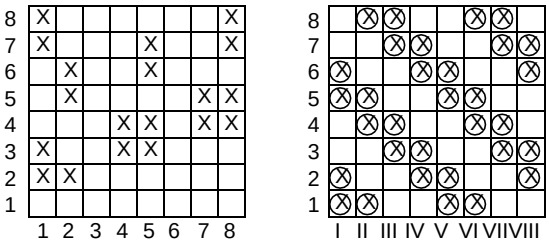
14.5 DOUBLE CLOTHS WITH WADDED THREADS

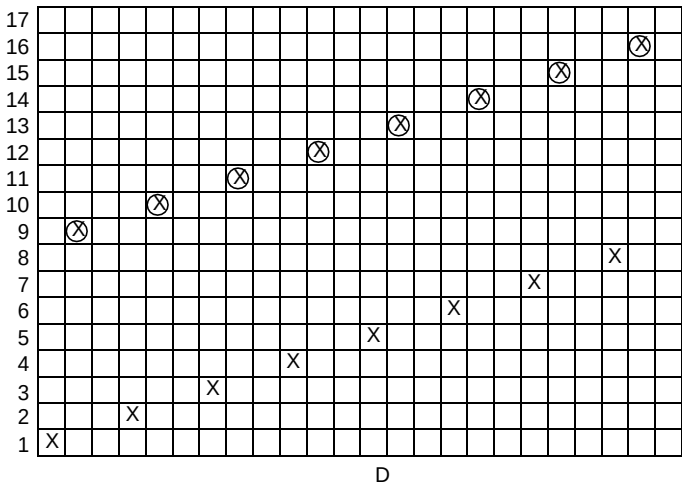
The purpose of introducing wadding threads is very similar to that seen in the case of bedford cord and welts. They are used to add weight and substance to the double cloth. The wadding threads may be introduced warp or weft way. The yarns used are generally considerably coarser than the other threads and are made of cheaper material. Thus economy is an added advantage. The commonest ratios are 1:1, 2:2 and 2:1 (wadded : face and back).

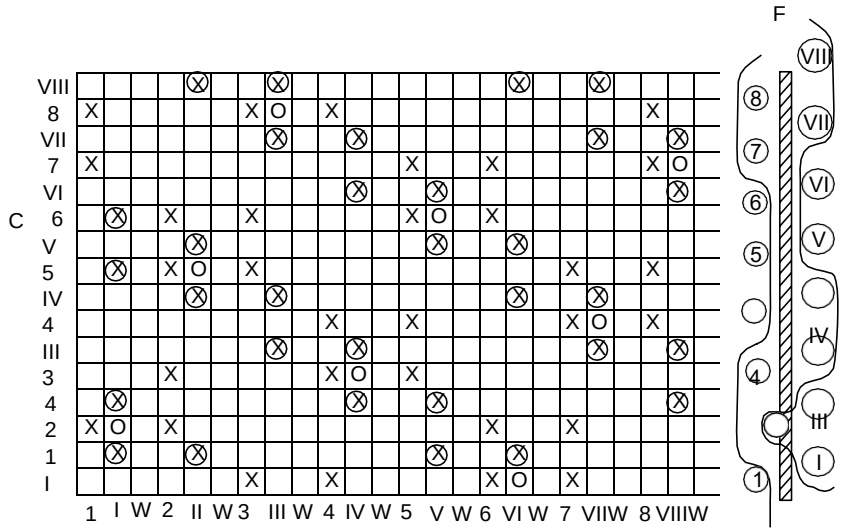
14.5.1 Double cloths with wadded warp

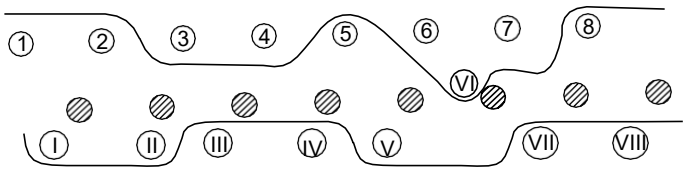
In these fabrics, the wadding threads are introduced warp way. This is a more convenient and economical method compared to the previous one. However, greater strain is put on the warp threads in weaving and this necessitates the use of a better quality wadding material. An example is shown in Fig. 14.6. The face and back weaves are given at A and B respectively, while the complete design is given at C and the draft at D. The ends are arranged in the order of 1 face, 1 back, 1 wadding, and the picks 1 face, 1 back. The face weave is 8 thread twilled hopsack, the back weave is 2 and 2 twill, and a sateen order for back warp tying lifts is used. In the warp wadded structures the wadding ends must be raised on all back picks

and left down on all face picks.









The draft for the design C is given at D. The wadding ends require only one heald, but in fine sets, to avoid crowding, they may be drawn on two or more healds which are then operated as one.

The introduction of wadding threads increases the strength of a double cloth in the direction of the wadding yarn; and sometimes, for the purpose of obtaining increased firmness the wadding threads are

stitched to the double cloth, these stitches being placed next to the ordinary stitches in order to minimize their effect. Thus, in stitching the wadding weft in Fig. 14.7, each back end would pass over the wadding pick which precedes the normal stitch. In Fig. 14.6 wadding ends would also lift over the face picks on the right of each backing warp stitch.

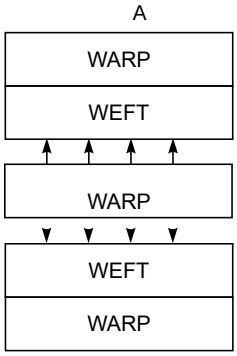
14.6 CENTRE STITCHED DOUBLE CLOTHS

In the self stitched double cloths it was seen that the face and back cloths were stitched together either by face with back threads or vice versa. However in the case of center stitched double cloths the face and back cloths are stitched together by means of a third group of threads known as center threads. These threads neither belong to the face or the back cloth. They are introduced in between the face and back fabrics separately. The center threads which form the stitching are normally finer than the face and the back threads. The firmness of the stitch is lesser compared to the self stitched double cloth. The cloth stitched by this method has a softer and fuller handle. The center stitching method is applicable to cases where there is difference in thickness or colour between the face and back yarns. There are two methodsof center stitching, namely,

(i) Centre warp stitching, and
(ii) Center weft stitching.

14.6.1 Stitching with center warp threads

In this method of stitching a separate series of warp threads is introduced between the face and back warps. This warp stitches with the face and back weft threads. The various stages of construction of the double cloth are shown in Fig. 14.8.



14.1 END USES OF DOUBLE CLOTHS

Double cloths find uses in industrial applications such as hose pipes, filter cloths, insulation fabrics etc. They are also used in overcoats where a thin fabric is used as internal cloth and a heavier fabric is usedas outer cloth.