K.S. RANGASAMY COLLEGE OF TECHNOLOGY

(Autonomous)

TIRUCHENGODE – 637 215

<u>COURSE MODULE</u>

WOVEN FABRIC STRUCTURE

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CONTENTS

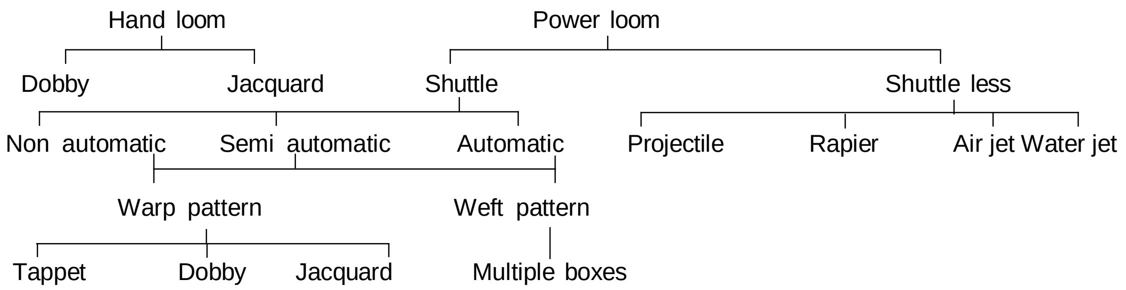
1
CHAPTER
Looms and Loom Mechanisms

1.1 INTRODUCTION

A loom is a device that causes interlacement two sets of threads, namely, warp and weft threads, to form a fabric. The very first loom in history is the pit loom. Subsequently the handloom was developed and then the power loom. After the advent of power looms, a number of developments have taken place. The very first power looms that had been developed were of the non automatic type. These looms had neither a positive let off device nor warp stop mechanism or a weft changing mechanism. This demanded a great deal of attention from the weaver. The semi automatic loom was then developed which incorporated two out of the above three mentioned mechanisms. Then the automatic loom was developed which had all the three essential mechanisms, namely, positive let off device, warp stop mechanism and weft replenishment mechanism. The last century saw the development of shuttle less weaving mechanisms.

1.2 CLASSIFICATION OF LOOMS

The chart below shows the broad classification of the various types of looms.



1.3 BRIEF DESCRIPTION OF VARIOUS LOOMS

The hand loom was operated by the weaver using his hands to propel the shuttle from one end to another. The weaver used his foot to operate the healds. The production in this type of loom was obviously very less and thus varied from weaver to weaver.

The power loom was operated by power. This reduced the strain of the weaver. Considerable automation has taken place which resulted in lesser strain of the operatives and increasing the production and efficiency of the loom. The shuttle less looms are good examples.

The tappet, dobby and jacquard are warp patterning mechanisms**.** Among the shuttle looms, the tappet loom is the simplest. It is suitable for weaving up to 8 heald shafts. The dobby loom is suitable for figuring upto 40 heald shafts and the jacquard is suitable for elaborate designs running to several picks. The advantage of the jacquard mechanism is that it can control individual warp ends and hence has a large figuring capacity.

- The multiple box mechanism is suitable for weft patterning, particularly in creating checked effects in the fabric. The colouring capacity of the multiple boxes ranges from 2 to 24.
- The shuttle less looms have the advantage of higher speed and efficiency than the conventional shuttle looms. Also larger weft packages minimize the frequency of weft changes thus improving the loom efficiency.

1.4 BASIC LOOM MECHANISMS

The basic mechanisms in any type of loom can be classified as follows:

(a) Primary motions
(b) Secondary motions, and
(c) Auxiliary motions.

The primary motions can further be divided as shedding, picking and beat up motions. The shedding opens the warp sheet into layers to facilitate passage of shuttle. The picking motion causes the shuttle carrying weft to be propelled from one end of loom to another. The beat up motion lays the previously laid weft to the fell of the cloth.

The secondary motions comprise of take up and let off motions. The take up motion helps to wind the cloth on to the cloth roller and also influences the pick density in the cloth. The let off motion helps to let the warp from the weaver's beam at an uniform rate thus maintaining the warp tension constant throughout the weaving process.

The auxiliary motions consist of the warp stop motion, weft stop motion and warp protector motion. The warp stop motion is used to stop the loom in the event of warp breakages. This is necessary to prevent fabric defects such as missing ends and floats. The weft stop motion is used to stop the loom in the event of weft exhaustion or weft breakages. This is necessary to prevent missing weft threads called cracks, in the fabric. The warp protector is used to prevent multiple warp thread breakages in the event of shuttle getting trapped in the middle of the warp sheet.

1.5 GENERAL PASSAGE OF MATERIAL THROUGH A LOOM

The passage of warp through a loom is shown in Fig. 1.1. The warp after leaving the weaver's beam 1 passes over two bars 2 and 3 connected by a bracket at each end. One half of the warp end now passes under the back lease rod 4, and the other half passes over this rod. Those warp ends which pass under the back lease rod pass over the front lease rod 5, and ends from over the back lease rod pass under the front lease rod. Therefore, the warp is completely divided as it passes through the lease rods, and facilitates the straightening of any warp ends which may break and become entangled before they reach the healds 6 and 7. The lease rods also assist in forming an even shed. Leaving the lease rods, the warp ends next pass through the healds. Odd numbered pass through the front heald 7, and the even numbered ends pass through the back heald 6. The healds consists of heald wires with eyes at the centre through which the warp ends are passed, the warp ends being thus controlled in their upward and downward movement. The warp ends next pass through the reed 8, this being comprised of a flat wire comb with the teeth secured at both ends. Usually two ends pass between one tooth and the next—this space being termed "dent". In the figure, two warp ends are represented as being in the same dent.

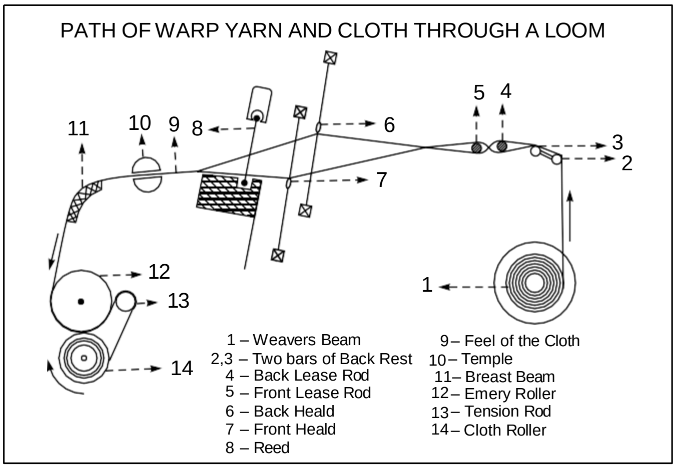


Fig. 1.1 *Passage of warp in a loom*

At the point 9 is what is known as the 'Cloth fell'. It may be considered as the point where the warp and weft become cloth, because it is at this point where the last pick of weft, which was left by the shuttle, becomes beaten up. Passing forward, the cloth is held at each side by a temple 10 which holds the cloth fell out to the width of the warp yarn, in the reed. From the temples the cloth passes over the breast beam/front rest 11, partly round the sand or emery roller K, over the steel roller, or tension rod L, and then on to the cloth roller M.

1.6 DESCRIPTION OF IMPORTANT PARTS OF A LOOM

1.6.1 Heald shaft

This part is related to the shedding mechanism. The heald shaft is made of wood or metal such as aluminium. It carries a number of heald wires through which the ends of the warp sheet pass. The heald shafts are also known as 'heald frames' or 'heald staves'. The number of heald shafts depends on the warp repeat of the weave. It is decided by the drafting plan of a weave. The main function of the heald shaft is as follows:

(i) It helps in shed formation
(ii) It is useful in identifying broken warp threads
(iii) It maintains the order or sequence of the warp threads
(iv) It determines the order of lifting or lowering the required number of healds for a pick. In other words it helps in forming the design or pattern in a fabric.
(v) It determines the warp thread density in a fabric, i.e. the numbers of heald wires per inch determine the warp thread density per inch.

1.6.2 Sley or lay

It is made of wood and consists of the sley race or race board, reed cap and metal swords carried at either ends. The sley mechanism swings to and fro. It is responsible for pushing the last pick of weft to the fell of the cloth by means of the beat up motion. The sley moves faster when moving towards the fell of the cloth and moves slower when moving backwards. This unequal movement is known as 'eccentricity of the sley'. It is needed in order to perform the beat up and also to give sufficient time for passage of shuttle to pass through the warp shed. The beat up of the lastly laid pick of weft is accomplished through a metal reed attached to the sley.

1.6.3 Shuttle

It is basically a weft carrier and helps in interlacement of the weft with the warp threads to form cloth. The shuttle which is made of wood passes from one end of the loom to the other. It travels along the wooden sley race and passes between the top and bottom layers of the warp sheet. The shuttle enters a shuttle box fitted at either ends of the loom, after passing through the warp shed. A shuttle normally weighs about 0.45 kgs.

1.6.4 Shuttle box

It is the housing for the shuttle and is made of wood. It has a spindle and a picker. It may also accommodate the picker without spindle. The top and side of the box towards the sley race are open. The shuttle dwells inside the box for the intermediate period between two successive picks.

1.6.5 Picker

The picker is a piece made either of leather or synthetic material. It may be placed on a spindle or grooves in the shuttle box. It is used to drive the shuttle from one box to another. It also sustains the force of the shuttle while entering the box.

1.6.6 Reed

It is a metallic comb that is fixed to the sley with a reed cap. The reed is made of a number of wires and the gap between wires is known as dents. Each dent can accommodate one, two or more warp ends. The count of the reed is decided by the number of dents in two inches. The reed performs a number of functions which are enumerated as follows:

(i) It pushes the lastly laid pick of weft to the cloth fell
(ii) It helps to maintain the position of the warp threads
(iii) It acts as a guide to the shuttle which passes from one end of the loom to the other.
(iv) It determines the fineness of the cloth in conjunction with the healds.
(v) It determines the openness or closeness of the fabric.

There are various types of reed such as ordinary reed, gauze reed, expanding reed, V reed etc.

1.6.7 Warp beam

This is also known as the weaver's beam. It is fixed at the back of the loom. The warp sheet is wound on to this beam. The length of warp in the beam may be more than a thousand metres.

1.6.8 Back beam

This is also known as the back rest. It is placed above the weaver's beam. It may be of the fixed or floating type. In the first case the back rest merely acts as a guide to the warp sheet coming from the weaver's beam. In the second case it acts both as a guide and as a sensor for sensing the warp tension.

1.6.9 Breast beam

It is also known as the front rest. It is placed above the cloth roller at the front of the loom and acts as a guide for the cloth being wound on to the cloth roller. The front rest together with the back rest helps to keep the warp yarn and cloth in horizontal position and also maintain proper tension to facilitate weaving.

1.6.10 Cloth beam

It is also known as the cloth roller. The woven cloth is wound on to this roller. This roller is placed below the front rest.

2
CHAPTER
Woven Design 7undamentals

2.1 INTRODUCTION

A woven cloth is formed by the interlacement of two sets of threads, namely, warp and weft threads. These threads are interlaced with one another according to the type of weave or design. The warp threads are those that run longitudinally along the length of the fabric and the weft threads are those that run transversely across the fabric. For the sake of convenience the warp threads are termed as ends and the weft as picks or fillings.

2.2 CLASSIFICATION OF WOVEN STRUCTURES

Woven structures are classified into the following categories:

(i) Simple structures
(ii) Compound structures

In case of simple structures, there is only one series of warp and weft threads. These threads interlace with one another perpendicularly. All the neighbouring warp and weft threads are parallel to one another and play an equally important role in determining the properties of the fabric.

In case of compound structures, there may be more than one series threads, of which one set forms the body or ground and the other forms the figuring or ornamentation. Unlike the simple structures, the neighbouring threads need not be parallel to one another.

2.3 METHODS OF WEAVE REPRESENTATION

A weave is the interlacing pattern of the warp and weft. Two kinds of interlacing are possible :

(i) Warp overlap in which warp is above weft
(ii) Weft overlap in which weft is above warp

When the warp is lifted above the inserted weft, a warp overlap is obtained. When the warp thread is lowered, the weft thread is inserted above the warp thread and the weft overlap is obtained.

There are two practical methods of weave representation :

(i) Linear
(ii) Canvas

In the linear method each warp thread is represented by a vertical line and each weft thread by a horizontal line. The point of intersection of lines corresponding to a warp overlap is marked by the dot, and the point of intersection corresponding to weft overlap remains unmarked.. Though this is a simple method, it is seldom used because the designer has to draw plenty of horizontal and vertical lines, which is time consuming.

In the canvas method, a squared paper is employed, on which each vertical space represents a warp thread and each horizontal space represents a weft thread. Each square therefore indicates an intersection of warp and weft thread. To show the warp overlap, a square is filled in or shaded. The blank square indicates that the weft thread is placed over the warp i.e. weft overlap. Several types of marks may be used to indicate the warp overlap. The 'x' mark is most commonly used.

A weave diagram is shown below (Fig. 2.1).

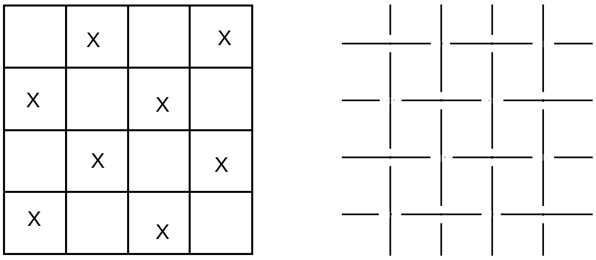


Fig. 2.1. *Weave representation (Canvas method)*

2.4 WEAVE REPEAT (REPEAT SIZE)

The repeat of a weave is a quantitative expression of any given weave. It indicates the minimum number of warp and weft threads for a given weave. It comprises of warp and weft repeat. The size of the repeat may be even or uneven depending upon the nature of the weave. In elementary weaves such as plain, twill, satin etc. the repeat size is normally even. However in weaves such as honey comb, huck a back the repeat size may be even or uneven. For any weave the repeat size is the sum of the warp and weft floats. Thus in case of a 2/1 twill the repeat size is 3 ¥ 3. It is common practice to denote one repeat of a weave on design paper.

2.5 BASIC ELEMENTS OF A WOVEN DESIGN

The three basic elements in a woven design are :

(i) Design
(ii) Draft or drawing plan
(iii) Peg or lifting plan

The design indicates the interlacement of warp and weft threads in the repeat of the design. It is made up of a number of squares, which constitute the repeat size of a design. The vertical direction of the squares indicate the picks and the horizontal direction indicates the ends. A blank in a square indicates that a warp goes below the corresponding weft and 'X' mark in the square indicates that the warp floats above the weft.

The draft or drawing plan indicates the manner of drawing the ends through the heald eyes and it also denotes the number of heald shaft required for a given weave repeat. The choice of the type of drafting plan depends upon the type of fabric woven.

The peg or lifting plan provides useful information to the weaver. It denotes the order of lifting of heald shafts. In a peg plan the vertical spaces indicate the heald shafts and the horizontal spaces indicate the picks. The peg plan depends upon the drafting plan. In the case of a straight draft, the peg plan will be the same as the design. Hence no peg plan is necessary in the case of a straight draft.

The design, draft and peg plan are illustrated with the aid of an example shown below (Fig. 2.2)

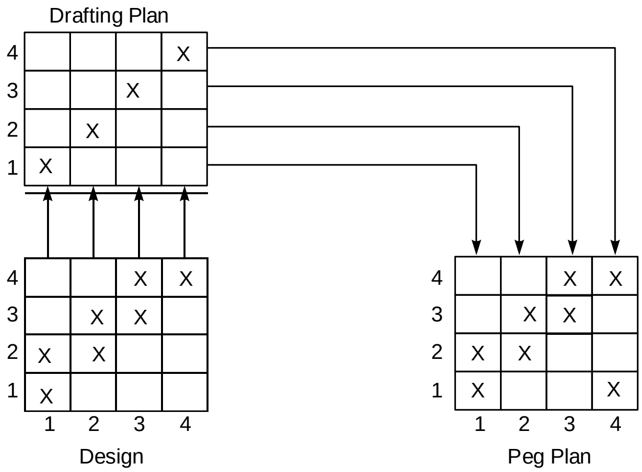


Fig. 2.2. *Basic elements of a Woven Design (2/2 twill weave)*

2.6 TYPES OF DRAFT PLANS

The various drafts are classified as follows :

(i) Straight
(ii) Pointed
(iii) Skip and sateen
(iv) Broken
(v) Divided
(vi) Grouped
(vii) Curved
(viii) Combination

2.6.1 Straight draft

This is the most commonly used draft. It is the simplest of all the types of draft plans. In this kind of draft the drafting order progresses successively from first to the last heald frame. Thus the first warp end of a weave is drawn through the first heald shaft, the second warp through the second heald frame and so on.

One important feature of the straight draft that distinguishes it from other types of draft plans is that the peg or lifting plan is same as the design. Hence it is sufficient to indicate only the design. Fig. 2.3 shows the straight draft.

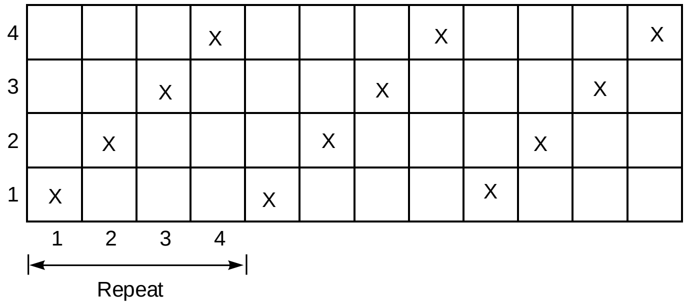


Fig. 2.3. *Straight Draft*

2.6.2 Skip draft

The skip draft is suitable for weaving fabrics having heavy warp thread density. In this kind of draft plan the number of heald frames may be twice or more than the minimum required for a weave. The purpose of using more heald frames than the minimum recommended is only to distribute the warp threads more uniformly so as to prevent abrasion of the threads due to overcrowding. (Fig. 2.4)

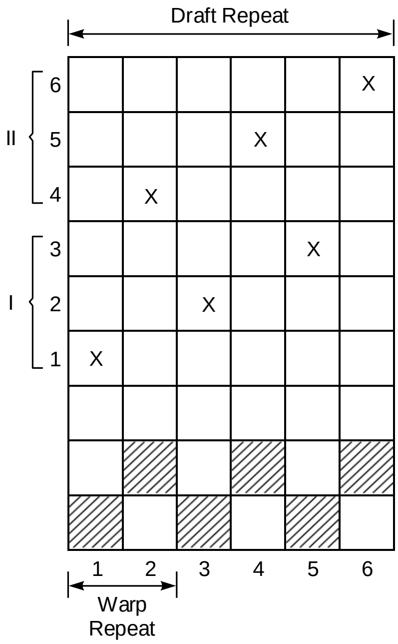


Fig. 2.4. *Skip Draft*

The heald frames are divided into two groups. All even numbered warp threads are drawn through the first group of heald frames and all odd numbered warp ends are drawn through the second group of heald frames.

The sateen draft serves the same purpose as the skip draft. A skip draft is normally employed for weaves such as plain and twill upto a repeat of 4. Whereas the sateen draft is used for weaves having repeat size of more than 5.

2.6.3 Pointed draft

This is similar to a straight draft. It is suitable for weaves such as pointed twill, diamond weaves and ordinary types of honeycombs. The straight draft is reversed after half the repeat warp way. The number of heald shafts is about half the repeat size of the weave. Fig. 2.5 shows a pointed draft.

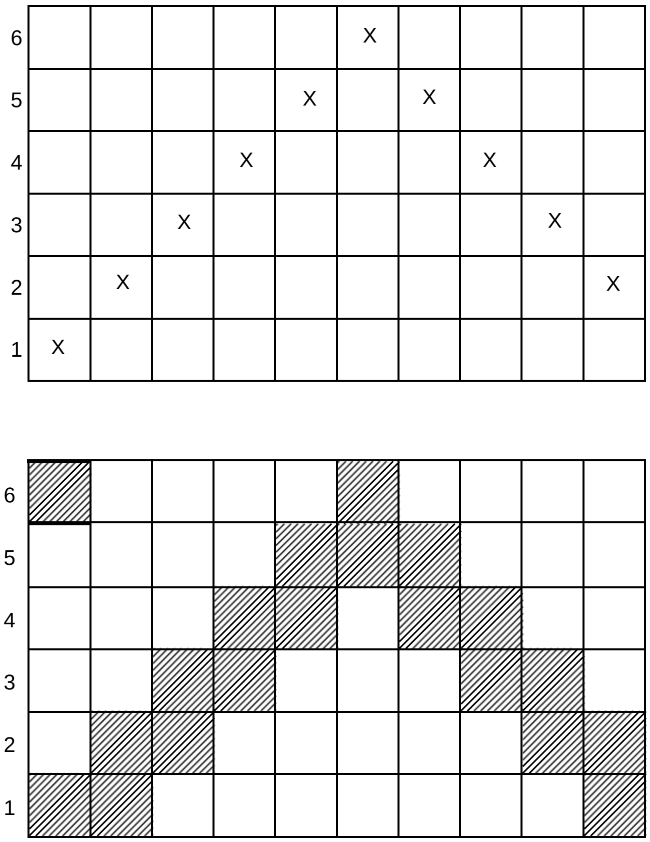


Fig. 2.5. *Waved Twill and Pointed Draft*

2.6.4 Broken draft

A broken draft almost resembles the pointed draft. However the pointed effect is broken. This type of draft is suitable for weaves such as herringbone twills (Fig. 2.6).

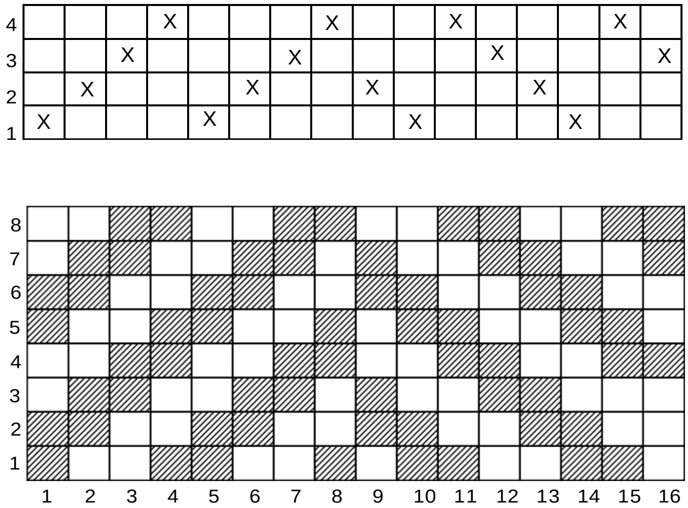


Fig. 2.6. *Waved Twill and Broken Draft*

2.6.5 Divided draft

This draft is used for weaves having two series of warp threads such as terry, double cloth, warp backed cloth etc. As can be seen in Fig. 2.7, the two sets of warp threads, say, face and back warps are divided into two groups. The first group is for 8 heald shafts and second for 9-12 heald shafts.

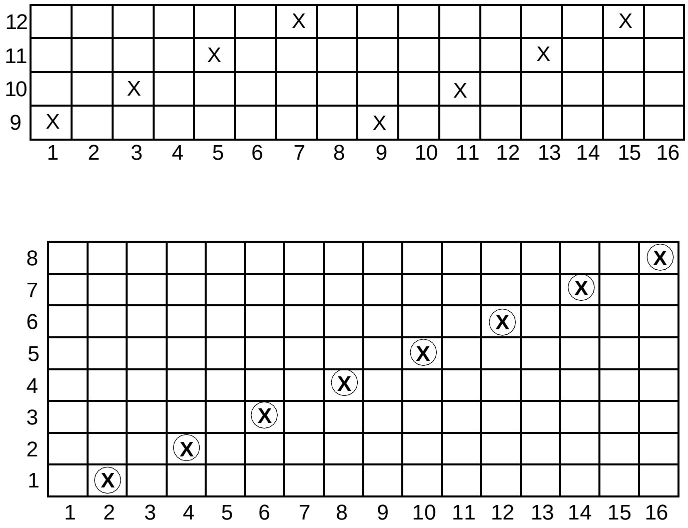


Fig. 2.7. *Divided Draft*

2.6.6 Grouped drafts

These drafts are employed for the production of stripe and check designs, in which the stripes have different weaves or their combinations. This draft (Fig. 2.8) is used for producing the fabric with two different stripes. The repeat of the draft is determined by the number of stripes and the number of threads in each stripe. The number of shafts in the draft depends upon the number of stripes and the warp repeat of weave of each stripe.

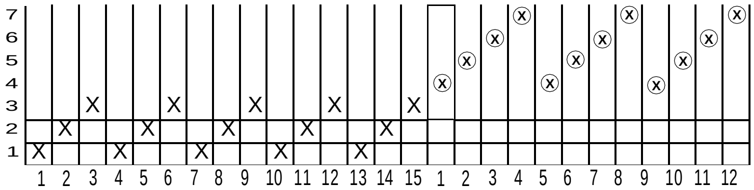


Fig. 2.8 *Grouped draft repeat size 12 +15=27 Grouped draft*

2.6.7 Combined draft

Various methods of drawing in can be combined in one draft for producing a certain type of fabric. Two or more drafts described above can be applied simultaneously, for example, straight and skip or sateen, grouped and curved, and so on. Combined draft is the most complicated and can be chosen only if there are some technological or economical reasons. The designer having a great experience can do it properly.

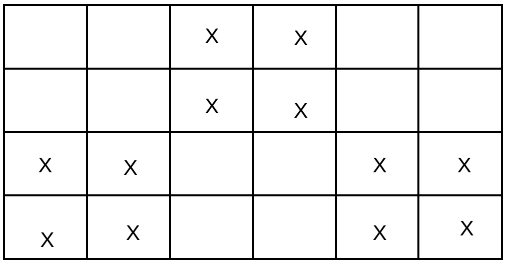
2.7 RELATION BETWEEN DESIGN, DRAFT AND LIFTING PLAN

The construction of any woven fabric depends upon the design, draft and the lifting plan and these are very closely dependent upon one another. A thorough knowledge of this interdependence is very valuable to the designer upon whose skill several mechanical limitations of the loom may be imposed. In many cases it is only his innate acquaintance with the drafting systems and the possibilities of manipulating the lifting orders which enables him to introduce variety into apparently rigid mechanical systems of operation. In normal practice the designer has to produce a range of designs for looms with a known pattern scope. This usually involves the draft and the lifting plan construction. A similar procedure is adopted when the designer is asked to reproduce a specific design from a sample. The weave in the sample is analysed and a suitable draft and lifting plan is derived**.**

2.8 DENTING PLAN

Warp ends during weaving are spaced out across the width of the warp sheet according to the desired density by the wires of the reed. The most frequent order of density is one, two, three, four ends per dent. There are some types of fabrics, however, which require an irregular order of denting to emphasize certain design feature, and in such cases the order of arrangement of the ends in the reed becomes an essential part of the design and must be indicated carefully and in the correct relationship in respect of the weave and the draft. The various methods of indicating the denting are shown in Fig. 2.9.

A



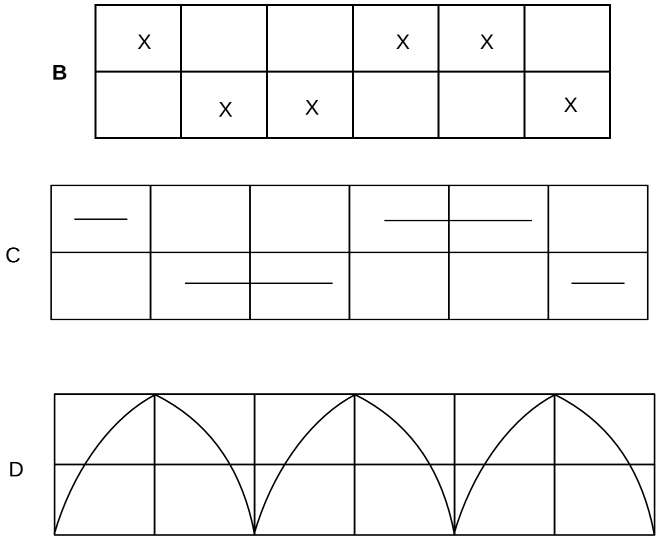


Fig. 2.9. *Various Methods of representing the Denting Plans*

At A, is shown a matt weave design. The different denting plans for this design are shown at B, C, and D. However the type of denting plans shown at B is most commonly used.

3
CHAPTER
Plain Weaves

3.1 INTRODUCTION

The plain weave is variously known as "calico" or "tabby" weave. It is the simplest of all weaves having a repeat size of 2. The range of application of this weave is wide.

The plain weave has the following characteristics :

(i) It has the maximum number of binding points
(ii) The threads interlace on alternate order of 1 up and 1 down.
(iii) The thread density is limited
(iv) Cloth thickness and mass per unit area are limited.
(v) It produces a relatively stronger fabric that is obtained by any other simple combination of threads, excepting that of "gauze"or "cross weaving".

The principle involved in the construction of plain cloth is the interlacement of any two continuous threads either warp or weft in an exactly contrary manner to each other, with every thread in each series passing alternately under and over consecutive threads of other series interlaces uniformly throughout the fabric. By this plan of interlacement, every thread in each series interlaces with every thread in the other series to the maximum extent, thereby producing a comparatively firm and strong texture of cloth. A complete unit of the plain weave occupies only two warp threads and two picks of weft (Fig. 3.1), which is the design for that weave.

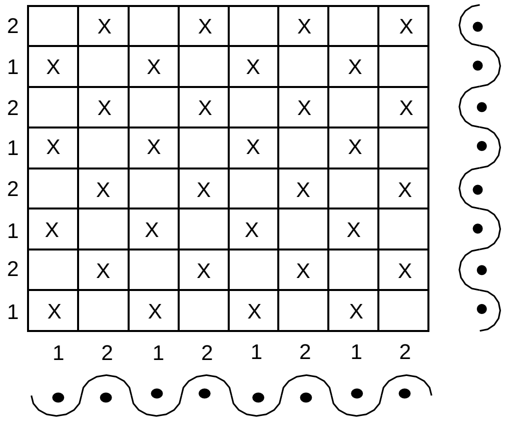


Fig. 3.1. *Plain or Tabby Weave*

3.2 TEXTURAL STABILITY OF PLAIN WEAVE IN RELATION TO OTHER WEAVES

The firmness of any woven structure depends on the frequency of interlacing between the warp and weft threads. The greater the number of intersections the better will be the firmness of the cloth. Let us consider the case of two fabrics woven with identical warp and weft counts and thread settings. Consider that one is woven as plain weave and the other with any other weave such as twill, sateen etc. It will be seen that the latter will be less firm, and therefore of weaker texture than the former, because the threads composing it would be bent in a lesser degree than those of the plain weave, thereby causing them to be less firmly compacted. Thus it is important that the counts of warp and weft, the number of warp threads and picks per inch, and the weave, should be properly proportioned, in order to obtain the best results.

3.3 RANGE OF TEXTURES PRODUCED IN PLAIN WEAVES

The plain weave is produced in a variety of forms and textures, possessing totally different characteristics, which adapt it for specific purposes. A variety of forms in textures are produced :

(i) By causing a differential tension between the warp threads during weaving.
(ii) By using various counts of yarn for weaving different types of fabrics,
(iii) By using warp and weft yarns of different counts in the same fabric,

The term ‘texture’ is related to type of material, counts of yarn, relative density of threads, weight, bulk, feel during handle, and other properties. The range of textures produced in plain cloth is wide. An ideal plain cloth is one which has identical or similar warp and weft constructional parameters.

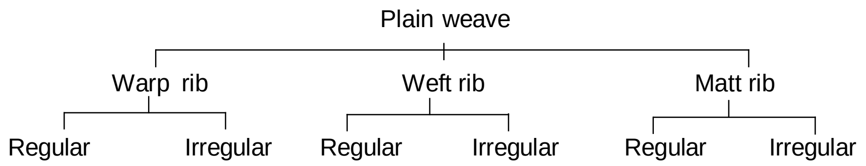
3.4 END USES

Plain weave finds extensive uses. It is used in cambric, muslin, blanket, canvas, dhothi, saree, shirting, suiting, etc.

3.5 MODIFICATION OF PLAIN WEAVE

The plain weave may be modified by extending it warp or weft way or both. The extension of the plain weave thus produces a rib effect. A warp rib results from extending the plain weave in the warp direction and a weft rib structure results from extending the plain weave in the weft direction. A matt rib results from extending the plain weave in both directions**.**

The chart below shows the derivatives/modifications of plain weave :



3.6 WARP RIB WEAVES

These are produced by extending the plain weave in warp wary direction. Fig 3.2 shows the warp rib weaves constructed on regular and irregular basis.

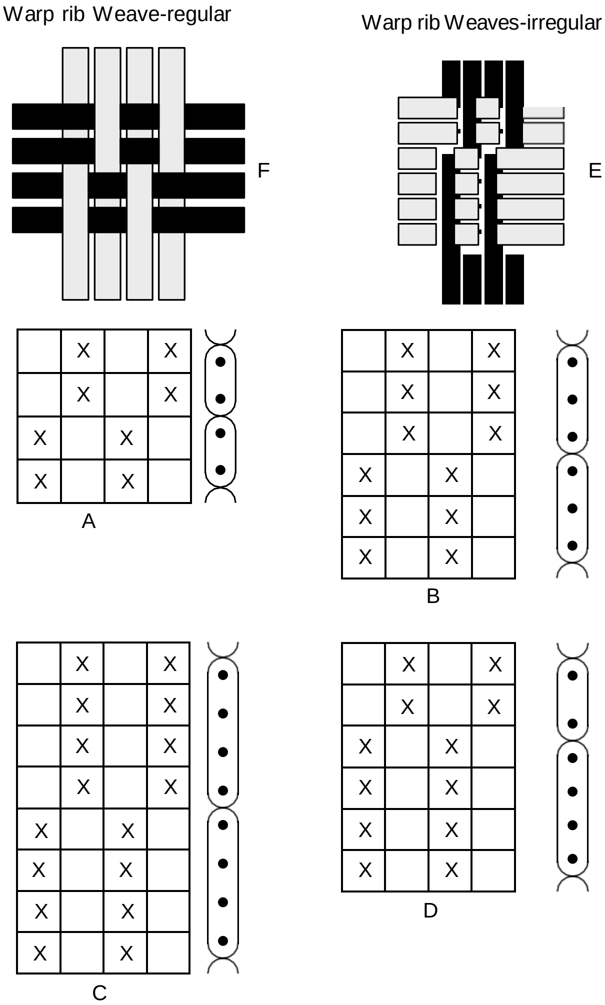
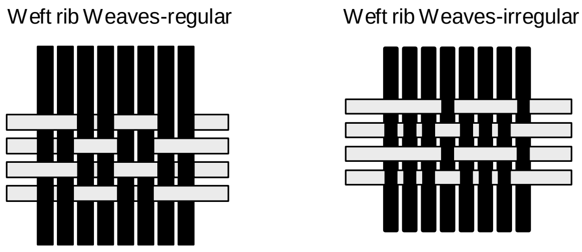


Fig. 3.2. *Warp rib Weaves*

At A, B and C are seen regular warp rib weaves and at D, is shown the irregular warp rib weave. E and F show the interlacing of D and A respectively.

3.7 WEFT RIB WEAVES

These are constructed by extending the plain weave in weft direction as shown in Fig. 3.3.



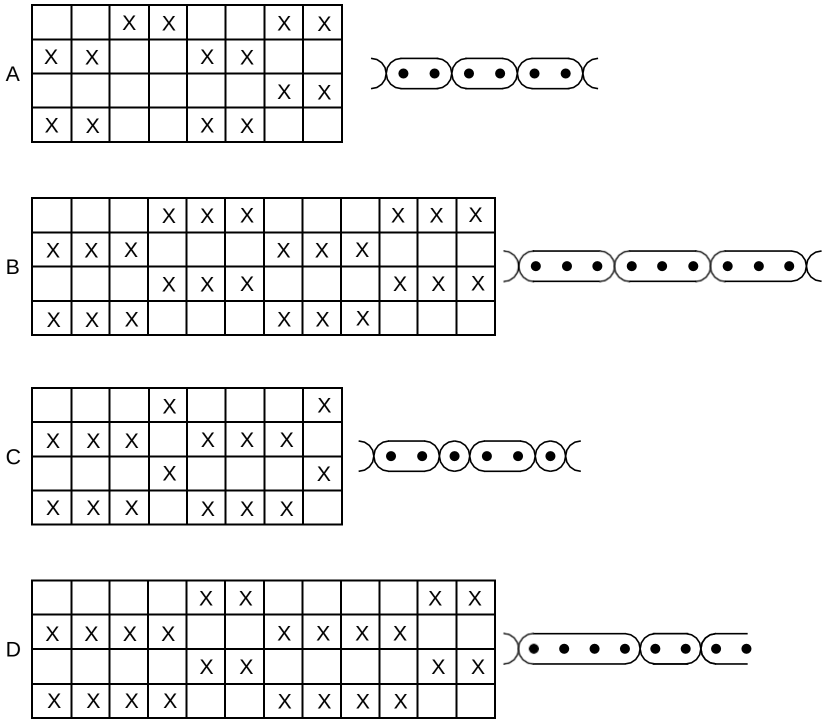


Fig. 3.3. *Weft rib Weaves*

In both the warp and weft rib weaves, the appearance of the cloth depends on the respective thread settings, and to achieve good effects, it is necessary to weave a weft rib with a high number of picks per inch and a comparatively low number of ends per inch. Similarly the warp rib effect can be enhanced with a high number of ends per inch and a comparatively low number of picks per inch. The prominence of the rib can be increased by suitable use of coarse and fine yarns. The dependence of all rib constructions upon the correct thread settings is marked.

The typical constructional particulars for a weft rib structure is given below:

Warp - 2/14s & 36s

Ends/inch - 56

Weft - 18s

Picks/inch - 100

The typical constructional particulars for a warp rib structure is given below:

Warp - 30s cotton

Ends/inch - 126

Weft - 15s cotton

Picks/inch - 38

3.8 USES

Rib weaves are used in gross grain cloths, matelasse fabrics, repp cloth which is extensively employed for window blinds in railway carriages and other vehicles, upholstering furniture, and cambric picket handkerchief.

3.9 MATT RIB WEAVES

These weaves are also variously known as hopsack or basket weaves. The matt rib structures result from extending the plain weave in both directions.

The regular and irregular types are shown in Fig. 3.4

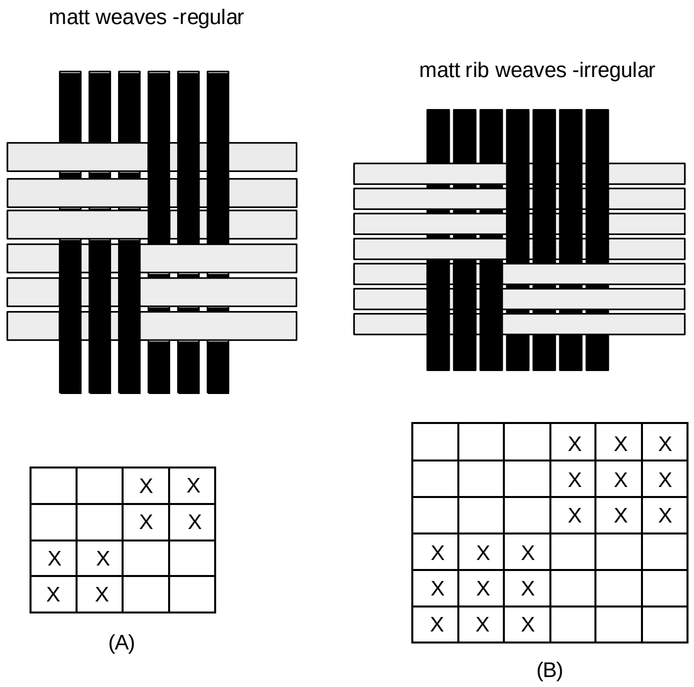


Fig. 3.4. ***Mat weaves***

In case of regular matt weave, the plain weaves are extended equally in the warp and weft directions, where as in case of irregular matt weaves, the plain weave is extended unevenly or irregularly in the warp and weft directions.

3.10 USES

Matt weave finds extensive uses for a great variety of fabrics such as dress materials, shirtings, sail cloth, duck cloth etc.

4

CHAPTER

Twill Weaves

4.1 INTRODUCTION

Twill weaves are the weaves that find a wide range of application. They can be constructed in a variety of ways. The main feature of these weaves that distinguishes from other types is the presence of pronounced diagonal lines that run along the width of the fabric.

The basic characteristics of twill weaves are :

(i) They form diagonal lines from one selvedge to another.
(ii) More ends per unit area and picks per unit area than plain cloth.
(iii) Less binding points than plain cloth
(iv) Better cover than plain weave
(v) More cloth thickness and mass per unit area.

4.2 CLASSIFICATION OF TWILL WEAVES

The twill weaves are produced in a wide variety of forms. They are however classified broadly into important categories, namely :

(i) Ordinary or continuous twills
(ii) Zig zag , pointed or wavy twills
(iii) Rearranged twills such as satin/sateen weaves and corkscrew weaves
(iv) Combination twills
(v) Broken twills
(vi) Figured and other related twill weaves

The above types of twills are further subclassified as:

(a) Warp face twills
(b) Weft face twills
(c) Warp and weft face twills

4.3 CONTINUOUS TWILLS

4.3.1 Warp faced twills

In these types of twills the warp thread floats over all the picks in a repeat except one pick. The minimum repeat size required is 3. Examples of warp faced twills are 2/1, 3/1, 4/1, 5/1 etc.

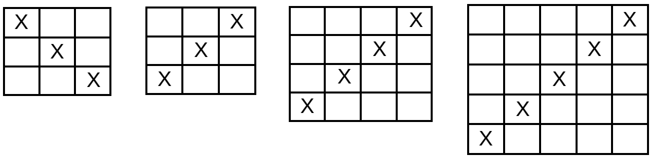
Some examples of warp faced twills are shown in Fig. 4.1.

Fig. 4.1A, C and D show a right handed or Z twill and Fig. 4.1B shows a left handed or ‘S’ twill.

4.3.2 Weft faced twills

These twills are the reverse of the previous ones. In these weaves the weft thread floats over the warp on all picks in a repeat except one. Examples of weft faced twills are 1/2, 1/3, 1/4, 1/5 etc.

Some types of weft faced twills are shown in Fig. 4.2.



A B C D

Fig. 4.2. *Weft Faced Twill*

Fig. 4.2 B, C and D show a right handed or ‘Z’ twill and Fig. A shows left handed or ‘S’ twill.

4.3.3 Balanced and unbalanced twills

In these types of twills the warp and weft floats may be equal or unequal. In other words the twills may be of the reversible or irreversible types. Accordingly they may be known as balanced and unbalanced twills. Examples of balanced twills are 2/2, 3/3, 4/4, 5/5 etc. Examples of unbalanced twills are 2/3, 4/2, 5/3 etc. The 2/2 twill is popularly known as “Gaberdene” weave. Fig. 4.3 A and B show designs for balanced and unbalanced twills and C and D show the interlacement diagrams of a 4/1 twill and 1/4 twill (warp faced) (weft faced).

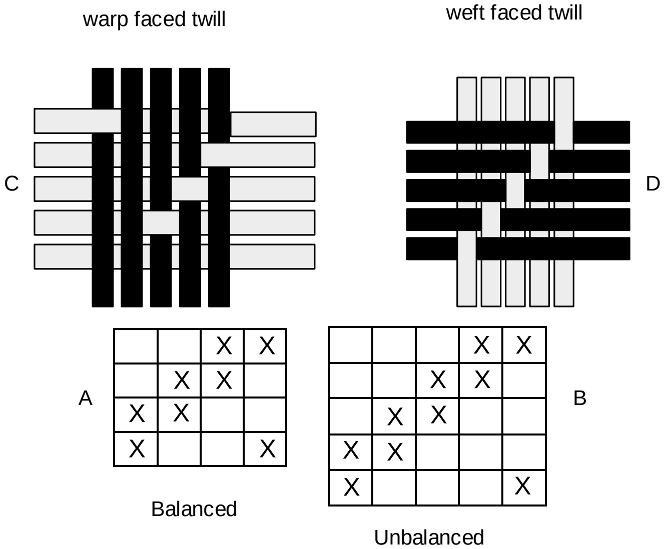
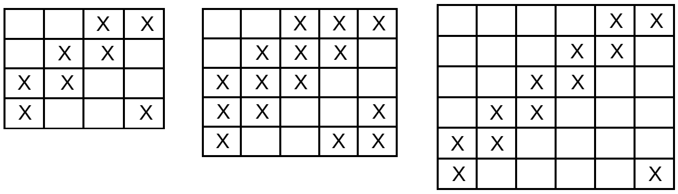


Fig. 4.3. *Balanced and unbalanced Twill*

4.4 WARP AND WEFT FACED TWILLS

In these twills the warp and weft floats may be equal or unequal with either the warp floats predominating the weft floats and vice versa. Some examples of these twills are shown in Fig. 4.4 A, B and C respectively.



A B C

Fig. 4.4. *Warp and Weft faced Twill*

4.5 THE ANGLE OF TWILL

The angle of twill is the angle between the diagonal twill line and an imaginary horizontal line or axis parallel to the weft. This angle is dependent on the ratio between the ends/inch and picks/inch in the cloth. When the warp ends/inch is equal to the weft picks/inch, the twill angle will be 45°. When the warp ends/inch exceeds the weft picks/inch the twill angle will be an obtuse angle i.e., $>45^\circ$ (high angle or steep twill). When the weft picks/inch exceeds the warp ends/inch, the twill angle will be an acute angle i.e., $<45^\circ$ (low angle or flat twill).

4.6 FACTORS DETERMINING THE PROMINENCE OF TWILL WEAVES

The following factors determine the relative prominence of twill weaves

(i) Nature of the yarn
(ii) Nature of the weave
(iii) The warp and weft threads/inch, and
(iv) The relative direction of twill and yarn twist

4.6.1 Nature of the yarn

The fineness of yarn and the amount of twist given to it influence the prominece of the twill. A coarse yarn of lower twist produces a greater effect on the twill as compared to a fine yarn of higher twist. On the other hand doubled or ply yarns have a stronger effect on the twill as compared to single yarns.

4.6.2 Nature of the weave

Twills with longer floats will give more prominence as compared to those with shorter floats. For example, a 3/1 twill will be more prominent as compared to a 2/2 twill. It is to be noted that an increase in float length has to be balanced by proportionately increasing the corresponding threads/inch.

4.6.3 Warp and weft threads/inch

The twill prominence increases proportionately with the increase in warp and weft threads/inch.

4.6.4 RELATIVE DIRECTION OF TWILL AND YARN TWIST (TWIST TWILL INTERACTION)

Another important factor that influences the prominence of twill is the direction of twist in the yarn. When the direction of yarn twist is same as the twill direction, the prominence is reduced and when the direction of the the yarn twist is opposite to the twill direction, the prominence of the twill is increased. In other words a Z twill with Z twist yarn or an S twill with S twist yarn shows less prominence. On the other hand a Z twill with S twist yarn or S twill with Z twist yarn gives more prominence.

4.7 COMPARISON OF THE FIRMNESS OF TWILLS

The firmness of a weave depends on the number of intersections. The greater the number of intersections, the better the firmness. On the other hand lesser the number of intersections, greater will be the cover of the cloth. This is due to the increase in the floats of the threads. Increase in the number of intersections restrict the thread density and vice versa.

The illustration in Fig. 4.5 shows three cases in which an 8 thread repeat of twill weave is chosen.

Case 1: In this case shown at A, a floating weave of 4/4 twill is chosen.

Case 2: In this case shown at B, a combination of 3/2 and 1 /2 twill is chosen

Case 3: In this case shown at C, a combination of 3/1, 1/1 and 1/1 weave is chosen

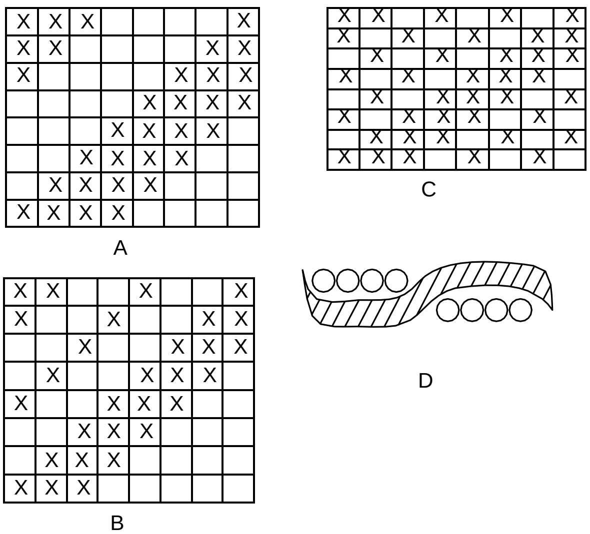
The corresponding cross sections are shown at D, E and F, respectively. The distance between the dotted lines represent a distance equal to the diameter of a single thread. It can be seen that design A occupies a space of ten threads (D), design B occupies a space of twelve threads (E) , and design C occupies a space of fourteen threads (F). It can be seen that a spacing of 10 threads in G is occupied as against the spacing of 14 threads at F.

The following conclusion can be drawn on observing the interlacings in the three above cases:

In case 1, the cloth will have the minimum level of firmness and maximum cover.

In case 2, the cloth will have firmness and cover intermediate between 1 and 2.

In case 3, the cloth will have maximum firmness and minimum cover.



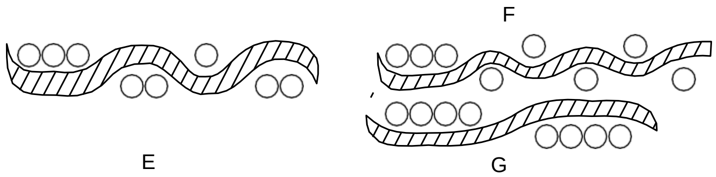


Fig. 4.5. *Relative firmness of Twill Weaves*

4.8 ZIG ZAG OR WAVY TWILLS

These are also known as pointed twills. In these classes of twill weaves the twill progresses in one direction for half of the repeat and then is reversed for the next half of the repeat. The reversal of the twill may be done in a regular or irregular manner. Ideally the reversal of the twill should be done considering the series of threads that predominate the face of the fabric. Thus warp way reversal is done in cases where the warp predominates over the weft and weft way reversal is done in cases where the weft predominates over the warp.

Figure 4.6 shows a design of the pointed twills.

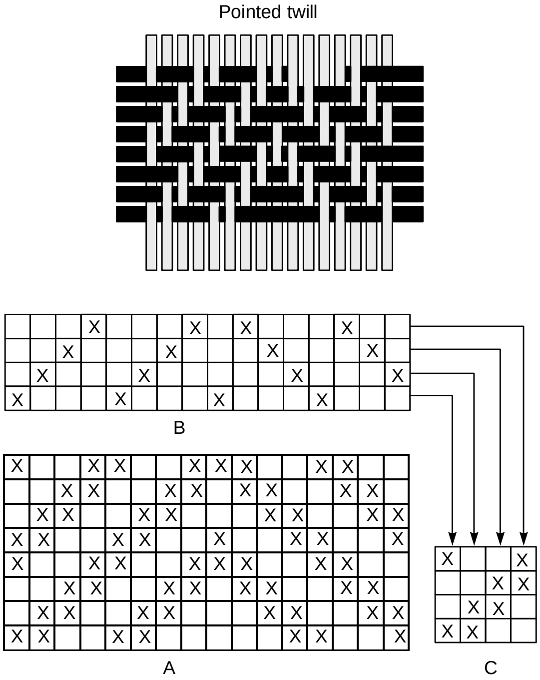


Fig. 4.6. *Pointed Twill*

4.9 HERRINGBONE TWILLS

In the case of these twills, the twill is reversed as in the case of pointed twills. However, the pointed effect is broken. This type of construction produces a distinct stripe effect and also prevents the formation of an extended float where the weave turns. In this aspect the herringbone twills are considered to be more advantageous than the pointed twills.

A typical example of herringbone twill is shown in Fig. 4.7.

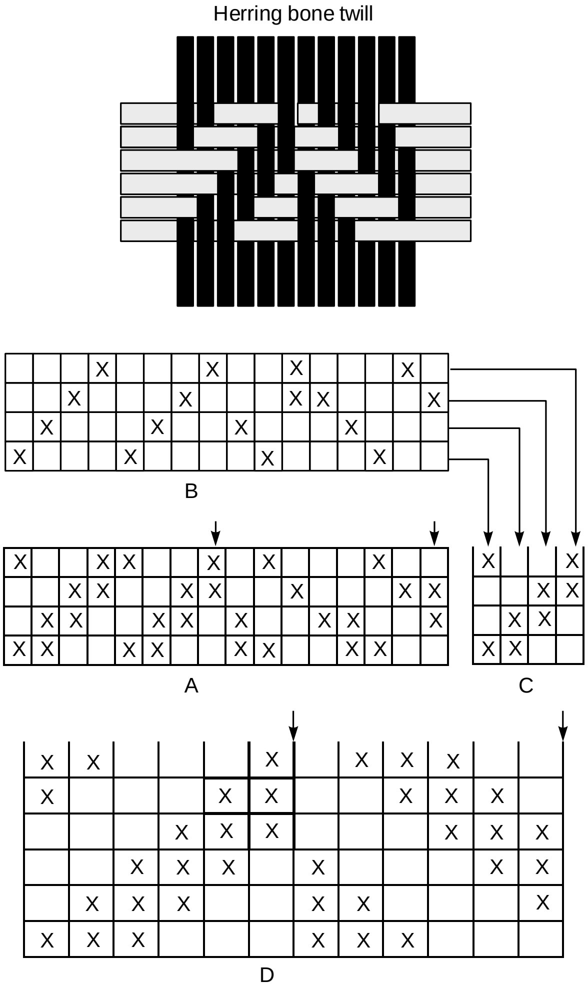


Fig. 4.7 *Herringbone Twill*

4.9 REARRANGED TWILLS

These twills are obtained by arrangement of a continuous twill either warp way or weft way. The rearrangement is normally done in a particular order or sequence.

Rearranged twills are of two types :

(i) Satin/sateen weaves
(ii) Corkscrew weaves

4.10 SATIN AND SATEEN WEAVES

Satin is a warp faced rearranged twill and sateen is a rearranged weft faced twill. Thus **s**atin is the reverse side of sateen weaves. These weaves form an important category of weaves. They are used in combination with other weaves, particularly in case of ornamented fabrics. The striking feature of these weaves is their bright appearance and smooth feel. The basic characteristic of satin/sateen weaves are :

(i) They are either warp or weft faced weaves.

(ii) Have no prominent weave structures
(iii) Only one binding point in each end or pick
(iv) No continuous twill lines
(v) Have poor seam strength due to thread mobility
(vi) More thread density is possible in warp and weft

(vii) More mass per unit area is possible
(viii) Have less binding points and more float lengths
(ix) Use of move numbers (intervals of selection) is necessary to construct these weaves.

In the construction of satin/sateen weaves, the stitching points of warp or weft for a given repeat size is done by the use of move numbers or stitch or float numbers. The move numbers are selected according to the repeat size of the weave.

In choosing move numbers for the construction of satin/sateen weaves, the following rules are to be adopted:

(a) The move number should not be equal to the repeat of the weave
(b) It should not be one less than the repeat size
(c) It should not be a factor of the repeat size, and
(d) It should not be a multiple of the factor .

The designs of some satin and sateen weaves are shown in Figs. 4.8 and 4.9

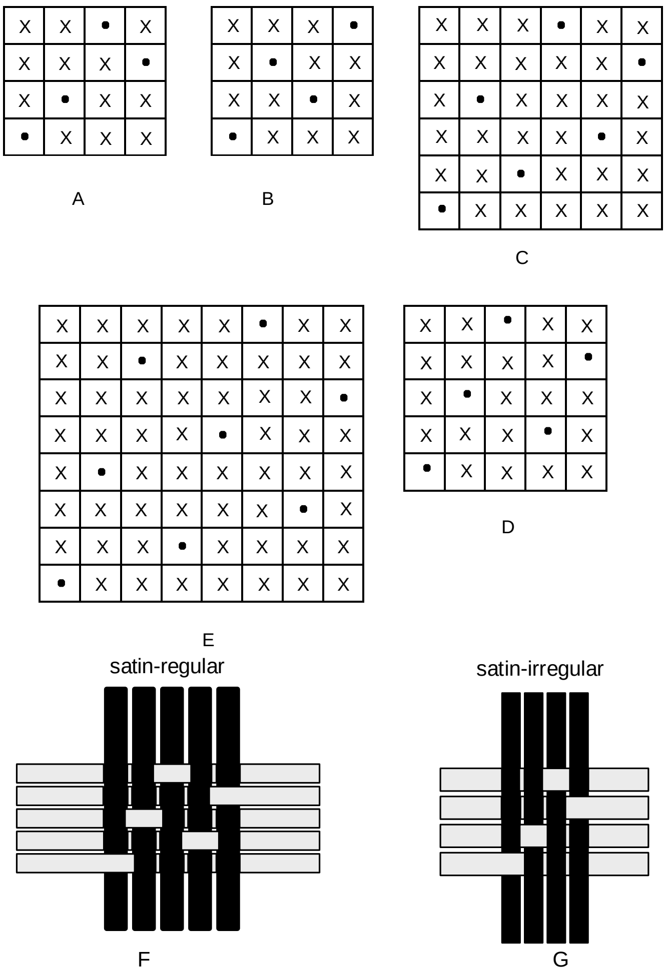


Fig. 4.8. *Regular and Irregular satin weaves*

Figs. 4.8 A, B and C show the different types of irregular satins and Figs. 4.8 D and E show the designs of regular satin. Fig. 4.8A shows a 4 end irregular satin constructed by using a step number of 1, while Fig. 4.8B show the same satin constructed using step number of 2. Fig. 4.8D shows a 5 end regular satin constructed with a step number of 3 and Fig. 4.8 E shows an 8 end regular satin constructed with a step number of 3. Fig. 4.8 F and G shows the corresponding interlacings of designs D and A respectively.

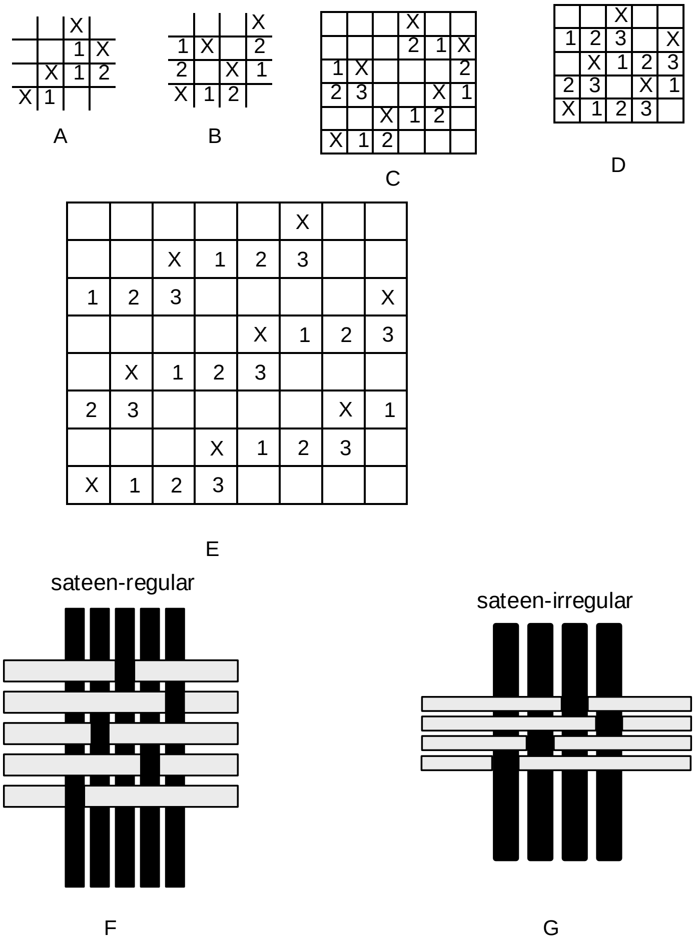


Fig. 4.9. *Regular and irregular sateen weaves*

Figs. 4.9A, B and C show the design of irregular sateen weaves and Figs. 4.9 D and E show regular sateen design. Fig. 4.9A shows a 4 end irregular sateen constructed with the step number of 1 and Fig. 4.9 B shows the same design using the step number f 2. Fig. 4.9 C shows a 6 end irregular sateen. Fig. 4.9 D and E show the designs of a regular 5 end and 8 end sateen constructed with step number of 3. Fig. 4.9 F and G show the interlacings of design 4.9 D and A respectively.

The following table shows the intervals of selection for the construction of satin weaves on five, and seven to twenty two threads. Instead of the numbers given, their reciprocals may be taken. Where two intervals are given, each of these or their reciprocals will produce similar results. Where more than two intervals are given, the number of numbers shown in heavy type (or their reciprocals) will give the most perfect distribution of intersections.

Table showing suitable move numbers for the construction of satin weaves

Type of satin	*Suitable move number*
5 end	2
7 end	2,3
8 end	3
9 end	2,4
10 end	3
11 end	2,3,4,5
12 end	5
13 end	2,3,4,5,6
14 end	3,5
15 end	2,4,7

4.11 STRIPE AND CHECK EFFECT ON SATIN-SATEEN WEAVES

By a combination of suitable identical satin-sateen designs, stripe and check effects can be produced as shown in Figs. 4.10 and 4.11

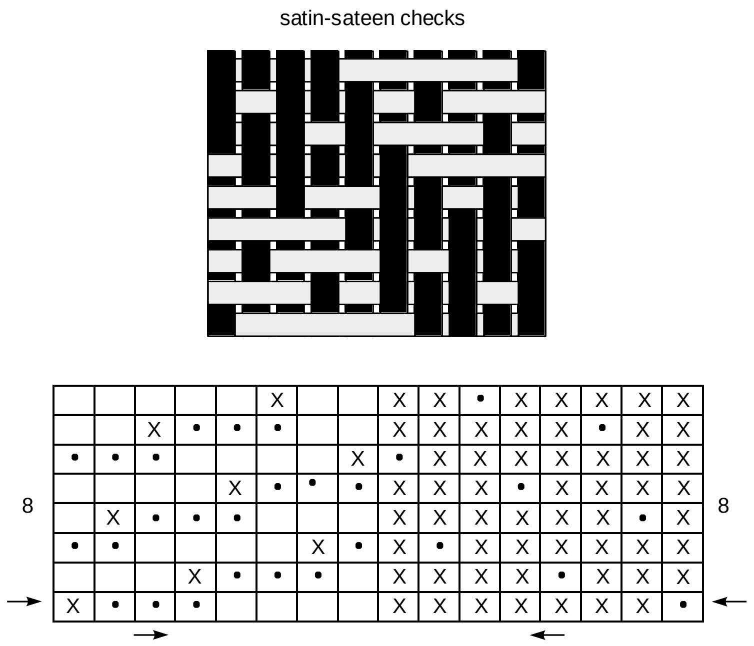


Fig. 4.10. *Satin-sateen stripes*

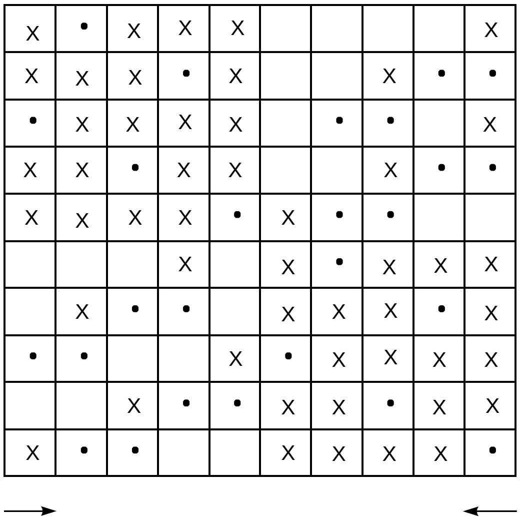


Fig. 4.11. *Satin-sateen checks*

Fig. 4.10 shows a satin-sateen stripe design constructed on 8 ends in a repeat and Fig. 4.11 shows a satin- sateen check design constructed on 5 ends in a repeat.

4.12 END USES OF SATIN-SATEEN WEAVES

Satin weaves find a wide range of application such as denim, interlining cloth, ribbons, dress materials (lustrous), children's dress materials etc.

4.13 CORK SCREW WEAVES

These are basically hard weaves and constitute another important category of rearranged twills. They are capable of producing firm and compact textures of good strength, durability and warmth. Hence these weaves are suitable in the production of garments from worsted fabrics. The two important requirements in the construction of corkscrew weaves are

(i) The repeat size should be an odd number, and

(ii) The warp float should be one greater than weft float in case of warp faced weaves and vice versa.

Corkscrew weaves are classified as

(i) Warp faced corkscrew weaves, and

(ii) Weft faced corkscrew weaves.

The warp faced weaves are constructed by rearranging continuous twills warp way and weft faced weaves are constructed by rearranging continuous twills weft way. The base twill chosen should have odd repeat size. It should have any one thread predominating over its counterpart by one. In other words either the warp float should exceed the weft float by one or weft float should exceed the warp float by one.

A typical weft faced corkscrew design is shown in Fig. 4.12 A and warp faced corkscrew design in Fig. 4.12 B.

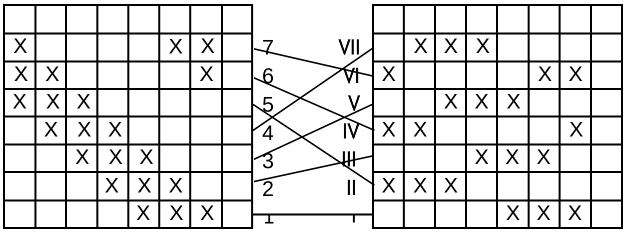


Fig. 4.12. A *Construction of weft faced corkscrew weaves*

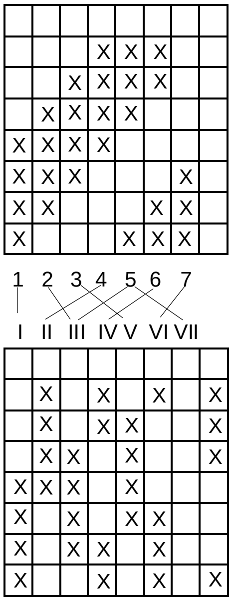


Fig. 4.12. B *Construction of warp faced corkscrew weave.*

4.14 COMBINATION TWILLS

In these types of weaves two different types of continuous twills are combined together alternately. The combination may be warp way or weft way. Accordingly warp or weft faced twills may be used suitably. The angle of twill is influenced by the method of combination. If the twills are combined warp way, then the angle of twill is less than 45° and if the twills are combined weft way the angle of twill angle is greater than 45°.

Combination twills find extensive use in the worsted industry in the production of garment fabrics, as these weaves are capable of producing compact textures. These twills are constructed by two methods :

(i) End and end combination

(ii) Pick and pick combination.

In the first method the twill weaves are combined end way and in the second method twill weaves are combined in pick way. The designs for the different types of combination twills are shown in Figs. 4.13 and 4.14.

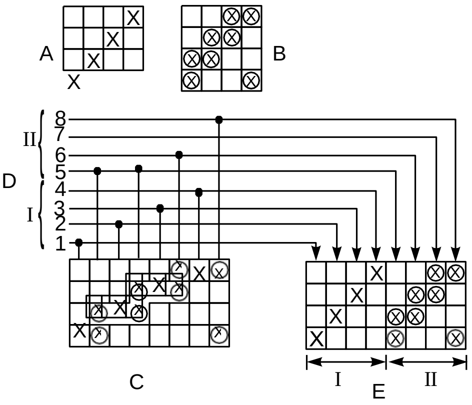


Fig. 4.13. *Combined twill constructed by end combination*

Fig. 4.13 A and B show the basic twill designs. In Fig. 4.13 A is shown a 1/3 twill and in Fig. 4.13 B is shown a 2/2 twill and in Figs. 4.13 C, D and E show the design, draft and peg plan respectively.

The type of draft used here is the divided draft. The heald shafts are divided into two groups, the first group controls the first design (1/3 twill) and the second heald shaft controls the second design (2/2 twill).

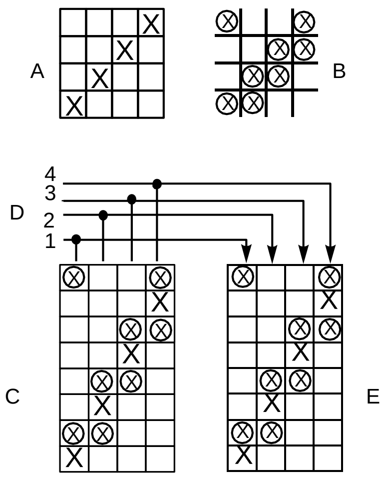


Fig. 4.14 *Combined twill constructed by Pick and Pick Combination*

In Fig. 4.14 is shown the design for combined twill constructed by pick and pick combination. Fig. 4.14A and B show the basic designs. The weave marked weft way. Figs. 4.14 C, D and E show the design, draft and peg plan respectively. The draft used is a straight draft and hence the peg plan is same as design.

4.15 BROKEN TWILLS

These twills are constructed by breaking the continuity of any continuous twill weave. The continuity can be broken in either a regular or an irregular order. Broken twills generally give a stripe like effect. The direction of the stripes can tend to be in either the direction of warp or weft accordingly as the continuity is broken warp or weft way.

A large variety of attractive effects, generally somewhat similar in appearance to herring bone twills, can be produced by breaking a regular twill. One of the simplest methods of constructing a broken twill is shown in Fig. 4.15. The method involves skipping a suitable warp thread in a repeat of the twill.

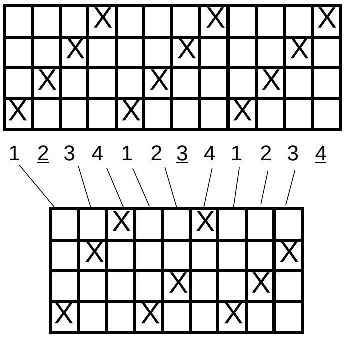


Fig. 4.15 *Broken twill*

At Fig. 4.15 A is shown a 1/3 twill with three repeats and the design of the broken twill is shown in Fig. 4.15 B. In the method adopted above, the most suitable number to skip is one less than half the number of threads in the repeat of the twill i.e (N/2 – 1) where N is the number of threads in the repeat of the twill. According to the above formula the number of threads to miss is 4/2 – 1 = 2 – 1 = 1. Thus in the design, the second end is missed in first repeat, third end is missed in second repeat and fourth end is missed in third repeat. It should be remembered that no similar ends must be missed in any two or three repeats.

4.16 TRANSPOSED TWILLS

In the case of these twills the diagonal effect is broken by transposition of the original order of the threads. This type of construction produces attractive designs. A number of methods can be adopted in the transposition of the regular twills. One of the commonly used method is shown in Fig. 4.16.

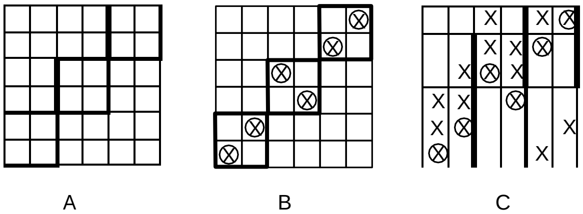


Fig. 4.16. *Transposed twill*

As shown in the figure above, the transposed twill is constructed in three stages. In the figure A the repeat size of the design is shown. The design adopted here is a base twill of 3/3 transposed on a repeat of 2. The repeat size is 6 ¥ 6. In the figure 4.16 B is shown the base marks that are made on repeat size of 2 ¥ 2, the squares of which are thickly lined. In the figure 4.16 C is shown the design of the transposed twill where the 3/3 twill is transposed in the thickly lined squares.

4.17 END USES OF TWILL WEAVES

Twill weaves find a wide range of application such as drill cloth, khakhi uniforms, denim cloth, blankets, shirtings, hangings and soft furnishings.

5

CHAPTER

Honey Comb Weaves

5.1 INTRODUCTION

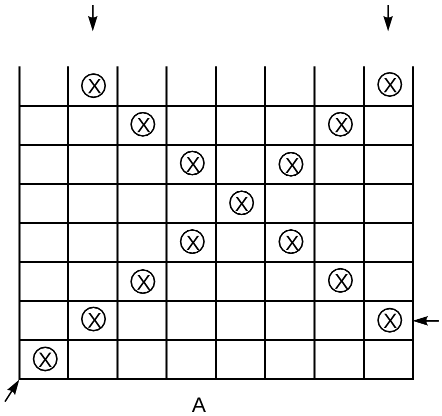
The honey comb weaves derive their name from their partial resemblance to the hexagonal honey comb cells of wax in which bees store their honey. These weaves form ridges and hollows which give a cell like appearance to the textures. Both warp and weft threads float somewhat on both sides, which coupled with the rough structure, renders this class of fabric readily absorbent of moisture. The weaves are of two classes, namely,

(i) Ordinary honey comb or honey comb proper
(ii) Brighton honey comb.

5.2 ORDINARY HONEY COMB WEAVES

These weaves are characterized by the following features

(a) Cell like appearance with ridges and hollows
(b) Single line crossing a single line or double line crossing a double diagonal line
(c) More warp and weft floats
(d) Moisture absorbent due to floats
(e) Constructed with pointed drafts
(f) A reversible fabric having similar effect on both sides.



A

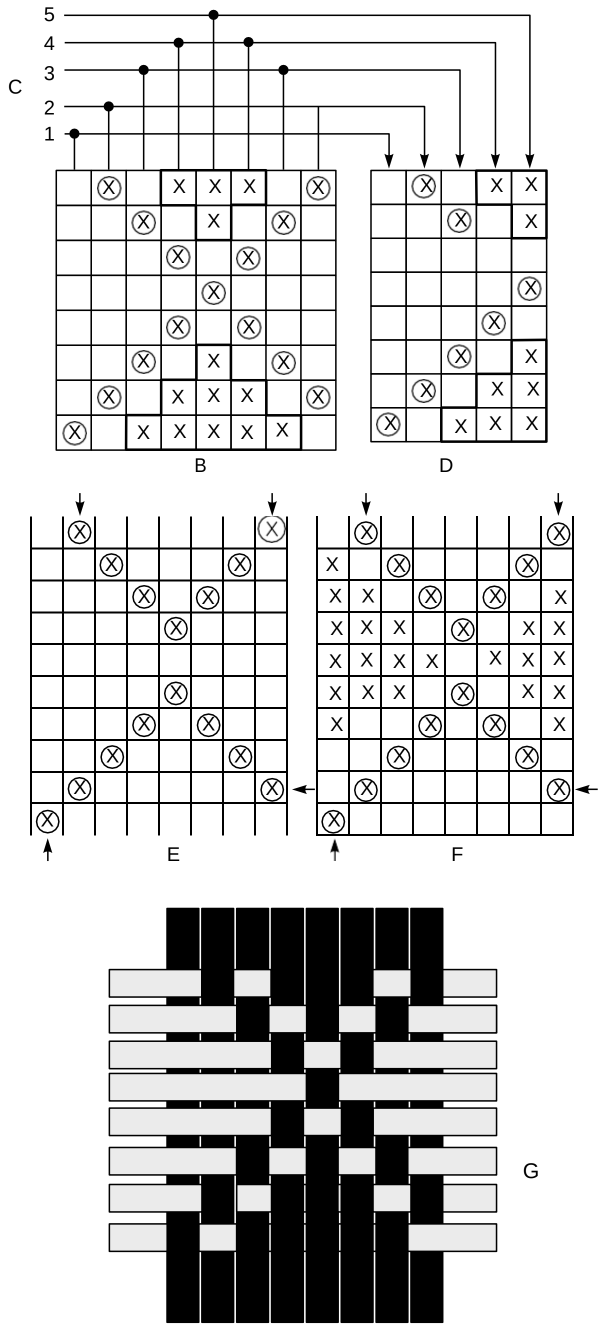


Fig. 5.1. *Ordinary Honey Comb*

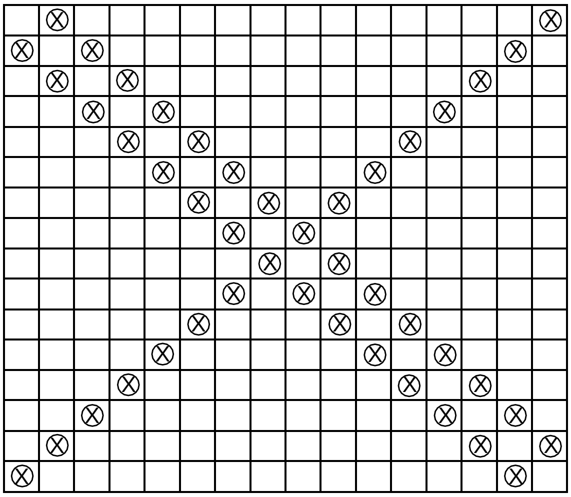
Fig. 5.1 A to F, show the design of an ordinary honey comb weave. Fig. 5.1 A shows the first step of constructing the design (single diagonal line). Fig. 5.1 B, C and D show the design, draft and peg plan or ordinary honey comb weave constructed on equal ends and picks. A pointed draft is used here. Fig. 5.1 E shows the first step in the construction of the honey comb weave on unequal ends and picks. Fig. 5.1 F shows the final design developed by incorporating a floating motif. Fig. 5.1 G shows the interlacement of design B.

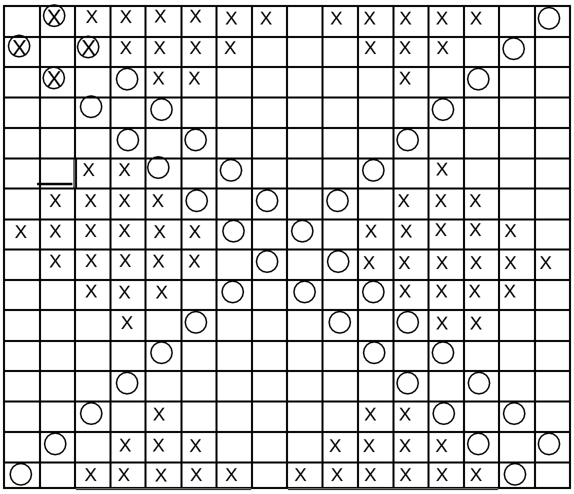
5.3 BRIGHTON HONEY COMB WEAVES

These weaves are characterized by the following features :

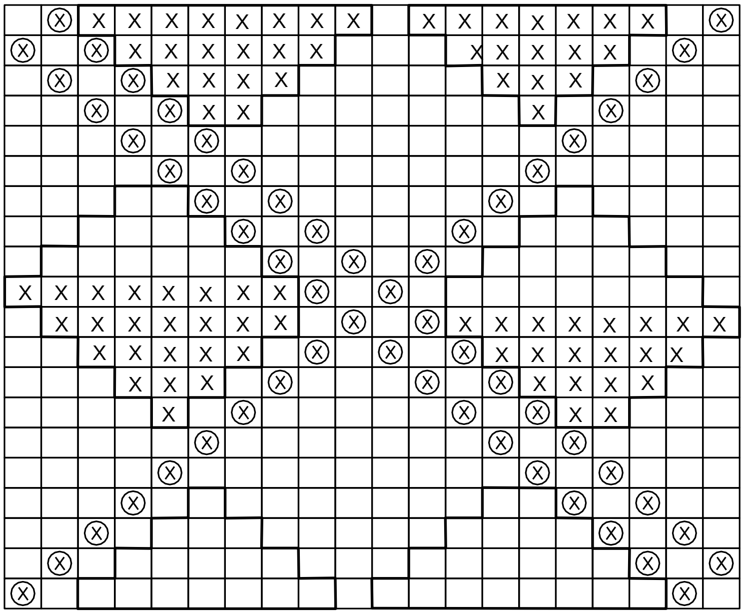
(a) Non-reversible cloths in which face appears different from back side of the cloth
(b) Constructed on straight drafts only
(c) Repeat size is a multiple of 4
(d) Length of longest float is N/2 – 1, where N is the repeat size
(e) A single diagonal line crosses a double diagonal line
(f) Formation of 4 cells per repeat i.e., two large and two small cells (ordinary honey comb forms only one cell per repeat)
(g) The number of threads in a repeat must be a multiple of 4.

Fig. 5.2 shows the construction of a brighton honey comb weave.





B



C

Fig. 5.2. *Brighton Honey Comb Weaves*

In the construction of Brighton honey comb weaves, a diamond base is first made by insertion of a single diagonal and then a double diagonal to cross it. Suitable motifs as shown in figure above are inserted inside the spaces of the diagonals. It is to be remembered that the length of the longest float in the motif should not exceed (N/2 – 1), where N is the size of the repeat of the weave. Figs. 5.2 B and C show brighten honeycomb designs constructed on repeat sizes of 16 & 20 respectively.

5.4 QUALITY PARTICULARS OF HONEY COMB WEAVES

The following cloth quality particulars are suitable for both ordinary and Brighton honey comb weaves,

For a heavy cloth,

Warp - 2/6s cotton

Weft - 2/6s cotton

Ends/inch - 50

Picks/inch - 20

For a lighter cloth,

Warp - 25s cotton

Weft - 16s cotton

Ends/inch - 88

Picks/inch - 82

5.5 END USES OF HONEY COMB WEAVES

The fabrics constructed from honey comb weaves have more thread floats on both sides and have a rough structure. This renders more absorption of moisture.

The weaves are, therefore, suitable for towels and also in various forms for bed covers and quilts.

REVIEW QUESTIONS

1. What are honeycomb weaves?
2. Classify the honeycomb weaves?
3. Mention the characteristics of ordinary honeycomb weaves.
4. Mention the characteristics of Brighton honey comb weaves.
5. Give the standard cloth quality particulars of honeycomb of lighter weight.
6. Give the standard cloth quality particulars of honey comb of heavier weight.
7. Mention the end uses of honey comb weaves.

EXERCISE

1. Give the design, draft and peg plan for an ordinary honey comb weave on a repeat size of 10 ¥ 10.
2. Give the design, draft and peg plan for an ordinary honey comb weave on a repeat size of 12 ¥ 12.
3. Give the design, draft and peg plan for an ordinary honey comb weave on a repeat size of 12 ¥ 10.
4. Give the design, draft and peg plan for an ordinary honey comb weave on a repeat size of 8 ¥ 12.
5. Give the design, draft and peg plan for a brighton honey comb weave on a repeat size of 8 ¥ 8.
6. Give the design, draft and peg plan for a brighton honey comb weave on a repeat size of 12 ¥ 12.
7. Give the design, draft and peg plan for a brighton honey comb weave on a repeat size of 24 ¥ 24.

PRACTICE

1. Analyse different varieties of ordinary honey comb fabrics for the various constructional particulars.
2. Analyse different varieties of brighton honey comb fabrics for the various constructional particulars.
3. Make a comparative study between the ordinary and brighton honey comb fabrics and observe how they differ from each other.

6

CHAPTER

Huck A Back Weaves

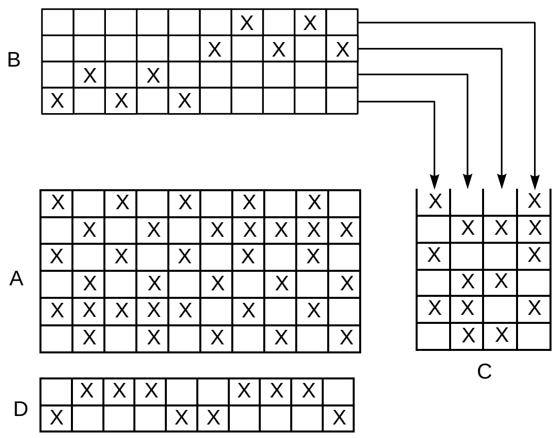
6.1 INTRODUCTION

The huck a back weaves are basically toweling fabrics. They are generally associated with honey comb fabrics and hence known as honeycomb effects. They are constructed by alternately combining a floating with a plain weave. Interestingly, a number of weaves are derived from these weaves. Huck a back weaves are suitable for producing thick and heavy textures. One of the well known heavier varieties of this class is the "Grecians". The design of huck a back weaves permits stripe and check effects to be brought out in the fabrics.

The huck a back weaves are generally characterized by the following features:

(a) Repeat is divided into four equal parts. Two parts are filled with plain weave and remaining two parts are filled with long float motif.
(b) Plain weave gives firmness to the cloth.
(c) Long float motif gives moisture absorbency.

The loom equipment required would ideally be a dobby loom fitted with a fast reed mechanism.



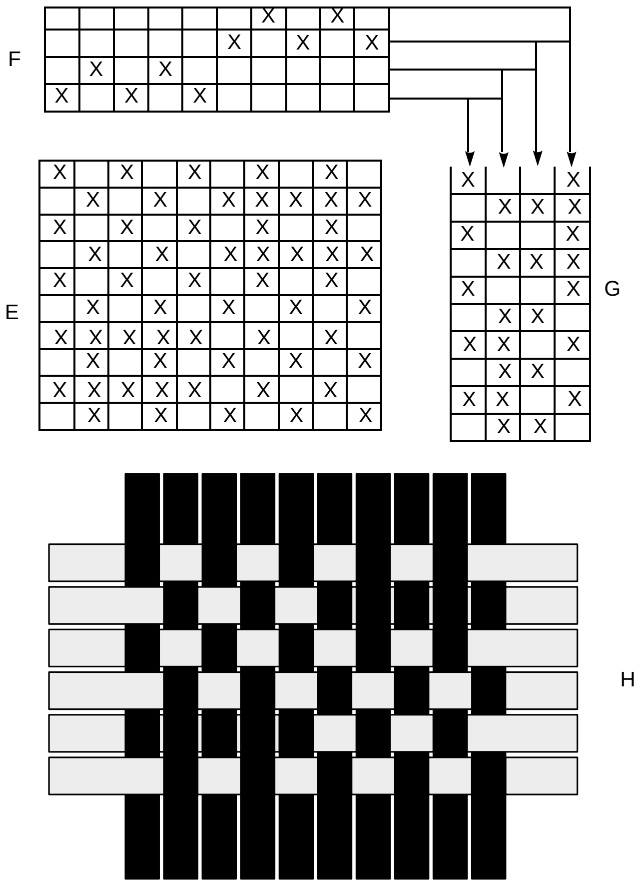


Fig. 6.1. *Design of Huck-A-Back Weave*

The standard types of huck a back weaves are shown in Figs. 6.1 A and E. Fig. A shows the design of a "Devon" thuck a back on 6 picks, which is used for lower grade of cloths and figure E shows the design of another type of huck a back suitable for finer qualities of cloths. Figure H shows the interlacement of design A.

6.2 END USES OF HUCK A BACK WEAVES

Huck a back weaves are largely employed in the manufacture of both linen and cotton towels for bath rooms, and also linen towels for use as glass cloths.

REVIEW QUESTIONS

1. Mention the basic features of huck a back weaves ?
2. Mention the loom equipments necessary for manufacturing huck a back weaves ?
3. Give the end uses of huck a back weaves?

EXERCISE

1. Give the design, draft and peg plan for a huck a back weave on a repeat size of 4 ¥ 12.
2. Give the design, draft and peg plan for a huck a back weave on a repeat size of 8 ¥ 8.
3. Give the design, draft and peg plan for a huck a back weave on a repeat size of 12 ¥ 12.
4. Give the design, draft and peg plan for a huck a back weave on a repeat size of 6 ¥ 14.
5. Give the design, draft and peg plan for a huck a back weave on a repeat size of 6 ¥ 16.
6. Give the design, draft and peg plan for a huck a back weave on a repeat size of 8 ¥ 12.

PRACTICE

1. Analyse different varieties of huck a back fabrics for various constructional particulars.

7

CHAPTER

Crepe Weaves

7.1 INTRODUCTION

Crepe weaves constitute an useful variety of simple weaves and are also known as "crape" or "oatmeal" fabrics due to their pebbly or crinkled (rough) surface. The size of the pebbles and their arrangement on the fabric surface determine the type of crepe fabric.

The crepe effect can be achieved either by the use of crepe yarns (highly twisted) or a crepe weave, and sometimes by special process of finishing, i.e., embossing. Crepe weaves are commonly used in combination with other elementary weaves, to produce a variety of various effects in elaborate jacquard designs for brocade and related fabrics.

The crepe weaves are characterized by the following features :

(a) They contain no twilled or other prominent effects
(b) The cloth is covered by minute spots or seeds
(c) Highly irregular surface-puckered in appearance
(d) High twist yarns are used with controlled shrinkage
(e) Formed mainly by four methods, though several methods are available.

Crepe weaves are constructed in a variety of forms based on the end use requirements and the type of texture desired. They are accordingly produced in light, medium and heavy constructions. Generally the count of the warp yarns used is finer than the weft yarn. The weave employed is of an irregular nature.

Though several methods are employed in the construction of crepe weaves, four methods are chiefly employed,

(i) Construction of crepe weaves upon sateen base
(ii) Combination of a floating weave with plain threads
(iii) By reversing a small motif
(iv) Insertion of one weave over another.

7.1.1 Construction of crepe weaves upon sateen base

In this case the base weave is a sateen, upon which a chosen weave is inserted to get the irregular effects. This is shown in Fig. 7.1.

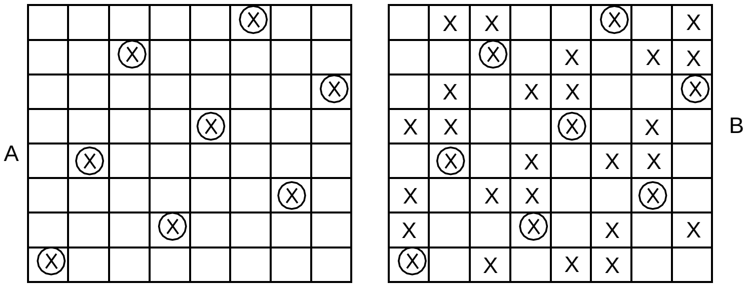


Fig. 7.1. *Crepe Weave upon Sateen Base*

At Fig. A, is shown the base sateen weave and at Fig. B, is shown the crepe effect obtained by insertion of a twill weave (3/1 and 1/3) upon the sateen base. The sateen weave has been marked with a different notation in order to identify the base weave.

7.1.2 Combination of a floating weave with plain threads

In this method a floating weave is inserted upon a plain weave to get the desired crepe effect as shown in Fig. 7.2.

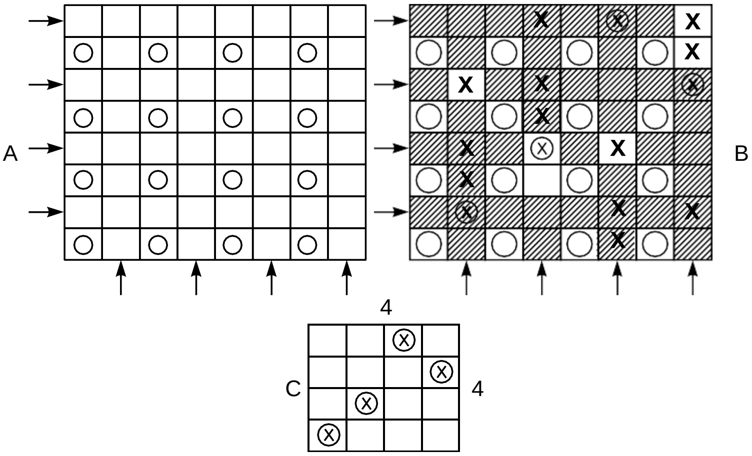


Fig. 7.2. *Combination of a Floatiing Weave with plain threads*

At Fig. A, is shown the insertion of plain weave. The arrow marks indicate the boxes where the floating weave is to be inserted. The floating weave chosen here is a combination of a 4 end sateen and a twill (2/1 and 1/3). At C, is shown the 4 end irregular sateen, separately.

7.1.3 By reversing of a small motif

In this method a simple motif can be chosen and reversed at intervals within the design repeat to get an irregular effect as shown in Fig. 7.3.

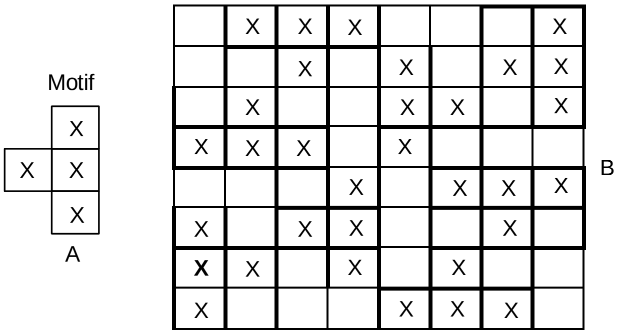


Fig. 7.3. *Construction of Crepe Weave by Reversing of a Small Motif*

At A, is shown a simple motif and at B, is shown the crepe designs obtained by reversal of the motif at regular intervals.

7.1.4 Insertion of one weave over another

In this method two different weaves are chosen and are inserted over one another to get the desired crepe effect as shown in the Fig. 7.4. In order to produce an irregular effect, atleast one of the weaves should be irregular and would be better if both are irregular. Sateen and sateen derivatives are generally used in this method.

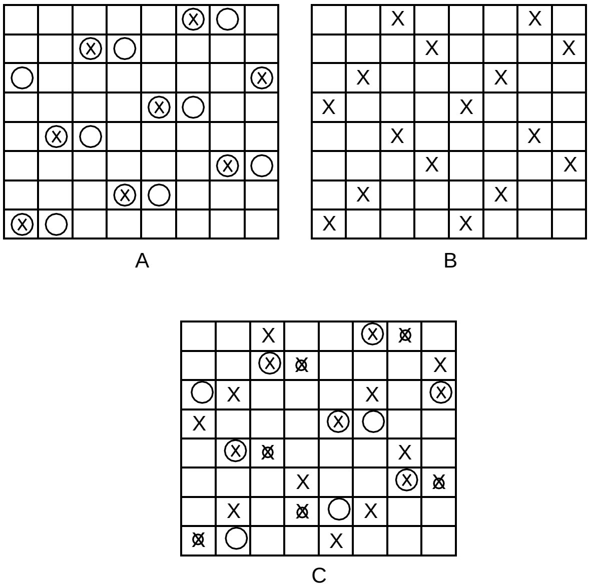


Fig. 7.4. *Construction of crepe weave by insertion of one weave over another*

In Fig. A, is shown a sateen derivative and in Fig. B, is shown a 4 end sateen. In Fig. C, is shown the crepe effect obtained by the insertion of A over B.

7.2 TYPICAL QUALITY PARTICULARS FOR A CREPE FABRIC

A typical type of a cotton crepe fabric of good quality and medium weight should have the following specifications :

Warp - 18s
Weft - 18s
Warp threads/inch - 56
Weft threads/inch - 56

Warp yarn should have a little more twist than the weft.

7.3 END USES OF CREPE WEAVES

Crepe weaves are frequently employed in conjunction with other elementary weaves, in order to produce a variety of different and contrasting effects in elaborate jacquard designs for brocade and similar fabrics. They are also employed in the production of cotton piece goods that are usually woven in the grey state, to be afterwards bleached and used for a variety of domestic purposes. Crepe fabrics are also sometimes printed with decorative designs and sold as a light and cheap material known as “cretonne”, which is employed extensively as loose coverings for furniture, antimacassars, covers, curtains and wall hangings, and for many other similar household articles.

REVIEW QUESTIONS

1. What are crepe weaves?
2. Mention the main features of crepe weaves?
3. Give the other name for crepe weave?
4. Name the different methods of constructing crepe weave.
5. Give the standard quality particulars for a crepe fabric.
6. Mention the practical utility of crepe weaves.
7. What do you understand by the term “cretonne”.

EXERCISE

1. Give the design, draft and peg plan for the following crepe weaves constructed upon sateen base
   (a) Twill weaves of 5/1 and 1/5
   (b) Twill weaves of 4/1 and 1/4
   (c) Twill weaves of 3/2 and 2/3
2. Give the design, draft and peg plan for the following crepe weaves constructed by combination of a floating weave with the plain threads
   (a) Twill weaves of 3/2 and 2/3
   (b) Twill weaves of 4/1 and 1/4
   (c) Twill weaves of 5/1 and 1/5
   (d) Twill weaves of 5/3 and 3/5
3. Give the design, draft and peg plan for the following crepe weaves constructed by reversing a small motif
   (a) Repeat size of 10 ¥ 10

(b) Repeat size of 12 ¥ 12
(c) Repeat size of 14 ¥ 14
(d) Repeat size of 16 ¥ 16

4. Give the design, draft and peg plan for the following crepe weaves constructed by insertion of one weave upon another
(a) A 5 end sateen derivative over a 5 end sateen
(b) A 3/1 twill over a 4 end sateen
(c) A 3/2 twill over a 5 end sateen
(d) A 3/1 twill over a 2/2 twill

PRACTICE

1. Analyse the different varieties of crepe fabrics constructed upon sateen bases. Give all the constructional particulars.

2. Analyse the different varieties of crepe fabrics constructed by reversal of motif. Give all the constructional particulars.

3. Analyze the different varieties of crepe fabrics constructed by combination of a floating weave with plain threads. Give all the constructional particulars.

4. Analyze the different varieties of crepe fabrics constructed by insertion of one weave over another.

8
CHAPTER
Bedford Cords

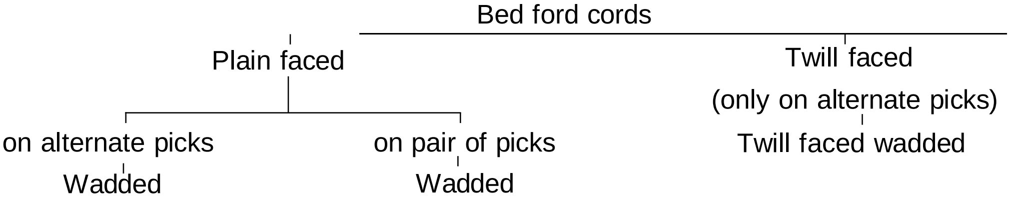
8.1 INTRODUCTION

The bed ford cords are a class of weaves that produce longitudinal warp lines in the cloth with fine sunken lines in between. They are constructed on a pair of picks or alternate picks. The cord weave is alternated by plain weave weft way. The cord effects so produced enable to bring out stripe effects in solid colours. Generally cotton and worsted yarns are used in the production of bed ford cords. Cotton is used in weaving of lighter textures while worsted is used in weaving of heavier textures. In the design of bed ford cords, two series of warp threads are considered. The first group constitutes the face threads which weave as cord and plain weave on alternate or pair of picks. The other group of threads known as cutting ends weave as plain. The cutting ends separate the neighbouring cords. The cords may be alternated by plain or twill weave weft way.

Sometimes special threads known as wadding threads are introduced in between the normal warp threads. The purpose of this is to increase the prominence of the cords and also to increase the weight, bulk and strength of the fabric. The wadding threads never interlace with weft, but lie perfectly straight between the ridges of their respective cords and the floating weft at the back. Generally wadding threads are of considerably coarser counts of yarn than the principal or face warp threads, and since they never interlace with weft but remain straight, their construction during weaving is nil. This condition necessitates the wadding threads being wound upon a separate warp beam, and held at greater tension than face warp threads during weaving.

8.2 CLASSIFICATION OF BED FORD CORDS

Bed ford cords are classified as shown below,



8.3 STANDARD QUALITY PARTICULARS

The following constructional particulars are suitable for Bedford cords used as worsted dress fabrics.

Warp : 2/20s
Weft : 18s
Ends/inch : 92
Picks/inch : 82

The following constructional particulars are suitable for a cotton twill faced Bedford cord (London cord).

Warp : 14s
Weft : 20s
Ends/inch : 86
Picks/inch : 78

8.4 LOOM EQUIPMENT

A dobby loom with fast reed and heavy beat up is suitable for manufacturing bed ford cord fabrics.

8.5 PLAIN FACED BED FORD CORDS

In this type, the cord or rib effect is produced by alternating plain weave with the cord either on alternate picks or a pair of picks. Fig. 8.1 shows the construction of a plain face Bedford cord on a pair of picks, and Fig. 8.2 shows a Bed Ford cord constructed on alternate picks**.**

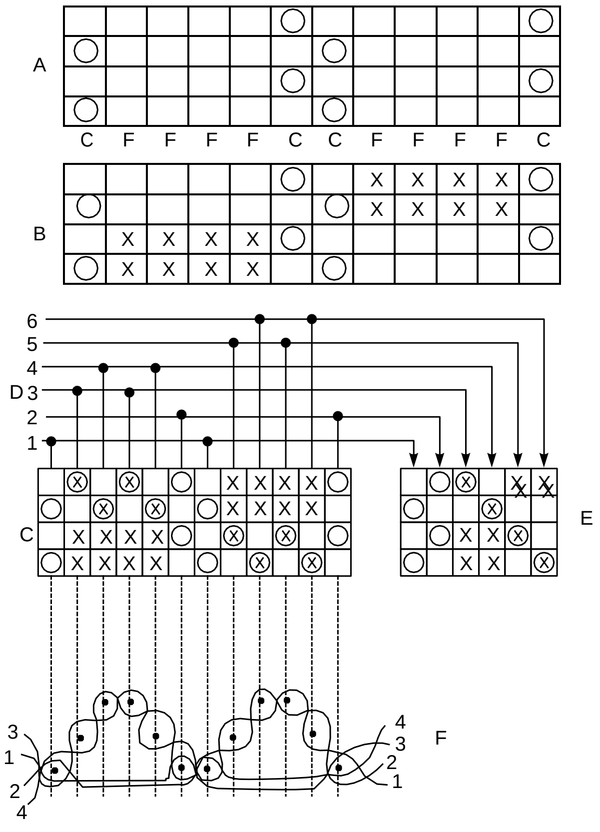


Fig. 8.1. *Construction of plain faced Bedford cord on a pair of picks*

In Fig. 8.1 A, is shown the repeat size of the Bedford cord. The repeat is split into cutting ends and face ends. The cutting ends weave plain and the face ends weave the cord. In Fig. A the insertion of the cutting ends are shown in the figure B, the insertion of the face ends are shown. Figs. C, D, E and F show the design, draft, peg plan and the cross section of the Bedford cord. At figure F, the interlacement of the various picks in the repeat with the face and the cutting ends are shown. In the example above the ratio of face ends to cutting ends is 2 : 4.

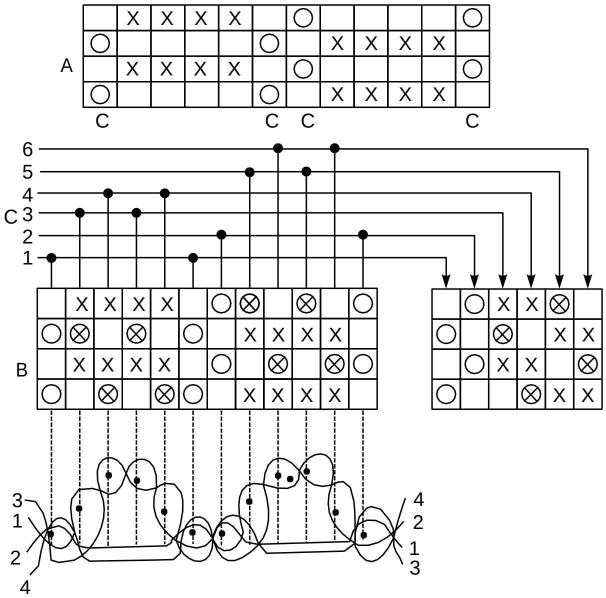


Fig. 8.2. *Construction of a plain faced bedford cord on alternate picks*

Fig. 8.2, shows the construction of a plain faced bed ford cord on alternate picks. Fig. A, shows the face and cutting threads. Fig. B, shows the insertion of plain weave on alternate picks to obtain the Bedford cord design.

Some wadded threads are introduced in between the face threads in order to increase the weight of the fabric or enhance the cord effect. The wadded threads so introduced will usually be coarser than the face threads and made of a cheaper material. A typical example is shown in Fig. 8.3.

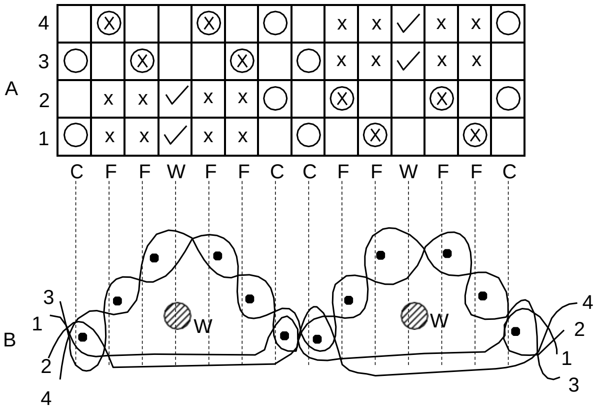


Fig. 8.3. *Construction of a plain 3 faced wadded Bedford cord design*

At A, is shown the design of plain faced wadded bed ford cord. The wadded threads are introduced at the middle in between the face threads. For the purpose of differentiation, the face, cutting and wadded threads are indicated by separate notations respectively. At C is shown the warp way cross section of the design.

8.6 TWILL FACED BED FORD CORD

In this type of cord, a twill weave is used instead of a plain weave, along with the cord or rib weave to get a better effect. In this type, the warp is brought more prominently to the surface. Figure 8.4, shows the design of a twill faced bed ford cord.

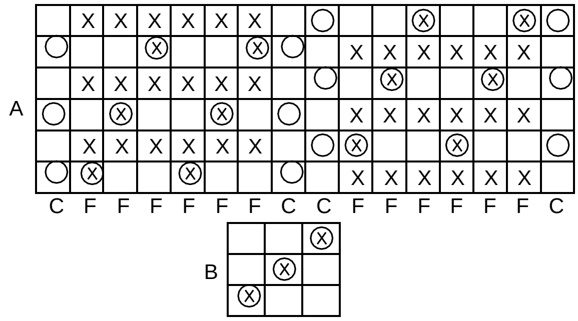


Fig. 8.4. *Construction of a twill faced Bedford cord design*

At figure A is shown the twill faced Bedford cord. The twill weave is inserted on alternate picks. At B, is shown the basic twill weave, which is a 1/3 twill. The repeat size of the cord is 16 ¥ 16 including the face and cutting ends.

Wadding threads can also be introduced as in the case of plain faced Bedford cords. This is shown in Fig. 8.5.

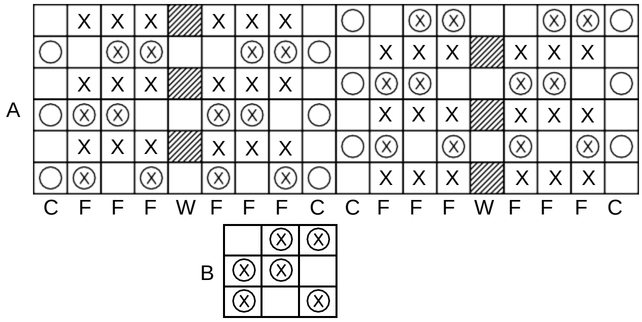


Fig. 8.5. *Design of a wadded twill faced bedford cord*

At A, is shown a wadded twill faced bed ford cord design. A 2/1 twill has been chosen(figure B) and inserted with the cord. The wadding threads are inserted in between the face threads and work with the cord threads. The wadded threads do not inter weave with the picks.

8.7 END USES OF BED FORD CORDS

Bed ford cords find a wide range of applications such as dress materials, military dresses, suitings, woolen and worsted fabrics (heavy type).

REVIEW QUESTIONS

1. Define the bed ford cord.
2. What are wadding threads? Mention their importance.
3. Classify bed ford cords.
4. Give the constructional particulars for a bedford cord suitable for worsted dress fabric.
5. Give the quality particulars for a London cord.
6. Bring out important distinctions between a plain and a twill faced bedford cord.
7. Mention the end uses of bedford cords.

EXERCISE

1. Discuss in detail the construction of Bedford cords and give their end use applications.
2. Give the design, draft, peg plan and cross section for a plain faced bed ford cord on a pair of picks. The ratio of face to cutting ends is 6:2.
3. Give the design, draft, peg plan and cross section for a plain faced bed ford cord on a pair of picks. The ratio of face to cutting ends is 8:2.
4. Give the design, draft, peg plan and cross section for a plain faced bed ford cord on alternate picks. The ratio of face to cutting ends is 6:2.
5. Give the design, draft, peg plan and cross section for a plain faced bed ford cord on alternate picks. The ratio of face to cutting ends is 8:2.
6. Give the design, draft, peg plan and cross section for a wadded plain faced bed ford cord on a pair of picks. The ratio of face to cutting ends and wadding is 6:2:2.
7. Give the design, draft, peg plan and cross section for a wadded plain faced bed ford cord on a pair of picks. The ratio of face to cutting ends and wadding is 8:2:2.
8. Give the design, draft, peg plan and cross section for a wadded plain faced bed ford cord on alternate picks. The ratio of face to cutting ends and wadding is 6:2:2.
9. Give the design, draft, peg plan and cross section for a wadded plain faced bed ford cord on alternate picks. The ratio of face to cutting ends and wadding is 8:2:2.
10. Give the design, draft, peg plan and cross section for a twill faced bed ford cord. The ratio of face to cutting ends 8:2. (use 2/2, 3/1 and 1/3 twills).
11. Give the design, draft, peg plan and cross section for a twill faced bed ford cord. The ratio of face to cutting ends is 10:2 (use 4/1, 3/2 , 2/3 and 1/4 twills).
12. Give the design, draft, peg plan and cross section for a wadded twill faced bed ford cord . The ratio of face to cutting ends and wadding is 8:2:1.
13. Give the design, draft, peg plan and cross section for a wadded twill faced bed ford cord . The ratio of face to cutting ends and wadding is 12:2:3.

PRACTICE

1. Analyse the different varieties of Bedford cord fabrics for the various constructional particulars. Also identify the method of construction.
2. Identify the manner of interlacement of the wadding threads.
3. Identify the various types of twills used in the construction of Bedford cords.
4. Check and compare the yarn linear densities of face, cutting and wadding threads.

9

CHAPTER

Welts and Piques

9.1 INTRODUCTION

Welts and piques are characterized by more or less pronounced ridges and furrows producing a series of ribs, welts or cords with a surface tissue of the plain calico weave, and extending in parallel lines transversely across the width of the fabric, i.e., in the direction of the weft threads. A pique structure consists of a plain face fabric composed of one series of warp and one series of weft threads, and a series of back or stitching warp threads. The stitching ends are placed on a separate beam which is heavily weighted to provide greater tension to the stitching warp.

The loom equipment necessary for manufacturing pique structures are a dobby loom with two warp beams (one for face warp under normal tension and another for stitching warp under heavier tension), a fast reed beat up mechanism and drop boxes (2 ¥ 1 or 2 ¥ 2), for wadded designs.

The tight stitching ends are interwoven into the plain face texture, with the result that the latter is pulled down and an indentation is formed on the surface. In order to increase the prominence of the unstitched portions of the cloth, wadding picks are normally inserted between the tight back stitching ends and the slack face fabric.

Pique fabrics are mainly manufactured entirely of cotton woven in the grey or natural state and then bleached. They are produced in a variety of different textures, according to the purpose for which they are intended.

9.2 STANDARD QUALITY PARTICULARS

Face warp : 30s - 60s
Stitching warp : 20s - 2/30s
Weft : 40s - 70s
Ends/inch : 92 - 132
Picks/inch : 96 - 152

9.3 CLASSIFICATION OF WELT STRUCTURES

Welt structures are classified as shown below :

- Welts
  - Ordinary welts
  - Weft wadded welts
    - Loose back welt
    - Fast back welt

9.3.1 Ordinary welt structures

In these types of welt structures the indentations form continuous sunken lines which run horizontally in the cloth. The number of face picks in the width of a cord is varied according to requirements, but usually the number of consecutive picks that are unstitched should not exceed twelve. Figure 9.1 shows the design of ordinary welt structures.

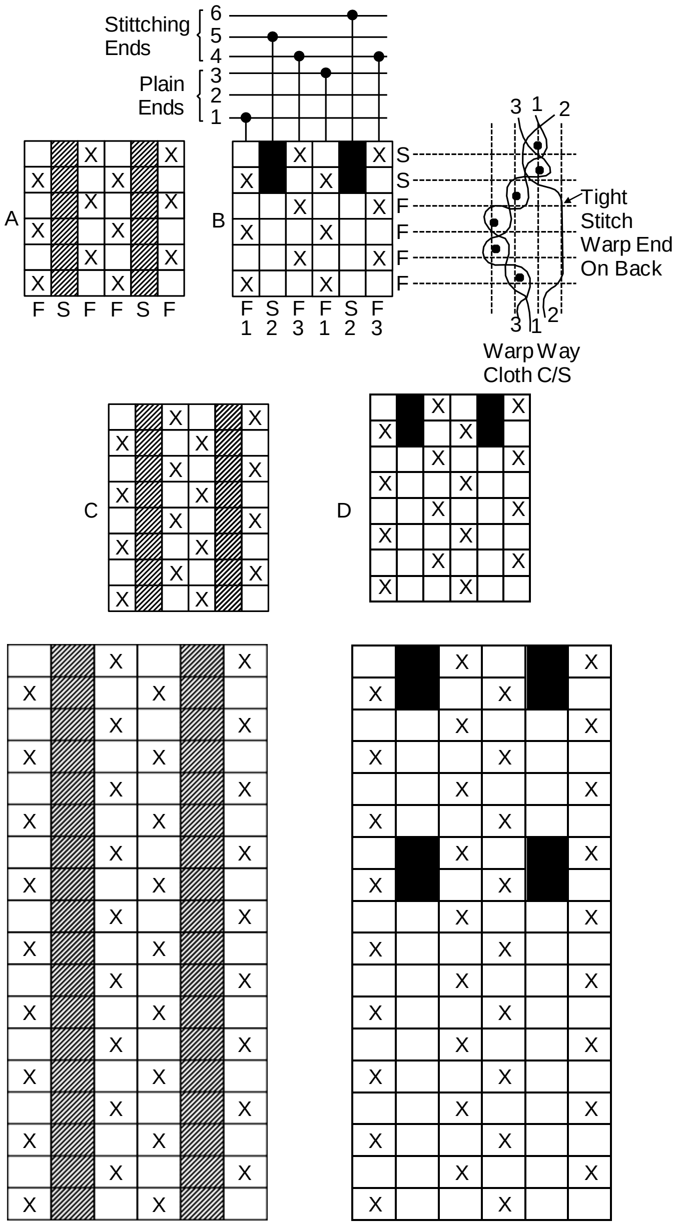


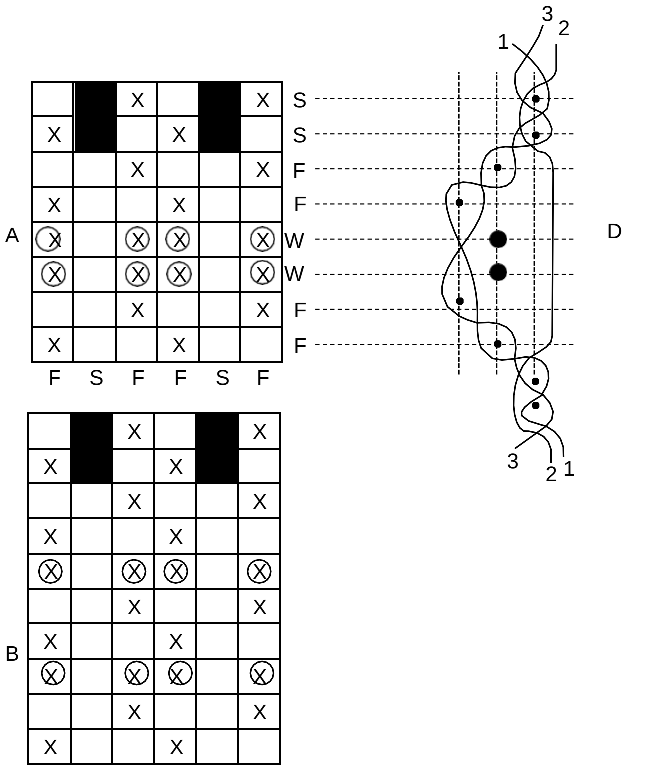
Fig. 9.1. *Design of ordinary welt structure*

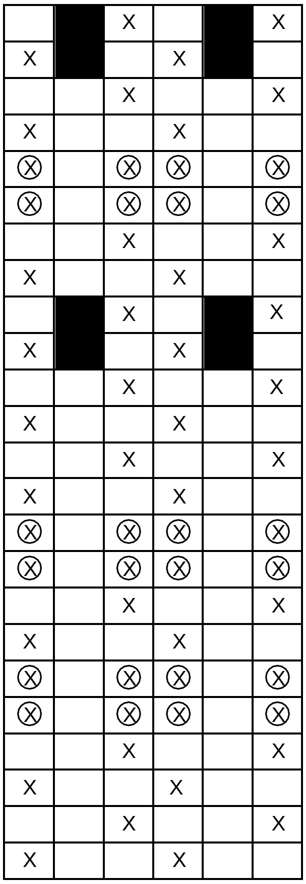
In the above figure, is shown some ordinary welt structures. Figs. A, C and E show the first stage in the construction of ordinary welt structures and Figs. 9.1 B, D and F show the corresponding final designs. The three different welt designs shown above are constructed on repeats of 6, 8 and 18 picks respectively. The ratio of the face to stitching warp is 2 : 1. The stitching ends are indicated by shaded squares. The ends are arranged in the order of one face, one stitching and one face, in each split of the reed. In the final designs B, D and F, the solid marks indicate the lifts of the tight stitching ends into the plain face texture on two consecutive picks.

9.3.2 Weft wadded welts

In the case of welt structures wadding threads can be introduced weft way. The object using the wadding threads is to enhance the prominence of the horizontal cords, and to make the cloth heavier. The wadding weft is coarser than the ground weft and is inserted as a pair of picks at a place. This is achieved with looms provided with multiple shuttle boxes at one side only. The face ends are lifted over the wadding picks, while the stitching ends are left down. Sometimes, the same kind of weft is used for both the face and the wadding. In such cases looms with a single box at each side are employed, and in such cases, one wadding pick at a place may be inserted.

Wadding picks are inserted only as extra picks and the take up motion is either rendered inoperative on wadding picks, or it is worked out in terms of the face picks only. Fig. 9.2 shows the various designs of weft wadded welt structure.





C

Fig. 9.2. *Design of weft wadded welt structure*

Fig. A, B and C show the design of weft wadded welts repeating on 8, 10 and 24 picks respectively. The stitching warp is indicated by the solid shade, the wadded thread by circled cross mark and the plain threads by cross mark. As can be seen from the designs, the stitching takes place on three picks. Figure D shows the weft way cross sectional view of design A.

9.3.3 FAST BACK WELTS

In these types of structures the stitchings are interwoven in plain order with all, or some wadding picks. Whereas in 'loose back' type of structures (previous two types) the stitching ends are only lifted to form the indentations. In case of fast back welts, the reduction of the float length of the stitching ends on the back of the fabric helps to produce a more serviceable cloth less liable to accidental damage. Fig. 9.3 shows the design of a fast back welt structure.

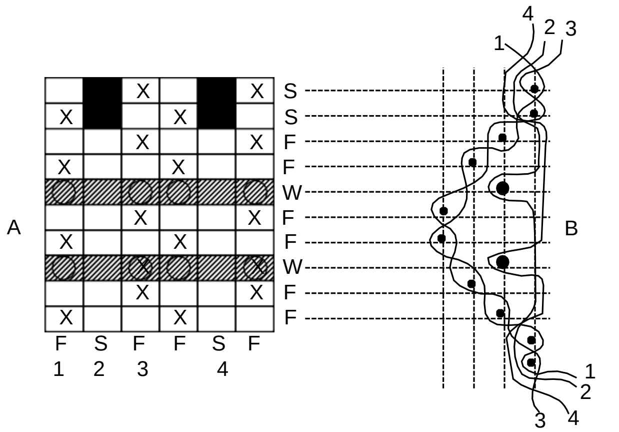


Fig. 9.3. *Design of fast back wadded welt structure*

Figure A shows the design of a fast wadded welt structure and figure B, shows the weft welt cross-section. The numbered threads represent the face and stitching warp.

9.4 END USES OF WELTS

Welts find uses in shirtings, ties and vestings.

REVIEW QUESTIONS

1. What are welts?
2. Differentiate welts and Bedford cords.
3. Mention the loom equipment necessary for manufacturing pique structures.
4. Give the quality particulars for a typical welts structure.
5. How are welt structure classified?
6. Differentiate fast and loose back welt structure.
7. Mention the role of wadding threads in the design of welt structure.
8. Give the practical utility of welts.

EXERCISE

1. Give the design, draft, peg plan and cross section for an ordinary welt structure with a repeat size of 6 ¥ 10. Assume that the stitching ends float over 2 picks.
2. Give the design, draft, peg plan and cross section for an ordinary welt structure with a repeat size of 6 ¥ 14. Assume that the stitching ends float over 4 picks.
3. Give the design, draft, peg plan and cross section for a weft wadded welt structure with ratio of face to stitching and wadded picks as 6 : 2 : 2.
4. Give the design, draft, peg plan and cross section for a weft wadded welt structure with ratio of face to stitching and wadded picks as 12 : 4 : 2.
5. Give the design, draft, peg plan and cross section for a fast back wadded welt structure with ratio of face to stitching and wadded picks as 8 : 2 : 2.

6. Give the design, draft, peg plan and cross section for a fast back wadded welt structure with ratio of face to stitching and wadded picks as 12 : 4 : 2.

PRACTICE

1. Analyze the different types of welt fabrics for the important constructional particulars.
2. Identify the type of welt structure in the fabric.
3. Check the ratio of the weft picks in the welt structures.
4. Check and compare the linear densities of the yarns used for face and wadded picks.

10
CHAPTER
Mock Leno Weaves

10.1 INTRODUCTION

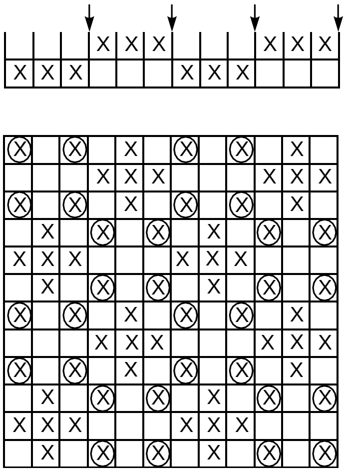
Mock lenos, also known as imitation lenos are a variety of weaves of ordinary construction which produce effects that are similar in appearance to the gauze or leno styles obtained with the aid of doup mounting. These weaves are generally produced in combination with a plain, twill, satin or other simple weaves or even with brocade figuring, to produce striped fabrics, which bear a very close resemblance to true leno fabrics. Two kinds of structures are produced by the weaves,

(i) Perforated fabrics which imitate open gauze effects

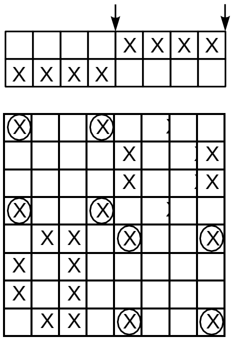
(ii) Distorted thread effects which imitate spider or net leno styles.

10.2 PERFORATED FABRICS

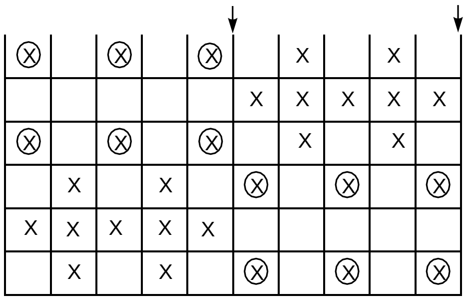
These are constructed by reversing a small unit of the weave. The weaves are in sections and tend to oppose each other. The outer threads of adjacent sections tend to be forced apart. The manner of interweaving in each section permits the threads to readily approach each other. Fig. 10.1 shows the various types of perforated fabric designs.



A



B



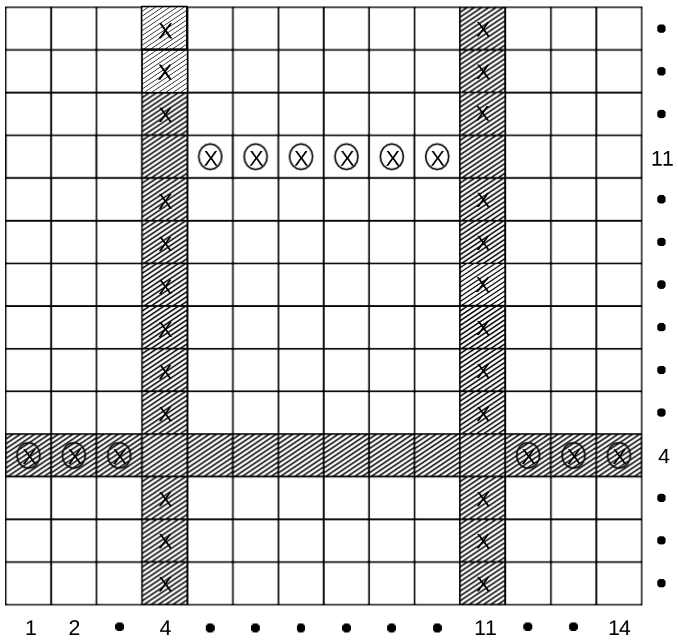
C

Fig. 10.1. *Design of perforated fabric*

Figures A, B and C show the 3 ¥ 3, 4 ¥ 4 and 3 ¥ 5 imitation gauzes. The warp threads run in groups with a space between, and are crossed by weft threads which are grouped together in similar manner. The designs A, B and C are dented 3, 4 and 5 ends respectively per split as shown above the plans. The arrows above the denting plans indicate the positions of the empty splits.

10.3 DISTORTED THREAD EFFECTS

The weaves of this category are so arranged to distort certain threads in either the weft or the warp, or in both weft and warp. The distorted thread effects are shown in Figs. 10.2 and 10.3.



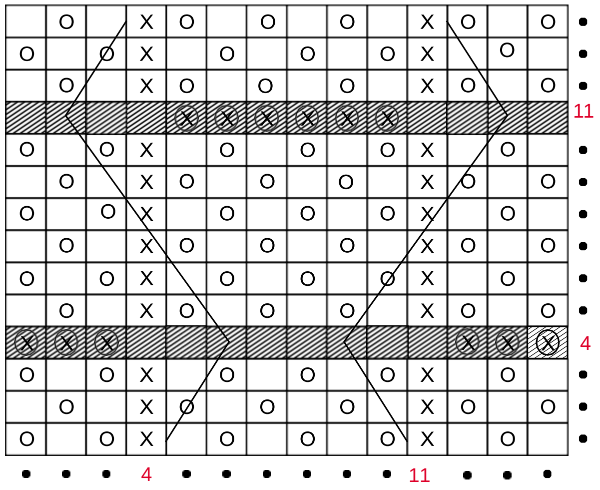


Fig. 10.2. *Design of warp way distorted mock leno weave*

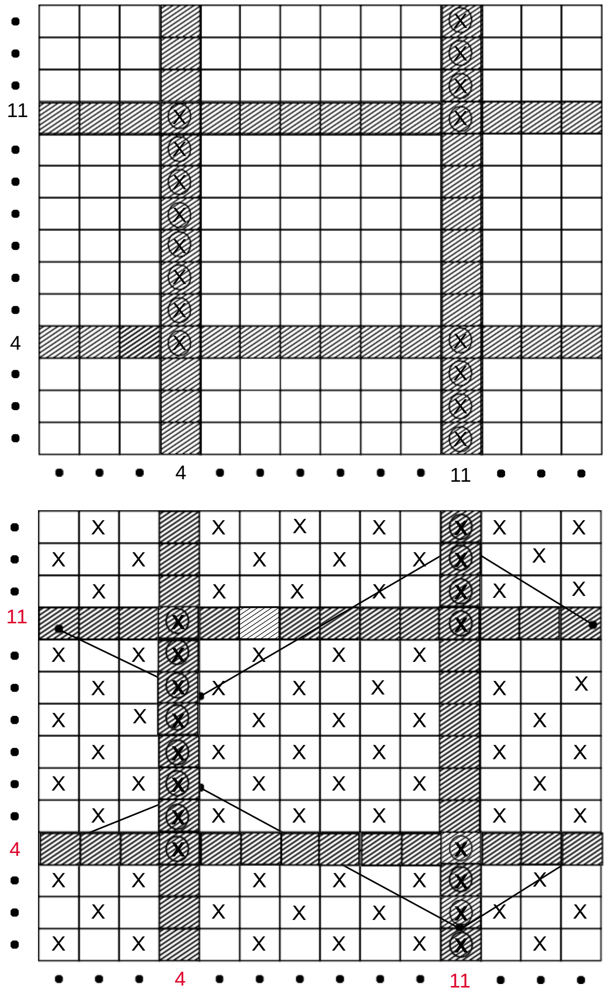


Fig. 10.3. *Design of weft way distorted mock leno weave*

In Fig. 10.2, the ground structure is plain weave, and the fourth and eleventh ends, which are distorted, float over all the plain picks, but pass under the fourth and eleventh picks. The latter float over one group of plain ends, and under the next group in alternate order. The distorted ends are placed on a separate beam and are given in more rapidly than the ground ends and hence they are drawn towards each other where the picks four and eleven, float over the ground ends. As the latter floats occur in alternate order, the ends are drawn together in pairs, and then separated, as indicated by the zig zag lines.

The distorted warp effects are chiefly used in combination with other weaves in stripe form. When used in stripe form the ends which form the zig zag effect should be somewhat crowded in the reed.

Figure 10.3, shows a distorted weft design. The design is arranged with plain ground similar to that in fig. 10.2. The floating ends pass over all the distorted picks, and alternately over the ground picks between. Therefore the distorted picks, which float over all the ground ends, are alternately drawn together and separated, as shown by the zig zag lines of Fig. 10.3.

10.4 END USES OF MOCK LENOS

Mock lenos find uses in canvas cloths, cheap fabrics for window curtains, light dress fabrics, blouses, aprons etc. In many cases, they are generally employed in combination with other weaves.

REVIEW QUESTIONS

1. What are mock lenos?
2. Mention the types of mock lenos.
3. How are perforated fabrics constructed?
4. What are the basic methods adopted in producing distorted thread effects?
5. Give the practical utility of distorted warp designs.
6. Give the end uses of mock leno weaves.

EXERCISE

1. Give the design, draft, peg and denting plan for a perforated type of mock leno on a repeat of 8 ¥ 4.
2. Give the design, draft, peg and denting plan for a perforated type of mock leno on a repeat of 14 ¥ 6.
3. Give the design, draft, peg and denting plan for a perforated type of mock leno on a repeat of 10 ¥ 10.
4. Give the design, draft, peg and denting plan for a perforated type of mock leno on a repeat of 6 ¥ 6.
5. Give the design, draft, and peg plan for a warp way distorted mock leno on a repeat of 18 ¥ 18. Assume that the 5th and 13th ends are to be distorted over the respective picks.
6. Give the design, draft, and peg plan for a warp way distorted mock leno on a repeat of 24 ¥ 24. Assume that the 8th and 17th ends are to be distorted over the respective picks.
7. Give the design, draft, and peg plan for a weft way distorted mock leno on a repeat of 18 ¥ 18. Assume that the 5th and 13th picks are to be distorted over the respective ends.
8. Give the design, draft, and peg plan for a weft way distorted mock leno on a repeat of 24 ¥ 24. Assume that the 8th and 17th picks are to be distorted over the respective ends.

PRACTICE

1. Analyze the different qualities of perforated mock leno fabrics for the various constructional particulars.
2. Check the order of denting in each type of the above fabrics.
3. Analyze the different qualities of warp distorted mock leno fabrics for the various constructional particulars.
4. Check the order of distortion of the warp over the weft threads.
5. Analyze the different qualities of weft distorted mock leno fabrics for the various constructional particulars.
6. Check the order of distortion of the weft over the warp threads.

11

CHAPTER

Backed 7abrics

11.1 INTRODUCTION

The backed fabrics are those types which employ a face and back weave alternatively on the two sides of the cloth. These weaves may be of a reversible or non reversible nature. These types of fabrics are mainly constructed for two purposes :

(i) Increasing the warmth retaining qualities of the cloth

(ii) Secure a greater weight and substance that 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 appears to be 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.

The purpose of inserting threads in forming a back to a face fabric is only to give additional weight. 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 backed warp principle. In the case of warp backed cloth there are two series of warp threads and one series of weft threads, and in the case of weft backed cloth there are two series of weft threads and one series of warp threads.

11.2 PRINCIPLE OF CONSTRUCTION

The construction of backed fabrics involves the following stages,

(i) The face and back threads are marked out on design paper. They are marked out according to the order of insertion.

(ii) The face weave is inserted on the face threads only using normal convention for warp backing and reverse convention for weft backing.

(iii) The back weave is inserted on back threads only using the normal and reversed convention. A mark is placed on the back weave between two long floats of the face weave. This hides the binding marks of the back weave by covering float on the face.

In reversible structures the binding marks of the face weave should be equally well concealed on the back. This is achieved by a suitable choice of face and the back weaves.

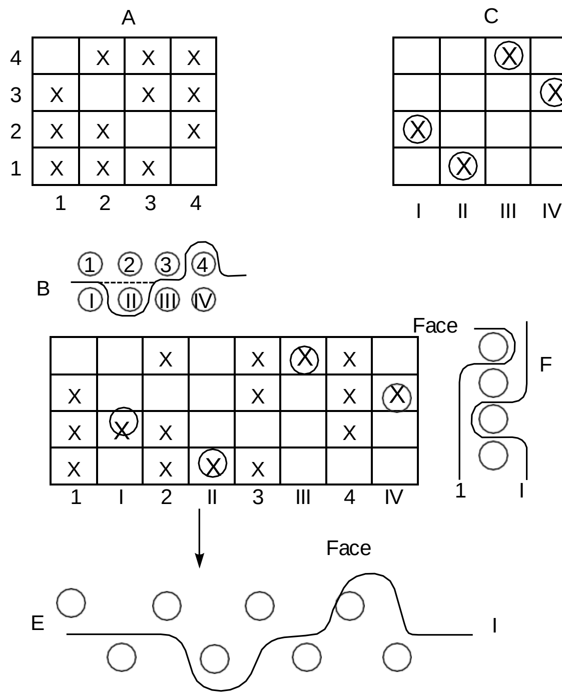
Warp faced weaves are more suitable for warp backing and weft faced weaves for weft backing , while certain square faced weaves can be successfully applied to both structures. In order to get a well covered face in the back cloth, correct settings are very important as without sufficient density of the face threads, the binding marks of the back weave cannot be covered, no matter how clearly they are placed.

11.3 WARP BACKED FABRICS

These fabrics are produced by alternately weaving two similar or different warp faced weaves. The objective of such a technique is to get greater thickness or mass of the fabric without using coarser yarns. For constructing warp backed fabrics two systems of warp and one system of weft is required. One series of warp threads constitute the face warp and the other constitutes the back warp. Obviously two warp beams are required. The ratio of the face to back warp threads is generally 1:1. Sometimes a ratio of 2:1 is also adopted.

The first step in the construction of warp backed fabric is the selection of the face weave. The next step is to choose the back weave. The back weave is selected so as to leave long weft floats on the back side in order to lower the back warp threads. Hence a warp faced weave is chosen for both the face and back threads.

A design of warp faced back weave is shown in Fig. 11.1 below.



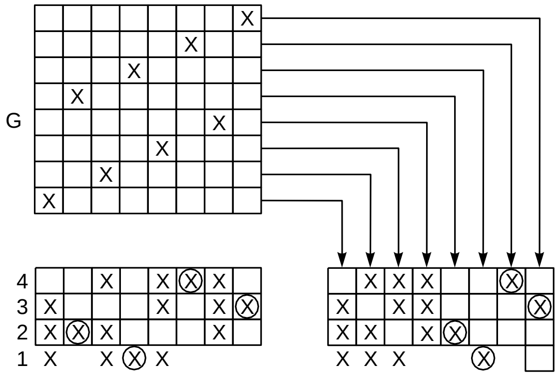


Fig. 11.1 *Design of warp backed weave*

A 3/1 twill is chosen as the base weave for both the face and back weaves. At A is shown the face weave and at C is shown the back weave. The design at C is a 3/1 twill as seen from back side and is 1/3 as viewed from the face side. For clarity the face and back warps are denoted by arabic and roman numerals respectively. The figure B shows the warp way cross section with the first pick as reference to show the manner of interlacement. As can be seen from this cross section, the first pick of weft goes below the face warp threads 1, 2 and 3 and above 4 respectively. The weft also goes above the back warp threads I, III and IV and below II respectively. It can be seen that the warp thread II is the binding point for the weft. This has been chosen since the binding point comes in the middle. The point of intersection of the weft thread 1, 2, 3 and 4 with the back warp threads I, II, III and IV respectively is denoted by the circled cross mark in diagram C.

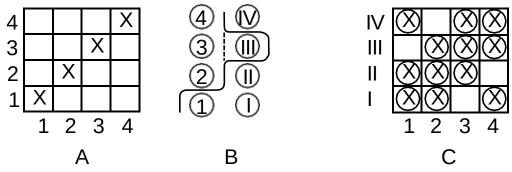
The face and back warp threads are arranged alternately in the ratio of 1:1 as shown at D. At E is shown the warp way cross section of the warp backed fabric. It is to be noted that this is the same as the one shown at B. The weft way cross section is shown at F. At G is shown the complete weaving plan of the warp backed design. The draft used here is a divided draft, since two sets of warp threads are used in the design.

11.4 WEFT BACKED FABRICS

In these types of fabrics two series of weft threads and one series of warp threads are used. A drop box is necessary for the purpose. The purpose of introducing back weft thread is to obtain additional weight or thickness of fabric. The face weft threads are placed in the upper layer of the fabric and the back weft threads are placed in the lower layer of the fabric.

As in the case of warp backed weave, the first step is selection of the base weave. This may be either a warp or weft faced weave. A weft faced weave is suitable since it has longer warp floats on the back side.

A design of weft faced back weave is shown in Fig. 11.2



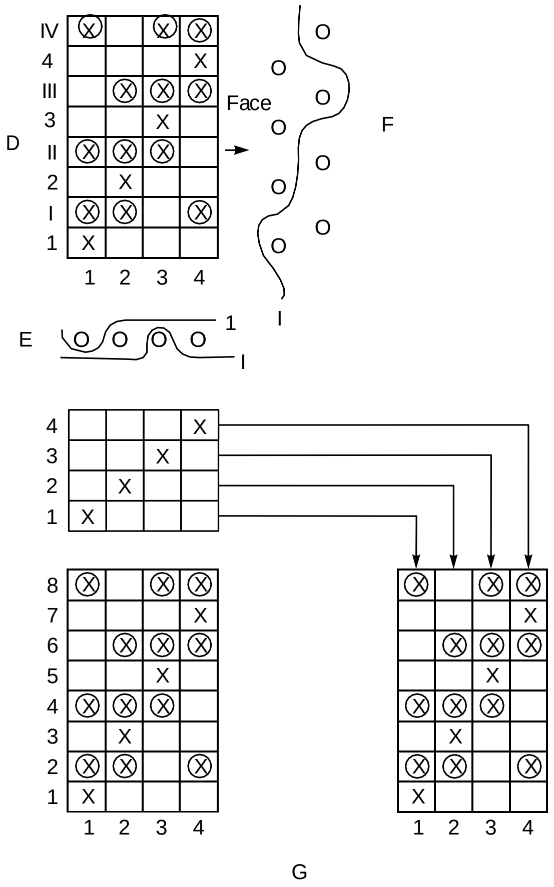


Fig. 11.2 *Design of weft faced back weave*

At A is shown a 1/3 twill which is weft faced. B shows the weft way cross section of the weft backed design. As in the case of warp backed fabric the most suitable stitching point is in the middle of the float. The face and back weft are denoted by arabic and roman numerals respectively. The binding point of the first warp thread is by lowering below the weft thread III. C shows the back weft design with the suitable stitching points based on Fig. B. D shows the final design of the weft backed fabric by alternating the face and back weaves in the ratio of 1:1 weft way. F shows the weft way cross section which is the same as B. E shows the warp way cross section. G shows the weaving plan of the design. Since only one series of warp threads is used a straight draft is employed.

11.5 COMPARISON BETWEEN WARP BACKED AND WEFT BACKED FABRICS

Weft backed fabrics	Warp backed fabrics
1. Softer and more lofty handling cloth can be obtained. This is due to weft containing less twist and being under less tension than the warp.	**1.** Less softer and loftier handle when compared to weft backed.

(*Contd.*)

Weft backed fabrics	Warp backed fabrics
2. Requires one warp beam and drop box (2 ¥ 1)	**2.** Requires two warp beams and no drop box.
3. Costlier to produce due to more picks/cm	**3.** Cheaper to produce owing to less picks/cm
4. Impossible to produce a solid appearance.	**4.** A more solid appearance can be given to the cloth by the formation of stripe patterns on the underside.
5. Lower strength warp way	**5.** Greater strength warp way.
6. Inferior from structural point of view	**6.** Superior from structural point of view.
7. Low quality of backing yarn can be used in weft due to less strain on yarn	**7.** Low quality of yarn cannot be used in warp due to greater strain in weaving
8. Drawing in is cheaper due to less number of ends	**8.** Drawing in is a costlier operation since there are more number of ends
9. Drafts are simpler	**9.** Drafts are usually more complicated, and a greater number of healds are required in producing similar effects
10. The standard orders of arranging the picks are – 1 face to 1 back, 2 face to 1 back, 3 face to 1 back, 2 face to 2 back, 4 face to 2 back	**10.** The standard order of arranging the ends in warp backed cloths are – 1 face to one back, 2 face to 1 back and 3 face to 1 back.

11.6 END USES

Backed fabrics find uses in shawls, heavier dress materials, overcoats etc.

12
CHAPTER
Pile 7abrics

12.1 INTRODUCTION

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.

12.2 CLASSIFICATION OF PILE FABRICS

The classification of pile fabrics is given below :

- Pile fabrics
  - Weft pile fabrics or Velveteens
    - All over or plain
    - Weft plushes
    - Corded Velveteens or Corduroys/Fustians
    - Figure Velveteens
  - Warp pile fabrics or Velvets
    - Terry piles
    - Wire piles
      - Fast Structures
      - Loose Structures

12.3 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.

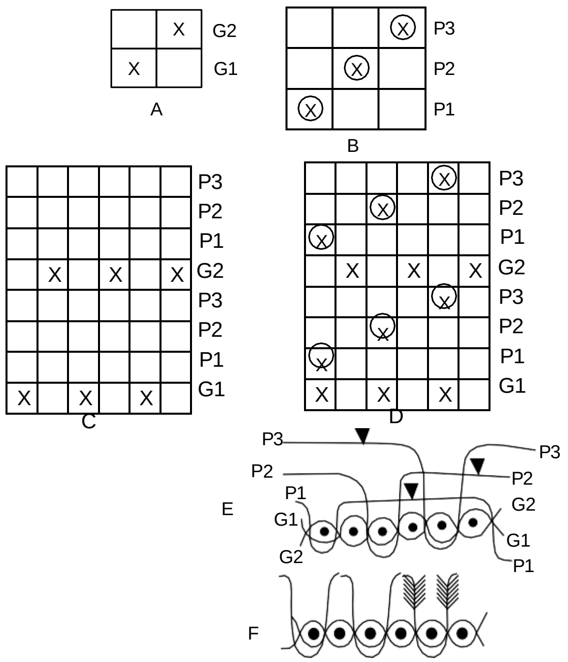
12.4 TYPES OF VELVETEENS

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

12.5 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 :



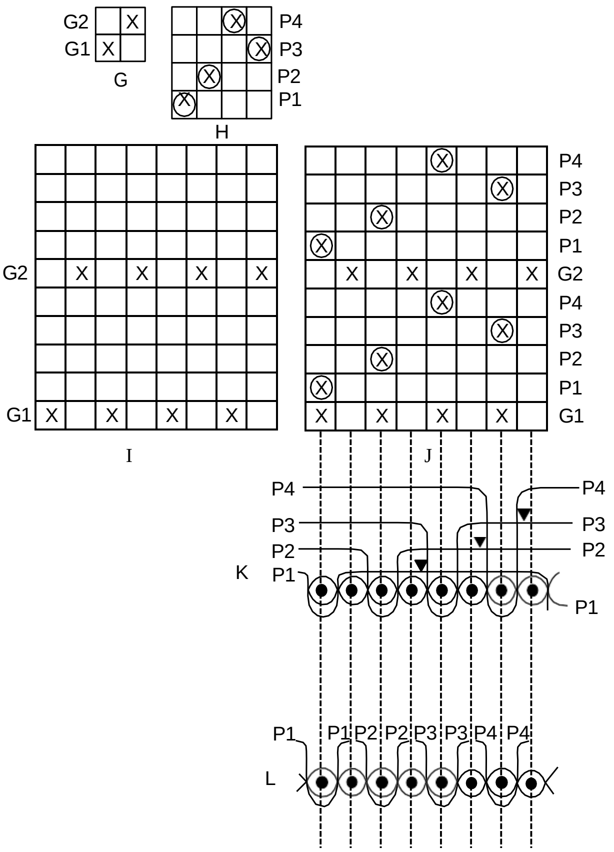


Fig. 12.1 *Design of Plain Back Velveteen*

In Fig. 12.1 is shown two designs of plain back velveteens. A indicates the plain weave which forms the ground and B shows the design of 1/2 twill which forms the pile. C shows the insertion of the ground weave and D shows the final design. E indicates the warp way cross section with cutting points for the pile, and F shows the open fringes of the cut piles.

Diagrams G to L indicate the various stages of constructing another design of the plain back velveteen. G shows the design for ground and H, a four end irregular sateen for the pile design. I shows the insertion of the ground weave, J the final design and K and L show the uncut and cut pile cross sections respectively.

12.6 STANDARD QUALITY PARTICULARS

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

Warp count - 2/30s cotton
Ends/inch - 72
Weft count - 50s cotton
Picks/inch of ground weft - 82
Tufts/sq.inch - 1060
Weft contraction - 12.5%

12.7 PLAIN VELVETEEN WITH FAST PILE STRUCTURES

In these types of structures the pile is firmly bound to the ground structure so that the fringes of the pile do not easily come out of the foundation. The firmness of the pile is generally influenced by the pick density. The longer the pile length the greater the pick density required. The advantage of the fast pile structures is that firmness of pile is achieved with lesser pick densities . Firmness of the pile improves the cloth quality with respect to serviceability.

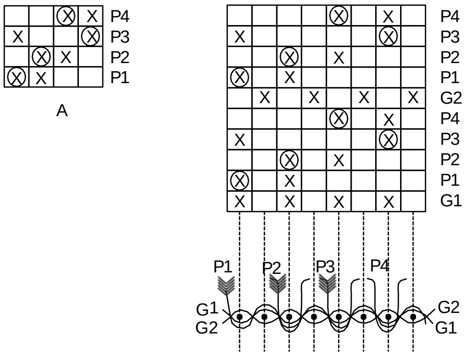


Fig. 12.2 *Design of fast pile structure*

In the earlier design, the tufts are bound in by one end 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 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 a 'fast pile' as shown in fig 12.2.

12.8 TWILL BACK VELVETEENS

As twill weaves have lesser number of intersections compared to the plain weave, a twill back velveteen having twill as the ground structure will have lesser firmness of structure compared to the plain back velveteen. As a result the twill back velveteens require higher pick densities than the plain back velveteens to give the same firmness. However the twill back velveteens have a softer feel and are more flexible. The standard design for a popular type of velveteen (Genoa back) is shown in Fig. 12.3 below.

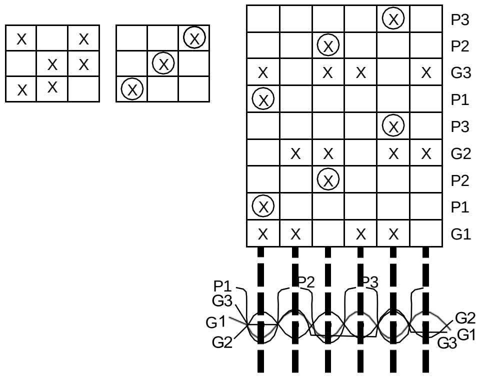


Fig. 12.3 *Design of twill back velveteen*

12.9 CUTTING AND QUALITY 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 varied by 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%.

12.10 STANDARD QUALITY PARTICULARS FOR ALLOVER VELVETEEN

The standard quality particulars of some well known all over velveteens is given below

For plain back velveteen

Warp count - 2/30s
Weft count - 40s
Ends/inch - 72
Picks/inch - 304
(including pile and ground)
Pile density/sq. inch - 1016
Crimp of weft - 15%

For a twill back velveteen

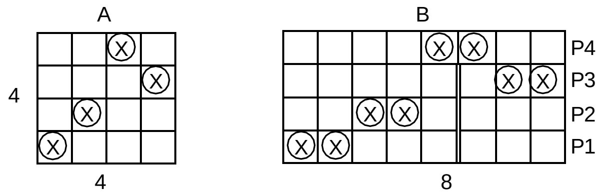
Type 1	**Type 2**
Warp count - 2/10s	Warp count - 2/36s
Ends/inch - 38	Ends/inch - 72
Weft count - 16s	Weft count - 60s
Picks/inch - 244*	Picks/inch* - 520
Tufts/sq.inch - 400	Tufts/sq.inch - 1880
Weft crimp - 17%	Weft crimp - 17%

* includes ground and pile picks

12.11 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.

The design of weft plushes is given in Fig. 12.4



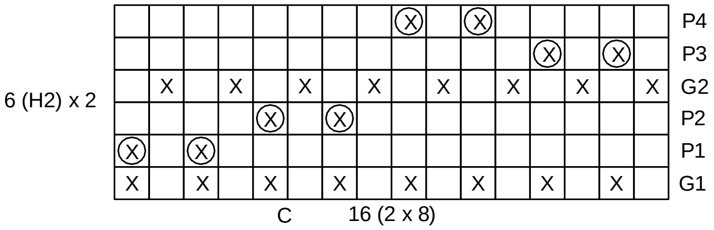


Fig. 12.4 *Design of a Weft Plush*

In the figure above the ground weave is plain. Fig. A shows the basic design for the pile weave, which is a 4 end irregular sateen. This has been extended by 2 in figure B and shown in the final design at C.

12.12 QUALITY PARTICULARS

The standard particulars for a typical weft plush weave are given below:

Warp count - 2/20s cotton

Ends/inch - 48

Picks/inch* - 214

Count of ground weft - 24s cotton

Count of pile weft - 18s acrylic

* Includes ground and pile weft

12.13 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 is 2:1. The design of a corded velveteen is shown in Fig. 12.5.

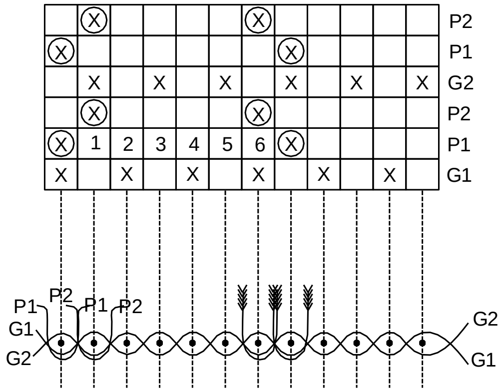


Fig. 12.5 *Design of Corded Velveteen*

In the figure above the pile picks are bound in plain order on two consecutive ends. Designs may be constructed to produce different widths of cords simply by varying the space between the binding ends.

As shown in figure above, the plain binding weave of the pile picks is reversed in alternative cords.In this case the design extends over the width of two cords, and each pile pick forms alternatively a long and a short float. Whatever be the method of binding, the cord effect produced is the same, because the floats are cut in the middle of the space between the pile binding points. In all the cases one side of each tuft is longer than the other side. The difference in the lengths of the tufts results in a circular formation of the cords. The longer side of the tufts forms the center, and the shorter side the outer parts of the cords.

Corded velveteens can also be produced with twill ground. These yield heavier structures.

12.14 CUTTING AND QUALITY 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.

12.15 STANDARD QUALITY PARTICULARS OF CORDUROY FABRIC

The quality particulars of some of the standard types of corduroy fabrics are given below

Warp count - 2/10s

Weft count - 18s

Ends/inch - 30

Picks/inch - 426*

Pile density/sq.inch - 568

Weft crimp - 20%

* Includes ground and pile picks.

12.16 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.

12.17 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:

(i) Count of the weft yarn

(ii) The pile length, and

(iii) 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.

12.18 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.

12.19 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.

12.20 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.

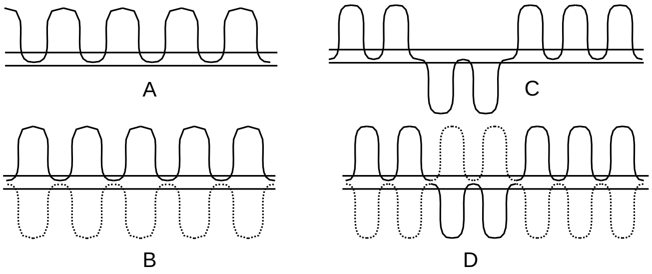


Fig. 12.6 *Schematic Diagram of various types of terry structures*

At A is shown a single sided terry. B shows a double sided continuous terry structure; C shows a pile thread alternating between the face and the back which permits the formation of pile figure on exposed ground while at D the structure shows that ornamentation is carried by having two differently coloured sets of threads which mutually alternate between the face and the back thus forming a figure in one colour on the back ground of another. All the structures apart from A are reversible.

The looped structure is ideally suitable for toweling purposes as the long, free floats of yarn, if made from absorbent materials, are capable of wicking up readily large amounts of moisture. Materials used for toweling are generally cotton, linen and viscose rayon. Of these, cotton is most ideally suited, as it not only absorbs moisture easily but also stands up well to frequent and severe launderings which the towel fabrics have to undergo.

12.21 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.

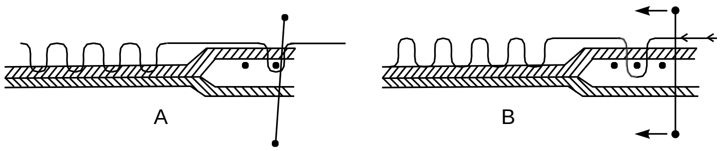


Fig. 12.7 *Formation of terry piles*

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

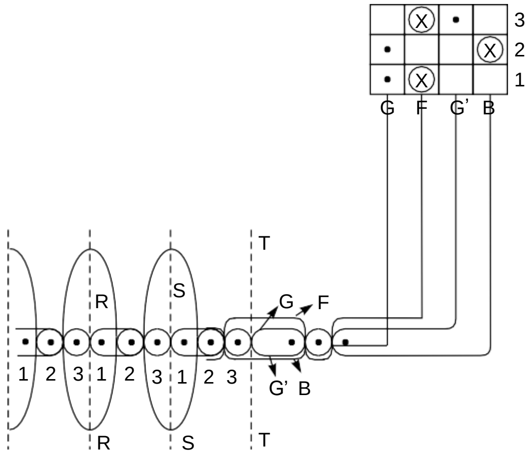


Fig 12.8 *Formation of pile*

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.

12.22 LOOM REQUIREMENTS FOR TERRY WEAVING

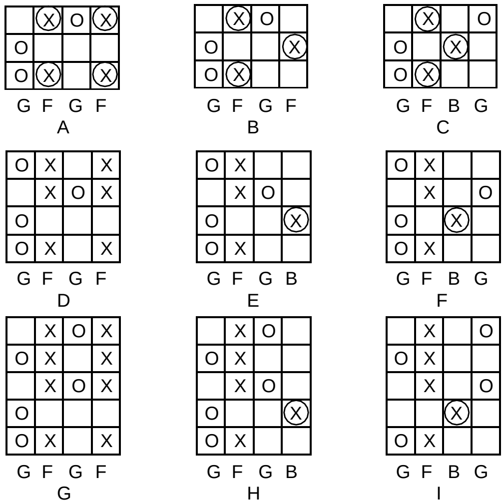
Normally terry fabrics are produced in either dobby or jacquard machines. Sometimes, however, tappet shedding is employed. Dobby or jacquard mechanisms are necessary for weaving fabrics with cross borders, as usually is the case. Previously cross border dobbies were used. Now a days high speed paper roll dobbies are used in which the length of pattern does not create the same encumberance as it does when the lags constitute the pattern chain.

Jacquards with inverted hooks are used for production of figured terries. However, fine pitch jacquards having large capacity and capable of running at higher speeds than the coarse pitch machines, are nowadays preferred.

The variable beat up motions are an essential part of the terry pile weaving and they fall into two main categories. The function of these motions is to create a gap between the cloth fell and the first two picks of a pile forming a group of picks termed ‘loose’ picks beaten up fully which are known as ‘fast’ picks. In the first category are those mechanisms in which the reed itself is drawn back on the loose picks thereby leaving them a small distance short of the cloth fell.

12.23 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.



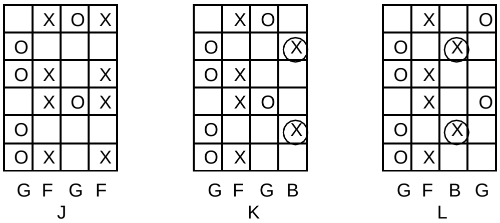


Fig. 12.9 *Various types of terry designs*

Figures A, B and C show the designs for a 3 pick terry. D, E and F show the designs for a 4 pick terry. G, H and I show the designs for a 5 pick terry and J, K and L for a 6 pick terry respectively.

Most of the terry cloth is produced in the 3 pick structures. 4 pick weaves are used occasionally but the amount of 5 pick or 6 pick cloth made at present is very small being restricted by the high cost of production. In a 6 pick fabric six picks need to be inserted to make one horizontal row of loops as opposed to only three in a 3 pick fabric. Also, to produce the same pile coverage in a 6 pick as in a 3 pick cloth, twice as many picks per cm are required.

Figure 12.10 shows the draft, peg plan and denting plan for terry weaves.

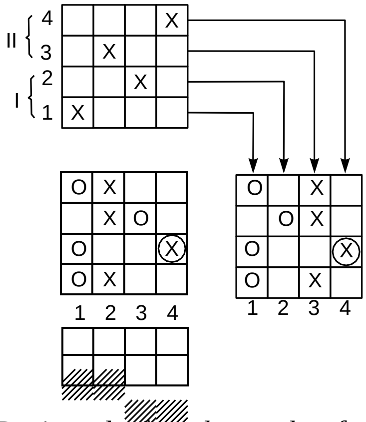


Fig. 12.10 *Design, draft and peg plan for terry weave*

It is to be noted that for all types of warp pile structures, the divided draft is used. Thus as can be seen in the figure above, the healds are divided into two sets. One set of healds control the ground warp threads and the other set of healds control the pile warp threads. The denting order is generally two ends per dent (one ground warp and one pile warp). However in case if the weave consists of 2 ground, 2 pile the two ends of the same series are placed and drawn together through the same dent of the reed.

12.24 STANDARD QUALITY PARTICULARS OF TERRY PILE FABRICS

The constructional particulars of a good quality 100% cotton 3 pick terry cloth are as follows

Pile warp - Two ends of 2/10s

Ground warp - 2/10s

Weft - 16s

Ends/inch - 50

Picks/inch - 56

Length of yarn required for producing 100cm of cloth - 500 meters of pile warp and 120 meters of ground warp.

Shrinkage in width - 12%

The particulars for a cheaper quality terry cloth is as follows

Pile warp - 16s

Ground warp - 14s

Weft - 20s

Picks/inch - 36 and above

The pile height influences the feel of the texture. A higher pile height gives a softer feel compared to a shorter pile. The height of the pile depends on the distance of the fell and the two picks (in case of a three pick terry). This distance usually varies between 10–15 mm. The pile yarns are made of lower twist so as to assist in moisture absorption.

12.25 TERRY STRIPE AND CHECK DESIGNS

These designs can be produced using a dobby mechanism. The designs produced are of reversible nature. The designs for stripe and check pattern are shown in Fig. 12.11

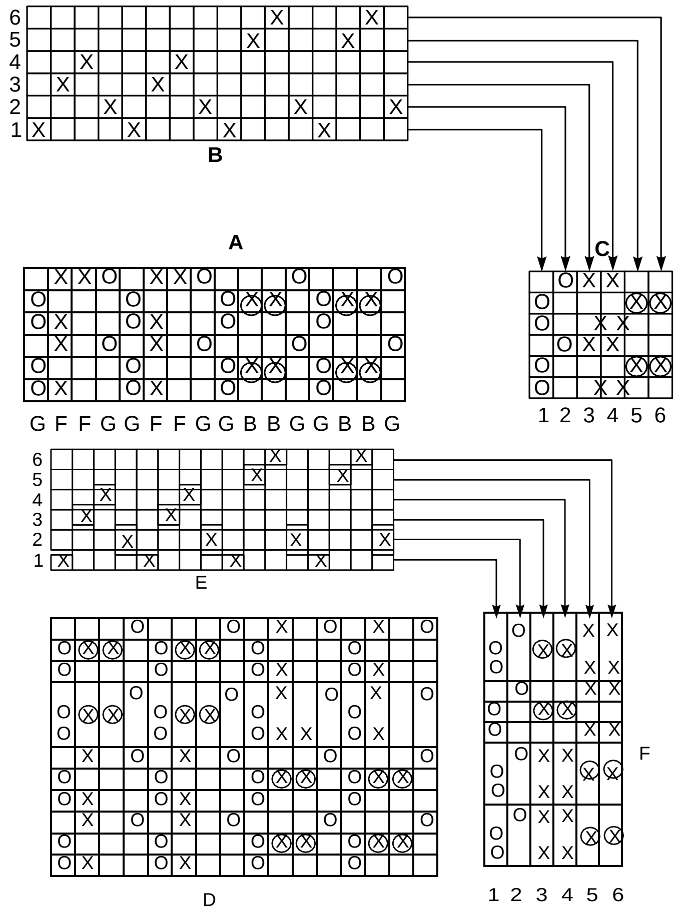


Fig. 12.11 *Weave plans of terry stripe and check designs*

A shows the design of terry stripe structure. B and C show the draft and peg plans respectively. As already stated, a divided draft is used, where the healds are divided into two groups: one for the ground yarn and the other for the pile yarn. D shows the design of a terry check structure. E and F show the draft and peg plan respectively.

12.26 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.

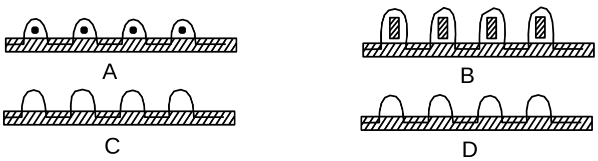


Fig. 12.12 *Loops Formed by Intersection of Wires*

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.

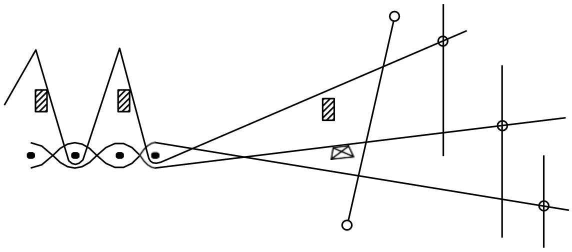


Fig. 12.13 *C/S Shed Formation of Wire Pile Structures*

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.

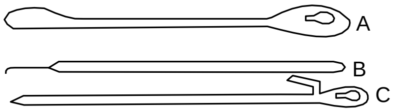


Fig 12.14 *Types of Drop Wires*

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.

12.27 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.

12.28 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

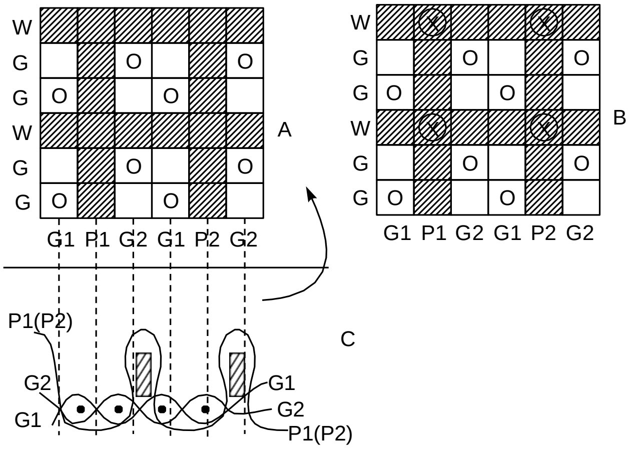


Fig 12.15 *Design of Ordinary Warp Pile Structures*

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.

12.29 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.

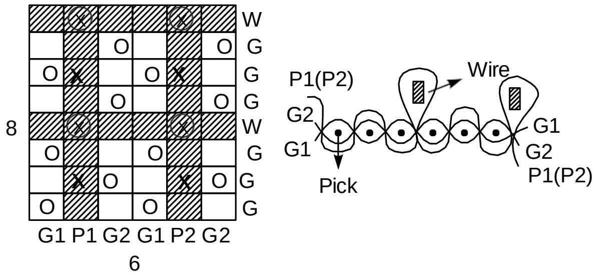


Fig 12.15 *Design of fast warp pile structure*

12.30 STANDARD QUALITY PARTICULARS OF WIRE PILE STRUCTURES

The density of thread spacing, the thickness of the yarn and height of pile in wire pile structures can be varied to a considerable extent depending on the end uses of the cloths. The particulars of some typical fabric qualities are given below :

(a) Velvet dress material

Ground warp	– 2/20s - 2/30s
Pile warp	– 30s - 60s
Ends/inch	– Pile warp - 26 - 40
Wire density/inch(weft)	– 15 - 30
Weft yarn count	– 2/20s - 2/30s cotton
Pile height	– 1.5 - 3 mm

The thread density of ground ends depends on the ratio of pile to ground ends. So also the weft density of ground weft depends on the ratio of ground weft to the wires.

(b) Upholstery plushes

Density of pile warp/inch	– 26 - 30
Ground warp	– 2/10s cotton or viscose
Pile warp	– 2/8s - 2/12s worsted

Wire density/inch(weft) – 20 - 30

Weft counts – 60 tex two fold or single cotton or staple Viscose rayon.

Pile height – 2.5 mm

Different materials such as polyamide, acrylic or polypropylene yarns can be used for pile warp in equivalent counts.

(c) Upholstery mocquette fabric without cut piles

Pile ends/inch - 34

Ground ends/inch - 34

Count of pile warp - 2/8s

& Ground warp

Density of wires/inch - 16 and

Density of weft/inch - 30

Weft count - 5s or 6s

Height of loop/pile - 1.5 - 2 mm

12.31 END USES OF WARP PILE FABRICS

Warp pile fabrics find a wide range of end use 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 velvet pile class.

13
CHAPTER

Extra Warp and Extra Weft 7igured 7abrics

13.1 INTRODUCTION

In certain classes of fabrics the ornamentation or figuring is done by using extra threads which are made to interlace with the ground fabric at intervals. The extra threads may be introduced in the warp or weft way direction or both. The notable feature of these fabrics is that the withdrawal of the extra threads from the cloth leaves a complete ground structure under the figure. The introduction of the extra threads does not affect the strength or durability of the cloth. However, the extra threads are liable to come out due to repeated use. In the case of ordinary fabrics where the figuring is formed by the ground threads the removal of any figuring thread does affect the strength and durability of the cloth. Extra thread figured fabrics, particularly extra weft figured ones, can produce attractive designs in bright and contrasting colours.

Fig. 13.1 shows the simple cross section of an extra thread fabric.

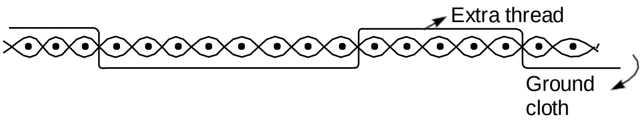


Fig. 13.1 *Cross-section of Extra Thread Fabric*

13.2 METHODS OF PRODUCTION

The extra thread figured fabrics may be produced by the following methods:

(a) By introduction of a separate set of warp threads in addition to the ground warp threads.
(b) By introduction of separate set of weft threads in addition to the ground weft threads, and
(c) By introduction of both separate warp and weft threads in addition to the ground warp and weft threads.

The production of extra warp figured fabrics requires a separate warp beam, in addition to the beam required for the ground warp threads. Also the take up rates for the two beams will be different. For producing extra weft figured fabrics, ideally the loom should be fitted with a multiple box mechanism such as a 4 ¥1, 4 ¥ 2 or a 4 ¥ 4, depending on the weft colour requirement. Generally a suitable ratio of ground to figuring threads is selected. The ratio may be 1:1, 1:2, 2:1 or 2:2 etc., depending on the solidity or prominence of the figure required.

13.3 LOOM EQUIPMENT NECESSARY FOR MANUFACTURING EXTRA THREAD FIGURED FABRICS

For manufacturing extra warp fabrics, the following loom equipments are necessary

(a) Dobby mechanism
(b) Two warp beams; one for ground warp and the other for the figuring warp

For manufacturing extra weft fabrics the following loom equipments are necessary

(a) Dobby mechanism
(b) Drop box for ground and figuring weft
(c) Single warp beam - ground warp.

13.4 METHODS OF REMOVAL OF SURPLUS FIGURING THREADS

It becomes necessary to remove the extra figuring threads at portions where they are not required. The following methods are suitable for the removal of the threads:

(a) In closely constructed figured fabrics the extra threads are allowed to float loosely on the back-side of the ground cloth.
(b) In lightly constructed ground fabrics the extra threads are allowed to float loosely on the back and are afterwards cut away.
(c) The extra threads are bound in on below the face side of the cloth by means of special stitching threads or by corresponding floats in the ground structure. This method is suitable for closely set fabrics.
(d) In some cases the extra threads are woven as small figures with the ground at places where the regular figure is not desired.

13.5 FIGURING WITH EXTRA WARP THREADS

In these fabrics the design is formed by allowing the extra warp threads to float on a ground structure. The main advantage of using extra warp in figuring is that it gives higher productivity. Extra warp method is mostly utilized for continuous styles arranged one of ground, one of extra thread warp way. Jacquard designs in this method are less popular due to the fact that each different design frequently requires the harness to be retied or otherwise modified which is costly in itself and which often leads to further costs by increasing the length of the weaving machine down time. Additional costs are incurred by the need to draw in new warps into the newly retied harness which is more expensive than knotting in. By using inferior quality materials for the figuring threads the higher cost of production can be compromised. Figuring with extra warps can be done with one, two or more colours.

13.6 EXTRA WARP FIGURING WITH SINGLE COLOUR

Simple effects can be produced by using a single colour extra warp. An example is given in Fig. 13.2.

				X	X			
			X	X	X	X		
		X	X	X	X	X	X	
	X	X	X	X	X	X	X	X
	X	X	X			X	X	X
	X	X					X	X
A	X	X	X	X	X	X	X	X
		X	X	X	X	X	X	
			X	X	X	X		
				X	X			
	F1	F2	F3	F4	F5	F6	F7	F8

	O
O	
G1	G2

B

			O			X	O	X			O				O
	O			X	O	X		X	O	X			O		
		X	O	X		X	O	X		X	O	X			O
X	O	X		X	O	X		X	O	X		X	O	X	
X		X	O	X			O			X	O	X		X	O
X	O	X			O				O			X	O	X	
X		X	O	X		X	O	X		X	O	X		X	O
	O	X		X	O	X		X	O	X		X	O		
			O	X		X	O	X		X	O				O
	O				O	X			X	O			O		
F1	G	F1	G	F3	G	F4	G	F5	G	F6	G	F7	G	F8	G

Fig. 13.2 *Design of Extra Warp Fabric with single colour*

In the figure above, A is the motif design of the extra warp threads. B shows the ground weave, which is plain. Other weaves can also be used for the ground. The repeat size of the extra figure chosen above is 8 ¥ 10; the ratio of ground to figuring threads is 1:1. Thus the repeat size of the final design is 16 ¥ 10. Other ratios can be chosen for the ground and figuring ends, such as 1:2, 2:2 etc.

In the ground of ordinary extra warp figured fabrics, it is usually necessary for the extra threads to be invisible from the face side, and they can be floated loosely on the back, or if the ground weave is suitable, be bound in between corresponding warp floats.

13.7 EXTRA WARP FIGURING WITH TWO COLOURS

This method can be used in weaving jacquard designs to obtain a width of repeat that appears to require twice as many needles as are actually necessary, e.g., a figure repeating upon 350 extra ends will produce an effect extending over 700 extra ends. The system can also be used to produce a large repeat in dobby weaving. A typical example of an extra warp design using two colours is shown in Fig. 13.3.

A shows the figuring motif. The two warps are shown by separate notations (x and ⊗). At B is shown the separation of the two figuring warps. C shows the final design completed by insertion of plain weave. The ratio of the ground to figuring threads is 1:1. The repeat size is 8 ¥ 8.

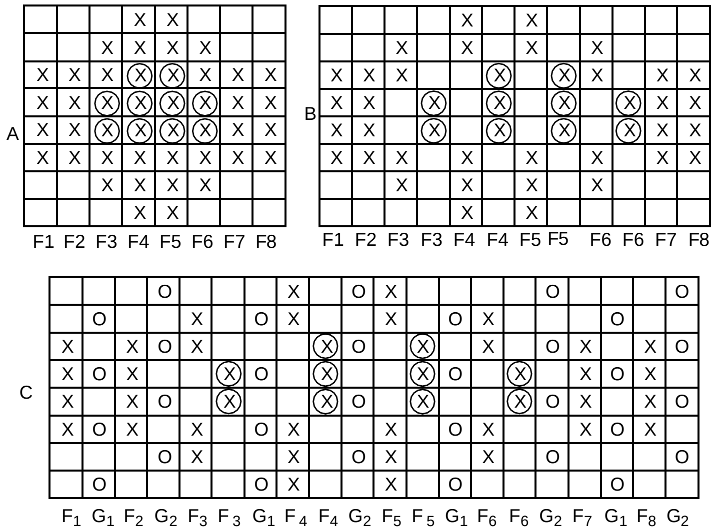


Fig. 13.3 *Design of Extra Warp Fabric with two colours*

13.8 FIGURING WITH EXTRA WEFT THREADS

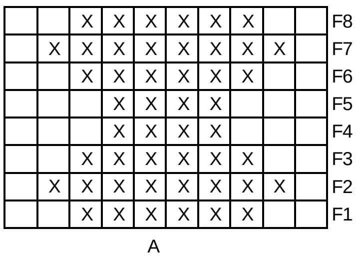
In this case the figuring or ornamentation is formed by the weft yarn. The figuring weft is introduced in addition to the ground weft. The figuring can be done using one, two or more extra weft picks in addition to the ground cloth produced by the interlacing of the warp with the ground weft in plain or in some other simple weave order. The weaving machines used for this purpose must have the capacity to insert more than one kind of weft.

The extra weft may be inserted either intermittently or continuously. In the former case the take up is of an intermittent nature, i.e. the take up operates only during insertion of the ground picks and becomes inoperative during the insertion of extra weft picks. In the latter case the take up operates continuously considering only the ground picks for the take up.

13.9 EXTRA WEFT FIGURING WITH SINGLE COLOUR

Here only one type or colour of weft is used. The ground to figuring weft ratio is generally 1:2, 2:2, 2:4 etc. A typical design is shown in Fig. 13.4

At A, is shown the repeat size of the motif (10 ¥ 8). The convention has been reversed here i.e the weft lift is indicated as 'X'. The ratio of ground to figuring picks is 2:2. Other suitable ratios can be chosen. The ground weave is shown as a plain, though other weaves like twill, hopsack etc., can be chosen.



	O		O		O		O		O	G2
O		O		O		O		O		G1
		X	X	X	X	X	X			F8
	X	X	X	X	X	X	X	X		F7
	O		O		O		O		O	G2
O		O		O		O		O		G1
		X	X	X	X	X	X			F6
			X	X	X	X				F5
	O		O		O		O		O	G2
O		O		O		O		O		G1
			X	X	X	X				F4
		X	X	X	X	X	X			F3
	O		O		O		O		O	G2
O		O		O		O		O		G1
	X	X	X	X	X	X	X	X		F2
		X	X	X	X	X	X			F1

B

Fig. 13.4 *Design of extra fabric with single colour*

13.10 EXTRA WEFT FIGURING WITH TWO COLOURS

In this case two different colours or types of weft form the figuring threads and are inserted in addition to the ground threads. An example is shown in Fig. 13.5.

At A is shown the motif repeat on 8 ¥ 8. The two extra figuring wefts are indicated by different notations (‘X’ and Ⓧ). B shows the separation of the two figuring wefts and at C is shown the final design. The ratio of the ground to figuring threads is 2:2. The convention is reversed here also as in the previous case (‘X’ and Ⓧ indicate weft lift).

	X	X	X	X	X	X		F8
		X	X	X	X	X		
	Ⓧ	Ⓧ	**X**	X	Ⓧ	Ⓧ		
	Ⓧ	Ⓧ	X	X	Ⓧ	Ⓧ	Ⓧ	
	Ⓧ	Ⓧ	X	X	Ⓧ	Ⓧ		
Ⓧ	Ⓧ	Ⓧ	X	X	Ⓧ	Ⓧ		
		X	X	X	X	X		F2
	X	X	X	X	X	X		F1

	X	X	X	X	X	X		F8
		X	X	X	X	X		F7
	Ⓧ	Ⓧ			Ⓧ	Ⓧ		F6
			X	X				
	Ⓧ	Ⓧ			Ⓧ	Ⓧ	Ⓧ	F5
			X	X				
	Ⓧ	Ⓧ			Ⓧ	Ⓧ		F4
			X	X				
Ⓧ	Ⓧ	Ⓧ			Ⓧ	Ⓧ		F3
			X	X				
		X	X	X	X	X		F2
	X	X	X	X	X	X		F1

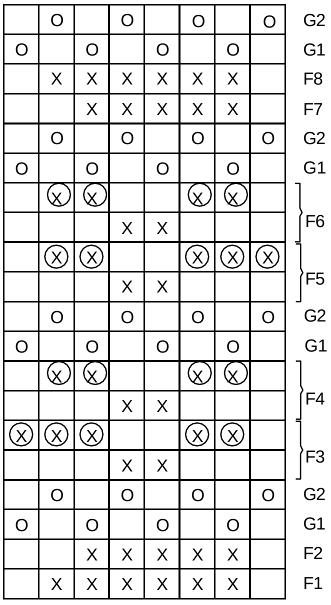


Fig 13.5 *Extra weft figuring with two colours*

13.11 COMPARISON BETWEEN EXTRA WARP AND EXTRA WEFT FIGURING

Extra warp figuring	Extra weft figuring
1. No additional shuttle box and special take up mechanisms are required.	1. Drop box with modified take up mechanisms are required.
2. Additional warp beams (2 or more) are necessary.	2. Requires only a single warp beam.
3. As only one type of weft is inserted, the production is higher.	3. As drop box is used to insert two or more series of weft yarns, the production is lesser.
4. Striped and spotted effects can be brought out by alternately arranging the figuring threads.	4. Spotted effects are possible but striped effects are not effective.
5. Requires warp yarns of good strength.	5. Yarns of good strength are not a necessity.
6. Draft plans are usually more complicated.	6. Draft plans are simpler.
7. Figured effects exhibit less prominently.	7. Figured effects show more prominently.
8. It is more difficult and expensive to dispose the extra threads at places where they are not required.	8. The disposal of the extra threads is easier and more economical.
9. Posess a constraint in repeat size when working on an ordinary type of jacquard.	9. No such problems.
10. Scope for introduction of more colours.	10. Scope for colouring is restricted to capacity of shuttle boxes.

13.12 STANDARD QUALITY PARTICULARS OF EXTRA FIGURED FABRICS

The following particulars are suitable for an extra warp figured fabric

Ground warp - 20s

Ends/inch - 30

Crimp - 22.5 %

Extra warp - 16s

Ends/mail eye - 2

Double ends/inch - 30

Crimp - 6 - 8%

Weft - 3s

Picks/cm - 30

Cotton yarns are normally used although good effects can be obtained with two fold viscose rayon staple yarns for the figuring ends.

The suitable particulars for an extra weft figured fabric are as given below:

Warp - 2/40s cotton

Ends/inch - 82

Weft- ground - 40s cotton

Picks/cm - 82 (ground)

Extra weft - 30s

13.13 END USES OF EXTRA FIGURED FABRICS

Extra figured fabrics find various end uses such as bed covers, furnishings, fine tie cloth etc.

14
CHAPTER
Double Cloths

14.1 INTRODUCTION

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.

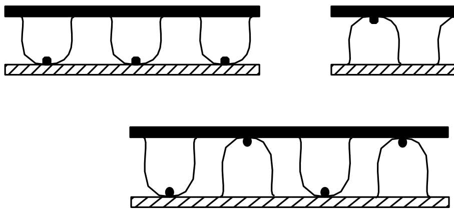


Fig. 14.1A *Different types of self stitched double cloths*

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.

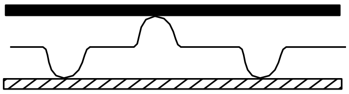


Fig. 14.1B *Center stitched double cloth*

14.2.3 Double cloths constructed on the principle of stitching by thread interchange

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.

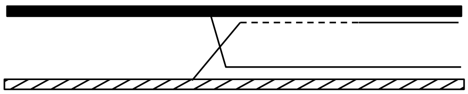


Fig. 14.1C *Double cloths constructed by thread interchange*

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.

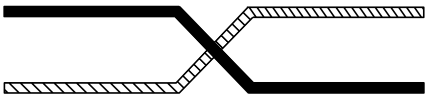


Fig. 14.1D *Double cloth stitched by cloth interchange*

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.

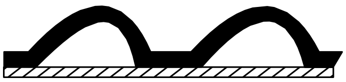


Fig. 14.1E *Double cloth based on alternate single ply and double ply construction*

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.

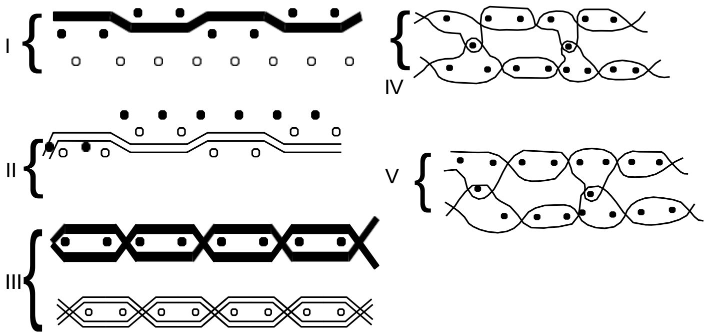


Fig 14.2 *Method of stitching in self stitched double cloths*

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 Criteria for selection of face and back threads

The type of weave to be chosen for the face and the back fabrics is dependent on the ratio of the face and back threads . For example when the ratio of the face to back threads is 1:1, weaves such 3/1 twill can be used for the face and the back weave can be 2/2 twill or 2/3 twill. It is to be noted that even if the weaves are not similar at least the relative number of intersections should be similar. When the ratio of the face to back threads is 2:1, a weave such as plain can be chosen and the back weave can be a 2 and 2 matt rib or a 2/2 twill. Also weaves such as 3/1 twill can be backed by 4/4 twill and so on.

The ratio of the face and back threads is based mainly on the consideration of the weight of the face fabric. However, the proportion of the weft threads is determined by the method of the weft insertion in the loom. The thread ratios generally preferred are 1:1 and 2:1 for the face and back. The relative thicknesses of the face and back fabrics is governed by choosing relative counts which are in proportion to the thread density per unit area.

14.3.2 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.

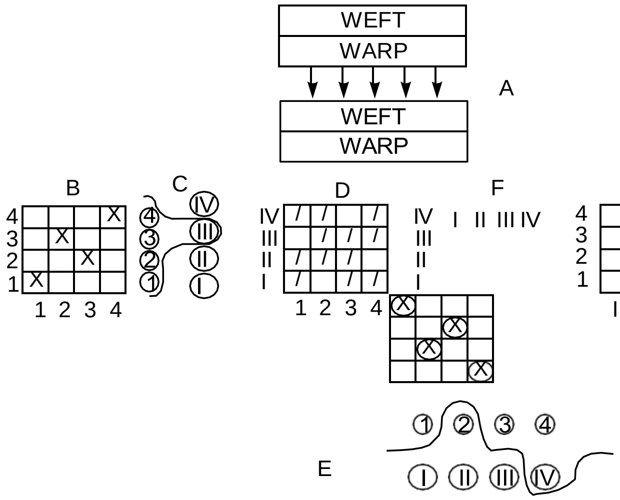
14.4 CONSTRUCTION OF SELF STITCHED DOUBLE CLOTHS

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.

14.4.1 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 is shown in Fig. 14.3.



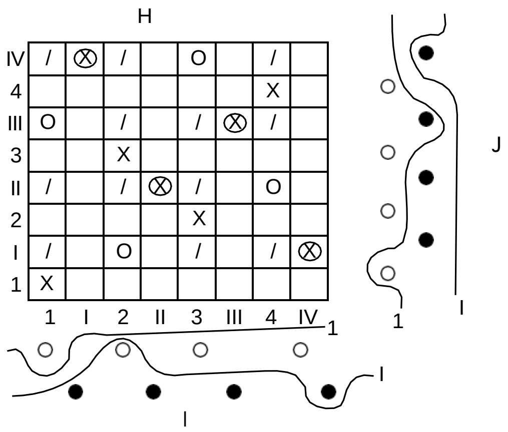


Fig. 14.3 *Construction of self stitched double fabric from face to back*

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.

14.4.2 STITCHING FROM BACK TO FACE

In this method the face and back fabrics are stitched together by causing the back warp to stitch with the face weft. Hence the stitching back warp threads are caused to float above the correspoding face weft picks. The various stages of construction of the double cloth constructed by this method is shown in Fig. 14.4.

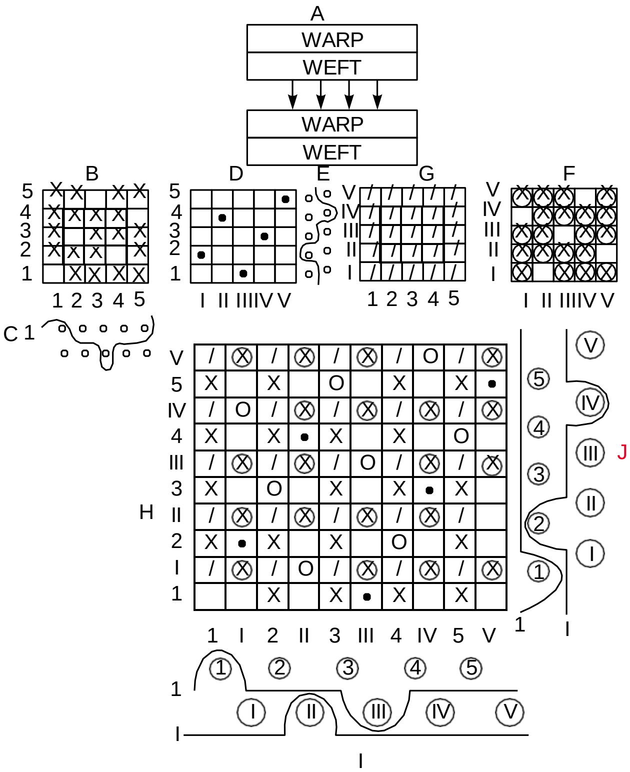


Fig. 14.4 *Constrution of self-stitiched double fabric by stitching from back to face*

The method of stitching is indicated in Fig. A. In order to achieve this type of stitching the lower side of the face fabric should have long weft floats and the upper side of the back fabric should have longer warp floats. Figure B shows the design for the face, which is a warp faced sateen. The weave has long floats of warp on the face and long weft floats on the back. This aids in selecting the stitching point of the back warp with the face weft. As in the previous case the design of the face fabric and that of the back fabric are indicated by arabic and roman numerals respectively. B and F indicate the designs of the face and back weaves respectively. C shows the warp way cross section of the design with the first weft pick as reference. The stitching point is selected in the middle of the long weft float at the lower side of the face fabric. D shows the interlacement of the face weft with the back warp. E shows the weft way cross section of the interlacement at D, using the first back warp as reference. The intersection points are represented by dots. The design for the back weave is constructed using D as the basis. The final design of the double cloth shown at H is obtained by combining B, D, G and F.The repeat size of the design is 10 ¥ 10. The warp way cross section of the design at H is shown at I. The first face and back weft threads of the design are shown as interlacing threads for reference. This clearly shows the intsection of the back warp with the face weft, i.e. the first face pick stitches with the third back warp in the figure at I. At J is shown the weft way cross section of the design H with the first face and back warps stitching with the weft threads, as reference. Here too the manner of interlacing of the face and back warps with the corresponding weft threads is shown. The first back warp stitches with the second face weft in the design.

As the repeat size of the design H is 10 the number of heald shafts required will obviously be 10. As in the previous case, since there are two series of warp threads, the divided draft is suitable.

14.4.3 Combination stitching

In this method of stitching the two layers of fabrics are stitched mutually by the face and back threads. The face warp stitches with the back weft threads and the back warp with the face weft threads. The various stages of constructing the double cloth by this method is shown in Fig. 14.5.

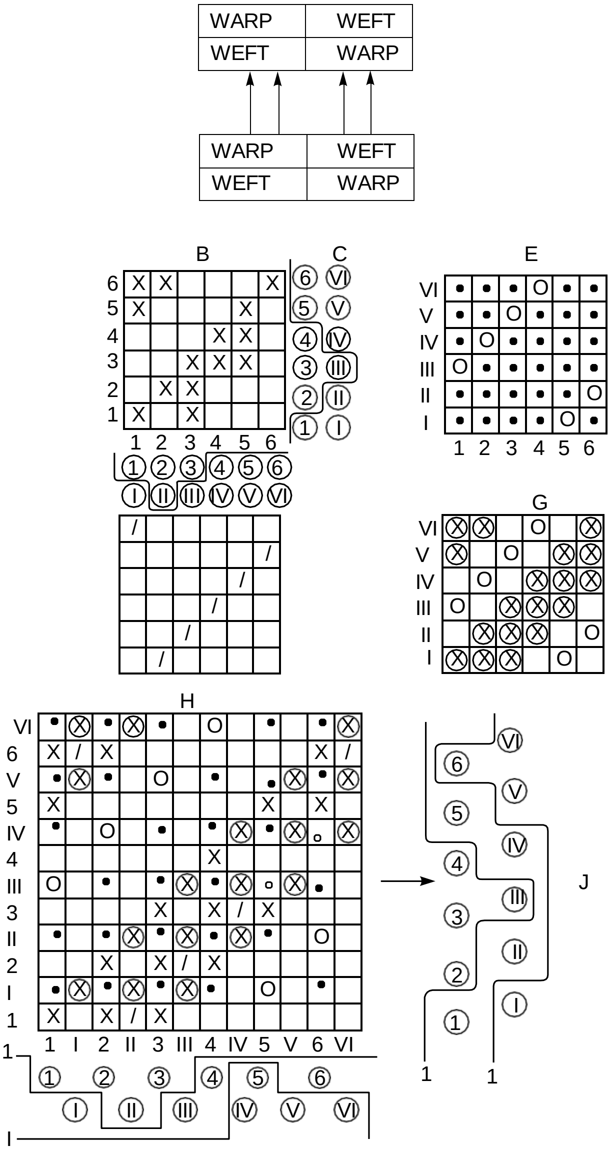


Fig. 14.5 *Construction of self stitched double fabric by combination stitching*

Fig. A shows the method of stitching. As can be seen both the previously mentioned methods are combined together. The lower portion of the face fabric and upper portion of the back fabric will have long warp and weft floats.

The base weave is one which has warp floats equal to the weft floats on the face as well as on the back of the fabric. The base weave for the face and back fabrics is 3/3 twill. As in the previous cases, the face and back threads (warp and weft) are denoted by arabic and roman numerals respectively. B shows the interlacement of the threads for the face fabric. C shows weft way cross section of B for construction of the weave E (interlacement of the face warp with the back weft). The numbered circles at C indicate the corresponding weft threads and the line represents the face warp thread. It can be seen that the first face warp is lowered below the third back weft (III). The other interlacements are done on this basis. The weave at E is constructed of the basis of these sections, where the warp floats are marked by dots and weft floats by circles.

Fig. F shows the interlacement of the back warp threads with the face weft threads. F has been constructed on the basis of cross section of the face weave shown at B. D shows the warp way cross section with the first pick of face weft as reference. The warp floats at F are denoted by half crosses. The design G is constructed based on E and F. F shows the manner of interlacement of the back warp with the face weft. The warp overlaps from F are transferred to G.

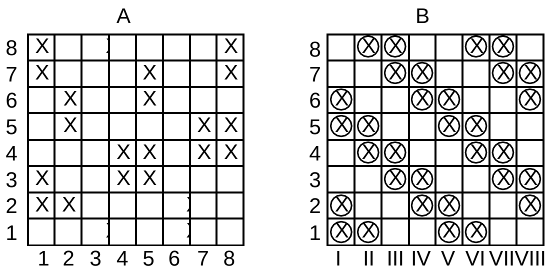
The ratio of the face and back threads for warp and weft is 1:1. The final design of the double cloth shown at H is constructed by combining B, E, F and G. The warp and weft way cross sections of the double cloth are shown at I and J respectively. The first face and back weft are considered for reference at I. The first face and back warp threads are considered as reference at J. From the cross section at I and J, the combination stitching can be seen.

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.



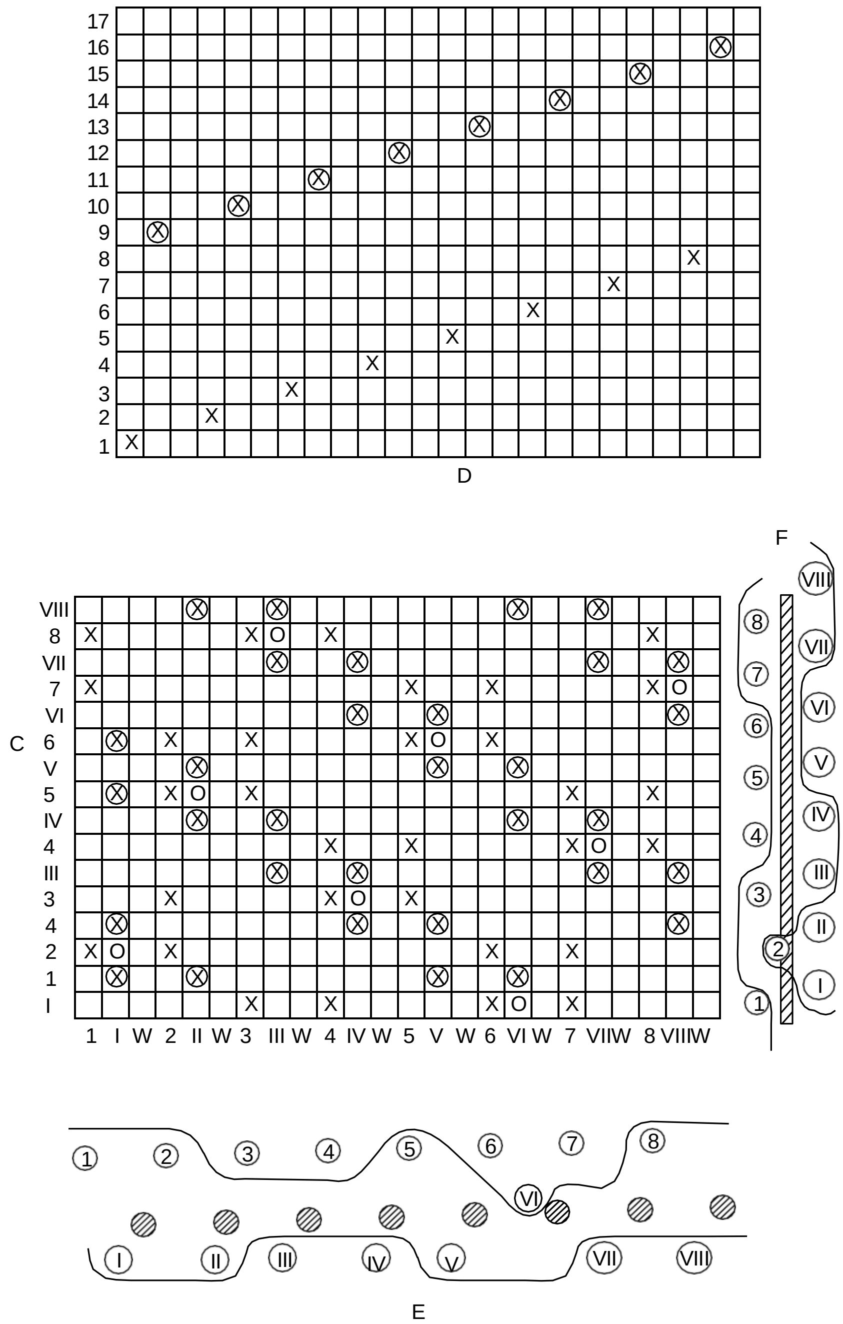


Fig. 14.6 *Constrution of warp wadded double cloth*

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.

14.5.2 Double cloth with wadded weft

These cloths are constructed by introducing wadded threads along weft. The wadded picks lie in between the face and back picks. A typical design is shown in Fig. 14.7 below.

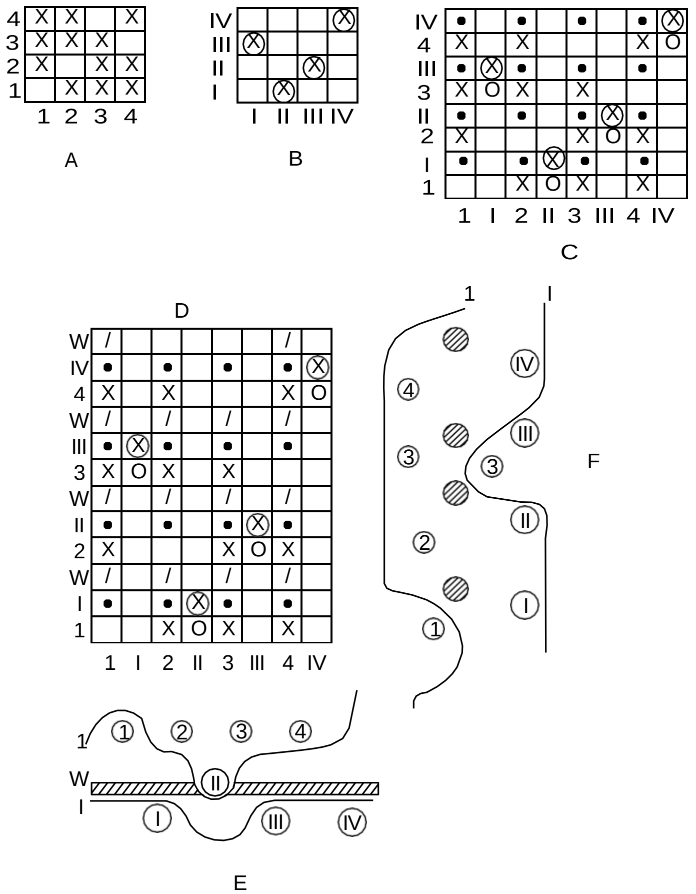


Fig. 14.7 *Constrution of weft wadded double cloth*

In the figure above, A is the plan of the face weave, and B of the back weave. Since the wadding yarn simply lies between the two fabrics without interweaving with either, the same conditions are necessary, so far as regards the face weave, the ties and the back weave, as in the construction of double cloths. The wadded design is therefore exactly the same as the ordinary double design except for the inclusion of the wadding threads, and in order that comparisons may be made, the double weave without the wadding is given at C.

In the complete design, given at D the cross marks indicate the face weave, the circles the ties (back warp up on the face picks), the circled cross marks the back weave, the dots the face ends up on the back picks, while diagonals are inserted to show the lifts of the wadding threads. It will be noted that in weft wadded structures all face ends are up, and all back ends are down, on wadding picks. E and F show the warp and weft way cross sections respectively. The wadding threads are represented as being of a larger diameter than the face and back threads.

In the above example the picks are arranged in the order of 1 face, 1 back, 1 wadding; and the ends 1 face, 1 back. The 4 thread satinette weave, warp surface on both sides of the cloth, is employed, the tying being effected by raising the backing ends in a similar order over the face picks. In the corresponding sectional views, the section on the right of the final design D, shows the interweaving of the ends 1 and I, and that below of the picks 1, 2 and W.

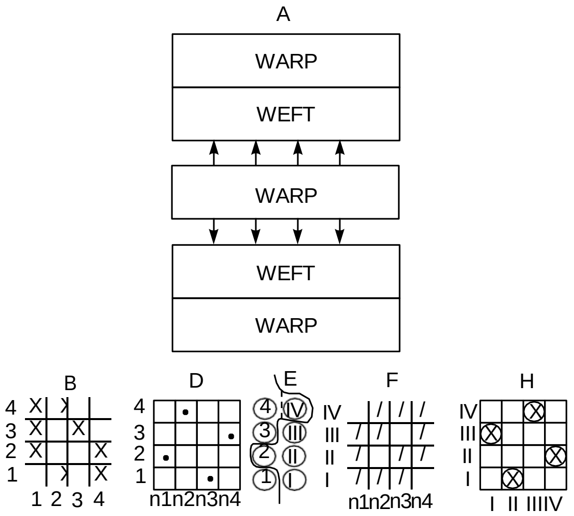
14.6 CENTRE STITCHED DOUBLE CLOTHS

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 methods of 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.



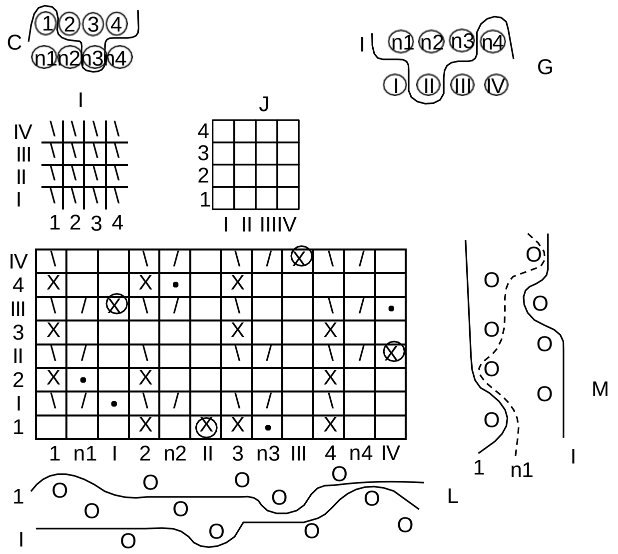


Fig. 14.8 *Constrution of center warp stitched double cloth*

It can be seen that this method of stitching requires three series of warp threads and two series of weft threads. As usual the face and back designs are denoted by arabic and roman numerals respectively. The center warp threads which form the stitching threads are denoted by the letter ‘n’ with indices.

Fig. A indicates the manner of stitching of the center warp with the face and back wefts. At B is shown the design of the face fabric. C shows the warp way cross section of the face weave with the interlacement of first face weft stitching over the face and center warp threads. D shows the stitching of the extra warp with the face weft. The stitching point is selected in the middle of the float. The stitching points are selected based on the figures C and E. F shows the stitching of the center-warp with the back weft. The center warp threads are denoted as n_1, n_2, n_3 and n_4. The semi cross marks indicate the overlap of center warp threads over the back weft picks.

Fig. H shows the design of the back cloth. For construction of the weave at H the section G of the weave F is made at the first weft thread of the back cloth. Figure I shows the mutual position of the face warp and the back weft. It can clearly be seen that all the face warp threads are well above the back weft threads. J shows the mutual position of the back warp and the face weft. It is obvious that all the back warp threads are below the face weft threads and hence all the squares at J are left blank.

The weave repeat is found before constructing the weave of the double fabric, considering the basic weave repeat. The ratio of the face, center and back warp threads is 1:1:1 and the face to back weft threads is 1:1. The repeat size of the double cloth design shown at K is 12 ¥ 8. The final design at K is constructed by transferring the warp overlaps at B, D, F, H and I. Figures L and M show the warp and weft way cross sections of the double cloth respectively.

The design at K requires 12 heald shafts. A divided draft is suitable and the heald shafts are divided into three groups (for face, center and back warps).

14.6.2 Stitching with centre weft threads

In this method of stitching, the face and back fabrics are stitched together by means of an extra set of weft threads that pass in between them. The system obviously requires two series of warp threads and three series of weft threads. The center weft threads which form the stitching threads pass over the face and back warp threads at suitable intervals. For this method of stitching it is preferable to have the warp floats on the lower sides of the face and back fabrics. This enables easier selection of stitching or binding points. Fig. 14.9 shows design of the center weft stitched double cloths.

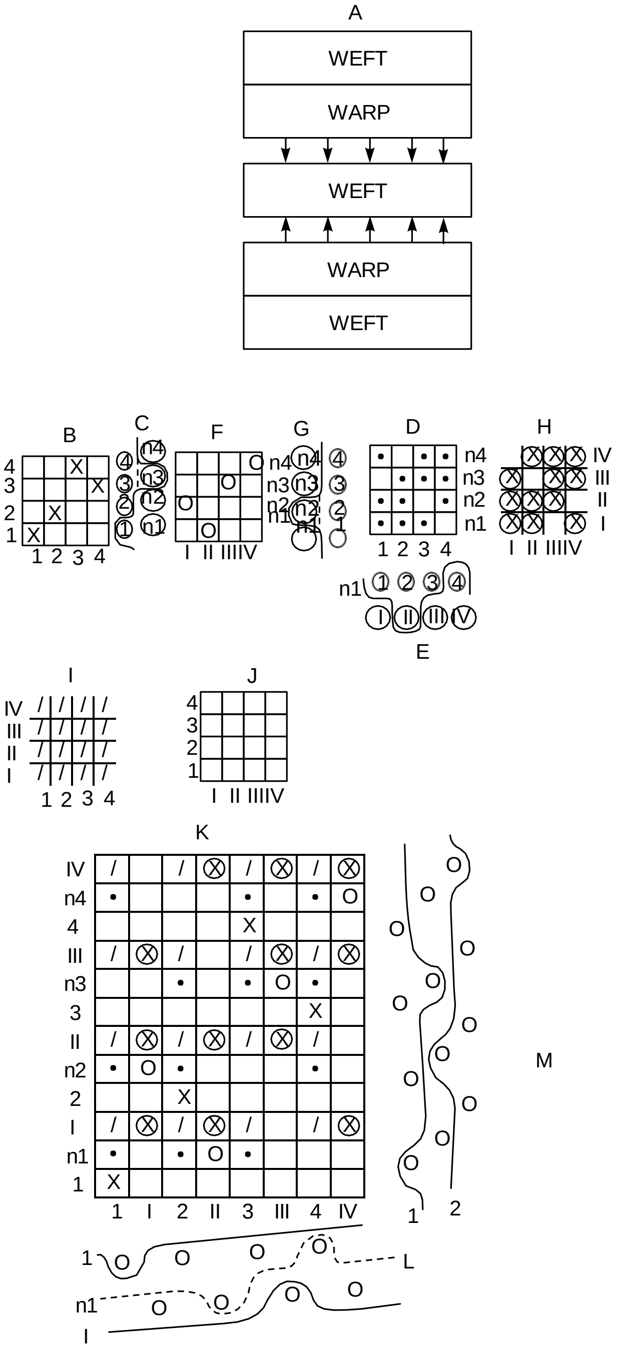


Fig. 14.9 *Constrution of center weft stitched double cloth*

The design of the double cloth is constructed in various stages shown in the diagram above. The basic weave chosen is 4 end irregular sateen. Fig. A shows the manner of stitching of the center weft with the face and the back warps. B shows the design of the face fabric, which is a 4 end irregular sateen. C shows the weft way cross section indicating the interlacement of the first face warp with the face and center weft threads. D shows the interlacement of the warp with the center weft threads. The center weft threads are denoted as n_1, n_2, n_3, and n_4. Fig. E shows the warp way cross section indicating the interlacement of the first center weft thread with the face and back warp threads. F shows the interlacement of the extra weft threads with the back warp threads. Diagram G shows the weft way cross section of the center and back weft threads with the interlacement of the first back warp thread. Figure I shows the position of the face warp threads in relation to the back weft threads. It can be seen that all the face warp threads are above the back weft threads. J shows the back warp threads in relation to the back weft threads. It can clearly be seen that all the back warp threads come below the face weft threads and hence all the squares at J are left blank.

The Fig. D is constructed on the basis of the design of the face weave at B. The stitching points of the face warp with the center weft is selected on the basis of the cross section at C. The diagram at F is constructed considering Fig. D as the basis. The design of the back fabric at H is constructed on the basis of the Fig. F. Also considering the cross sectional view at G, the design at H has been constructed.

The final design of the double fabric is constructed as shown at K. This is done by transferring the warp floats of the weave at B, D, F, H, I, and J. Figure M shows the weft way cross section of the double fabric at K. The interlacement of the first face and back warp with the face, back and center weft threads can be seen. At L is shown the warp way cross section of the double fabric K. The manner of interlacement of the first face, center and back weft threads with the face and back warp threads can clearly be seen. Thus the design of a center weft stitched double cloth is constructed.

14.7 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 used as outer cloth.

CHAPTER

Basic Aspects of Colour and its Effects on Weaves

15.1 INTRODUCTION

In the design of a fabric, luster and colour are two important aspects that can demand attention from the textile designer as they have a considerable influence on the aesthetic appeal of the fabrics.

Lustre arises from the reflection of light from the surface of a textile material. Colour is due to the reflection of light by the irregularities within fibres of a textile material. In case of luster, the light reflection is regular, as if from a mirror and in case of colour, the light reflection is diffuse, reducing luster, as in case of dyed materials.

The degree of luster of a textile material is influenced by the following factors:

(i) The characteristics of the fibres,
(ii) The manner of arrangement of fibres in the yarn
(iii) The type of weave
(iv) The type of finishing treatment.

Fibres such as Polyester, Viscose etc. have a smooth and uniform surface. They have the ability to reflect light and thus give a very high luster. On the other hand irregular and twisted fibres such cotton give very poor luster. Filament yarns with low twist present long continuous surfaces to view, which give good reflection. In spun yarn composed of staple fibres, the twist level is higher and thus the continuity of the surface is broken up and the luster reduced. Some man made filaments, however, exhibit excessive luster or brilliance, which is undesirable for the required uses and hence have to be delustred to a certain extent.

The nature of the weave too has a prominent influence on the luster. A weave such as sateen has a longer float lengths of yarn in fabric and thus presents large continuous areas of yarn to view. Similarly, finishes which are designed to enhance the luster increase the uniformity and regularity of the cloth surface, e.g., calendaring, beetling etc., while techniques intended to destroy luster achieve their aim by disturbing the surface, e.g. raising.

The observations of colour effects are purely subjective and, even when free from physiological defects such as colour blindness no two people agree in their description of every colour effect.

15.2 FUNDAMENTAL BASIS OF COLOUR

Experiments have determined the composition of white light and established that light is the source of colour. When a narrow beam of sunlight passes through a glass prism, the light is refracted and splits into its constituent elements, resulting in a band of different colours. These colours are arranged in the manner of a rainbow and termed as spectral colours. The colours are classified as - red, orange, yellow, green, blue, and violet. Though every gradation of colour is seen in the spectrum, the change from one to another cannot be seen clearly. Yellow and green colours constitute the brightest regions of the solar spectrum, while red and violet form the dullest regions.

Light is an electromagnetic wave motion. It differs from radio waves and x-rays in the frequency of vibrations. Visible light waves differ in frequency. The frequency increases through the spectrum, going from red to violet and this is why the red rays are refracted less than the violet ones. Thus a spectral colour can be described by its frequency, or more usually by its wavelength, which decreases as frequency increases so that, frequency ¥ wavelength = a constant. Any light when analysed will be found to be made up of light of different wavelengths (or colours) in different proportions.

15.3 THEORIES OF COLOUR

There are two theories of colour mixing. These are

(i) Light theory
(ii) Pigment theory.

The above two theories depend upon the twin ideas of reflection and absorption. In mixing the differently coloured lights reflected by a body the colours are added, whereas in mixing pigments, as in dyeing, the absorptions are added, and so far as colour is concerned, the process is substractive.

15.3.1 Light theory of colour

In this theory the colours are divided into primary and secondary colours. The secondary colours are obtained by mixing of primary colours. The colour classification is shown below:

Primary colours	**Secondary colours**
Red	Yellow
Blue	Purple
Green	Blue-Green

The secondary colour yellow is obtained by combination of red and green. Purple is obtained by combination of red and blue and Blue-green is obtained by combination of blue and green. Mixing the three primary colours can produce any colour including white. Thus white can be produced by adding to any colour a mixture of the three primaries in a particular proportion. This mixture of primaries will be a colour in its own right and is said to be complementary to the first colour. Thus blue and yellow, green and purple, and red and bluish green are complementary. Any two complementary colours are in the greatest possible contrast to one another. The Fig. 15.1 shows a chromatic circle that enables the colours that are complementary to be readily seen.

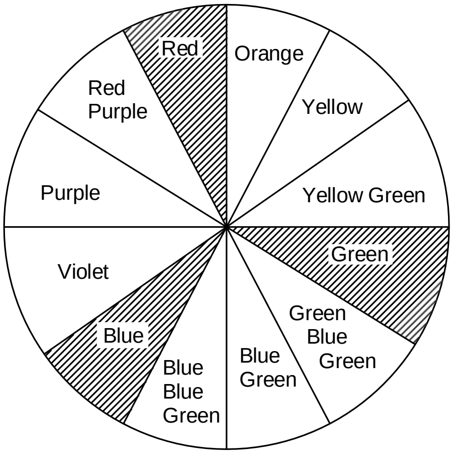


Fig. 15.1 *Chromatic circle*

The circle is divided into twelve equal parts. The primary colours—red, green and blue are painted in. From the red to the green the colours are then changed to orange, yellow and yellow green; from the green to the blue through greenish blue to bluish green; and from the blue to the red through violet, purple and reddish purple. Opposite colours in the circle are complementary and are in greatest contrast to one another.

15.3.2 Pigment theory of colour

In this theory the colours are divided into primary, secondary and tertiary colours. The secondary colours are obtained by mixing of primary colours and tertiary colours are obtained by mixing of secondary colours. The colour classification is as shown below:

Primary colours	**Secondary colours**	**Tertiary colours**
Red	Green	Russet
Yellow	Purple	Citron
Blue	Orange	Olive

It is to be noted that the effects obtained by mixing dyes or coloured pigments together are different from those resulting from the mixing of coloured lights. The colour effect produced by mixing different coloured pigments is subtractive.

The pigment theory of colour is based on the Brewster theory, which explains the effects produced by mixing coloured pigments. In this theory red, yellow and blue are the primary colours. Primary colours cannot be obtained by mixing other pigment colours. The secondary colour green is produced by combination of primary colours yellow and blue, purple is obtained by combination of red and blue and orange is obtained by combination of red and yellow. The tertiary colour russet is obtained by combination of secondary colours, purple and orange, citron by combination of green and orange, and olive by combination of green and purple.

The tertiary colours result from the mixture of three primary colours as can be seen. However in each case one of the three is in excess of the other colours. The tertiary colours are duller in appearance as compared with primary and secondary colours due to the predominance of a colour. Thus red is the predominant colour in russet, yellow in citron, and blue in olive.

The arrangement of the primary, secondary, and intermediate colours as per Brewster theory is shown in Fig. 15.2 . The circle is divided into eighteen equal parts, and the primary colours, red, yellow, and blue are placed equidistant from each other, with the secondary colours between them. Between each primary and secondary colour two intermediate colours are indicated in which the primary is in excess of the secondary in different proportions.

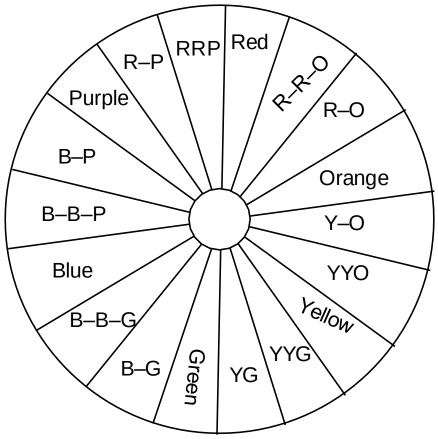


Fig. 15.2 *Brewster Circle*

15.4 VISUAL EFFECTS OF VARIOUS COLOURS

Each colour creates a certain impression on the mind of the observer. Red appears as a brilliant and cheerful colour, and gives the impression of warmth. It is a very powerful colour and appears to advance towards the observer. Blue is a cold colour and appears to recede from the eye. Yellow is a very luminous and vivid colour and conveys the idea of purity. The qualities of the secondary colours are some what intermediate between the primary colours of which they are composed. Thus orange is a very strong colour and possesses warmth and brightness, but it is not so intense as yellow. Green is a retiring and rather cold colour, but appears cheerful and fresh. Purple is a beautiful rich and deep colour, and for bloom and softness is unsurpassed. The primary and secondary colours are too strong and assertive to be used in large quantities in their pure form except for very special purposes. They are chiefly employed in comparatively small spaces for the purposee of imparting brightness and freshness to fabrics. Their strength is greatly reduced by mixing with black or white when they are used in large quantities as ground shades.

15.5 MODIFICATION OF COLOURS

Modification of pigment colours can be done in the following ways

(a) By mixing with a different colour
(b) By mixing a colour with black
(c) By mixing a colour with white.

A change in hue results by mixing two different colours. For example, scarlet colour is obtained by adding a small quantity of yellow colour to red. The relative proportions of the colours mixed determine the change in the degree of hue. For example, if red predominates in a mixture of red and blue the hue is reddish violet.

15.6 IMPORTANT DEFINITIONS RELATING TO COLOUR THEORY

Tone

It results from mixing a colour with white or black

Tint

It results from mixing a colour with white in different proportions. It is a tone which is lighter.

Shade

It results from mixing a colour with black in different proportions. It is a tone which is darker.

Coloured grey

These are certain neutral or broken colours which result from mixing a normal colour with both black and white in varying proportions.

Mode shade

It is a broken colour in which a certain hue predominates.

Monochromatic contrasts

These are contrasts in which two tones of the same colour are combined.

Example : Two shades of red or three tints of blue. Some of these contrasts in softer version are suitable for over coatings, suitings and costumes.

Polychromatic contrasts

These are contrasts in which two or more different colours are combined which may be alike or different in tone.

Example : Light green and light blue, light green and dark red.

Style

A style is one which partakes of both classes of contrast when a ground pattern, consisting of different tones of the same colour, has bright threads of another colour introduced upon it at intervals for the purpose of improving the effect.

Successive contrast

In successive contrast the colours are such a distance apart that one is perceived after the other.

Simultaneous contrast

In simultaneous contrast the colours are placed in juxtaposition so that both are seen at the same time.

Contrast of hue

In contrast of hue each colour influences its heighbour.

Example : Dark blue and light blue and when dark and light colours are placed together - dark blue and light green. The dark colour, by contrast, makes the light colour appear lighter than it actually is, while the light colour makes the dark colour appear darker than it is.

Colour harmony

It results from any combination of hues that is pleasing and gives full satisfaction to the observer.

Harmony of analogy

There are two ways of producing harmony of analogy :

(a) By the combination of tones of the same colour that do not differ widely from each other.

(b) By the combination of hues which are closely related and are equal or nearly equal in depth of tone.

Example : Different tints of red, or shades of blue when combined, yield a harmony of analogy of tone, if the difference between them is not too marked.

Tone shaded effects

These are produced by combining a series of scale of tones of a colour which are so graded and arranged as to run impercetably one into other.

Harmony of analogy of tone

This results from combination of different tints or shades of a colour, if the difference between them is not too marked.

Harmony of contrast

There are two ways of producing a harmony of contrast

(a) By the combination of widely different tones of the same colour.

(b) By the combination of unlike colours

An example of 'harmony of contrast of tone' is a pleasing combination of 2 tones of blue marked by an interval in between.

An example of 'harmony of contrast of hue' is the harmonious union of red and green. Harmonies of analogy are of chief value in producing quiet effects. Harmonies of contrast are useful when clear and smart effects are required.

Harmony of succession or gradation of hue

It is one in which there is a succession of hues that pass gradually one into the other. The colour spectrum is a typical example.

Divisional colours

These are colours which are introduced to separate two contrast colours, as other wise the colours appear blurred and confused at their joining. By using divisional colours, the strength of the contrast is thereby reduced, and the colours are made to appear clear and precise.

15.7 RELATIONSHIP BETWEEN FABRIC CHARACTERISTICS AND APPEARANCE OF COLOURS

Textile materials may be dyed during any stage of their processing such as fibre, sliver, roving, yarn or fabric. The dyeing of the textile material at any stage has its own effect on the colour appearance of the finished cloth. Besides this, the type of dyestuff, its quality, etc., affect the nature of the luster of the finished textile material. The nature of the weave also has considerable influence on the colour appearance.

15.8 METHODS OF COLOUR APPLICATION

The following are the various methods of producing colour application that give a mixed colour effect:

(a) Combination of two or more types of fibres and dyeing the fabric made out of them.
(b) Printing of the spun yarn in different colours.
(c) Using differently dyed yarns which are arranged alternately, and weaving them in an irregular or broken manner.
(d) Addition of small dyed tufts of fibres at some stage prior to spinning. This results in a spotted colour effect on the yarn.
(e) Fibres of different colours can be blended to produce a mixture yarn.
(f) Twisting together differently coloured threads to produce fancy type yarns.
(g) By printing slivers in strands of different colours 'melange' yarns can be produced.

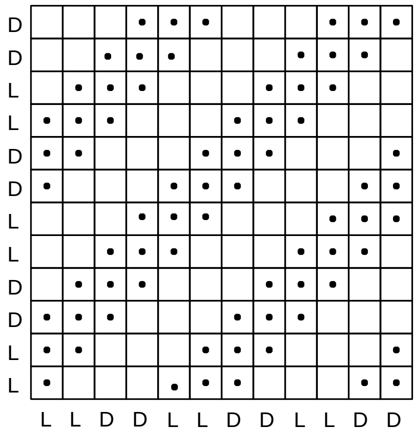
15.9 COLOUR AND WEAVE EFFECTS

When a fabric is woven with a particular weave using two or more colours in a particular pattern, a colour and weave effect is produced. In such an effect the weave tends to show a discontinuity of the colours of the warp and weft and the colour shows on the face of the fabric, irrespective of the warp or weft float.

Colour and weave effects enable the designer to observe the effect that a colour plan will produce for a given weave. They can be indicated on point paper and serve as an experimental tool in assessing the effect. Three important parameters are required to be known, namely

(a) The order of warping
(b) The order of wefting, and
(c) The weave

Fig. 15.3 shows the different stages of designing a colour and weave effect.



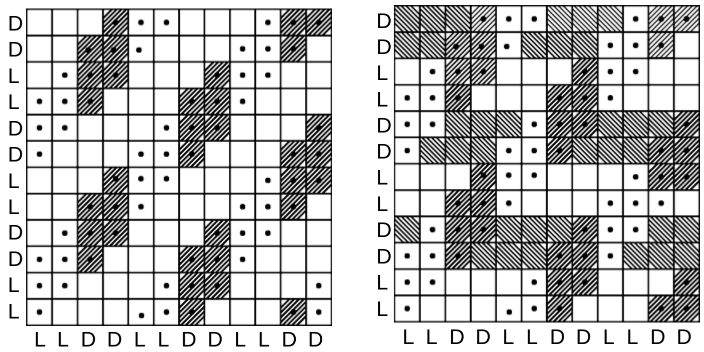


Fig. 15.3 *Design of a colour and weave effect*

Fig. A above shows the first step in the design of a colour and weave effect. The basic design is a 4/4 twill represented by dots. The next step in Fig. B shows the shading of warp representing dark colour and Fig. C shows the final design obtained by colouring/shading the weft representing the dark colour.

15.10 CLASSIFICATION OF COLOUR AND WEAVE EFFECTS

The orders of colouring the threads can be classified as follows:

(a) Simple warping and simple wefting
(b) Simple warping and compound wefting
(c) Simple wefting and compound warping
(d) Compound warping and compound wefting

In the first and the last the order of warping may be the same, or different from the order of wefting. Simple stripe and check patterns may be applied to each order of colouring.

15.11 EFFECTS PRODUCED BY SIMPLE COLOUR AND WEAVE COMBINATIONS

In designing simple colour and weave combinations the arrangement of the threads as to colour may be regular (e.g.: 2 dark, 2 light or 4 dark, 4 medium, 4 light), or irregular (e.g.: 3 dark, 1 light, 3 dark, 2 medium, 1 light). By arranging the weft in a different order from the warp, attractive effects can be brought out.

By applying simple weaves to simple orders of colouring the following effects can be produced

(a) Continuous line effects
(b) Hound tooth patterns
(c) Bird's eye and spot effects
(d) Step patterns
(e) Hairlines
(f) All over patterns.

15.12 A CONTINUOUS EFFECTS

Here the line produced by the pattern runs lengthwise along the cloth. An example of this effect is shown in Fig. 15.4

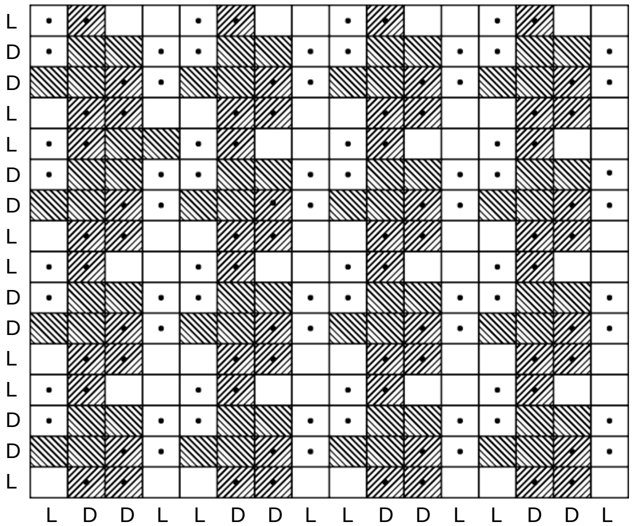


Fig. 15.4 *Design of continuous line effect*

The figure above shows the typical line effect produced by colouring the 2 and 2 twill in the order of 2 dark, 2 light. The same effect can be produced in different ways such as symmetrical zig zag, serrated etc.

15.12B HOUND'S TOOTH PATTERN

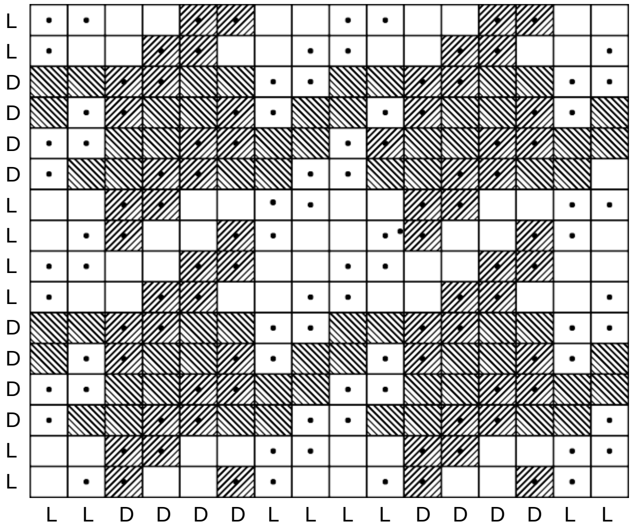


Fig. 15.5 *Design of hound's tooth pattern*

In the above design, the order of colouring is 4 dark, 4 light in warp and weft, and the weave 2 and 2 twill. Different variations are possible by changing the weave and order of colouring.

15.12C BIRD'S EYE AND SPOT EFFECTS

These effects are related to patterns in which the surface of the cloth is covered with distinct, small detached spots of colour. An example of this is shown in Fig. 15.6.

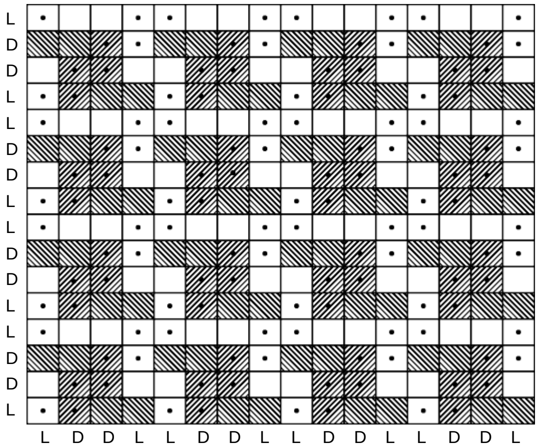


Fig. 15.6 *Design of Bird's eye effect*

Spot patterns can be produced by simple orders of warping and wefting. A spot is formed where a warp colour is intersected by the same colour of weft. Thus the desirable pattern can be produced by arranging the warp or weft floats suitably at places where different colours intersect.

15.12D HAIRLINE EFFECT

These effects produce solid vertical or horizontal lines in 2 or more colours. Each line of colour is equal to the width of one thread. It is possible to produce solid lines of colour which are equal in width to two or more threads, by suitably arranging the weave and colouring. Fig. 15.7 shows a hairline effect.

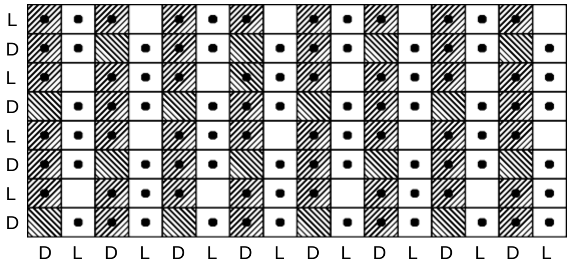


Fig. 15.7 *Design of hairline effect*

Weaves such as plain, hopsack, satinete etc., can be used with different colouring orders. Figure above shows an effect produced by using a 4-thread twill (3/1) and choosing order of colouring 1 dark and 4 light both warp and weft way.

15.12E STEP PATTERNS

These patterns are those in which vertical and horizontal lines unite and form zig zag lines of colour that run diagonally. An ordinary twill weave with equal warp and weft floats is suitable. A typical design is shown in Fig. 15.8.

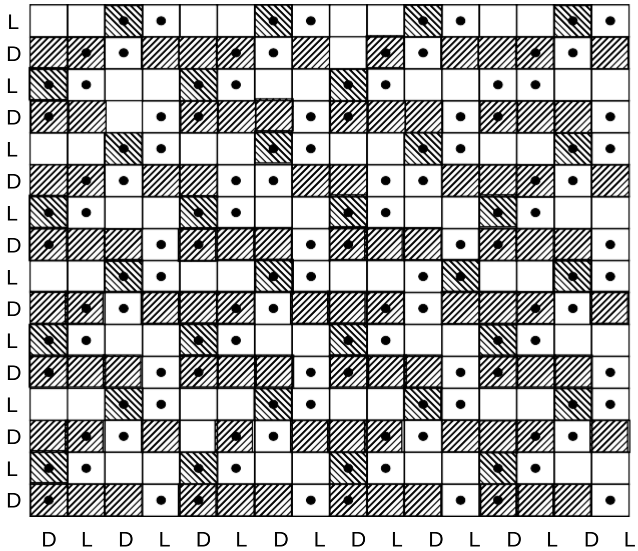


Fig. 15.8 *Design of a step pattern*

The above design shows a 2 and 2 twill coloured 1 dark and 1 light. Similar effects can be produced with different twills as 3 and 3, 4 and 4 etc. with different orders of colouring.

15.12F ALL OVER EFFECTS

In these patterns, the colour effect runs in an unbroken pattern over the surface of the cloth. All over effects can be constructed by suitably arranging the repeat of the colour plan and the repeat of the weave in a such a way that two or more repeats of a weave are required to produce a complete repeat of the pattern.

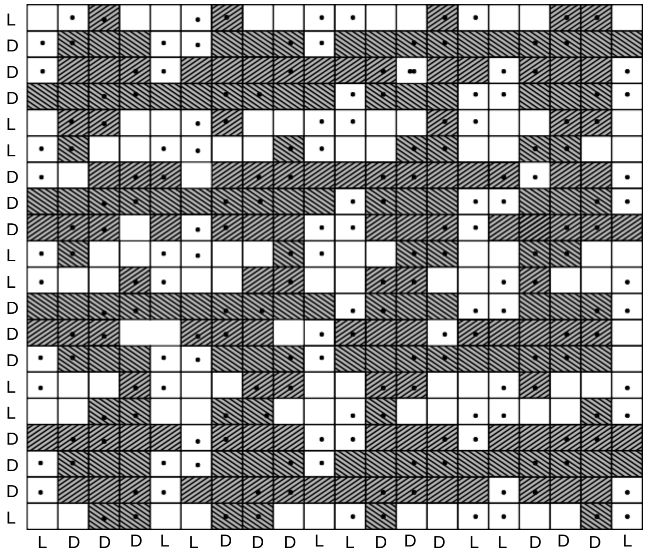


Fig. 15.9 *Design of all over pattern*

Fig. 15.9 above shows the design of all over effect. The design is constructed using a 2 and 2 twill and 3 dark, 2 light as order of colouring.