

TREATISE

ON THE

Designing *and* Construction

OF

Woven Fabrics

BY

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BOOK ONE

Page 6, first line should read: Figure 4 shows four repeats and also in the first line of the fifth paragraph it should read four repeats.

Page 17, first word in the last line of the third paragraph should be weave.

Page 21, first line should read made from pointed twills, figured plains, etc.

Page 22, first paragraph, second line should have a comma after double.

Page 32, figure 61 should have the first end and first pick in the place where the last end and last pick now is.

BOOK TWO

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CHAPTER ONE.

THE COMPOSITION OF TEXTILE FABRICS, POINT PAPER, THE FOUNDATION WEAVES.

1. Ends and Picks. Textile Fabrics are composed of two distinct systems of threads, known as "Warp Threads" and "Filling Threads." The *warp threads* always run *lengthwise* in the fabric, while the *filling threads* run *crosswise*.

In this book, the *warp threads* will be called *Ends* and the *filling threads* *Picks*. When the term *threads* is used it includes both *ends* and *picks*. The warp is also sometimes called *Woof*, and the filling *Weft*, but these terms will not be used in this book.

The warp and filling are interlaced with each other at right angles. The interlacing is done by raising a number of ends, allowing the other ends to remain down in a fixed order, and by passing the filling through the opening thus obtained. This opening is termed a *shed*. In Fig. 1 the interlacing of the warp and filling is illustrated. The two systems of threads can be distinguished very readily. The threads marked A, or the longitudinal threads (those running lengthwise), and which are usually shown on the paper in a vertical position, are the *ends*, and the threads in the horizontal position, B, are the *picks*. From this figure it can also be seen that the ends are at times raised and lowered over and under the picks.

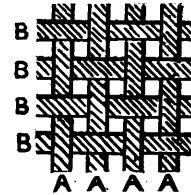


Figure 1

The raising and lowering of the ends is planned on point, or squared designing paper, — the lines on this paper running vertically and horizontally. *The spaces between the vertical lines indicate the ends and the spaces between the horizontal lines indicate the picks.*

2. Textile Designing Paper. Point, or squared designing paper, as used for textile design, is ruled with both fine and heavy lines; the fine lines form small squares, or rectangles, which are generally termed *blocks*, and the heavy lines form squares, which are always termed *squares*. Every square, as formed by the heavy lines, encloses a number of the small blocks. Point paper is designated according to the number of blocks enclosed by every one of the squares.

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The designing paper mostly in use is laid off in squares containing 8 x 8, or 64 blocks. The sizes of the blocks and squares vary according to the different sizes preferred by each designer and according to the kind of fabrics to be designed. The point paper, designated by 8 x 8, is usually made with squares of $\frac{1}{2}$ ", 1" in size, and larger. If a design is to be made which requires a large number of threads the designing paper with the smaller squares is to be preferred; if, on the other hand, designs are to be made which require but a small number of threads, the paper with the larger squares is preferable. The number of blocks to the square *warpwise* is always indicated first.

Other designing papers used are 8 x 6, 8 x 7, 8 x 9, 8 x 10, 8 x 12, 8 x 16, 4 x 12, 6 x 12, 10 x 10, 12 x 12, 24 x 12, etc., etc.

The heavy lines, or squares, serve as a unit for measurement, as well as in helping to count off the required number of blocks. In this way they help to find the size of any design on point paper, at a glance.

For ordinary designing, *i. e.*, when designing for harness looms, point paper is generally used which has the same number of blocks each way; such as 8 x 8, 10 x 10 and 12 x 12.

The point paper, for figured designs, is selected according to the texture of the fabric for which the design is to be made. For instance, if a fabric is to be woven which is to have 80 ends and 100 picks, an 8 x 10 point paper must be used, as the proportion of warp and filling is as 8 to 10.

3. The Foundation Weaves. All weaves may be divided into three main classes: These three classes of weaves are termed the *Foundation Weaves*. The three foundation weaves are:

I. The Plain Weave.

II. The Twill Weaves.

III. The Satin Weaves.

All weaves are derived from some one of these three classes, and, in order to become a successful designer, it is necessary to understand these three weaves thoroughly. The first of these is:

4. The Plain Weave. There is only one plain weave, which is illustrated by Fig. 1; from this figure it can be seen that every other thread weaves, or interlaces, in the same manner. The first end (the one farthest to the left) is raised over the first pick, then lowered under the second pick, raised over the third pick, then lowered under the fourth pick, etc., etc. The second end from the left is lowered under the first pick, raised over the second pick, lowered under the third pick, and raised over the fourth pick, etc., etc. The third end interlaces in the same

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manner as the first end, and the fourth end interlaces in the same manner as the second end, etc. From this it can be seen that two threads are repeated over the whole plan. These two threads, or two ends and two picks, constitute what is termed the *Repeat* of the weave. In other words, *one repeat of any weave indicates the number of ends and picks necessary to complete the weave.*

The interlacing of the warp and filling, *the weave*, is usually planned out on point, or squared designing paper. When planning out a weave it is customary to indicate the raising and lowering of the ends. Where an end is to be raised over a pick, the block, at which the end is crossed by the pick over which it is to be raised, is painted; this painted block is then known as a *Raiser*. Where an end is to be lowered under a pick, the block, at which the end is crossed by the pick under which it is to be lowered, is allowed to remain blank, or white; this blank block is then known as a *Sinker*. Fig. 2 illustrates the plain weave with four repeats in each direction; the painted, or solid, blocks indicate raisers and the blank blocks indicate sinkers. In Fig. 2 it can readily be seen that every alternate end and pick interlaces in the same manner. The lines marked A indicate one repeat.

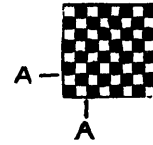


Figure 2

When planning a weave on point paper, we usually start at the lower left-hand corner of the space reserved for the weave.

Fig. 3 is the section-cut of a fabric woven with the plain weave, showing six warp threads in black. The filling is represented by a light pick (1), and by a shaded pick (2).



Figure 3

The plain weave is the most closely interlaced of all weaves. This makes the fabric strong and durable. Small perforations are formed, due to the manifold interlacing of each thread; a very high texture cannot be used in connection with the plain weave.

The plain weave is employed in all kinds of fabrics. In cotton goods it is better known as the *Cotton Weave* and in silks it is known as the *Tajjeta Weave*.

5. The Twill Weaves. The second class of the foundation weaves, the twill weaves, can be made in many varieties. Any number of ends and picks may be used in one repeat of a twill weave; the smallest twill that can be woven repeats on three ends and three picks, but any number of ends and picks may be used for one repeat, from three upwards.

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Fig. 4 shows five repeats each way of the $\frac{1}{2}$ twill. The lines marked A indicate the size of one repeat. From Fig. 4 it can be seen that diagonal lines are formed in fabrics woven with twill weaves, caused by the manner in which they interlace.

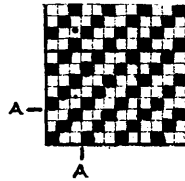


Figure 4

In the case of the plain weave, every alternate end interlaces in the same manner, but in twill weaves we find that *every successive end interlaces one pick higher than the preceding one.*

Twill weaves, in turn, may be divided into three classes:

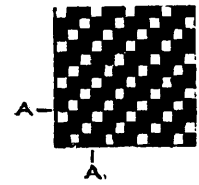


Figure 5

(1) twills that are made up of more sinkers than raisers, which are termed *Filling-Effects*, as shown in Fig. 4; (2) twills that are made up of more raisers than sinkers, which are termed *Warp-Effects*, as shown in Fig. 5, and (3) twills that are made

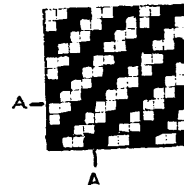


Figure 6

up of as many raisers as sinkers, which are termed *Even-sided Twills*, and are shown in Fig. 6.

Filling-effects are so called because fabrics woven with such a twill have more filling than warp on the top, or face. Warp-effects are so called because fabrics woven with such a twill have more warp than filling on the top, or face. An even-sided twill is so called because fabrics woven with such a twill have as much warp as filling on the top, or face.

Fig. 5 illustrates the $\frac{2}{1}$ twill, carried out for five repeats.

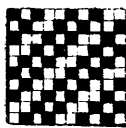


Figure 7

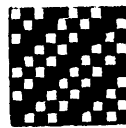


Figure 8

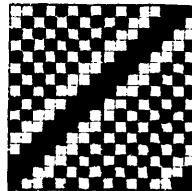


Figure 9

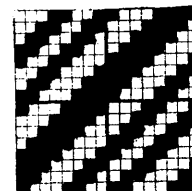


Figure 10

Fig. 6 illustrates the $\frac{2}{2}$ twill, carried out for three repeats. This is also known as the *cassimere twill*. It is used in all kinds

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of fabrics, probably the best known being "cassimere suiting," from which it receives its name.

Twill weaves are usually indicated according to the interlacing of the first end; sometimes according to the interlacing of the first pick. The first method is used in this book.

Twill weaves enter into almost all classes of woven fabrics, and their variety is practically unlimited; Figs. 7, 8, 9 and 10 illustrate a few more patterns. Fig. 7 shows the regular twill known as the $\frac{1}{2}11$ twill, Fig. 8 shows the warp-effect of the twill illustrated by Fig. 7, and is known as the $\frac{2}{1}11$ twill; both of these twills can be woven with five harness-frames. Fig. 9 illustrates a 16-harness twill, known as the $\frac{3}{2}11111111111111$ twill; Fig. 10 shows another 16-harness twill, known as the $\frac{4}{3}2222$ twill.

6. Regular Satin Weaves. Satin weaves are bare of the characteristic degree lines, which we find in twill weaves, but have, instead, a smooth-appearing surface. The interlacing of the ends and picks is done in a different rotation from that in twill weaves, where every successive end interlaces one pick higher than the preceding one. This is never the case in regular satin weaves.

In satin weaves the points of interlacing are scattered as much as possible, but they are still arranged in regular order. The farther apart the points of interlacing are, the less they will be noticeable on the face of the fabric, giving it a fine and smooth appearance.

The smallest regular satin that can be woven is one repeating on five ends and five picks. This satin is technically known as the five-harness, or "five-leaf," satin.

Satin weaves are usually indicated by the number of ends and picks they repeat on, or by the number of harness frames required to weave them (which is the same, as every end in one repeat of a satin weave requires one harness frame): thus we speak of a seven-end, or seven-harness, satin, etc.

Every end interlaces but once, *i. e.*, with one pick, in one repeat of any regular satin weave, and every pick interlaces but once, *i. e.*, with one end in one repeat of any regular satin weave.

To find the points of interlacing for any regular satin, the number indicating the satin (or indicating the number of ends and picks the satin repeats on, or the number of harness frames required to weave the satin in question), is divided into two unequal parts which have not a common divisor, nor should one of the parts be the unit 1; either one of these parts is termed and may be used as the *Counter*.

Rule: To find the points of interlacing for any regular

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satin weave, add the counter to the numeral one (1), then add the counter to this sum. Keep on adding the counter to the sums until a sum exceeds the number which indicates the satin weave in question; from this last sum subtract the number indicating the satin, and add the counter to the difference, then add the counter to the sum, etc., etc. Keep on adding the counter to the sums (which do not exceed the number indicating the satin), and differences, until the difference of one (1) is obtained. The sums, not exceeding the number indicating the satin weave in question, and the differences [excepting the last one (1)], are the points of interlacing.

For an illustration of the above rule the finding of the points of interlacing for a five-harness satin is given by the following: The number 5 can be divided into two unequal parts as 2 and 3. Either the 2 or the 3 may now be taken for the counter. Taking the number 2 and adding it to the numeral 1, and to the different sums and differences obtained through the following of the rule, gives $\underline{1}+2=\underline{3}+2=\underline{5}+2=7-5=\underline{2}+2=\underline{4}+2=6-5=1$. Underlining the sums [considering the numeral one (1) as the first sum] not exceeding the number indicating the satin weave (in this case 5) and the differences, and then writing these points of interlacing separately and numbering them in rotation there is ^{1, 2, 3, 4} 1, 3, 5, 2 and ⁵ 4. Now considering the large numbers, or the points of interlacing, as the ends and the small numbers as the picks we find:

- That the first end interlaces with the first pick.
- That the third end interlaces with the second pick.
- That the fifth end interlaces with the third pick.
- That the second end interlaces with the fourth pick.
- And that the fourth end interlaces with the fifth pick.

Fig. 11 represents a five-harness satin, two as the counter,

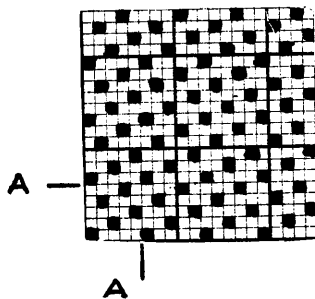


Figure 11

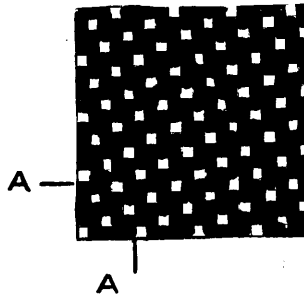


Figure 12

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filling-effect, carried out for four repeats each way. The projecting lines A indicate the size of one repeat. Fig. 12 is the warp-effect of the same satin.

Satin weaves are used for sateens, linings, and other high-textured fabrics; they are also largely employed as stitching in double cloths, etc., and as ground weaves for all kinds of fancy fabrics woven on the Jacquard loom. The best known of these fabrics is probably the Linen Damask used for table covers, etc. For this purpose satin weaves are used, which repeat on as many as 21, and sometimes 36, ends and picks.

CHAPTER TWO.

FANCY EFFECTS IN PLAIN WEAVE FABRICS AND
THOSE DERIVED FROM THE PLAIN WEAVE.

7. Plain Weave Fabrics Figured by Means of Coarse (heavy) and Fine Yarn. This method of figuring fabrics which are to be woven with the plain weave, is largely carried on in producing fancy borders and edges as they are found in *Cambric Handkerchiefs*.

In cotton goods, used for shirtings and shirt waistings, over-checks are produced by means of heavy threads in warp and filling, or by having two or more threads side by side weaving together taking up the space of but one thread. In this same manner so-called corded effects are produced in silk goods, etc.

8. Plain Weave Fabrics Figured by means of Two or More Colors in Warp and Filling. This idea is largely carried out in cottons, woolens, worsteds, and silk goods destined for ladies' dress goods. It is also employed in men's woolen and worsted wear.

By having two or more colors in the warp and one color in the filling, broken stripes will be produced running lengthwise in the goods. If colored picks, corresponding to the color arrangement in the warp, are introduced into a warp which has a fancy color arrangement, solid colored stripes and checks will be the result, depending upon the arrangement of the colors in the warp and filling.

When planning a color effect on paper, it is customary to reserve a large enough space for the effect, indicating the color arrangement of the warp above this space, and the color arrangement of the filling on the left-hand side, placing the weave in the upper left-hand corner. See Fig. 13.

After having indicated the color arrangement of the warp and filling, the plain weave should be dotted (with pencil) in the space reserved for the color effect, always starting by raising the first end over the first pick. The

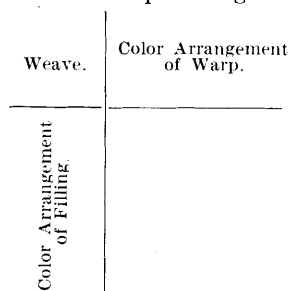


Figure 13

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effect may then be painted. This is done by painting all the ends (with their respective color) wherever they are raised over the picks, and by painting all the picks (with their respective color) wherever they pass over the ends; *i. e.*, *warp shows at raisers and filling shows at sinkers.*

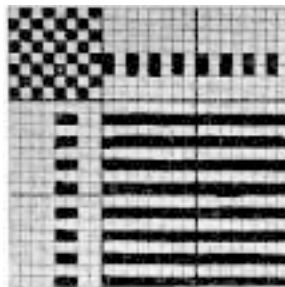


Figure 14

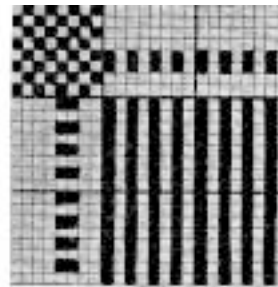


Figure 15

Fig. 14 illustrates the color effect obtained by having the warp and filling colors arranged, one of black, one of white. The effect is carried out for 8 repeats. This is known as the *Tricot Effect*, having stripes of solid color running across the fabric.

Fig. 15 illustrates the color effect obtained by having the warp colors arranged one of black, one of white. The filling colors are arranged one of white, one of black. The effect is carried out for 8 repeats. This is known as the *Hair-Line Effect*, having stripes of solid color running lengthwise in the fabric.

A combination of checks of hair-line and tricot effects may be obtained by having the warp and filling colors arranged one of black to alternate with one of white for a total of from 4 to 16 threads or more, then reversing the order arranging the colors one of white to alternate with one of black for a total of from 4 to 16 threads or more. The size of the checks depends upon the total number of threads for which each color arrangement is repeated before the arrangement of colors is reversed. In this way many different effects may be obtained.

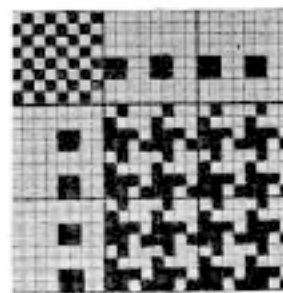


Figure 16

Fig. 16 illustrates the effect obtained by having the warp and filling colors arranged two of black, two of white. It is carried for four repeats, and is somewhat of a *Star Effect*.

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9. Rib Weaves. Rib weaves are derived from the Plain, or cotton weave, and are divided into two classes.

- A. Warp-Rib Weaves.
- B. Filling-Rib Weaves.

A. As seen in Chapter 1, Section 4, in the plain weave every other end interlaces in the same manner, *i. e.*, when one end is raised, the next but one is also raised, etc. This is also the case with *Warp-Rib Weaves*. Warp-rib weaves differ from the plain weaves by having the ends raised for more than one pick (at least once in one repeat of the weave) causing two or more picks to enter the same shed. This causes cords or *Rib Lines* to form *running in the direction of the filling*. The larger these rib lines are to be, the more picks must enter the same shed, or the coarser must be the material required for the filling. Both the face and back of fabrics, which have been woven with the warp-rib weave, are made up of the warp, the interweaving filling being invisible. From this fact we derive the name, Warp-Rib Weaves.

In order to have more than one pick enter the same shed, extra raisers and sinkers must be added on top of those of the plain weave. In this way, one end is raised for more than one pick in succession, and the ends, on either side of the raised end, remain down for more than one pick. In regular warp-rib weaves all ends are raised and lowered alternately, every lowered end remaining down as long as the raised ends are up, *i. e.*, *the ends lowered remain down for as many picks as the raised ends remain up*.

Having the face and back of fabrics, woven with warp-rib weaves, made up of warp and entirely covering the filling, calls for a large number of ends per inch, *i. e.*, a high texture is required.

Warp-rib weaves are indicated by naming the number of picks which enter each shed. For instance, a 2 and 2 warp-rib weave has two picks enter each shed that is formed, two sheds completing the weave. A 2 and 2 warp-rib weave repeats on 2 ends and 4 picks. A 2 and 3 warp-rib weave indicates that 2

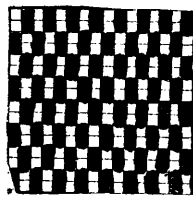


Figure 17

picks are to enter the first and 3 picks the second shed; this warp-rib weave also repeats on 2 sheds. The entire weave repeats on 2 ends and 5 picks.

All regular warp-rib weaves repeat on 2 ends and at least 3 picks.

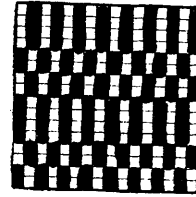


Figure 18

Fig. 17 illustrates a 2 and 2 warp-rib weave,—8 repeats wide and 4 repeats high.

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Fig. 18 illustrates a 2, 2, and 4 warp-rib weave, 8 repeats wide and 1 repeat high. This weave repeats on 6 sheds or ribs. Two picks enter the first shed, two picks enter the second, four picks enter the third, two picks enter the fourth, two picks enter the fifth and four picks enter the sixth. Thus 6 sheds are necessary to complete this weave, because every other one (according to the plain weave) is formed alike; the odd numbered sheds are formed by the raising of the odd numbered ends, while the even numbered ones are formed by the raising of the even numbered ends. Now if the weave is started over again after the third shed, the next one, or first shed, would be the same as the third, both being numbered odd; this would cause all the picks from the third shed and all the picks from the first to be thrown together.

B. The face and back of fabrics woven with *Filling-Rib Weaves* are made up of the filling, the warp, lying in between the filling, being invisible. In this case two or more ends (at least once in one repeat) which lie side by side interlace in the same manner; this causes cords, or Rib Lines, to form, *running in the direction of the warp*. The larger the rib-lines are to be, the more ends, lying side by side, must weave together, or the coarser must be the material required for the warp.

In order to have two or more ends, lying side by side, interlace in the same manner, extra raisers and sinkers must be added on the side of those of the plain weave.

Filling-rib weaves are indicated by the number of ends, side by side, interlacing in the same manner. For instance, a 2 and 2 filling-rib weave has all the ends working in pairs; that is, the first two ends are raised while the next two ends are lowered, etc., according to the plain weave. All regular filling-rib weaves repeat on at least 3 ends and 2 picks.

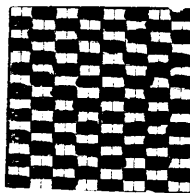


Figure 19

Fig. 19 shows a 2 and 2 filling-rib weave, 4 repeats wide and 8 repeats high.

Fig. 20 is a 2, 2 and 4 filling-rib weave, 1 repeat wide and 8 repeats high. In this, the first two ends weave together forming the first rib;

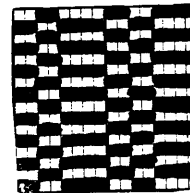


Figure 20

the next two ends weave together forming the second rib; and the next four ends weave together forming the third rib, etc., etc. This, like the corresponding weave of the warp-rib type, requires six ribs to be complete.

DESIGNING AND CONSTRUCTION

10. Figured-Rib Weaves. The simplest way of figuring rib weaves is to cause breaks in the rib lines. This is done by laying out a regular rib weave, for the distance the rib line is to continue without a break, and then start the next end in such a manner that the highest raiser, of a series of raisers,

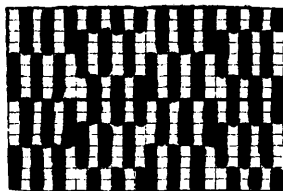


Figure 21

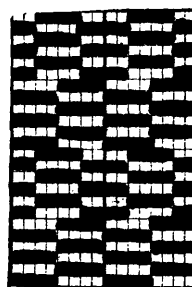


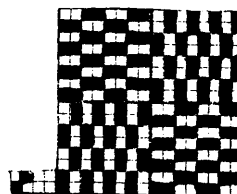
Figure 22

comes in the centre of a series of sinkers of the preceding end. Continue the rib weave in accordance with this last end until another break is required.

Fig. 21 illustrates this principle as applied to a warp-rib weave. It is made from the regular 4 and 4 warp-rib weave. A break in the rib line occurs after every sixth end.

Fig. 22 illustrates the same principle, carried out with a filling-rib weave. It is made from the regular 4 and 4 filling-rib weave. A break in the rib line occurs after every sixth pick.

Another method of figuring these weaves is to combine warp and filling-rib weaves. This is done by laying out a ground of either warp or filling-rib weave and figuring this ground with the opposite rib weave. The simplest form of these figured-rib weaves is shown in Fig. 23. It is composed of blocks of warp-rib weave alternating with blocks of filling-rib weave, a 2 and 2 warp and filling-rib weave being used.



A Figure 23

This class of figured-rib weaves is usually figured according to some *Motive*, or pre-arranged plan.

A "motive" is a pre-arranged plan or design according to which a weave may be carried out. The motive, like the weave (in Weave Formation), is laid out on point paper, every block in the motive representing a certain number of blocks in the

DESIGNING AND CONSTRUCTION

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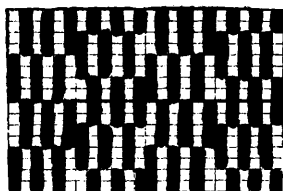


Figure 21

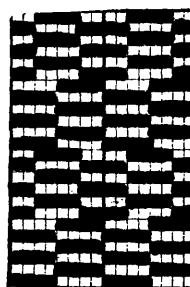


Figure 22

comes in the centre of a series of sinkers of the preceding end. Continue the rib weave in accordance with this last end until another break is required.

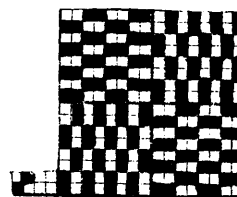
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Fig. 22 illustrates the same principle, carried out with a filling-rib weave. It is made from the regular 4 and 4 filling-rib weave. A break in the rib line occurs after every sixth pick.

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A Figure 23

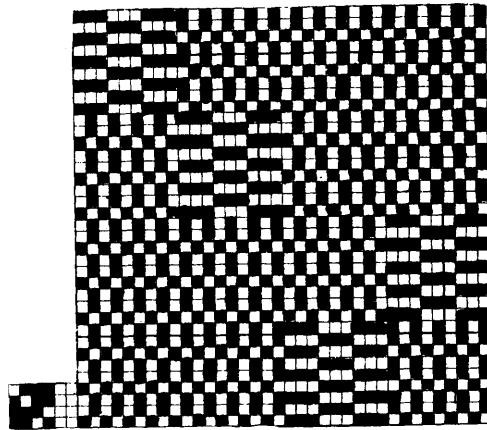


Figure 24

warp-rib weave is used for the ground and a 3 and 3 filling-rib weave is used for the figure.

weave. In motive Fig. 23 A, every block represents eight ends and eight picks, causing the weave to repeat on sixteen ends and sixteen picks. Fig. 24 shows another of these figured-rib weaves carried out according to motive A; every block in the motive represents nine ends and nine picks. A 1 and 2

11. Oblique Rib Weaves. Oblique rib weaves represent another form of combination warp and filling rib weaves arranged in an entirely different manner from the figured rib weaves described above.

They are constructed in the following manner. First determine on the point paper the size of one repeat of the weave which is to be laid out. Next divide this space into eight equal sections (see diagram, Fig. 25), by drawing one line horizontally and one line perpendicularly through the centre of the space, and then by drawing lines diagonally (one from left to right and the other from right to left), through the centre. Then number these sections, beginning at the lower left-hand corner, up and around until all the sections have been numbered.

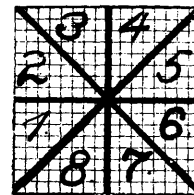


Figure 25

There are two methods in which the oblique rib weaves may be constructed. First method: Fill out every odd numbered section with a filling-rib weave and every even numbered section with a warp-rib weave. (See Fig. 26.)

Second method: Select two connecting sections, such as 1 and 2, and fill them out with filling-rib weave; then take sections 3 and 4 and fill them out with warp-rib weave; next take sections 5 and 6 and fill them out with filling-rib weave; sections

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7 and 8 are then filled out with warp-rib weave. (See Fig. 27.)

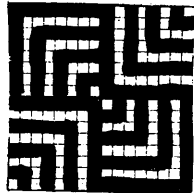


Figure 26

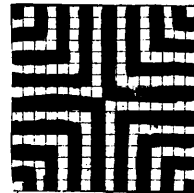


Figure 27

Oblique rib weaves are used in a line of fabrics known as "Basket Cloth"; in worsted-suitings, dress goods, cloakings, etc.

12. Basket Weaves. "Basket," like rib weaves, are derived from the plain weave, and in cloth have the appearance of a combination of warp and filling blocks, which are either square or oblong in shape. Basket weaves on paper have the appearance of a combination of blocks of raisers and sinkers. In other words, basket weaves have the appearance of an enlarged plain weave.

Basket weaves are constructed by making two or more ends, which lie side by side, interlace in the same manner and by causing two or more picks to enter the same shed.

Basket weaves are indicated by the number of ends working together and by the number of picks entering the same shed. For instance, a 2 and 2 basket weave calls for the first two ends to interlace in the same manner; that is, work together, and for the first two picks to enter the same shed; the next two ends to work together, and the next two picks to enter the same shed. Fig. 28 illustrates this weave.

A 1, 2, 1, and 3 basket weave calls for the first end and the first pick to work alone; the second and third ends to work together and the second and third picks to enter the same shed; the fourth end to work alone and the fourth pick to enter one shed alone; the fifth, sixth and seventh ends to work together and the fifth, sixth and seventh picks to enter the same shed.

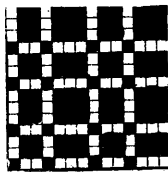


Figure 29

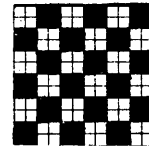


Figure 28

(See Fig. 29.)

When laying out these weaves it must be remembered that they are derived from the plain weave, and require every other set of ends to interlace in the same manner and every other shed to be the same, *i. e.*, raising the same ends for every other shed.

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13. Figured Plain Weaves. Figured effects can be produced by forming spots of warp or filling floats on a plain weave ground. When laying out these weaves on point paper it is customary first to determine the size of one repeat of the complete design (weave); then determine the size and number of figure spots to be distributed over one repeat, after which mark off the blocks, where the spots are to fall on the point paper, and fill in the plain weave where no spots are to be.

The spots are usually arranged according to some motive, and the shape of the spots is often of some special design. In

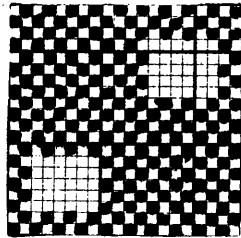


Figure 30



A.

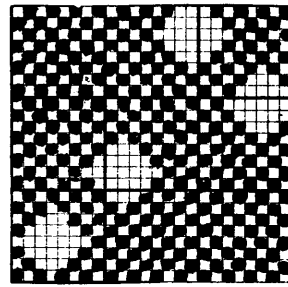


Figure 31

Fig. 30 we have a figured plain weave which has spots of filling floats extending over six ends and five picks; the spots are arranged according to a plain-weave motive. The entire weave repeats on 20 ends and 20 picks.

When laying out these weaves, special care must be taken so that the figure spots will run evenly over the whole design or wave in the rotation for which the motive calls.

Fig. 31 is another figured plain weave with a somewhat fancier character than Fig. 30. This weave repeats on 24 ends and 24 picks. The spots are arranged according to motive Fig. 31, A.

Figured plain weaves are employed in many kinds of woven fabrics, but are mostly used in a variety of white cotton goods technically known as "Plain Fancies." They are also largely used in a class of fabrics made of a fine worsted warp and silk filling, etc., etc.

CHAPTER III.

FANCY EFFECTS IN TWILL WEAVES, DRAFTING, AND WEAVES DERIVED FROM THE REGULAR TWILLS.

14. **Figured Effects Produced by Means of Two or More Colors in Warp and Filling.** These effects are carried out similarly to those in plain-weave fabrics, the only difference being in the weave. A twill weave is substituted in place of the plain weave, and the color effect carried out according to the twill weave used.

Fig. 32 illustrates the color effect obtained in a fabric woven

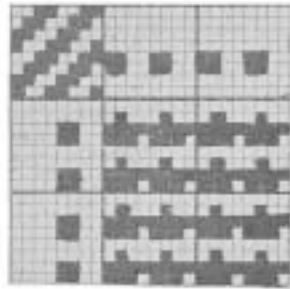


Figure 32

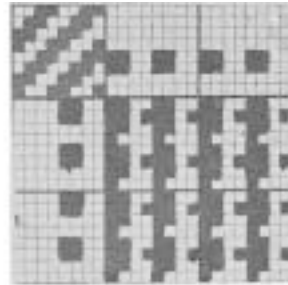


Figure 33

with the $\frac{2}{2}$ twill, the warp and filling colors arranged two of black and two of white. This is the best tricot effect obtainable with a $\frac{2}{2}$ twill.

Fig. 33 illustrates the best hairline effect obtainable with a $\frac{2}{2}$ twill. The warp colors are arranged two of black and two of white and the filling colors are arranged two of white and two of black.

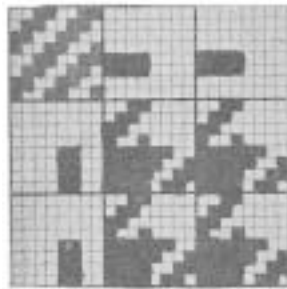


Figure 34

Fig. 34 illustrates the effect technically known as "shepherd's plaid;" it is made by having warp and filling colors arranged four of black and four of white, using the $\frac{2}{2}$ twill.

When laying out these effects care should be taken to start the twill weave used in the right way; *i. e.*, a $\frac{1}{3}$ twill should be started

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with one up, and a $\frac{1}{3}$ twill should be started with three down, etc.

15. Drafting. Two kinds of drafts are distinguished in relation to textile design:

- (A) Drawing-in Drafts.
- (B) Chain Drafts.

(A) A drawing-in draft is a plan by which the ends are drawn through the eyes, or openings, in the heddles which are adjusted to the different harness-frames.

There are two distinct methods of making drawing-in drafts, (a) from front to rear, (b) from rear to front.

(a) This plan is generally used in this country and consists in starting the drawing-in of a warp by drawing the first end on the first harness; *i. e.*, the harness nearest to the loom reed, the second end on the harness behind the first, etc., etc.

(b) This method consists in drawing the first end of a warp on the harness nearest to the warp beam, the second end on the harness in front of this, etc., etc.

Note. These methods are given with the understanding that the breast-beam is in the front of the loom.

A drawing-in draft may be prepared on the regular point paper, or it may be prepared on paper which is ruled horizontally. When preparing a drawing-in draft on point paper, the spaces between the perpendicular lines indicate the ends, and the spaces between the horizontal lines indicate the harness-frames.

When preparing a drawing-in draft on horizontally ruled paper, the horizontal lines indicate the harness-frames, and the ends must be indicated by lines drawn perpendicularly. The horizontal lines on which these perpendicular lines terminate, indicate the harness-frame on which the ends represented by the perpendicular lines are to be drawn.

Another method, often used, of preparing drawing-in drafts is to put down the numbers of the harness-frames on which the different ends are to be drawn. For instance, 1, 2, 3, 4, 5, 6, 7, 8, 6, 5, 4, 3, indicates that the ends are drawn in rotation on the first eight harness-frames; then reversing they start with the sixth harness and return to the third.

When laying out a drawing-in draft on point paper, the harness-frames on which the different ends are to be drawn, are indicated by filling in the block at which the end and the harness-frame (on which the end is to be drawn) intersect.

Fig. 35 illustrates a drawing-in draft carried out on point paper. The numbers on the left indicate the harness-frames. It is not always necessary to number them. Placing the word *front* at the proper place on the draft



Figure 35

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is quite sufficient in many instances, especially when a low number of harness-frames are being used.

Drawing-in drafts are generally governed by the weaves for which they are used, and may be divided into "Straight" and "Fancy" drawing-in drafts.

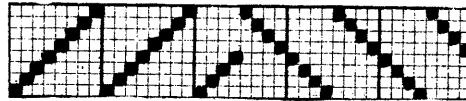
In a straight drawing-in draft, the ends are drawn in rotation in the heddles on the different harness-frames, *i. e.*, the first end is drawn in the first heddle of the first harness, the second end is drawn in the first heddle of the second harness, the third end is drawn in the first heddle of the third harness, the fourth end is drawn in the first heddle of the fourth harness, the fifth end is drawn in the second heddle of the first harness, the sixth end is drawn in the second heddle of the second harness, and so on, until every end in the warp has been drawn in. This is a straight draw for four harness-frames. If more than four harness-frames are to be used, the ends must be drawn in from the first to the last in rotation, after which it is necessary to commence again with the first harness.

So-called "Fancy Drawing-in Drafts" are generally used to reduce the number of harness-frames; as some weaves, which repeat on a high number of ends (several of the ends interlacing in the same manner), would require too many harness-frames if they should be drawn in straight.

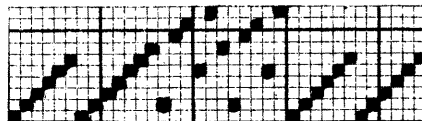
Among fancy drawing-in drafts are distinguished "Broken draws," "Point draws," "Skip draws," "Sectional draws," "Double draws," etc.

Broken draws, as the name indicates, are those which are more or less broken up. They are generally used for weaves which have a broken-up effect; as, broken twills, combination weaves, etc., and are obtained by reducing a weave to its lowest number of harness-frames. These drafts find extensive use in the manufacture of worsted and woolen suiting and of woolen and cotton goods of a fancy nature.

Figs. 36 and 37 illustrate two broken draws of different characters. Fig. 36 is made for a broken



Front
Figure 36



Front
Figure 37

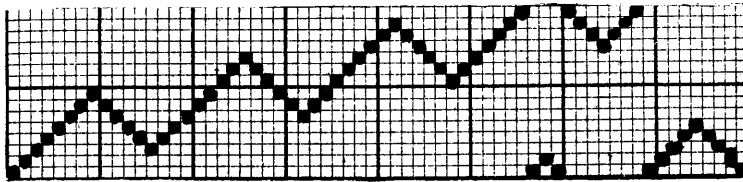
twill with long twill lines in both directions and Fig. 37 illustrates a draw obtained by reducing a fancy weave to its lowest number of harness-frames.

Point draws are usu-

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ally made from pointed, twill, figured plains, etc., and, as the name indicates, they run to a point.

Fig. 38 illustrates one of the point draws of a somewhat fancy nature. The ends are drawn from the first to the eighth

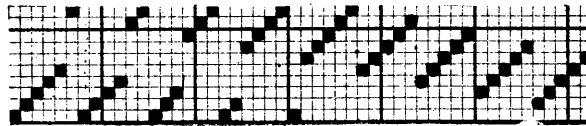


Front
Figure 38

harness; from there back to the third; from there to the twelfth; from there to the sixth, etc.

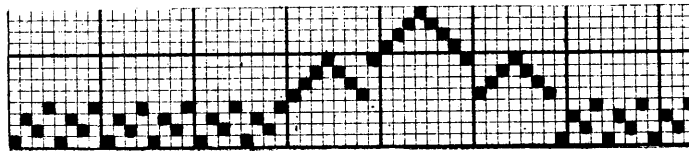
Skip draws are used in the production of skip twill and other fancy weaves. They have the appearance of a series of straight draws, one following the other. They are made by drawing a number of ends straight, then beginning over again, starting one or more harness higher (if the first end was drawn on the first harness, the first end, when beginning over again, should be started on any harness between the second and last, inclusive).

Fig. 39 illustrates a skip draw, skipping after every five ends.



Front
Figure 39

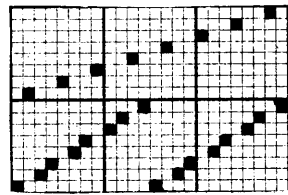
Sectional draws are used in the manufacture of fabrics which have either fancy weave or fancy color stripes; also in the manufacture of damask table cloths, towels, etc., where two weaves are combined, each weave receiving its separate set of harness-frames. The front set of harness-frames is usually



Front
Figure 40

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reserved for the ground weave, and the set, or sets, in back of this is used for the figure. Fig. 40 illustrates a sectional draw. Harness-frames 1 to 4, inclusive, form the first set and are used for the ground weave; harness-frames 5 to 12, inclusive, form the second set and are used for the figure.



Front
Figure 41

Double draws are sometimes classed with sectional draws, and are mostly used for double threeply, or more, cloth weaves. In this case one set of harness-frames is reserved for the face weave and the other set, or sets, is reserved for the back weave, etc. Fig. 41 illustrates a double draw made for a double cloth weave. Harness-frames 1 to 8, inclusive, form the first set and are used for the face weave; harness-frames 9 to 16, inclusive, form the

second set and are used for the back weave.

When making a drawing-in draft for a weave it is customary to begin by drawing the first end of the weave on the first harness-frame, the second end on the second harness-frame, etc., if the weave repeats on but a few number of ends and a straight draw is at all practical. In making a drawing-in draft for a weave which requires a fancy draw, it is also customary to draw the first end on the first harness-frame, the second end on the second harness-frame, if it interlaces differently from the first end, etc., and draw all the ends which interlace in the same manner on the same harness-frames.

Fig. 42 illustrates a fancy draw made from the weave A. In order to help the student to understand the above better, let us add that ends interlace alike when they are raised over, and lowered under, the same picks throughout the weave. In Fig. 42 the end drawn on the first harness interlaces $\frac{2}{3} \frac{3}{3} \frac{1}{3} \frac{3}{3} \frac{2}{3} \frac{3}{3} \frac{3}{3}$. The next end interlacing in the same manner is the seventh; consequently the first and seventh ends are drawn on the first harness-frame; these are the only ends interlacing in this way; that is, $\frac{2}{3} \frac{3}{3} \frac{1}{3} \frac{3}{3} \frac{2}{3} \frac{3}{3} \frac{3}{3} \frac{1}{3}$, therefore these are the only ends drawn on the first harness-frame.

The second end interlaces $\frac{3}{3} \frac{3}{3} \frac{3}{3} \frac{3}{3} \frac{3}{3} \frac{3}{3} \frac{3}{3} \frac{3}{3}$. The next end interlacing in this way is end No. 8, then No. 14, 20, 26, 32, 38 and 44. All these ends weaving $\frac{3}{3}$ throughout are drawn on the same harness-frame. The student can now compare the interlacing of the different ends and find that all those ends weaving (interlacing) alike are drawn on the same harness-frame.

Fig. 42 illustrates a draw made on the least-number-of-

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harness-frame principle, from weave Fig. 42, A. Fig. 43 illustrates a draw for the same weave (Fig. 42, A), in which the straightness of the draw has received more consideration than the number of harness-frames to be used. In this draw the

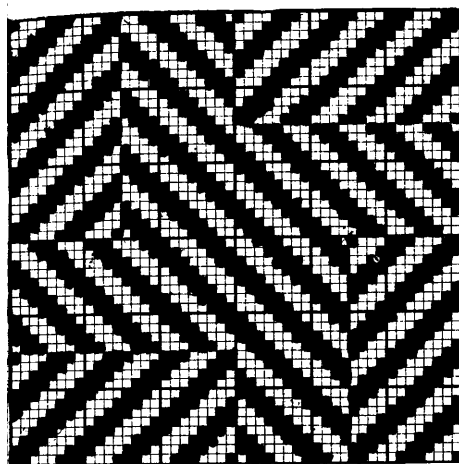


Fig. 42.—A.

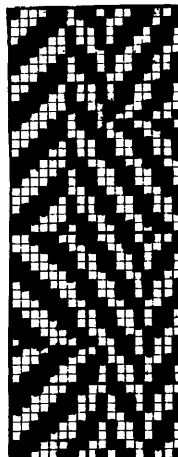


Figure 44

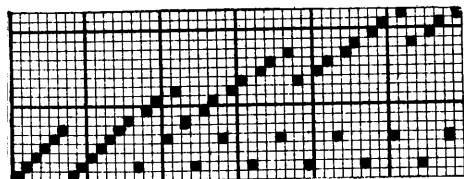


Figure 42

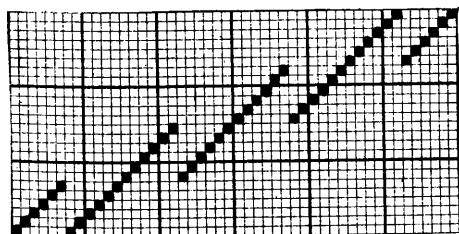


Figure 43

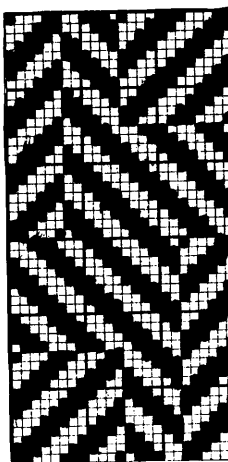


Figure 45

number of heddles (ends drawn on each harness-frame) on each harness-frame are alike. No harness-frame is crowded with heddles, thus helping materially in the weaving. But it must also be considered that in draw Figure 42, only 18 harness-frames are required, while draw Figure 43, calls for 24 harness-frames, making a difference of six.

(B) A "chain draft" is a plan according to which the different harness-frames are raised and lowered. Chain drafts are planned on point

paper, from the weave, after the drawing-in draft has been made. On point paper the spaces between the perpendicular

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lines indicate the harness-frames, and the spaces between the horizontal lines indicate the picks. When a harness-frame is to be raised over a certain pick, the block at their intersection is filled in, indicating a raiser. When a harness-frame is to be lowered under a certain pick, the block at their intersection is not filled in, indicating a sinker.

After the drawing-in draft is made and the number of harness-frames to be used decided upon, the chain draft is made. The first step towards making a chain draft is to reserve as many ends (spaces between perpendicular lines) on the right-hand side of the weave, as harness-frames are required. The space between the perpendicular lines nearest to the weave (the farthest to the left) always indicates the first harness-frame; the next space to the right indicates the second harness-frame, etc. After this is all arranged the chain draft can be planned.

Fill in the space reserved for the first harness-frame with raisers and sinkers corresponding to the raisers and sinkers of the end drawn on the first harness-frame. (The drawing-in draft must be constantly kept in the eye in order to get the right rotation of the harness-frames.) The space reserved for the second harness-frame is then filled in with the raisers and sinkers corresponding to the raisers and sinkers of the end drawn on the second harness-frame, etc. Fig. 44 illustrates a chain draft made according to weave Fig. 42 A, and drawing-in draft under Fig. 42. Fig. 45 illustrates a chain draft made according to weave Fig. 42, A, and drawing-in draft Fig. 43.

The following points must be remembered when laying out drawing-in and chain drafts.

(1) Always begin with the end farthest to the left when making a drawing-in draft.

(2) Draw only those ends on the same harness-frame which interlace exactly alike.

(3) In a drawing-in draft the picks (spaces between the horizontal lines) indicate the harness-frames, and in chain drafts the ends (spaces between the perpendicular lines) indicate the harness-frames.

(4) The raisers and sinkers in the chain draft must correspond to the raisers and sinkers in the weave, because the ends in the weave regulate the raising and lowering of the harness-frames on which they are drawn.

16. Broken Twills. Broken twills, derived from the regular twills, have twill lines running both from left to right and from right to left. They are best made of even-sided twills and of such twills as $\frac{1}{3}$, $\frac{1}{5}$ and $\frac{2}{1}$; *i. e.*, such filling or warp-effect twills as have an odd number of raisers or sinkers

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in any series of raisers and sinkers in the entire weave. Twills like the $\frac{2}{1} \frac{2}{2} \frac{1}{2}$ are also adapted for broken twill, but those like the $\frac{4}{3} \frac{2}{5}$ are not at all adapted for the sort. The reason for this will readily be seen in the following:

Broken twills are made by running the line of a regular twill, for a certain number of ends to the right (these twills can also be started with the twill line running to the left), after which the direction of the twill line is changed, running it to the left for the required number of ends. Where the direction of the twill line is changed, a "Clear Break" is formed by causing the raisers of the first end of the twill line running to the left to come opposite the sinkers of the last end of the twill line running to the right. In the case of filling-effect twills being used, the raiser of the first end running to the left should come in the centre of the series of sinkers on the last end running to the right. In the case of warp-effect twills, the sinker will come in the centre of the series of raisers.

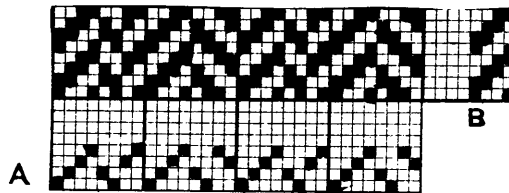


Figure 46

Fig. 46 illustrates a broken twill made from the regular $\frac{2}{2}$ twill, the lines running for 4 ends to the right, 2 ends to the left, 6 ends to the right, and 4 ends to the left. This weave repeats on 16 ends and 4 picks.

Fig. 46, A, is the drawing-in draft for the above weave, and Fig. 46, B, is the chain draft for same.

Fig. 47 illustrates the $\frac{3}{1}$ broken twill, 2 ends to the right and 2 ends to the left. Fig. 48 illustrates the filling-effect of Fig. 47. Both of these weaves are known as the "four-harness (leaf) satin," "four-leaf clover," and "crowfoot weave."

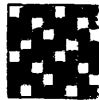


Figure 47

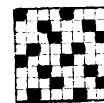


Figure 48

Fig. 49 illustrates a broken twill made from the $\frac{3}{3}$ regular twill, by running the line for 8 ends to the right, then reversing same and running it for 3 ends to the left. This weave is carried out for one repeat wide and 2 repeats high; A is the drawing-in draft and B is the chain draft. This weave will also illustrate the rule that "In broken twills a weave will not

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repeat until the first end of the first twill line running to the right, interlaces again the same as the first end of the weave, at the same time forming a clear break with the last end of the last twill line running to the left."

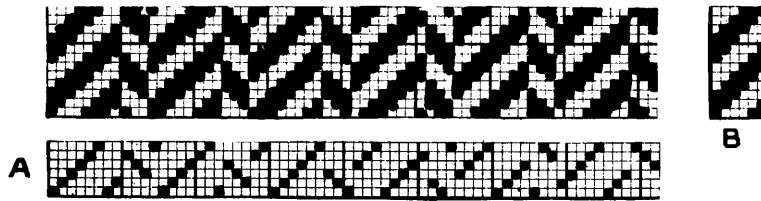


Figure 49

Broken twills are used in nearly all classes of woven fabrics, but mostly in fancy worsteds and woolens.

17. Figured Broken Twills. Broken twills are figured by means of clear breaks both warp and filling ways. After every clear-break line the direction of the twill is reversed, thus forming blocks of right and left-hand twills.

Fancy broken twills are used in fancy worsteds and woolens and sometimes in cloakings; they are also found in other fabrics of a fancy character.

The figuring is generally done according to some motive; the $\frac{2}{2}$ and the $\frac{3}{3}$ regular twills are best adapted for this class.

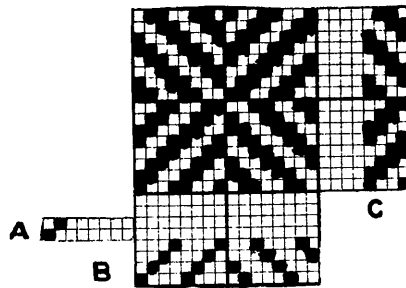


Figure 50

Fig. 50 illustrates a figured broken twill made from the regular $\frac{2}{2}$ twill according to motive Fig. 50, A. Every block in the motive represents 8 ends and 8 picks, B and C representing the drawing-in and chain drafts respectively, of weave Fig. 50.

Fig. 51 illustrates a figured broken twill made from the regular $\frac{2}{2}$ twill according to motive Fig. 51, A. Every block in the motive represents 8 ends and 8 picks. Fig. 51, B is the drawing-in draft and C the chain draft.

18. Skip Twills. In skip twills, as in broken twills, clear

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breaks are formed, but the twill lines continue in the same direction.

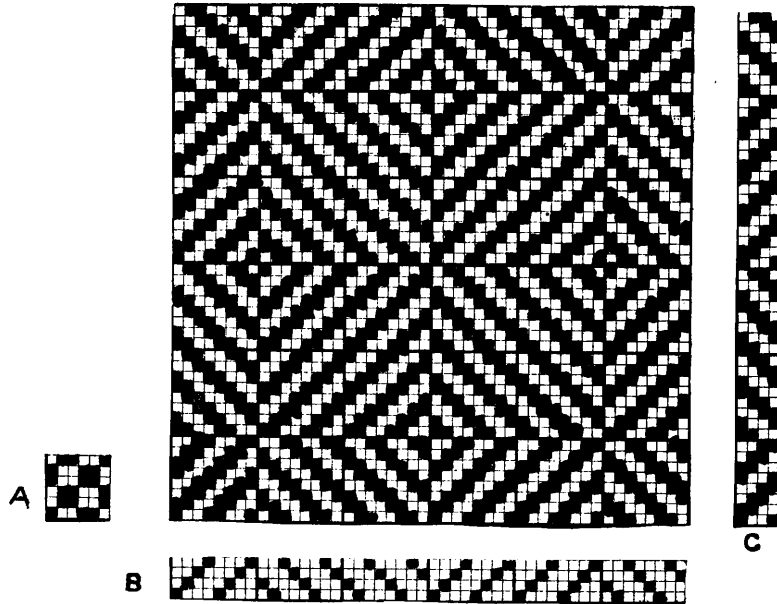


Figure 51

They are made by running a twill line for a certain number of ends in either direction (usually to the right), then skipping a sufficient number of ends, in order to form a clear break, continuing the twill line in the same direction. Those twills best adaptable for broken are also adaptable for skip twills.

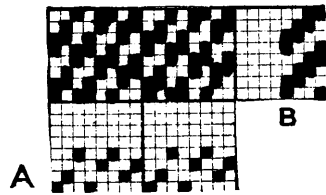


Figure 52

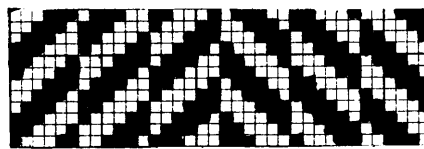


Figure 53

Fig. 52 illustrates a skip twill made from the regular $\frac{2}{2}$ twill, by taking two ends and skipping one. Fig. 52, A and B, are the drawing-in and chain drafts, respectively, for this weave.

Skip twills, with lines running to the right and lines running

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to the left, are sometimes combined, forming what may be termed "Broken Skip Twills." Fig. 53 illustrates one of these made from the regular $\frac{3}{3}$ twill, by taking 6 ends and skipping 2. The direction of the line is changed after skipping three times. The left-hand twill is carried out in a corresponding manner to the right-hand.

19. Fancy Skip Twills. Fancy effects may be produced by means of skip twills, by forming skips in the twill lines both warp and filling ways, thus forming little blocks surrounded by clear break lines. This gives the appearance of warp effect gradually changing into filling effect.

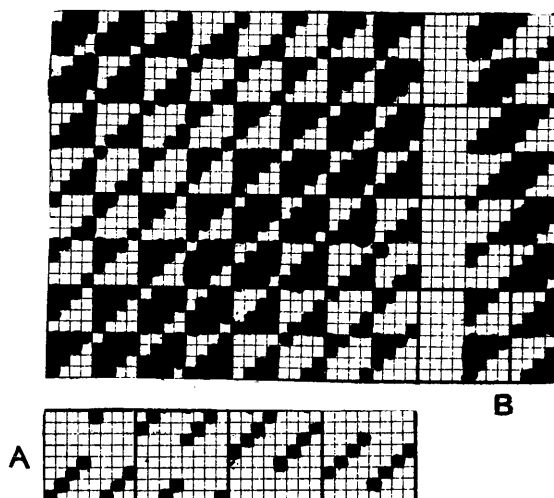


Figure 54

Fig. 54 illustrates a fancy skip twill made from the regular $\frac{4}{4}$, by taking 4 and skipping 3, both warp and filling ways. Fig. 54, A and B, respectively, illustrates the drawing-in and chain draft for this weave.

20. Diagonal (Steep) Twills. Regular twills have a line which forms an angle of 45 degrees. Twills can be made with lines of a steeper or higher degree, by taking but every other end of the regular twill, or every third end, etc.

Fig. 55 is a diagram which illustrates the different degree-twills ordinarily used in the designing of textile fabrics. The degree of the twill line in the cloth does not always correspond with the degree of the twill line on the designing paper, due to

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having more ends than picks per inch in the cloth, or vice versa. For this reason it is often necessary to use a twill with a steeper line than that required in the cloth, when more picks per inch than ends per inch are called for. At times a steep twill line is required in the cloth, especially for fabrics known as "Diagonals."

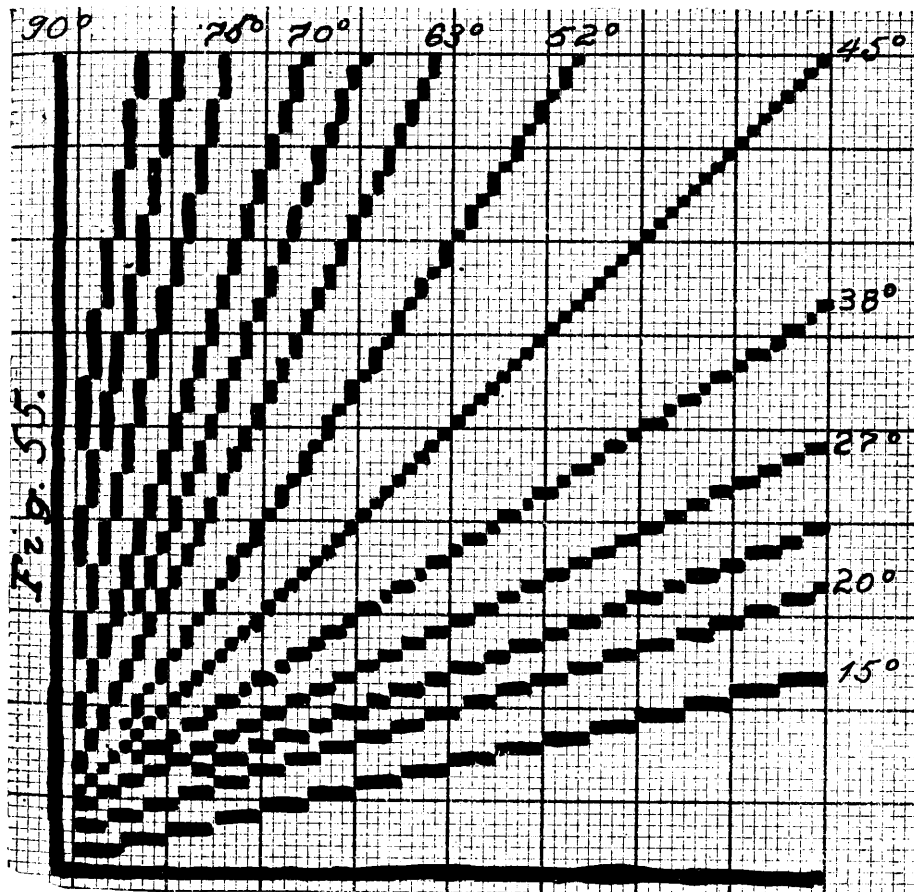


Figure 55

The diagonal (steep) twills most often used are the 63, 70, and 75-degree. With some of these steep twills figured effects are obtained.

63-degree twills are made from the regular (45-degree) ones

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by omitting every other end of the regular twills, thus causing every successive end to interlace two picks higher than the preceding one.

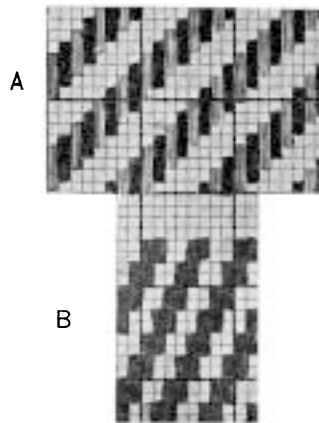


Figure 56

Fig. 56 illustrates the construction of a 63-degree twill. A is the regular $\frac{2}{4}$ twill, from which the 63-degree twill is to be constructed. By omitting every other end of this twill (those on which the raisers are indicated with black) we obtain the 63-degree twill B. Upon examining B, we find that every successive end interlaces two picks higher than the preceding one, giving a twill line of 63-degrees.

Rule: If the regular twill, from which the 63-degree twill is to be formed, repeats on an even number of ends, the 63-degree twill repeats on one-half that number of ends; otherwise the same number of ends is required as in the regular twill.

70-degree twills are made from the regular (45-degree) by omitting two out of every three ends of the regular twill, thus causing every successive end to interlace three picks higher than the preceding one.

Fig. 57 illustrates the construction of a 70-degree twill. A is the regular $\frac{3}{4}$ twill from which the 70-degree is to be constructed; by omitting two ends (those on which the raisers are indicated with heavy black) out of every three of this, we obtain the 70-degree twill B. Upon examining B, we find that every successive end interlaces three picks higher than the preceding one, thus giving a twill line of 70-degrees.

Rule: If the regular twill, from which the 70-degree is to be constructed, repeats on a number of ends which is a multiple

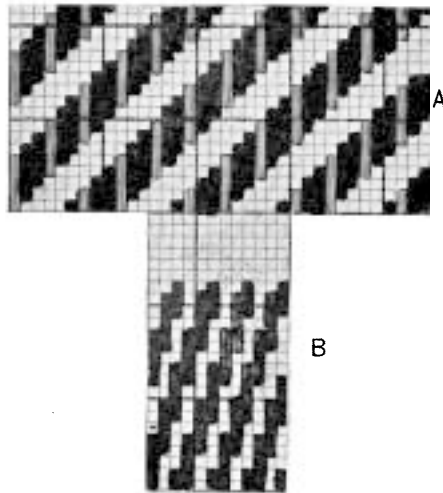


Figure 57

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of three, the 70-degree twill repeats on one-third that number of ends; otherwise the same number of ends is required as in the regular twill.

75-degree twills are made from the regular (45-degree) by omitting three ends out of every four of the regular twill, thus causing every successive end to interlace four picks higher than the preceding one.

Fig. 58 illustrates the construction of a 75-degree twill. A is the regular $\frac{2}{3}$ twill from which the 75-degree is to be constructed. By omitting three ends (those on which the raisers are indicated with heavy black) out of every four of this twill, we obtain the 75-degree, B. Upon examining B, we find that every successive end interlaces four picks higher than the preceding one, thus giving a twill line of 75-degrees.

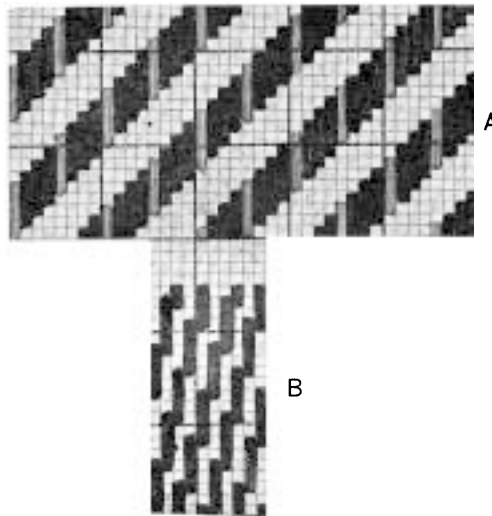


Figure 58

Rule: If the regular twill, from which the 75-degree is to be constructed, repeats on a number of ends which is a multiple of four, the 75-degree twill repeats on one-fourth that number of ends; if the regular twill repeats on a number of ends which is a multiple of two, the 75-degree repeats on one-half that number of ends; if the regular twill repeats on a number of ends which is not a multiple of four nor two, the same number of ends is required for one repeat of the 75-degree as for one repeat of the regular twill.

21. Reclining (27-degree) Twills. Of the reclining twills we will consider the 27-degree only. The other twills of this order are so little used that it does not seem necessary to go into more detail concerning them than is shown in Fig. 55.

In the steep twills we omitted one or more ends, taking only every other one, every third and every fourth one. In the 27-degree twill we take every end twice; *i. e.*, two times in succession, thus causing only every other end to interlace one pick higher than the preceding one.

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Fig. 59 illustrates the construction of a 27-degree twill. A is the regular $\frac{2}{3}$ twill from which the 27-degree is to be constructed. By taking every end of the regular twill twice, we

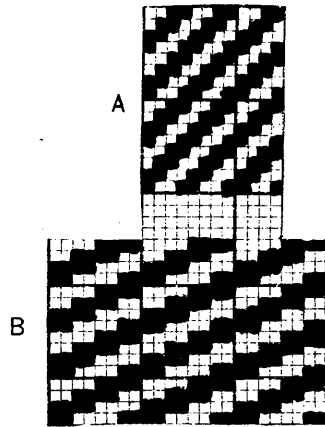


Figure 59

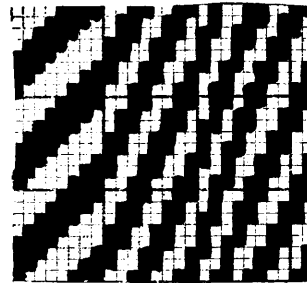
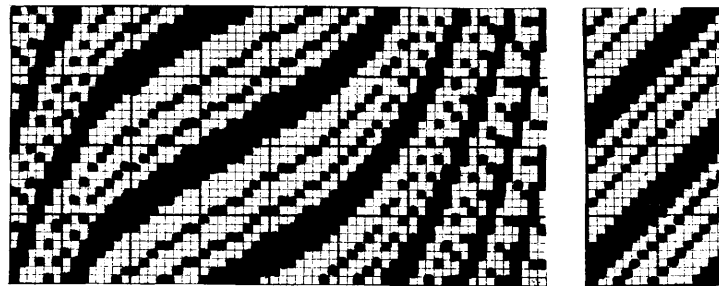


Figure 60

obtain the 27-degree twill B. Upon examining B, we find every other end interlacing one pick higher than the preceding end, thus giving a twill line of 27 degrees.

Twice the number of ends are required for one repeat of a 27-degree twill, as for one repeat of the regular twill from which it is constructed.



B

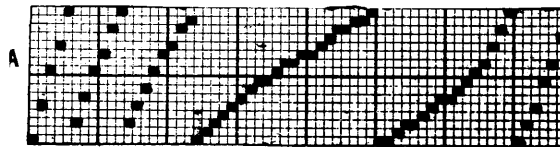


Figure 61

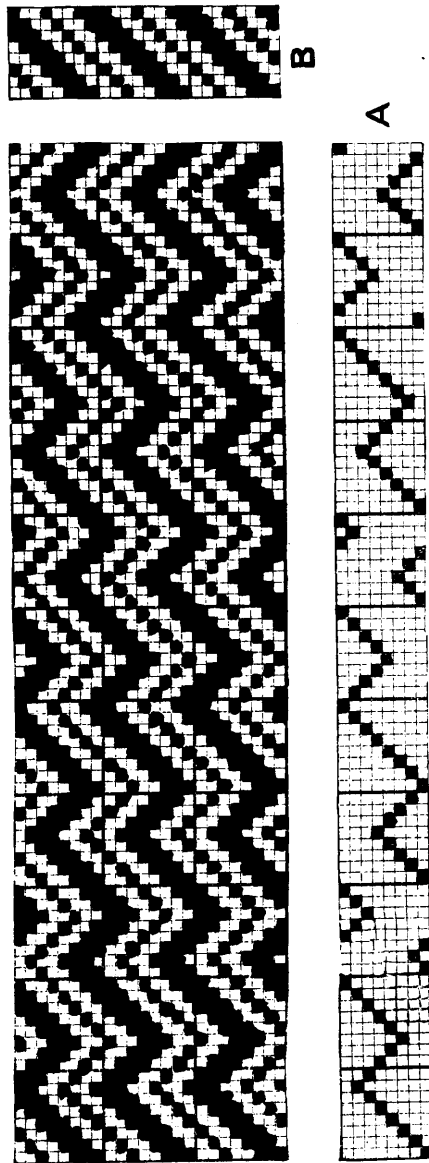


Figure 62

Fig. 62 illustrates a pointed twill made from the regular $3\frac{1}{2}\frac{1}{2}$

22. Curved Twills. By combining twills of the different degrees some very pretty effects can be obtained, forming curved twill lines.

When laying out curved twills, it is customary to first make an outline in pencil, then have the twill follow this line.

Fig. 60 illustrates an elementary form of curved twills. It is made from the regular $\frac{3}{4}$ twill with the first eight ends interlacing as in a 45-degree twill. The next eight ends interlace as in a 63-degree; the next four ends interlace as in a 70-degree; and the last six ends interlace as in a 63-degree twill.

Fig. 61 illustrates a curved twill of a more elaborate nature. It is made from the regular $\frac{5}{4}\frac{1}{3}\frac{1}{2}$ 16-harness twill. A and B, respectively, are the drawing-in and chain draft for this weave.

23. Pointed Twills. Pointed twills, like the broken, have twill lines running both to the right and to the left, but, unlike broken ones, they have no clear break lines at the points where the direction of the twill is changed. Instead they come to a "Point;" *i. e.*, the twill lines meet, forming a point.

The point is formed by the last end of every twill line running in either direction. The first end after the point interlaces like the end preceding the point, etc.

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8-harness twill by running the twill for seven ends to the right, then reversing its direction and running it for four ends to the left. The weave repeats on 88 ends and 8 picks; it is carried out for one repeat wide and three repeats high.

When laying out pointed twills, those of a loose nature should be avoided, because the pointed ones are inclined to form long filling floats near the point.

From Fig. 62 it can be seen that quite a number of effects can be obtained by means of pointed twills, the whole effect being made by the point draw (see Fig. 62, A). Fig. 62, B is the chain draft for this weave. This is an advanced variety of

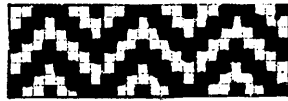


Figure 63

pointed twills. One of plainer construction can be obtained by running the twill line of the regular $\frac{2}{3}$ twill for four ends to the right, and then reversing its direction and running it for four ends to the left. This weave is illustrated by Fig. 63.

24. Figured Pointed Twills. By having the twill lines come to a point, both warp and filling ways, figured pointed twills are produced. They are generally made according to some motive. The filled-in blocks (raisers), in the motive, generally call for right-hand twill, and the blank blocks (sinkers) generally call for the left-hand.

Fig. 64 illustrates a figured pointed twill made from the regular $\frac{2}{3}$ twill according to motive A. Every block in the motive calls for eight ends and eight picks in the weave.

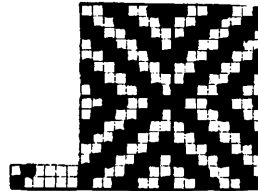


Figure 64

Fig. 65 illustrates a figured pointed twill made from the regular $\frac{1}{3} \frac{3}{1} \frac{3}{3}$ twill according to motive A. Every block in the motive represents one (1) end and 13 picks. B and C, respectively, of Fig. 65 represent the drawing-in and chain draft; from these it can be seen that this weave requires but 14 harness-frames.

25. Double Twill Effects. This class of weaves gives the effect of twill lines of right-hand twill, crossing over twill lines of left-hand, or vice versa.

The effect is produced with the help of regular twills which have a broad line of filling-effect, such as the regular $\frac{2}{3}$ twill, etc. On this line of filling-effect, twill lines of warp-effect are placed, which run in the opposite direction to the filling

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twill line. For this purpose twills of the nature of the regular $\frac{2}{2}$ are generally employed. When laying out weaves of this order, care must be taken that the lines of left-hand twill will not interfere with those of right-hand.

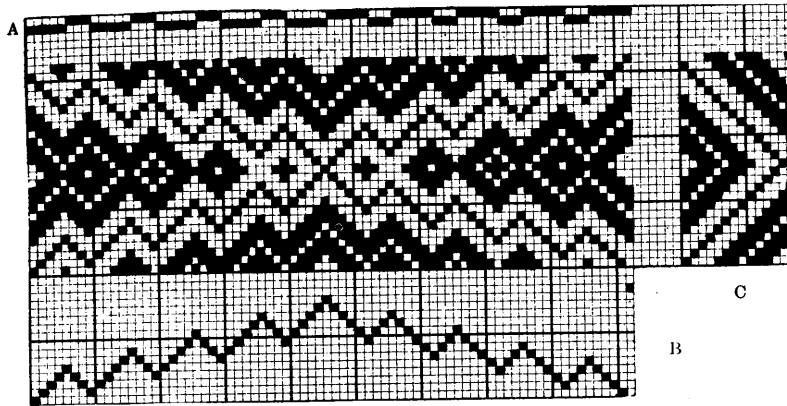


Figure 65

Weaves of this character, at times, require more ends than picks for one repeat, or vice versa. In regard to this, it is customary to keep the repeat of the weave at as small a number of ends as possible and practical, in order to minimize the number of harness frames.

Fig. 66 illustrates the regular $\frac{2}{8}$ right-hand twill crossed by the regular $\frac{2}{2}$ left-hand twill

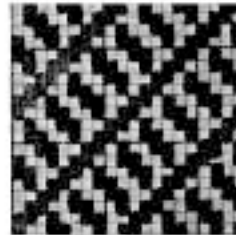


Figure 66

26. Fancy Twill Effects. Using twills with broad lines of filling-effect, and placing a fancy arrangement of raisers and sinkers (or some weave) on the twill line

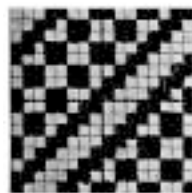


Figure 67

of filling-effect, very pretty effects can be obtained. Basket weaves, warp and filling-rib weaves, and combination weaves are generally used for this purpose.

Fig. 67 is a fancy twill effect made from the regular $\frac{2}{9} \frac{2}{3}$ right-hand twill with a 2 and 2 basket weave on its filling float of nine.

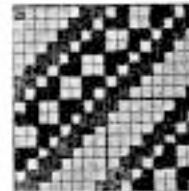


Figure 68

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These effects can be varied by figuring every other line of filling-effect only. Fig. 68 illustrates one of these weaves. It is made from the regular $\frac{2}{2} \frac{2}{2}$ right-hand twill with a 2 and 2 basket on the filling float of seven. The basket weave is started so that a complete square of filling-effect will run along the centre of the twill line.

27. Entwining Twills. These are probably the most novel of all the weaves derived from the regular (45-degree) twills. They have the appearance of sets of right-hand twill lines interlacing (entwining) with sets of left-hand twill lines. Weaves best adapted for the construction of entwining twills are the regular $\frac{2}{2}$, $\frac{3}{3}$, $\frac{4}{4}$, etc., twills.

In order to lay out one of these weaves it is necessary first to find the number of ends and picks required for one repeat of the weave; this is done by the following rule:

Rule: Multiply the number of ends required in one repeat of the regular twill (from which the entwining twill is to be constructed) by the number of twill lines to one set, required in the entwining twill.

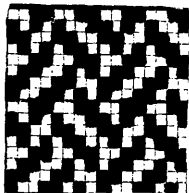


Figure 69

Fig. 69 is an entwining twill made from the regular $\frac{2}{2}$ twill, having two twill lines in every set. To illustrate the above rule: The $\frac{2}{2}$ twill repeats on four ends; the entwining twill is to have two twill lines; according to the rule $4 \times 2 = 8$ ends are required for one repeat of the entwining twill, Fig. 69.

Every twill line in an entwining twill should extend over one-half the number of ends on which the weave repeats.

When constructing these weaves, the best plan to follow is to carry the first twill line for as many ends to the right as the weave requires, beginning the twill line in the same manner as you would the regular one; then carry the twill line for the same number of ends to the left, beginning on the end next to the one on which the right-hand twill line terminated, by placing the lowest raiser on the pick above the highest raiser of the right-hand twill line. The other twill lines are now filled-in; they must all extend over the same number of ends as the first lines.

When the regular $\frac{3}{3}$ twill is used in the construction of an entwining twill, it is customary to place an extra raiser in the centre of the three raisers, on the next end to the ones on which the different twill lines terminate.

Another way of constructing entwining twills from the regular $\frac{3}{3}$ twill, is by beginning the first twill line running to the right, on the first end of the weave with *two up*, then

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running the twill line (to the right) for one end beyond the number of ends required (see rule). On this last end, but two raisers are placed (in accordance with the twill line), the highest raiser coming on the same pick as the highest raiser of the preceding end. The twill line running to the left is also started, and terminates with *two up*; the twill line begins on the same end on which the other terminates, one sinker being placed between the highest raiser of the right-hand twill line, and the lowest raiser of the left-hand line. All the other twill lines are carried out in the same manner, *i. e.*, always beginning with two raisers and ending with two raisers. They all extend one end beyond the number of ends called for by the rule.

Fig. 70 is an entwining twill made from the regular $\frac{3}{3}$ twill, having three twill lines. This weave is constructed in the manner mentioned above; *i. e.*, all twill lines begin and terminate with two raisers.

When the regular $\frac{4}{4}$ twill is used in the construction of entwining twills, it is customary to place two extra raisers in the centre of the four raisers, on the next end to the ones on which the different twill lines terminate.

In all entwining twills, no lines of right-hand twill should interfere with those of the left-hand twill, and vice versa.

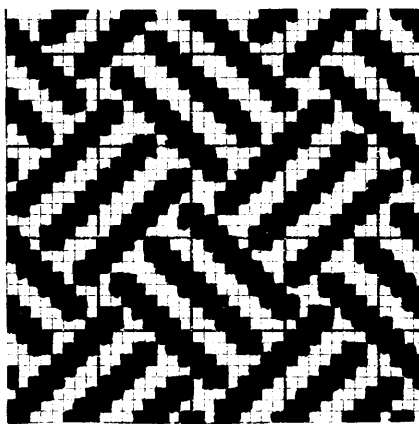


Figure 70

28. Fancy Weaves Produced on the Entwining Twill Principle. When using regular twills, which have a longer filling-float than warp-float, for the construction of entwining twills, diamond-shaped squares of sinkers are formed, surrounded by twill lines.

In this case the twill lines are generally carried out over about three-quarters the number of ends required in one repeat of the weave. These weaves are planned so that the twill lines running to the left terminate at the centre of the twill lines running to the right, and vice versa.

The diamond-shaped squares of sinkers, produced by these weaves, can be filled up by other weaves, or they can remain empty.

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Fig. 71 illustrates one of these weaves made from the

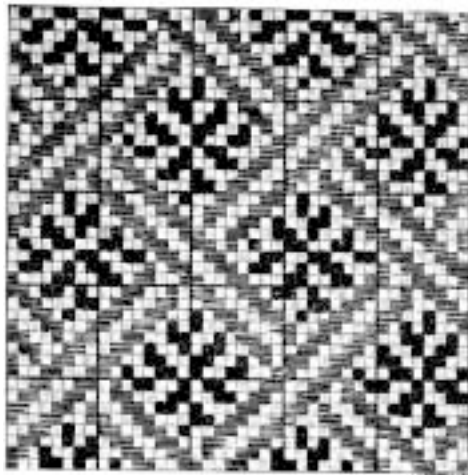


Figure 71

regular $\frac{2}{2} \frac{2}{14}$ twill; the squares in this weave are filled out with a figured broken twill. This weave, besides illustrating the principle, suggests the variety of effects which can be produced with these weaves.

Sometimes regular entwining twills are broken up, forming what may be termed "Broken Entwining Twills." They are carried out in the same manner as the regular entwining twills for a certain number of ends, then a clear break

is formed (in the same manner as in broken twills), and the direction of the twill line reversed. The break lines can occur both warp and filling ways.

Fig. 72 illustrates one of these weaves; it is made from the regular $\frac{2}{2}$ entwining twill (with eight twill lines), the break occurring after the sixteenth end and after the sixteenth pick.

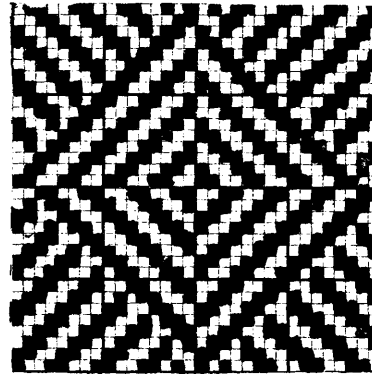


Figure 72

29. Corkscrew Weaves. Corkscrew weaves are derived from the regular twill weaves, and are made by placing the regular twill on every alternate end, then placing the same twill on the ends skipped, in such a manner as to make the sinkers of the even numbered ends come opposite the raisers of the odd numbered ends. Placing the regular twill on but every other end gives a twill line of 27 degrees.

Fig. 73 A shows the regular $\frac{3}{2}$ twill; B shows the same started $\frac{1}{2}$. By first placing twill A on the odd numbered

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ends, and twill B on the even numbered ends, the corkscrew weave C is formed. This of all corkscrew weaves, can be woven on the least number of harness-frames. A

The regular twills best adapted for the construction of these weaves are (besides the above) the $\frac{4}{3}$, $\frac{4}{4}$, $\frac{5}{5}$, and other regular twills of this nature.

Corkscrew weave fabrics closely resemble those woven with warp-ribs, the rib lines running diagonally across the fabric. The face and back of fabrics woven with corkscrew weaves are made up of the warp. The filling lying embedded between the ends is practically invisible. A high number of ends and a lower number of picks per inch are generally used in the weaving of these fabrics; this brings the twill line to an angle of 45 degrees in the cloth. Corkscrew weaves are generally drawn-in on the double-draw principle.

Corkscrew weaves, which have a twill of a loose nature for their foundation, often receive an extra amount of stitching. This is done by the raising of the ends in the centre, or as near to the centre as possible, of their long filling float.

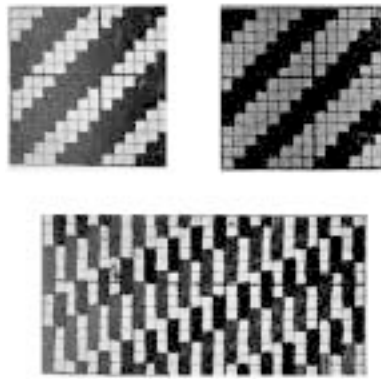


Figure 74

twill on the odd numbered ends is to be started different from that on the even numbered ends.

In the foregoing only such corkscrew weaves have been considered as form fabrics in which the face and the back are made up of the warp, the filling being practically invisible.

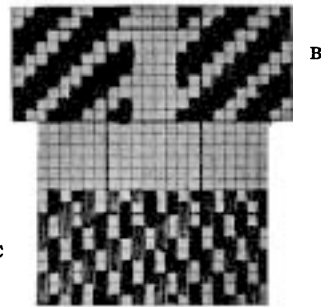


Figure 73

Two weaves are sometimes combined in the construction of corkscrew weaves. In this way twill lines of different widths may be formed. Fig. 74 illustrates one of these corkscrew weaves made from the regular $\frac{4}{3}$ and $\frac{4}{4}$ twills. Both twills are started as called for.

With twills like the regular $\frac{7}{5}$, $\frac{3}{3}$, $\frac{4}{2}$, corkscrew weaves can be formed which have twill lines of different widths. In this case the regular twill is to be used as the regular twills are used in the construction of weaves like the one under Fig. 73, *i.e.*, the

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With filling effect twills (like the regular $\frac{4}{8}$ twill), corkscrew weaves can be formed which have lines of both warp and filling on the face and back of the goods.

30. Figured Corkscrew Weaves. Corkscrew weaves can be figured by means of the "Filling," "Curving of the Twill Lines" and by means of the "Warp."

As mentioned above (in corkscrew weaves like the one illustrated by Fig. 73) the face and back of the fabrics woven with these corkscrew weaves are made up of the warp, the filling lying embedded between the ends being practically invisible. By omitting some of the raisers on two or more of the odd numbered ends (omitting raisers on the even numbered ends will give the same result), filling floats are produced which may extend over from three to five, and more ends. By allowing two or more picks to float in succession, spots of filling floats are formed, which stand out distinctly. This method of figuring corkscrew weaves is employed in piece dyes (where usually a two-ply warp and a single filling are used), fancy vesting, etc. The effect is heightened by the use of lustre yarn, and sometimes silk, for the figure picks. The spots may be arranged according to some motive.

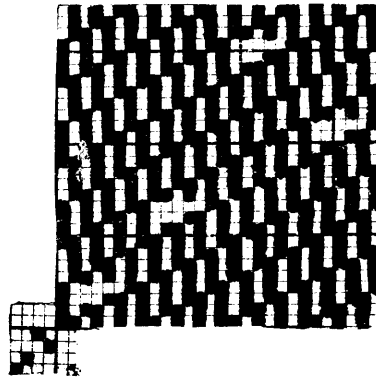


Figure 75

Fig. 75 shows a figured corkscrew weave made from the regular $\frac{4}{3}$ corkscrew. The filling spots are produced by floating the third pick over the third end, and the fourth pick over the third and fifth ends. The spots are arranged according to motive Fig. 75, A. Every block in the motive represents seven ends and seven picks in the weave.

When laying-out these weaves, care must be taken to have the spots occur on the corresponding place of every repeat of the regular corkscrew weave.

Curves in corkscrew weaves can be obtained in much the same manner as in curved twills; the lines generally being run from left to right and reverse. The slope of the twill lines is never as steep on paper as the 63-degree lines and indeed very seldom as steep as 45-degrees.

Warp figures in corkscrew weaves are generally made with

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a warp of two kinds of yarn. The yarns differ in size, material or color. The odd numbered ends are usually of one kind of yarn, and the even numbered ends are of another. When using two colors with this arrangement, twill lines of different colors will result.

Moreover the odd numbered ends can produce the figure, by lengthening and shortening the warp floats (according to the effect to be produced), and the even numbered ends can produce the ground, or vice versa.

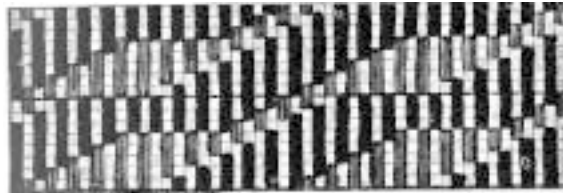


Figure 76

Fig. 76 illustrates one of these effects.

Besides the different corkscrew weaves mentioned above, filling effect corkscrews can be formed. These are made in much the same manner as warp effect corkscrews, the picks of the regular twill are placed on the odd numbered picks of the corkscrew weaves. The even numbered picks may then be filled in in accordance with the warp effect corkscrew, *i.e.*, the raisers of the even numbered picks against the sinkers of the odd numbered ones.

CHAPTER FOUR.

WEAVES DERIVED FROM THE SATIN WEAVES.

31. Double Satins. In regular satin weaves every end and pick receives but one interlacing in one repeat of the weave. In double satins, extra points of interlacing are added to those in the regular satin; thus the name "Double Satins."

The purpose in making these double satin weaves is to increase the amount of interlacing of the regular satin. In this way a tighter interlacing is obtained which adds strength to the fabric, and, at the same time, does away with extra long floats of both warp and filling without changing the satin effect.

The extra amount of interlacing is added by means of extra raisers to the raisers of the filling-effect satins, and extra sinkers to the sinkers of the warp-effect satin weaves.

When laying-out these weaves it must be remembered that the satin effect is not to be disturbed and the floats of either warp or filling, whichever forms the face of the fabric, are not to be broken up too much. When constructing a double satin for filling-effect face, it is customary to add the extra raisers on either side of the original raisers; when constructing one of these weaves for warp-effect face, it is customary to add the extra sinkers on either top or bottom of the original sinkers. Extra raisers or sinkers added to either corner of the original raisers and sinkers are generally used in only those weaves which repeat on eight or more threads. Adding the extra points at either corner gives a very strong interlacing.

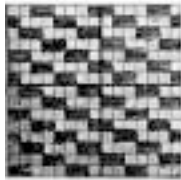


Figure 77

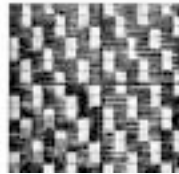


Figure 78

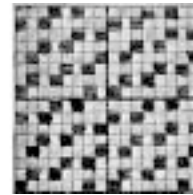


Figure 79

Figs. 77, 78, and 79 will illustrate the principle of double satin weaves. Fig. 77 is made from the five-harness satin; the extra raisers are added on the sides of the original raisers of the filling effect of this satin. The original raisers, for one repeat,

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are indicated by dark blocks. This weave is best suited for filling effects; the filling floats, not being broken up enough to interfere with the satin effect, leaving floats of three; the warp floats are broken up to $\frac{1}{2}$, the longest float being two.

Fig. 78 shows a double satin suitable for warp effects; it is made from the five-harness satin. The original sinkers in the first repeat, are indicated by light blocks.

Fig. 79 shows a double satin suitable both for warp and filling effects; the extra raisers are added on the upper right-hand corner of the original raisers. It is made from the eight-harness satin; the original raisers are indicated for one repeat by dark blocks.

This class of weaves is used in cotton fabrics which have a plain weave ground and satin stripes, in striped worsted goods, and as the pile weave in chinchilla overcoatings, etc.

32. Granite Weaves. Under this heading weaves are described which give the cloth a rough, broken-up appearance. They are usually made from the filling-effect satin weaves by the addition of extra raisers.

A good granite should have the following characteristics: The interlacing should be broken up; no floats should extend over more than four ends or picks; no pronounced twill lines should be visible on the face; they should be as even sided as possible; *i.e.*, there should be as many raisers as sinkers in one repeat of the weave.

The smallest satin that can be used in the construction of granite weaves is the seven-harness. This satin, however, is little used for their construction, those from eight-harness and upwards being generally employed.

The extra raisers in the construction of granite weaves may be added on top, below, on either side, or in either corner of the original raisers. More than one raiser must be added to every original raiser, in order to make the weave even sided. The

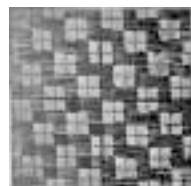


Figure 80

raisers can also be added according to some other weave between the raisers of the satin.

Fig. 80 illustrates a granite weave made from the regular eight-harness satin. The extra raisers, three in all, are added

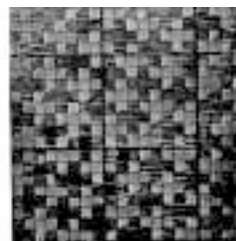


Figure 81

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side of the original raisers of the filling-effect satin weave. The original raisers of the satin weave, for one repeat, are indicated by dark blocks.

Fig. 81 illustrates a granite weave made from the regular ten-harness satin. The original raisers of the satin weave, for one repeat, are indicated by dark blocks.

Besides the above, there are numerous other ways of constructing granite weaves. Another method is to rearrange the ends of twill weaves, specially twills which repeat on an odd number of ends. These can be rearranged to produce various changes of this kind.

Still another method of constructing granite weaves is by the overturning of squares of weaves; *i.e.*, after carrying out a weave in the regular manner for a certain number of ends and picks (usually a twill weave, or some weave of a fancy arrangement of raisers and sinkers), overturn the weave by forming clear break lines, and, at the same time, change the weave so that raisers are changed to sinkers, and vice versa.

Fig. 82 will illustrate this principle and make it clearer to the student. The first repeat (eight ends and 8 picks) is divided into four squares, A, B, C, and D. A fancy arrangement of raisers and sinkers is first placed in square A; then by overturning this weave and placing it in the squares B and D, connecting with square A, exchanging raisers for sinkers and vice versa. The other square, C, is then readily filled in.

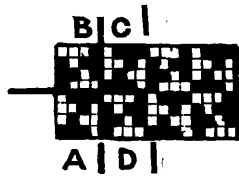


Figure 82

33. Clear Breaks in Satin Weaves. In such fabrics as damask table covers, etc., it is required to have warp and filling effect satin in the same fabric. Usually blocks of warp-effect satin change off with blocks of filling-effect satin. Where the satin changes from warp to filling-effect, clear breaks are formed (this means checkerboard and similar effects only), by making the raisers of the filling-effect satin come opposite the sinkers of the warp-effect. This can only be done if there is no point of interlacing at the intersection of the first end and first pick, the first end and last pick, the last end and first pick, and the last end and last pick. In other words, there should be no point of interlacing in any of the corners of one repeat of the weave. To obtain this point, the satin weaves must never be started with the first end or any other end which interlaces with either the first or last pick, nor with an end next to any one of these.

Another point to observe in the construction of these weaves, is to use the opposite counter in constructing the blocks

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of warp-effect, to the one used in the construction of the blocks of filling-effect. For instance, if an eight-harness satin is used,

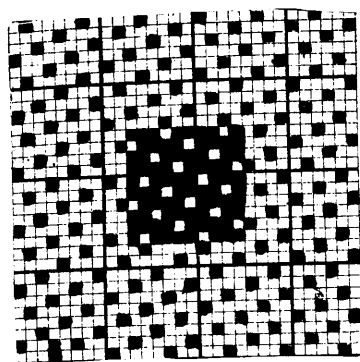


Figure 83

Blocks of warp and filling-effect satin can also be arranged according to some motive, by which means some novel effects are obtained.

34. Shaded Satins. Satin weaves are shaded by the addition of raisers to the raisers of the filling-effect, at regular intervals, until the warp-effect satin is obtained.

When laying out these weaves the entire space to be occupied by the weave is filled-in with the filling-effect of the satin. Then this space is divided off into sections which require different shadings. Extra raisers are then added wherever required. For instance, if we wish to shade a five-harness satin from filling-effect to warp-effect, at intervals of ten picks each (this is shading in the direction of the warp), there will be four changes: first, filling-effect; second, one raiser added; third, two raisers added; and fourth, three raisers added. Every change requiring ten picks makes a total of forty picks for one repeat of the weave. The first thing to do, after laying off forty picks about two repeats wide, is to fill in the filling-effect of the five-harness satin; then mark off the spaces, ten picks each, four in all; the first space (see A, in Fig. 84), is complete, being made up of filling-effect; to the next space, B, one raiser is added above every raiser of the filling-effect; in the next, the third

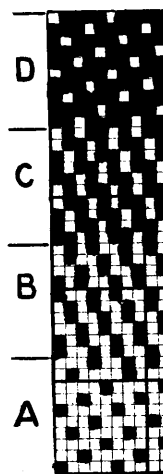


Figure 84

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space, C, two raisers are added above every raiser of the filling-effect; in the fourth space, D, three raisers are added above every raiser of the filling-effect. Fig. 84 illustrates the above explained weave. Letters A, B, C, and D, correspond with the letters in the above description.

This same principle of shading is used in the shading of squares, curves, circles, etc. The method of construction is to place the filling-effect over the entire design; the extra raisers are added afterwards, as many and wherever the design requires it.

In Jacquard figured effects, shading is mostly used to bring out the figures, etc.

CHAPTER FIVE.

WEAVES FOR FABRICS CONSTRUCTED WITH TWO WARPS AND ONE FILLING.

35. An Extra Warp for Weight. In woolens and worsteds, for men's wear, it is often impossible to produce a fabric of the required weight with but one warp and filling. In such cases an extra warp, an extra filling, or both, may be added. When adding an extra warp for weight to a fabric, the fabric is termed *backed by warp*. For this purpose we must consider two warps, (*a*) the face warp, and (*b*) the back warp. The face warp weaves with the filling to form the face of the fabric, while the back warp weaves with the filling to form the back of the fabric.

For the interlacing of the face warp a closer weave,—such as the $\frac{2}{2}$ twill, etc.,—is usually employed than for the interlacing of the back warp, where satin weaves are mostly used. Filling effect weaves are always used for the interlacings of the back warp, while even sided and warp effect weaves are employed for the face; for special fabrics only, a filling effect weave is used for the interlacing of the face warp, in which every end interlaces but once in one repeat of the weave. The reason for this will be seen presently.

The proportion of face and back mostly used is one of face to one of back, two of face to one of back, and three of face to one of back. The first two arrangements of face and back warps are mostly used. There should never be more back ends than face in the arrangement of an extra warp for weight fabric.

The yarns for the back warp should not be coarser than those of the face warp, where the warps are arranged one of face to one of back, although it may be made of some cheaper material. In an arrangement of two of face to one of back, the back warp can be heavier than that of the face; the yarns for the back warp are usually of some cheaper material. In fabrics which are to be fulled after weaving, the back warp should have about the same amount of fulling properties as the face, otherwise the fabric will not have a finished, but baggy, appearance.

In the weaving of fabrics with an extra warp for weight the back warp, at times, is placed on an extra beam. This is especially the case when the weave used for the back has a much looser interlacing than the one used for the face.

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When laying out weaves for an extra warp for weight, it must always be remembered that unless the back warp is to be used for figuring, it should not interfere with the appearance of the face of the fabric; therefore the points of interlacing of the back weave must not be seen on the face; *i.e.*, an invisible stitch must be made. This is done by having the raisers of the back warp arranged in relation to those of the face warp. There are three positions, in relation to those of the face warp, to which the raisers of the back warp may come. First, *the raisers of the back warp may come between two raisers of the face warp*; second, *the raisers of the back warp may come between a raiser and a sinker of the face warp*; third, *the raisers of the back warp may come between two sinkers of the face warp*. These are the three possible ways of interlacing (*stitching*) the back warp.

The first produces an invisible stitch and should always be used, if possible. The second produces a fairly good stitch and should be used where the first can not. The third produces a visible stitch and should never be used where the back warp is not to be seen on the face of the fabric.

When the back warp is raised over the filling between two raisers of the face warp, there is a face end raised over the same pick on both sides of the back end, which is completely covered by them. If the back warp is raised over the filling between a raiser and a sinker of the face warp, there will be one face end raised over the same pick on one side of the back end, thus partly covering it. In the third case the back end is raised over the filling between two sinkers of the face warp; in this, there is no possible chance of concealing the back end as there is no face end raised over the same pick near enough to the back end to cover it. This would make it stand out and change the effect on the face of the fabric.

Fig. 85 is a section-cut illustrating the raising of a back end over the filling between two raisers of the face warp. The solid dots indicate the filling, the line *A* indicates the face warp, and

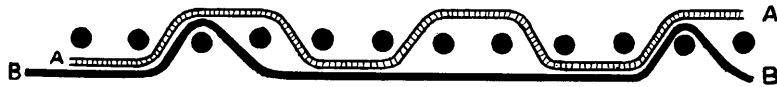


Figure 85

the line *B* indicates the back warp. The $\frac{2}{2}$ twill is used for the interlacing of the face warp and the eight-harness satin for the back.

Fig. 86 illustrates the weave for section-cut Fig. 85. In

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this case the warps are arranged one of face to one of back. The face weave repeats on four ends and four picks, the back weave repeats on eight ends and eight picks. Therefore eight back ends are required for one repeat of the weave; there being one face end to every back end, making the entire weave repeat on sixteen (16) ends and eight (8) picks.

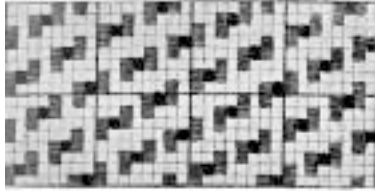


Figure 86

Fig. 87 illustrates another one of these weaves. In this case the warps are arranged two of face to one of back; the face warp weaves according to the $\frac{3}{1}$ broken twill, two to the right and two to the left (four leaf clover), and the back warp weaves according to the filling effect of the same broken twill.

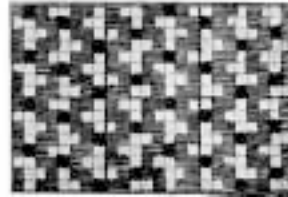


Figure 87

This same principle, as in an extra warp for weight, is used in double face fabrics, found mostly in silk ribbons and in some cloakings. In these fabrics it is also necessary to produce an invisible stitch with the back warp. In the case of ribbons satin weaves are used, warp effect for the face and filling effect for the back of the fabric.

36. An Extra Warp for Figure. The principle of two warps and one filling is extensively employed in the production of spot and stripe effects used for ladies' dress goods, shirtings, etc. In this class we distinguish the warps as ground warp and figure warp. The ground warp weaves with the filling to produce the ground, or body of the goods, and the figure warp weaves with the filling to produce the figure upon the face of the goods.

The warps can be arranged one of ground to one of figure, etc., over the entire fabric, or stripes of figure warp at certain intervals only may be used. For these stripes the warps are arranged one of ground to one of figure, etc., or the ground warp may be omitted, as in such fabrics where the figure warp forms stripes which cover the body (ground) of the fabric completely. Where the figure warp is to show on the face, in order to form the figure, it is raised over the filling and either floated on the face of the goods or (when the floats are too long), it is stitched down with a warp-effect satin. Where the figure warp is to be invisible

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it is allowed to float on the back, so that it can be sheared off during the finishing, or it may be stitched to the body of the fabric with some loosely interlaced weave according to the extra warp for weight principle; *i.e.*, with an invisible stitch.

In fabrics which are sheared after the weaving, it is customary to give the figure warp an extra point of interlacing before and after its appearance on the face of the fabric. This keeps the figure ends from pulling out after the shearing. Fig. 88 illustrates this principle. This extra point of interlacing consists of a raiser and a sinker before the float, and a sinker and a raiser after the float.

In Fig. 88 a plain weave ground is used, figured by means of

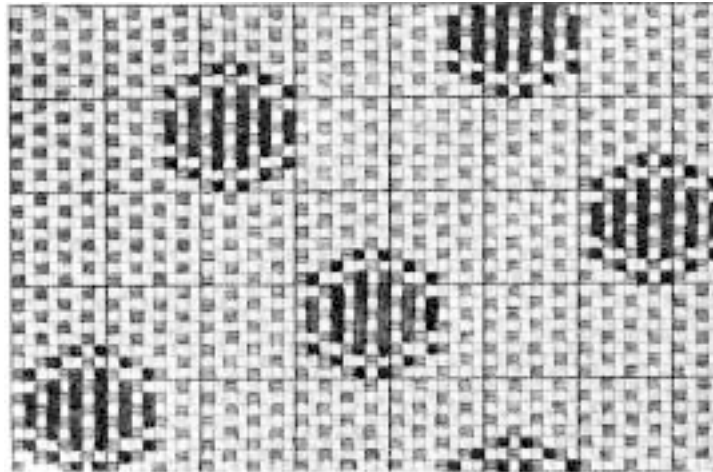


Figure 88

spots produced by an extra warp; the spots are arranged according to the five-harness satin.

Fig. 89 illustrates a section-cut of weave Fig. 88, cut between



Figure 89

the second and third figure end; A is figure end, B the ground end; the solid dots indicate the picks.

37. Lappet and Swivel Weaving. Although the interlacing of warp and filling (weaves) is only to be mentioned in these

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chapters, nevertheless a few words will be said upon this subject.

Lappet weaving is a form of extra warp for figure; the extra warp is passed from the rear, or above, the loom through the reed and through the eye of a needle which is set close in front of the reed. This needle is arranged so that it can move from side to side for various distances; one thread only is passed through each needle. These threads run direct from spools placed in the rear of the loom. With the lappet arrangement various-shaped spots may be produced such as oblong, diamond-shaped, round, etc.

Lappet weaving is fast going out of use, and swivel weaving taking its place. The swivel consists of an extra lay placed over the regular lay of the loom; small shuttles are placed in various places across the lay. One of these small shuttles is required for every figure spot in the width of the fabric.

The small shuttles are operated by means of a ratchet and pinion, separate from the operation of the shuttle in the regular lay. The figure threads are placed in these small shuttles, the shuttles travelling back and forth (every small shuttle travels across but a short distance of the width of the fabric), carrying the figure thread along with them. The interlacing of the figure threads is regulated by the raising and lowering of the harness-frames.

Producing spot effects by means of lapped and swivel weaving is a large saving in material, as every inch of yarn woven into the goods is used in the production of the effect, none whatever being wasted by shearing or floating on the back. The process of weaving, however, is much slower and the production of goods very much diminished.

Swivel weaving is generally classed under the heading of an extra filling for figure.

CHAPTER SIX.

WEAVES FOR FABRICS CONSTRUCTED WITH ONE WARP AND TWO FILLINGS.

38. An Extra Filling for Weight. Weight is often added to a fabric by means of an extra filling instead of an extra warp. Filling, undergoing less strain during the weaving than the warp, can be of a softer and cheaper grade than would be required for warp purposes; a heavier texture can also be used filling ways than warp ways, as there is no chafing of consequence on the filling, nor is there as much tension on the filling as there is on the warp.

From this it is seen that a saving can be made on the material by adding weight to a fabric by means of an extra filling instead of an extra warp. This however is counterbalanced by the decreased production during the weaving. For instance, if we have a piece of single cloth which has eighty (80) picks per inch and we wish to add an extra filling to this, with an arrangement of one of face to one of back, in the entire cloth there would be $80 + 80 = 160$ picks per inch. Supposing this cloth is to be woven in a loom which makes eighty (80) revolutions per minute (80 is used for the convenience of this illustration), it would require one minute to weave one inch of the single cloth and two minutes to weave the same amount of cloth (one inch), when an extra filling is added to increase its weight, thus halving the production.

In this class of goods the weaves are the same as those used in connection with the principle of an extra warp for weight. The face filling weaves with the warp to form the face of the goods and the back filling weaves with the warp to form the back. From this it can be seen that the two fillings are distinguished as face filling and back filling.

The back filling is stitched to the fabric by the lowering of an end under the back picks according to some weave, usually a satin or some other of this nature. The back pick should pass over an end at the point where the preceding and following face picks pass over the end; as the two face picks will cover the back pick completely, this method gives an invisible stitching. Where this stitch can not be obtained, the stitching should be done between a sinker and a raiser of the end with which the

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back filling is to interlace, thus bringing the back pick over an end over which either the preceding or following face pick passes, covering to a certain extent the back pick.

Fig. 90 illustrates one of these weaves; the face weave is the regular $\frac{2}{2}$ twill; the back weave is the eight-harness satin, warp effect; the fillings are arranged one of face to one of back.

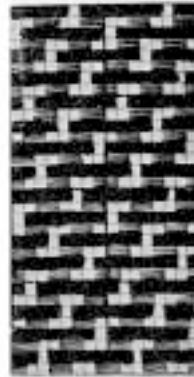


Figure 90

39. An Extra Filling for Figure. The principle of two fillings and one warp, like that of two warps and one filling, is often used in the production of figured effects for ladies' dress goods, fancy vestings, etc. In this class the fillings are distinguished as ground and figure. The ground filling weaves with the warp to form the ground, or body, and the figure filling weaves with the warp to produce the figure upon the face.

The fillings can be arranged one of ground to one of figure, etc., over the entire fabric, or stripes of figure filling at certain intervals only may be used. At these stripes the fillings are arranged one of ground to one of figure, etc., or the ground filling can be omitted, especially in fabrics in which the figure filling forms stripes which completely cover the ground of the fabric. When the figure filling is to show on the face in order to form the figure, it is passed over the warp and either floated on the face of the goods, or (when the floats are too long) it is stitched down with a filling-effect satin weave. Where the figure filling is to be invisible, it is allowed to float on the back of the goods so that it can be sheared; or it is stitched to the body of the fabric with some loosely interlaced weave according to the extra filling for weight principle; *i.e.*, with an invisible stitch.

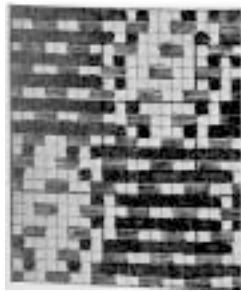


Figure 91

Figuring with an extra filling is largely done by means of the swivel lay which is explained under Chapter V., Section 37.

When the figure is sheared off the back after the weaving, it is customary to give it an extra point of interlacing before and after its appearance on the face of the fabric. This keeps the figure picks from pulling out. Fig. 91 illustrates this principle; the extra point of interlacing consists of a sinker and a raiser before the float, and a raiser and a sinker after the

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float. In Fig. 91 the regular $\frac{2}{2}$ twill is used for the ground weave. This ground is figured by means of filling spots which are arranged according to the plain weave.

40. Coin Spots. This is another form of effect produced by means of an extra filling for figure. These effects obtain their name from the shape of the spots, which are usually circular or coin-shaped. In the smaller effects they are known as "Dotted Swiss" and consist of round spots on a plain weave ground. The extra filling generally enters the same shed as the preceding or following plain weave pick; the shed for the figure pick being formed for the width of the spot only. The figure picks float between the spots and are afterwards sheared off, thus causing considerable waste.

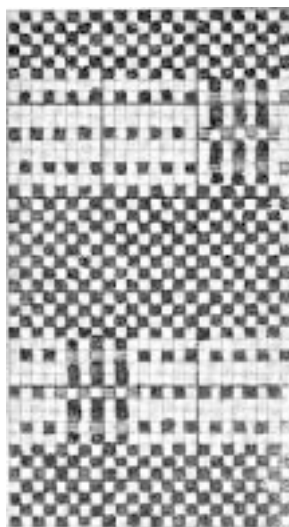


Figure 92

every repeat and are arranged according to the plain weave. Where the spots come, the fillings are arranged one figure, one ground, two figure, one ground, two figure, one ground, and one figure. This weave is laid out to weave face down.

In these effects a soft material is usually used for the fillings; when two kinds are used, the figure filling is generally coarser than the ground. The fabrics are of an open nature and are used for ladies' dress goods, curtains, etc.

41. Rib Fabrics Produced by Means of Two Fillings and One

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Warp. These may be of two classes. The first is known as the *Longitudinal Rib Weave* and the second as *Diagonal Rib Weave*.

Longitudinal Rib Weaves, in cottons, are often confounded with "Piques." They also come under the heading of Bedford-Cords, and are made by having the filling interlace with a certain number of ends and then floating on the back for another series of ends. Two fillings are used for the construction of these goods, generally arranged one and one, or two and two. The fillings, both weaving on the face and back, are distinguished as the first and second picks, or as the first two picks and second two picks, etc. The first pick generally weaves with a certain number of ends, then floats on the back for a certain number of ends; the second pick floats on the back of the ends with which the first pick interlaced, then weaves with the ends under which the first pick floated, etc.

Through the filling interweaving and floating on the back, alternately, for a certain number of ends, cords or welts running in the direction of the warp are formed. These cords are brought out stronger by the addition of a number of ends which weave in the centre of every cord; and these extra ends are at times of some fancy material and are used for figuring the cords besides bringing them out. At times they are woven in as stuffer ends; *i.e.*, they do not interlace with the filling but lie between the body of the fabric and the filling which floats on the back.

Fig 93 illustrates one of these weaves known as the Bedford-Cord; it is made by having the first two picks interlace with the first eight ends according to the plain weave, then floating under the next eight; the next two picks weave opposite to the first two; *i.e.*, they float under the first eight ends, and weave with the next eight according to the plain weave.



Figure 93

This class of weaves is also used in the manufacture of worsteds for trouserings and suitings. They are carried out in much the same manner as in cottons, a two-colored warp and fillings of different colors sometimes being used; or the fabric is woven in the grey and dyed in the piece.

When using a two-colored warp, arranging the colors eight of black and eight of blue, a black pick is to alternate with one of blue at the same time, solid colored stripes, running in the direction of the warp, can be produced by having the black pick weave with the black ends and floating under the blue ones and the blue pick float under the black ends and weave with the blue. Either the plain or a twill weave can be used wherever the warp inter-

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laces with the filling, or a different weave, from that used for the black stripe, can be used for the blue, providing both weaves have about the same amount of take-up.

These weaves may be figured by means of an extra warp as explained above, or they may be figured by having the filling float on the face of the fabric for a number of ends, thus producing spots which can be arranged according to some motive.

Diagonal Rib Weaves are mostly employed in the production of worsted dress goods and worsted suitings. They are made in much the same manner as the longitudinal rib weaves; *i.e.*, by having the filling weaving and floating alternately with sets of ends. In this case we desire to form rib lines, or cords running diagonally across the fabric. It is done by having every successive pick interlace with a set of ends which is one end farther to the right than the set of ends under which the preceding pick floated; *i.e.*, if the first pick weaves with the first eight ends and floats under the next eight, the second pick will weave with the first end, float under the next eight, and weave with the next seven ends.

To illustrate this still better Fig. 94 has been constructed. In this case the first pick weaves,

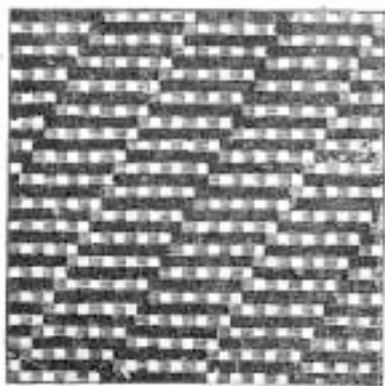


Figure 94

according to the plain weave, for eight ends and floats under the next eight, etc.; *i.e.* the first pick weaves $\begin{smallmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{smallmatrix}$. The second pick weaves with the first end, according to the plain weave, and floats under the next eight, then weaves with the next seven ends according to the plain weave, etc.; *i.e.*, the second pick weaves $\begin{smallmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{smallmatrix}$. The third pick floats under the first two ends, weaves plain weave with the next eight and floats under the next six, etc.; *i.e.*, the third pick weaves $\begin{smallmatrix} 2 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{smallmatrix}$. The fourth pick weaves with the first three ends, floats under the next eight, and weaves with the next five ends according to the plain weave, etc.; *i.e.*, the fourth pick weaves $\begin{smallmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{smallmatrix}$, etc.

Diagonal rib weaves may also be figured by means of filling floats; thus forming spots which may be arranged according to some motive. •In piece dyes, when a single yarn is used for the filling and a ply yarn for the warp, the single yarn will appear bright, thus giving a very pretty effect.

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By having the filling weave with sets of ends two or more ends further to the right than the set of ends under which the preceding pick floated, diagonal rib-lines of a lower degree may be formed. When the rib-lines are to run from right to left every successive pick must interlace one or more ends further to the left.

42. Figured Beavers. In this class of fabrics, like the foregoing, two fillings are employed, both of which weave on the face and back of the goods. A cotton warp and woolen filling are used, the filling being of two colors, one producing the ground and the other the figure. After the weaving the goods are usually *napped* (gigged) very heavily in order to cover up the warp and soften the face of the fabric. These weaves are also extensively used in a class of fabrics known as *Eider Down*; in this case a cotton warp is also used, the filling being of a soft spun cotton or woolen yarn. The goods are napped on both sides.

The 3_1 broken twill, two to the right and two to the left, (the four-leaf clover, filling effect), is used for the face weave and

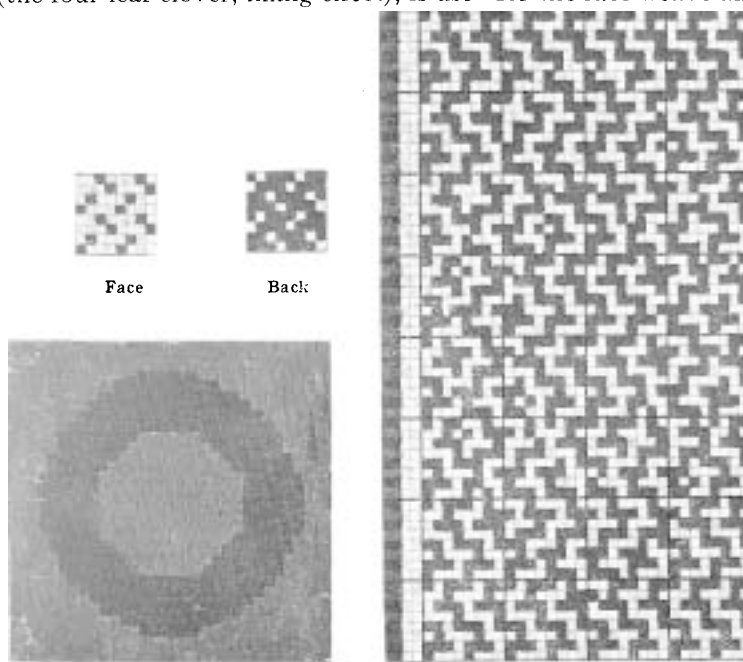


Figure 95

the 3_1 broken twill, two to the right and two to the left (the four-leaf clover, warp-effect), is used for the back weave. Therefore

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wherever a pick is to be visible on the face the first weave is used, otherwise the latter is employed.

These weaves are generally laid out according to a figure or motive, especially in eider-downs for bath-robos, which are often figured by means of the Jacquard machine.

Fig. 95 illustrates a weave for a figured beaver, made according to motive A. The fillings are arranged one of red to one of black which are indicated on the left-hand side of the weave. Every pick in the motive calls for one pick red and one black in the weave. In order to make the back picks invisible, the raisers on the back picks must bear a certain relation to those on the face picks. This is done according to the same rule as in an extra filling for weight.

The five-harness satin weave, filling and warp effect, the 1_4 and 3_4 straight and broken twills, and similar weaves of this nature, are also used for these goods.

CHAPTER SEVEN.

DOUBLE CLOTHS.

43. The Principle and Construction of Double Cloths. Double cloths consist of two independent fabrics, woven one on top of the other. These two fabrics may, or may not, be stitched together as the case may warrant.

In order to weave two independent fabrics, one on top of the other, at the same time, two warps and two fillings are required,

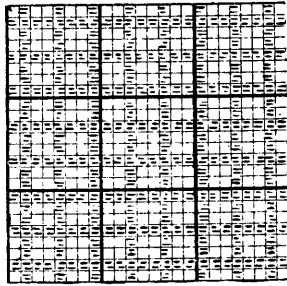


Figure 96

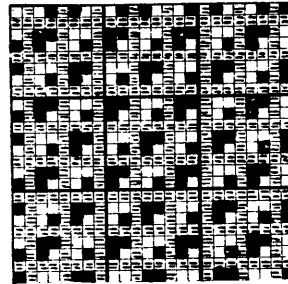


Figure 97

one warp and one filling for each fabric. The warps are known as face and back, and the fillings also as face and back. The face

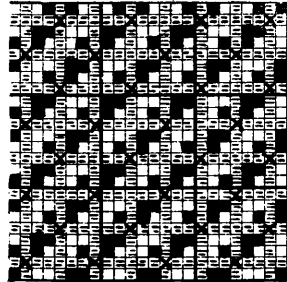


Figure 98

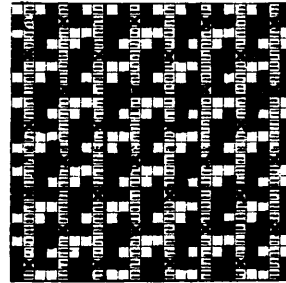


Figure 99

warp weaves with the face filling to form the face (top) fabric, and the back warp weaves with the back filling to form the back

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(bottom) fabric. The stitching (combining) of these two fabrics can be done by either having the back warp or filling interweave with the face fabric, or by having the face warp or filling interweave with the back.

When planning these weaves on point paper it is customary to treat the face threads separately from those on the back, one after the other.

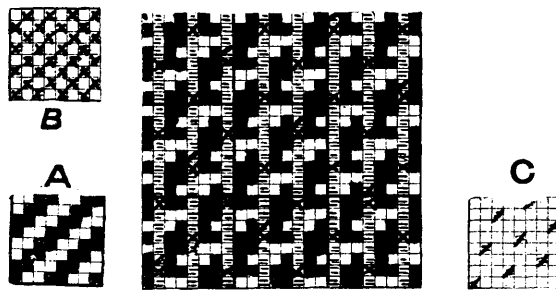


Figure 100

The proportion of face to back threads can be one of face to one of back, two of face to one of back, two of face to two of back, three of face to one of back, etc.; or the proportions of the fillings can be different from that of the warps; *i.e.*, the warps can be arranged one of face to one of back and the fillings two of face to one of back, etc.

Figs. 96, 97, 98, 99, 100, and 101 illustrate the different rules followed in the construction of double cloth weaves on point paper. In this case the warps and fillings are arranged two of face to one of back; the $\frac{2}{2}$ twill is used for the face weave (see Fig. 100, A), and the plain weave is used for the back (see Fig. 100, B). The laying out should be done according to the following rules.

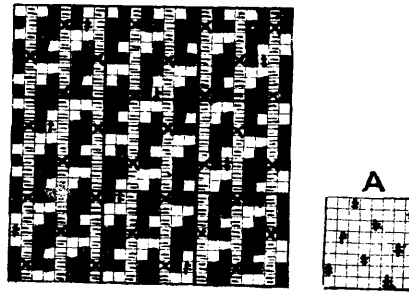


Figure 101

Rule 1. Indicate the back ends and picks (see Fig. 96). When the arrangement of warps and fillings is two of face to one of back, it is customary to start the weave with one of face.

Rule 2. Place the face weave on the face ends and picks, skipping the back threads as if they were not in the weave (see Fig. 97).

Rule 3. Place the back weave on the back ends and picks.

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skipping the face threads as if they were not in the weave (see Fig. 98).

Rule 4. Raise the face ends over the back picks (see Fig. 99).

Rule 5. Stitch the two fabrics together (see Fig. 100).

In this case the two fabrics have been stitched by the raising of the back ends over face picks in an eight-harness satin order, three as the counter. When stitching these weaves care must be taken to form an invisible stitch; *i.e.*, the same rules must be observed as in chapters five and six, sections 36 and 38, respectively. When a back end is raised over a face pick it should be done between two raisers of the face weave and next to a raiser of the back weave. When the stitching is done by lowering a face end under a back pick, it should be done between two sinkers of the face weave and next to a sinker of the back (see Fig. 101). Fig. 100, C illustrates the eight-harness satin used in the stitching of the fabrics in Fig. 100. Fig. 101, A illustrates the eight-harness satin used in the stitching of Fig. 101.

When it is impossible to stitch a double cloth in the manner described above, the following method should be used. Stitch by raising the back ends over face picks between a raiser and a sinker of the face weave and next to a raiser of the back weave. Or, stitch by lowering the face ends under back picks between a sinker and raiser of the face weave and next to a sinker of the back. A back end should never be raised over a face pick between two sinkers of the face weave, nor should a face end be lowered under a back pick between two raisers of the face weave for stitchings of this sort will interfere with the face of the fabric.

In order to keep the back filling from passing over the face warp, the face warp (ends) is raised over the back filling (picks) (see rule 4), thus keeping the two fabrics separate. As the back warp is originally down (on point paper) when the face filling crosses, it need not be lowered, hence no rule for this.

A double cloth weave generally has one, two, or more face threads to every back thread; excepting, however, the case where the arrangement of warps and fillings is two of face to two of back, in which case there are two face ends and picks to every two back ends and picks. Therefore for every back thread there are required one, two, or more face threads in one repeat of a double cloth weave, hence a double cloth weave will repeat on the number of ends and picks equalling the number of ends and picks of the face weave plus the number of ends and picks of the back weave. For example, calculate the number of ends and picks required for one repeat of the double cloth weave under Figs. 96 to 101 inclusive. In this case the face weave is the $\cdot \frac{2}{2}$ twill which repeats on four ends and picks; the back weaves accord-

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ing to the plain weave which repeats on two ends and picks; for the stitching the eight-harness satin is used which repeats on eight ends and picks. The stitching, being done by raising the back ends over face picks, requires at least eight back ends and the double number of face picks (in the arrangement of two of face to one of back every other face pick, or every other face end, is used for the stitching), or sixteen face picks. For every back end there are two of face in this weave, hence in the whole weave we have $8 \times 2 + 8$, or 24 ends per repeat. For every two face picks there is one of back, hence in the whole weave we have $8 \times 2 + 8$, or 24 picks per repeat. The number of face ends required in one repeat of the whole weave must be a multiple of the number of ends for one repeat of the face weave; in accordance with the back weave and stitching, sixteen face threads are required in one repeat of the double cloth weave; sixteen is a multiple of four, therefore sixteen face ends and picks will complete this weave. The same must be the case in regard to the back weave.

If the number of ends and picks required in one repeat, of either face or back, of the double cloth weave is not a multiple of the number on which the respective weaves repeat, then the weave must be enlarged until the number of ends and picks (both of face and back) used, is a multiple of the number of ends on which the respective weaves repeat.

Double cloth weaves are generally drawn in on the double-draw principle; the front set of harness-frames is used for the face warp and the rear set for the back warp. In some of the mills a straight draw is used for these weaves, although it is not as practical as the double one.

Double cloths are used in the construction of fabrics of a heavy nature, as backing for worsted suiting, double-faced fabrics such as cloakings, etc. In the case of backing for extra weight a cheaper and coarser material can be used than would be practical by backing with an extra filling or warp.

When constructing these weaves the back warp and filling should always be regulated according to the face warp and filling; *i.e.*, when the warps and fillings are arranged one of face to one of back, the back warp and filling should never be heavier than the face warp and filling; when the warps and fillings are arranged two of face to one of back, then the back warp and filling can be of a heavier (coarser) yarn than that used for the face, etc. When using a one and one arrangement, the back warp should not have a tighter interlacing than the face. If this should be the case, the back warp would not take the picks as the texture is usually calculated to suit the face cloth.

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Fig. 102 illustrates another double cloth weave. In this case a $\frac{2}{2}$ entwining twill is used, which has two twill lines, for the face weave. The plain weave is used for the back; the stitch-

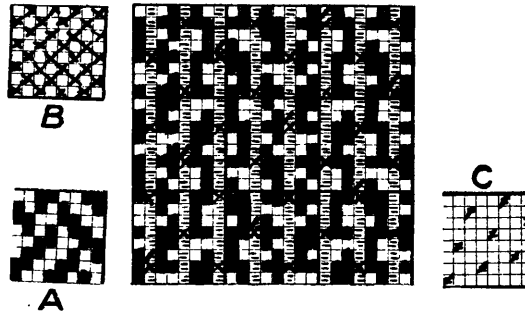


Figure 102

ing is done by raising the back warp over the face filling in an eight-harness satin order. The warps and fillings are arranged two of face to one of back.

44. Double Plain Weaves. This is a variety of the regular double cloths, carried out in exactly the same manner as the regular double cloth weaves using the plain weave for both face and back, with an arrangement of one of face to one of back.

They are used in the production of solid colored stripe and check effects for cotton table-spreads, bed-spreads, woolen trouserings, suitings, etc. A two-colored warp and filling is generally employed, such as one of black to one of blue, etc., in warp and filling. The black warp weaves with the black filling to form the face of the goods, and the blue warp weaves with the blue filling to form the back. This arrangement produces a double-faced fabric.

If we desire to make a fabric which has solid colored stripes, running lengthwise in the goods, the black warp would weave with



A

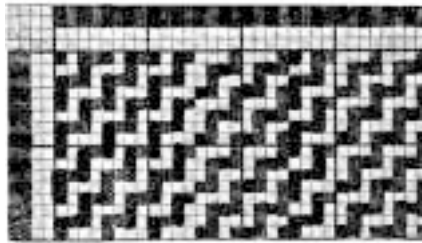


Figure 103

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the black filling to form the face of the fabric, for the desired width of the stripe, and the blue warp would weave with the blue filling to form the back of the fabric for the same width, after which the order would be reversed; *i.e.*, the blue warp and filling would weave on the face and the black warp and filling on the back.

Fig. 103, *A* represents a stripe effect which is to be produced by means of the double-plain weave. This motive calls for a stripe of black for six face ends, a stripe of red for four face ends, one of black for two, and one of red for four ends. Fig. 103 illustrates the weave which will produce this effect.

This class of fabrics is not stitched, unless the different stripes are very wide. The fabrics receive sufficient stitching through the changing of the face warp and filling to the back, and vice versa.

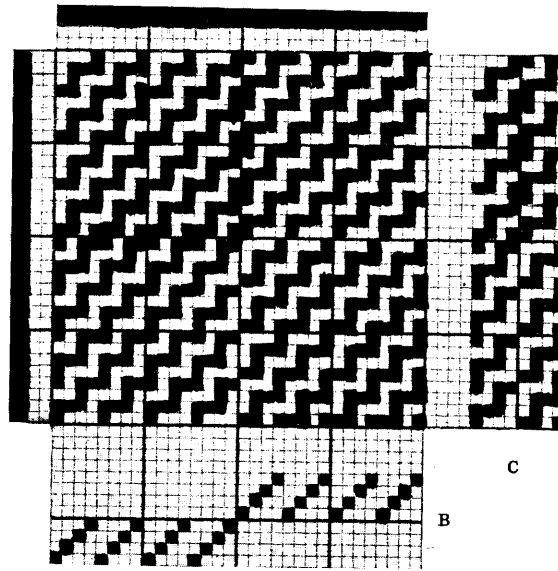


Figure 104

Fig. 104, *A* is the motive for a checked double-plain; every block in the motive calls for two face ends and two face picks in the weave. Fig. 104 is the weave which will produce the effect required by this motive. Fig. 104, *B* and *C* respectively illustrate the drawing-in and chain drafts for this weave.

Double-plain weaves are also used in the production of fabrics known as "Double-Plain Plaids." They are generally made of two, three, or more colors; the goods are used for vest-

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ings, cloakings; etc. In this class of fabrics it is the object to produce a ground of solid color, or colors, and to figure this ground with various colored stripes and blocks which may, or may not, be of solid color.

Fig. 105 illustrates the motive for one of these weaves, *i.e.*, it represents the face of the fabric. In this case the face warp and filling are arranged twelve black, four blue, eight black, four red, and eight green. The back warp and filling are arranged

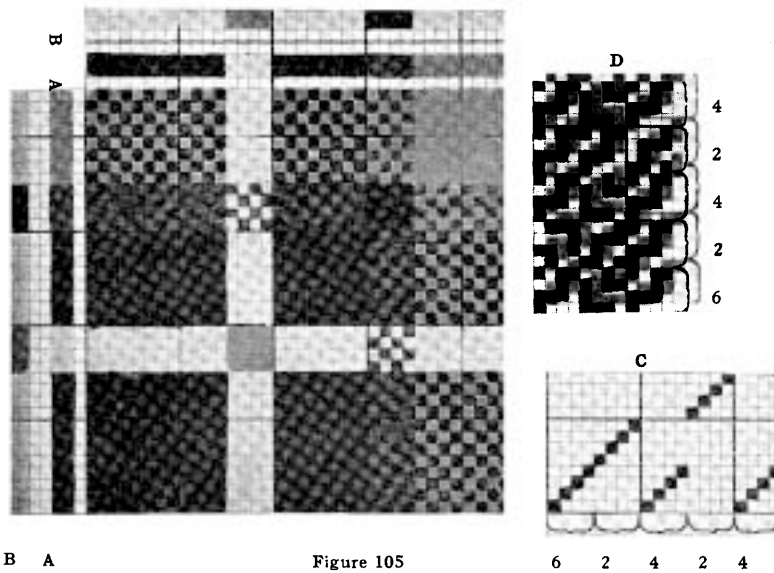


Figure 105
 twelve blue, four green, eight blue, four black, and eight blue. Fig. 105, *A* is the arrangement of the face warp and filling colors, *B* is the arrangement of the back warp and filling colors, *C* is the drawing-in draft, and *D* the chain draft for this weave. The weave is not reproduced here as the student can carry it out from the drawing-in and chain drafts given.

In Fig. 105 it can readily be seen where the back warp and filling changes off with the face warp and filling in order to produce solid colored stripes and blocks. The solid colored stripes of blue, warp and filling ways, are obtained by having the back filling weave with the face warp where the stripe runs in the direction of the warp, and the face filling weave with the back warp where the stripe runs in the direction of the filling. The solid colored block of green is obtained by bringing the back warp and filling on the face of the fabric, having it change place with the

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face warp and filling. This weave may be stitched, but the stitching is omitted in the chain draft.

45. Tricot Weaves. These are another form of double-plain weave and have a slightly ribbed appearance. Tricots are used for the production of dress goods, suitings, full-dress fabrics, and coatings. In dress goods, dress fabrics, and coatings, they are generally piece-dyed, but in suitings, and sometimes in coatings, they are woven with colored (mixed) yarns.

Two kinds of tricot weaves may be distinguished: the first, which forms rib lines running across the fabric, and the second, which forms rib lines running lengthwise of the fabric. The first is known simply as the "Tricot," and the second as the "Tricot-Long." Both give a very elastic, soft piece of goods. In the very heavy grades, especially tricot-longs, an extra filling or an extra warp for weight is added.

Tricots are made by having the face warp change places with the back warp at certain intervals, a rib (groove) being formed in the goods by this change. The change of the warps may occur after every four, six, or more picks.

Tricot-longs are made by having the face filling change places with the back filling at certain intervals, a rib (groove) being formed in the goods by this change. The change of the fillings may occur after every four, six, or more ends.

Fig. 106 illustrates a tricot weave, the face warp changing place with the back warp after every four picks; *i.e.*, the first four picks weave double-plain with the warps arranged one of face to one of back, the next four picks weave double-plain with the warps arranged one of back to one of face. The fillings are arranged one of face to one of back throughout.

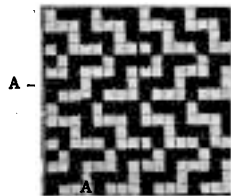


Figure 106

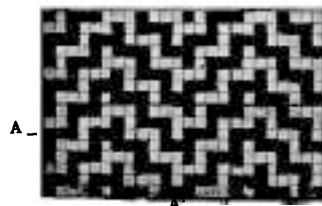


Figure 107

throughout. In both of these weaves one repeat is designated by A.

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46. Combination of Single and Double Plains. In the manufacture of certain classes of dress goods a combination of single-plain and double-plain weaves is used, especially in colored goods, thus producing a two-colored ground and figures of solid colors; either one or both colors may be used for the figure.

They are carried out in worsteds, woolens, and cottons.

Fig. 108 illustrates an elementary form of these combinations. The colors, in warp and filling, are arranged two of red and two of black; the first sixteen ends and picks interlace according to the plain weave, thus forming a block of star-like effect; like that in color effect Fig. 16. The first sixteen picks and the second sixteen ends weave double-plain, warps and fillings arranged two of face to two of back, thus forming solid colored blocks of red

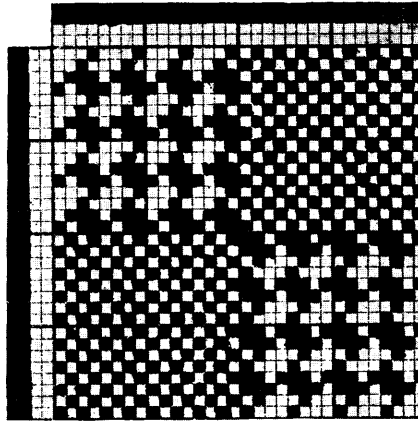


Figure 108

on the face of the goods. The first sixteen ends and second sixteen picks weave double-plain, the warps and fillings being arranged two of back to two of face, thus forming a solid colored block of black on the face of the goods. The second sixteen ends and picks interlace according to the plain weave and form the same effect as the first sixteen ends and picks.

Some very pretty effects can be obtained in this manner, especially when the weaves are used as called for by a motive. These effects are generally kept down to the capacity of the harness loom, although at times they are woven on the Jacquard looms.

47. Matelasse Weaves. This is another form of double cloth weaves, made according to the regular double cloths, the $\frac{2}{2}$ twill being used for the face weave and the plain weave for the back; the warps and fillings are arranged two of face to one of back. In the construction of the regular matelasses the face weave is usually a broken twill, a combination of $\frac{2}{2}$ twill and 2 and 2 basket, a figured broken twill, or any $\frac{2}{2}$ arrangement of raisers and sinkers with lines of clear breaks. In figured matelasses the $\frac{2}{2}$ twill is used for the face weave throughout.

The matelasse effect is imparted to the fabric by means of

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the stitching. They have a quilted appearance which at times is

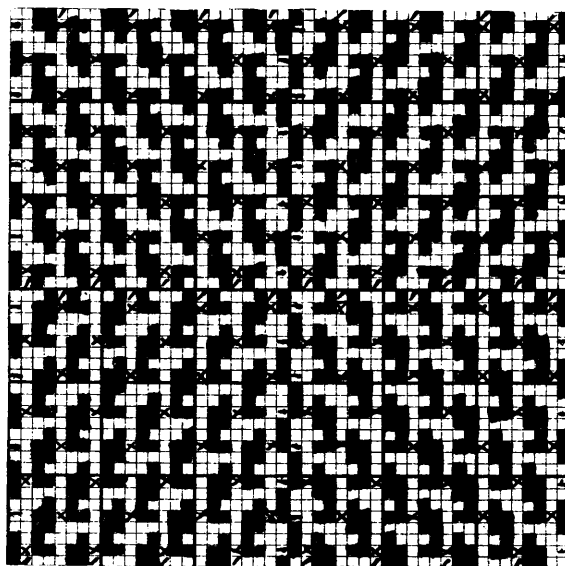


Figure 109

with worsted face and wool or worsted back, etc., in which case they are used for overcoatings, etc.

The stitching, in regular matelasse weaves, is confined to one face end on each side of the break lines, although some of these ends may be omitted if the break lines are too close together. The stitching is done by the lowering of these ends under the back picks between two sinkers, or between a raiser and a sinker of the face weave, and next to a sinker of the back. This stitching will tie down the face at the break lines, thus bringing them up distinctly.

When break lines occur both warp and filling ways in the face weave, as for instance, when a figured broken twill

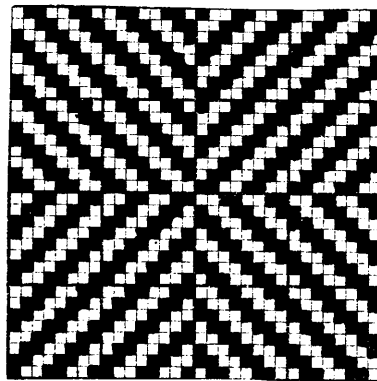


Figure 109 A

brought out stronger by the addition of an extra filling woven in between the face and back cloths.

These goods are made in silk face and cotton backs, silk face and wool or worsted back; when woven in either of these two combinations they are mostly used for dress goods. They are also made

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is used, then the stitching, in addition to the method described above, is done by the raising of the back ends over the face picks preceding and following the break lines, between two raisers of the face weave and next to a raiser of the back.

Fig. 109 illustrates a matelasse weave carried out according to the above method. Fig. 109, A illustrates the weave used for the face.

Figured matelasses, usually used for overcoatings, etc., are stitched by raising the back ends over the face pick preceding and over the face pick following the back pick. In this case the stitching is done according to some motive. They are woven on both the harness and Jacquard loom. When woven on a harness loom the motive is confined to some geometrical figure, every block in the motive representing one back end and one back pick.

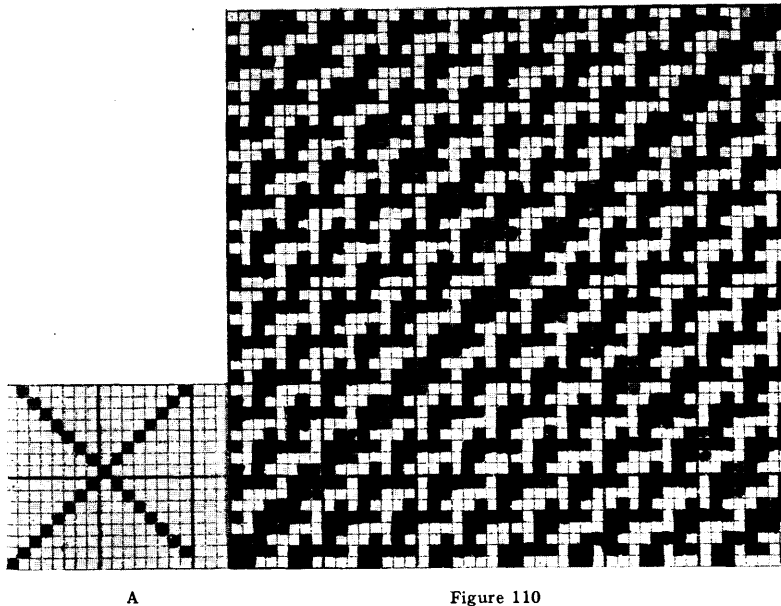


Fig. 110 illustrates a figured matelasse, stitched according to motive Fig. 110, A.

48. Pique Weaves. These weaves are made of two warps and one, two, or three fillings. The warps are termed face and back, and the fillings are termed face, stuffer, and back. These goods have ribs, or welts, running across the fabric. On this

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account they are often confounded with longitudinal rib weaves which have rib-lines running lengthwise in the fabric. The warps are generally arranged two of face to one of back. The back warp weaves with the back filling, if there is any; otherwise the back warp floats on the back, excepting where all the back warp is raised over one or more face picks, which forms the depressions between the ribs. The picks over which all the back warp is raised are known as the "Binder." This effect may be increased by keeping the back warp very tight, and the face warp somewhat loose, during the weaving. In order to enable the ribs to withstand pressing, a stuffer filling is introduced. This stuffer filling enters the goods when all the face warp is raised and all the back warp lowered. This naturally increases the weight of the goods but this can be overcome by omitting the back filling.

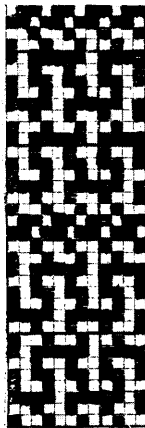


Figure 111

Pique weaves can be varied only by different widths of the ribs. The plain weave is used, in all of them, for the face weave, and if there is a back filling, the plain weave is also used for the back. They are used for dress goods, vestings, neckties, etc.

Fig. 111 illustrates a pique weave in which the fillings are arranged two face, one back, one face, one stuffer, one face, one back, two face, one back, one face, one stuffer, one face, one back, two face, and two binders. The warps are arranged two of face to one of back.

Pique weaves may be figured by floating the face warp over two or more ribs, thus forming spots of warp floats. These spots can then be arranged according to some motive. They are used for the same classes of fabrics as the regular piques.

49. Marseilles Weaves. The weaves used for the face and back of these fabrics are the same as used for piques. In the stitching, marseilles weaves resemble the figured matelasses. They are generally made with cotton face and back and are used for bed-quilts, and other heavy fabrics of this nature. They are woven on either the harness or Jacquard loom, depending upon the pattern required for the stitching. The stitching, as in matelasses, produces a quilted effect.

50. Crepons. These are another variety of double cloths in which the figuring is done by means of the stitching. In this case two warps and two fillings are generally used, although at times two warps and one filling are employed.

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When making this class of goods on the double cloth principle it is customary to use a light texture, and to combine two materials, one of which is shrinkable and the other non-shrinkable. The stitching, of the two fabrics, is done according to some motive, the raisers in the motive indicating the points of stitching at which points (through the stitching) depressions (low or tight places) are formed in the goods. In the unstitched places we find the elevated or loose parts, which give the crepon effect. They are made in combinations of worsted and cotton, worsted and silk, and, at times, silk and cotton. The face warp is generally kept loose during the weaving and the back warp tight; the goods are mostly piece-dyed. The arrangements of warps and fillings are usually two of face to one of back, or one of face to one of back for the warps, and two of face to one of back for the fillings, etc.

Fig. 112 illustrates a crepon weave, which is stitched according to motive Fig. 112, *A*. In this case the warps are arranged

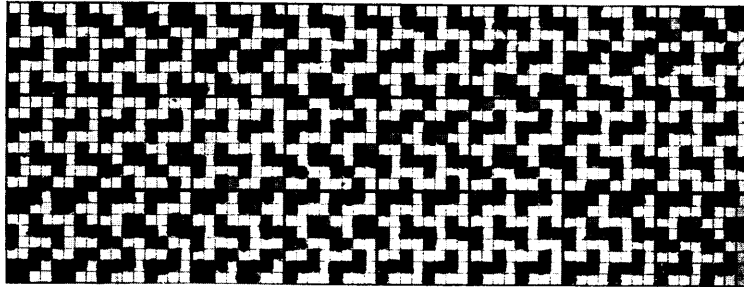
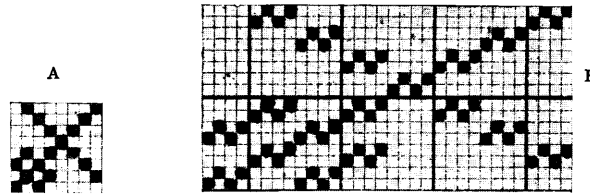


Figure 112

one of face to one of back, and the fillings two of face to one of back. Fig. 112, *B* represents the enlargement of motive; every block in the motive (Fig. 112, *A*) represents four ends and two picks in the enlarged motive (Fig. 112, *B*). The spots in the

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enlarged view show where the back warp is to be raised over the face filling. Every block in the enlarged motive calls for one back end and one face pick; and every painted block in the small motive calls for four ends and two picks of plain weave in the enlarged one.

51. Weaves for Beavers, Kerseys, and Meltons. These goods are generally termed "Face Finished." All three may be woven alike, although a looser weave is generally employed for the beaver than for the kersey, and a looser weave is employed for the kersey than for the melton; the distinction between these goods being brought out in the finishing.

In their lightest weights, woven in a single cloth, they are made in various grades and are used as dress goods; in a little heavier grade, for suitings and full-dress fabrics; and in a heavy grade, woven on the double cloth principle, for overcoating.

In the production of beavers a twill weave is generally employed, although satins are sometimes used (mostly double satins) for the face weave; in the production of kerseys, a twill of a tighter nature than that used in the production of beavers is used for the face weave; for the face weaves for meltons, either a closely interlaced twill or the plain weave is used. All three classes of goods are woven in the grey, fulled to the extent of *felting*, and piece-dyed.

As stated above, the same weave can be used in the production of any of these three fabrics, the difference being in the finishing. Beavers, as a rule, are not felted as heavily as the other two fabrics, but are napped extensively and sheared less; thus producing a nice, soft-feeling piece of goods with a rather long nap.

Kerseys are felted to a greater extent than beavers, they are napped well and sheared somewhat closer. The extra amount of felting they receive imparts a closer feeling to the goods. Both beavers and kerseys will give a smooth feel when rubbed downward; *i.e.*, when rubbed in the direction of the warp, from the top to the bottom. If rubbed in the opposite direction, *i.e.* from the bottom to the top (in the direction of the warp), they will feel rough. This is due to the fact that beavers and kerseys are sheared but once; *i.e.* they are run through the shears in one direction only; therefore when rubbing the goods with the nap (in the direction of the nap), they will feel smooth, but when rubbing in the opposite direction, or against the nap, they will have a harsh, rough feeling.

Of these three fabrics, meltons undergo the heaviest felting and the closest shearing; in fact, they are sheared in both directions, thus giving a short but very heavy nap, which will feel

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smooth when rubbed in either direction of the warp. This is due to the fact that the fibres stand upright on the face of the goods produced by the double shearing, *i.e.* the shearing they receive in both directions. This double shearing, combined with an extra amount of brushing, also imparts an extra high and lustrous finish to the face of the goods. In all three of these fabrics, one of the main objects is to conceal all appearances of the weave and threads.

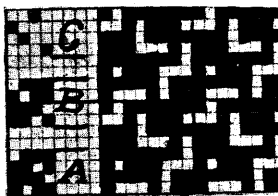


Figure 113

Fig. 113 illustrates a weave which is best adapted for beavers. Figs. 113, *A*, *B*, and *C* represent respectively the face weave, back weave, and stitching. In this case the warps and fillings are arranged one of face to one of back.

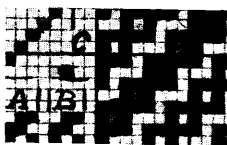


Figure 114

Fig. 114 illustrates a weave which is adaptable for both kerseys and meltons. Figs. 114, *A*, *B*, and *C* represent the face weave, back weave, and the stitching, respectively. In this case the warps and fillings are arranged one of face to one of back.

52. Chinchillas (Flackone). Although this style of goods is generally classed under pile fabrics, and indeed is a sort of a filling-pile cloth, it will be considered among the double cloths, though as many as four fillings can be used in their construction.

One or two warps and two, three, or four fillings may be used in the making of chinchillas. The warps are termed face and back; and the fillings are termed pile, ground, stuffer, and back. The pile filling weaves (interlaces) with the face warp to form the face of the fabric; the ground filling weaves with the face warp to form the ground or body; the stuffer filling lies between the face and back warps; and the back filling weaves with the back warp to form the back of the fabric.

These goods are generally used for overcoatings, and in their construction little stress is placed upon the closeness and strength of the fabric; instead, a woolly face of a soft, spongy nature is to be produced. Therefore the goods are set in the loom comparatively narrow, with light-textured warps so that they will readily take a high number of picks, the filling being of more consequence than the warps, as the latter need not show on either face or back of the fabric. The cheaper grades of these fabrics are made with

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pile and back fillings only, but in better grades at least three fillings are used: pile, ground, and back.

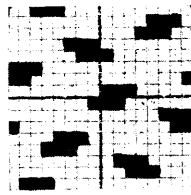
In order to impart a soft, woolly face to the goods, the pile filling (that forming the face of the goods) must necessarily be of a fine, short-stapled stock. This filling is wound single, double, three, four, or five-fold on the bobbin. A double (two-fold) reeled (wound) yarn is ordinarily used.

For the interlacing of the pile filling a weave of long filling floats is generally employed; one of a tight nature for the ground and back fillings, the same weave being used for both, *i.e.*, weaves which have the same amount of interlacings.

The pile filling is torn up during the gigging (napping) of the finishing process, the picks being torn in the middle of the long floats.

A double pile pick presents a better surface for this tearing, hence it is preferable to a single pile pick. This tearing of the pile filling forms tufts or lumps on the face of the fabric which are raised still more by a so called whipping or beating machine; these tufts are then put into a more compact

form by the chinchilla machine, which has a rubbing motion, thus forming compact lumps on



A

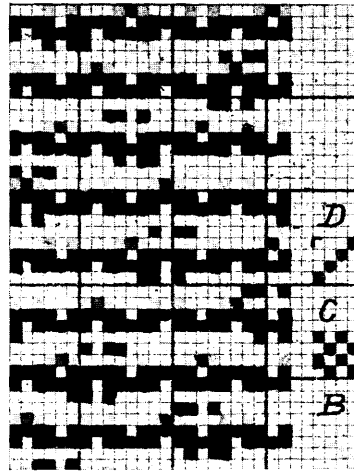


Figure 115

the face of the goods. The shearing is done before they are run through the chinchilla machine, so that all the lumps will be of the same height when the fabric is finished.

The interlacing used for the pile filling regulates the rotation of these lumps on the face of the goods. If we wish to have these lumps form stripes, a filling rib weave would be the proper interlacing to use; if the lumps are to come in a twill order, *i.e.*, run diagonally across the goods, a twill weave with a broad filling line would be the right interlacing. At times the lumps are scattered in a satin order; in such cases a double-satin is the most likely weave to use. It must always be remembered that the pile filling must be sufficiently interlaced with the face warp, so that the broken bits of filling will not pull out during the rubbing process.

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Chinchillas in their plainer forms are generally termed "Whitneys," and in their more elaborate forms, "Flackones."

When planning patterns for this class of goods, it is best first to make a motive of the rotation in which the lumps are to come on the face of the goods.

Fig. 115 illustrates a complete weave for a chinchilla. Fig. 115, *A* is the interlacing used for the pile filling; *B* is the interlacing used for the ground; and *C* is the back weave. The stitching is illustrated by *D*. In this case two warps and three fillings are used; the warps are arranged two of face to one of back; and the fillings two pile, two back, and one ground.

CHAPTER EIGHT.

SINGLE AND DOUBLE CLOTH WEAVES FOR FABRICS OF A SPECIAL CONSTRUCTION.

53. Through-and-Through Weaves. It is not always advisable to increase the weight of a fabric by means of either an extra warp or an extra filling, or both, because in certain kinds these back threads would interfere with the face of the goods. This is especially the case in medium-weight fabrics for summer wear, in which the stitching of an extra warp or an extra filling interferes with the face of the goods, and a double cloth would make it too bulky and heavy. It also happens that some looms have but one beam-stand, therefore goods which are backed by an extra warp can not be woven on them, unless the back warp has about the same amount of take-up as the face.

In order to increase the weight of fabrics without adding an extra warp or filling, weaves have been constructed which cause either the ends or picks (or sometimes both) to weave both on the face and back of the goods. This arrangement will allow a higher texture to be used, thereby increasing the weight without adding another series of threads to the fabric. When planning these weaves care must be taken not to spoil the effect which would be produced by the weave in use, if carried out strictly according to the single-cloth principle.

Figs. 116, *A*, *B*, *C*, and *D* illustrate the construction of one of these through-and-through weaves made from the regular $\frac{2}{2}$ twill.

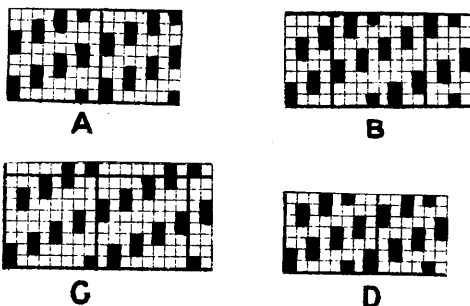


Figure 116

In this illustration two twill-lines are running from left to right, omitting every other end; if the upper twill line is taken from the odd numbered ends and placed on the even ones, all of the ends

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will have the same amount of interlacing. This is illustrated by *B*. The first end then weaves 2_8 , and the second 4_2 , the third 1_5 , and the fourth 5_1 , etc. Upon examining *B* carefully it is seen that the distances between the two twill-lines vary; *i.e.*, there is but one sinker between the top of the first twill-line and the bottom of the second, but there are two sinkers between the top of the second twill-line and the bottom of the first. This can readily be overcome by either moving the raisers of the second twill-line up for one pick, adding another pick to the top of the weave, making the repeat nine picks high; or by cutting off the top pick, making the weave repeat on seven picks. Of course the weave must be altered to suit these changes. *C* and *D* illustrate these methods of changing the twill-lines so that they come at even intervals. *C* repeats on nine ends and picks, due to the addition of an extra pick and the changing of the weave in accordance with this rule. *D* repeats on seven ends and picks, due to the cutting off of the top pick and the changing of the weave.

This class of weaves can be carried out with all the foundation weaves. Nearly all of those derived from the regular twills are suitable in the construction of the through-and-throughs. If *C* and *D* of Fig. 116 are carefully examined, it will be readily seen that they resemble corkscrew weaves to a certain extent. In them both the warp and filling are on the face of the goods, but the filling is not always visible on the back.

If it is desired to have the filling weave both on the face and on the back of a fabric, the method is much the same as illustrated by Fig. 116. In this instance, the weave is placed on every other pick, instead of every other end, the sinkers being indicated on the different picks, and all the remainder of the picks which are not reserved for sinkers, pass underneath the warp; *i.e.*, raisers are painted on them.

The class of weaves illustrated by Fig. 116 is known as through-and-through, with an arrangement of one and one. They can also be arranged two and one, three and one, etc., as well as one and one. This is done by placing the original weave on two threads and skipping one, in the case of an arrangement of two and one. When the arrangement is three and one, the weave is placed on three threads and skipping one, etc. In this manner all kinds of arrangements can be used.

Stuffer fillings may be added to the fabric made with these weaves without interfering with the face of the goods. This, however, is not often practiced. At times an extra warp is added thus producing practically a double cloth with two warps and but one filling.

54. Bracket Weaves. These weaves could be classed with

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those described above, although they differ in their construction. They are made of two warps and one filling, two warps and two fillings, and at times even an extra filling is added.

The most common bracket weaves will here be described. They are made with two warps and one filling; the warps being known as the inside and outside, or bracket warps, and both weave with the filling. The inside warp weaves according to some closely interlaced weave, generally the plain, and the outside warp interlaces according to some very loose weave, a basket or loose twill being mostly used.

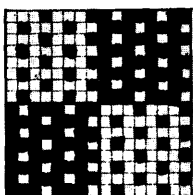


Figure 117

Fig. 117 illustrates one of these. The warps are arranged one of outside and one of inside. The inside warp weaves plain, and the outside (bracket warp) according to the

eight and four basket.

These, like the through-and-through weaves, may also be arranged two and one. When made with two warps and two fillings the weave to form the bracket is placed on every other end and pick, but (the same as the face weave for double cloths) the bracket warp, when weaving on the face, must be raised over the inside picks. The bracket, or outside filling, weaves on the face when the bracket warp weaves on the back, and vice versa. When this filling weaves on the back, all the inside warp must be raised over it. The plain weave is generally used for the interlacing of the inside warp and filling. A cheaper material can be used for these, as they (the inside warp and filling) are entirely covered by the bracket.

By having the inside warp and filling change places with the bracket, warp and filling figured effects can be produced; if a different color is used for every set of ends, a four-colored face results.

55. Weaves for Towelings. Special weaves are generally used in the manufacture of towels, as they require a very rough surface; the fabric, at the same time, must stand extreme wear.

Two classes of towels are ordinarily used in this country, the "Huck Towels," and the "Turkish Towels." Huck towels are made in single cloths, a peculiar weave, resembling the granites, being used. Fig. 118 illustrates this interlacing. It repeats on ten ends and eight picks, and can be woven on five harness-



Figure 118

frames.

Turkish towels are generally classed with the pile weaves. They are made with two warps and one filling. The effect is pro-

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duced by the method employed in the weaving. The method of weaving this class of towelings will be described as well as possible, without using an illustration.

Two warps are used each of which is on a separate beam. The ends of both warps weave side by side according to the plain weave. A movable reed is used, so arranged that it can be moved backward and forward. The first number of picks, usually three or four, is woven with the reed at its back position; *i.e.*, as near to the harness-frames as possible. After these picks have been interlaced with the warps, the reed moves forward for the next pick, as far, or near to the cloth, as it will go; at the same time all the weight (tension) is taken off of one of the warp beams. The reed then travelling farther to the front, or nearer to the cloth, will take along the ends from the slackened beam, thus making them bulge out on the face and back of the goods.

This beam is usually placed on top of the other in the rear of the loom. The warps are generally arranged two of face (pile warp) to one of ground. The higher the texture of the warps, the bulkier will be the towels, at the same time increasing the cost.

56. Imitation Gauze. Gauze is an open, transparent fabric in which the ends twist around each other, thus forming openings or perforations.

In imitating these weaves, the first aim is to produce an open and perforated fabric, in which certain sets of ends cling to one another. This, in the imitation, is done by grouping the ends in sets of three, four, five, etc.; these ends, in the different groups, cling together without being twisted around one another.

Imitation gauze is not as stable a fabric as the regular, nor is it very often used entirely in a piece of goods, being, rather, in combination with the plain weave, forming stripes and checks of gauze effect on a plain weave ground.

Fig. 119 illustrates one of these weaves known as the six-end imitation gauze. It is made by having the first and third ends weave $\frac{1}{1}$, the fourth and sixth ends weave $\frac{1}{1}$, the second end weave $\frac{3}{3}$, and the fifth $\frac{3}{3}$. The first three ends are reeded into one dent, and the next three into another, three ends thus forming a set. Upon examining this weave it will be noticed that two ends in every dent weave alike. This causes them to cling together; the third end, weaving much looser than the others, needs no additional space in the reed, thus increasing the height of the group without adding to its width.

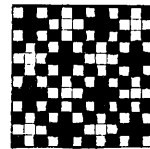


Figure 119

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This principle is found in all of the imitation gauze weaves although applied in different forms.

Fig. 120 illustrates another of these weaves. In this case it repeats on eight ends and picks, the ends being divided into groups of four. The first and fourth ends weave $1^2_1 1^2_2$; the second and third 1^4_4 ; the fifth and eighth $1^2_2 1^2_1$; and the sixth and seventh 1^4_4 .

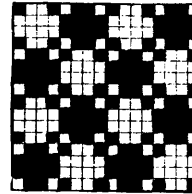


Figure 120

57. Honeycomb Weaves. This class of weaves produces hollow or depressed squares in the goods. Two classes are generally distinguished: first, honeycomb weaves; and second, honeycomb effects. The regular honeycomb weaves consist of squares the centres of which are plain weave gradually changing to a looser interlacing until it comes to the sides, which are either warp or filling floats.

Where the corners of the four adjoining squares meet on one side of the goods, the centre of the square is formed on the other side. Fabrics woven with these weaves are reversible, the centre of the square on one side coming next to the corner of a square on the other side.

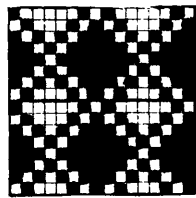


Figure 121

Fig. 121 illustrates a regular honeycomb weave which repeats on eight ends and eight picks.

These weaves are principally used for bed-spreads, but are sometimes found in dress goods, cloakings and neckties.

Fig. 122 illustrates a honeycomb effect which repeats on sixteen ends and sixteen picks. Upon examination this weave will explain itself. Various other weaves of this description can be made repeating on a larger number of threads.

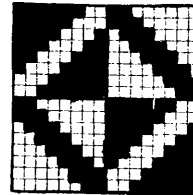


Figure 122

58. Gauze (Leno or Doup Weaves). Gauze fabrics differ from all other woven fabrics by having the ends interlace, not only with the filling, but also with one another. The texture of these fabrics being generally very light, gives a transparent nature to them, due to the mode of interlacing. Having the warp threads practically interlace with each other makes the fabrics extraordinarily durable and strong.

All gauze effects are made by means of the warp, the filling

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being only of secondary consideration in their designing and production. This is true, even when it is used in the figuring, by being forced out of its regular horizontal position, forming diagonal lines in the goods. The ground for these weaves is not always made of gauze, but gauze weaves are often used in the figuring of fabrics which have a plain ground.

When speaking of a gauze fabric, one woven entirely with the gauze weave is understood. (This does not include ordinary gauze fabrics for linings, and, in this section, these are not considered.) When but a few ends weave according to the principle

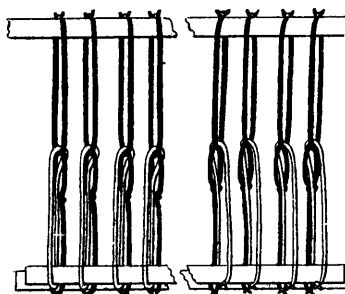


Figure 123

of these weaves, we generally call the fabrics leno. Both gauze and leno weaving are generally spoken of as "Doup Weaving." They are all woven according to the same theory.

Of gauze weaves, only the theoretical part, or designing of them, can first be taken up. For the peculiar interlacing of the ends must first be understood thoroughly, before any progress can be made in the practical part of the construction of these fabrics. The practical part, or the weaving, will be considered later.

In the construction of gauze or leno fabrics (doup weaving), two warps, or two sets of warp threads, are to be considered; first, the ground warp, generally classified as the *standard ends*; and second, the leno warp, generally classified as the *doup ends*.

The standard ends weave straight like the ends in ordinary fabrics, while the doup ends whip or twist around the standard ends during the weaving.

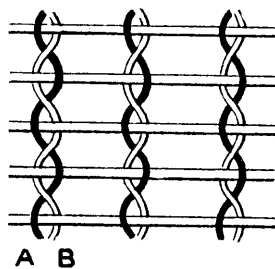


Figure 124

For gauze weaves two sets of harnesses are required; the ground or standard harnesses, and the doup or leno harnesses. (At the present time it seems as if the term *leno* is oftener used in the connection with these weaves than either gauze or doup.) For the set of ground harnesses the regular frames are used. A special harness, consisting of one whole and one half-harness, is used for the doup harnesses; the doup ends only being drawn through this set of harness-frames.

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The doup harness, as mentioned in the foregoing paragraph, consists of one whole and one half-harness; *i.e.*, it consists of one harness-frame with regular heddles (either cotton or wire) on same, and one half-harness with half heddles (generally made of fine cotton, fine, hard twisted worsted, or silk), which are

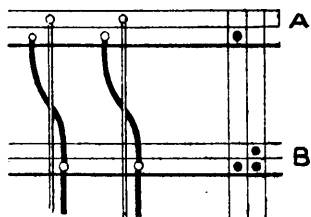


Figure 125

threaded through the eyes of the heddles on the whole frame. (See Fig. 123 which illustrates a doup harness made of cotton twine heddles.) When wire heddles are used on the whole-harness frame, it should be those which have two openings, or eyes, and the heddles of the half-harness should be threaded much the same as in Fig. 123 through these eyes.

The interlacing of the ends, with the ends and picks, is best explained by means of the plainest of all doup weaves, namely, the gauze weave. This weave repeats on two ends and two picks; *i.e.*, two ends and two picks are required. It is illustrated by Fig. 124, which can be termed "cloth view," as this is exactly the appearance of a gauze fabric, though somewhat enlarged.

The first end, indicated by A, is the doup end, and the second, indicated by B, is the standard end. These are drawn through the ground harnesses, from front to rear. Fig. 125 illustrates the drawing-in of these ends; A is the ground harnesses and B the doup harness. From this illustration it can be seen

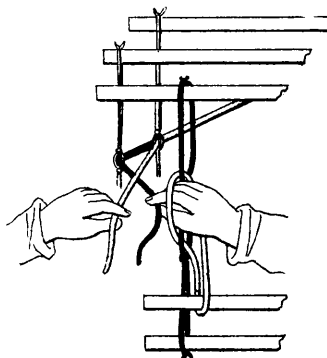


Figure 126

that the doup ends are passed underneath the standard ends, and then drawn through the doup heddles. This is the case when the half-heddles of the half-harness are below; when they are on top, then the doup ends are passed over the standard ends.

From Fig. 124 it can readily be seen that the doup ends weave on both sides of the standard ends, the doup ends being raised first on one, then on the other side of the standard ends. Fig. 126 illustrates the manner in which the doup ends are drawn through the doup heddles, after they have been drawn through those of the ground harness. From this it is seen that all the doup ends are drawn in twice.

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In doup weaving we distinguish three sheds, but only two of them are used in the construction of the gauze weave. The first shed, Fig. 127, illustrates that known as the *half-doup*, or *half-leno*. It is formed by raising the ground harness, through which

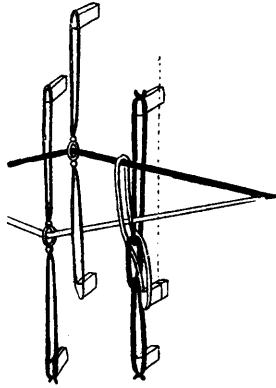


Figure 127

the doup ends are drawn, and the half-harness; the ground harness, on which the standard ends are drawn, remains down. Fig. 128 illustrates the second of these sheds, which is known as the *full-doup* or *full-leno*. This one is formed by the raising of the full-doup harness; *i.e.*, the whole and half harness together, both of the ground harnesses remaining down. These two sheds are the only ones formed in the weaving of the regular gauze fabrics. The third shed, illustrated by Fig. 129, is formed by raising the ground harness, on which the standard ends are drawn. This one is known as the *open doup* or *open leno* shed.

The third of these sheds is used in the construction of fabrics illustrated by Fig. 130. Fig. 131 illustrates the drawing-in and chain drafts for this weave; A are the ground harness, B the doup harness, and C are the picks. The dots on each pick indicate which harness, or harnesses, are raised while the picks enter the shed.

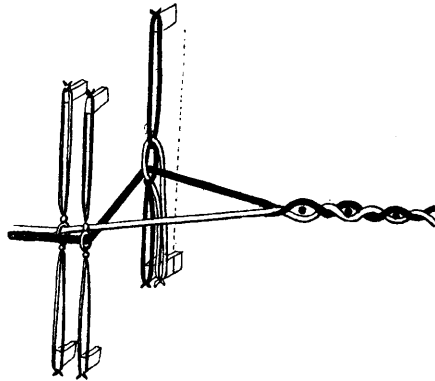


Figure 128

Thus far the regular gauze weave only has been considered. This, as mentioned above, repeats on two ends and two picks. In all gauze weaves, the standard ends which are crossed by one or more doup ends, including the doup ends, are reeded into the same dent. Therefore, in the regular gauze weave, two ends are reeded into every dent, or every other dent, as the case may require, the two ends consisting of one standard and one doup end. The doup end, twisting or whipping around the standard end, must therefore be drawn into the same dent

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with the one around which it is to whip; otherwise the doup end could not whip around the standard end.

The desired effects for these fabrics are first drawn out on paper. In doing this, care must be taken that all the ends receive their right interlacing and crossing. When designing these effects it is best first to draw vertical lines, two for every end to be used, leaving about the same space between the ends as occupied by them; after this, horizontal lines, indicating the picks,

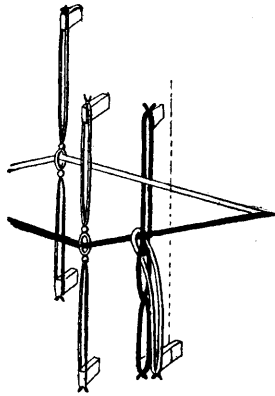


Figure 129

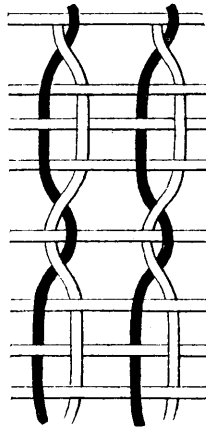


Figure 130

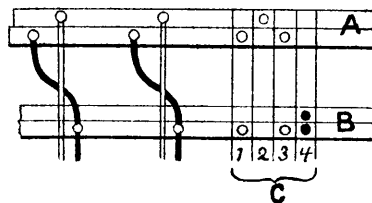


Figure 131

gauze (leno) effects. If there are but a limited number of doup ends, the designing may be done on point paper, reserving one end for every doup end on each side of the ones around which it is to whip.

The drawing-in can be planned either as illustrated by Fig. 125, or it may be done on point paper. In this case the space of two ends is also required for every doup end, one on each side of the one, or ones, around which it is to whip. The drawing-in draft is started by first drawing all the ends on their respective ground harness; the doup ends are then crossed over or under the

are drawn in the same manner. This should be done with pencil. Two sets of ends must be considered when drawing these effects: the standard ends, which are generally indicated by light, unshaded lines, and the doup ends, which are indicated by heavily shaded lines. After having penciled out a sufficient number of ends and picks, the interlacing is first penciled in and afterwards carried out with either color or ink.

This method is mostly used for the designing of all

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standard ends (depending upon whether the half-harness is on top or bottom), and drawn on its respective doup harness. It is always advisable to draw a line, indicating the crossing of the doup end over or under the standard end, from the line which indicates the drawing-in of the doup end on the ground harness (beginning this line in front of all the ground harness), to the line which indicates the drawing-in of the doup end on the doup harness.

Fig. 132 illustrates a drawing-in draft for a leno carried out on point paper; A are the ends (spaces between the vertical lines), reserved for the indicating of the doup ends where they are drawn on the ground harness; B are the spaces reserved for the indicating of the doup ends where they are drawn on the doup harness; C are the standard ends; D is the ground, and E the doup harness.

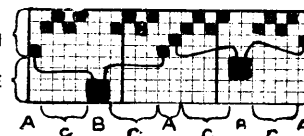


Figure 132

In order better to understand the interlacing of the ends and picks, and the whipping of the doup ends around the others, it will be well to refer to the regular gauze weave Fig. 124.

This weave repeats on two ends and two picks, which necessarily calls for the formation of two sheds per repeat. The first shed is formed by the raising of the ground harness, on which the doup ends are drawn, together with the half-harness (see Fig. 127).

From this figure it can be seen that the standard end remains down, the whole heddle of the doup harness being on the right-hand side of this end; and the heddle on the ground harness and the half-heddle, through which the doup end is drawn, being on the left-hand side of the standard end. The pick, passing through the shed formed in this manner, will force the doup end to remain on the left-hand side of the standard one.

After the first shed the second one is formed. This is done by raising the whole doup harness (the whole and half-harness together), see Fig. 128. From this figure it can be seen that both ground harness remain down, the doup end being crossed underneath the standard end and raised on the right-hand side of same. The pick, passing through this shed, will force the doup end to remain on the right-hand side of the standard one. The next shed (the first one) will again bring the doup end on the left-hand side of the standard, etc., etc. In this manner the doup or whip ends are whipped alternately from one side to the other.

In the foregoing, the regular gauze weave has principally been mentioned: this is generally known as a *full-turn leno*. There will now be considered what is termed *half-turn leno*. In this weave,—sketched under Fig 133,—A is the drawing-in draft, and at the same time, also the chain draft. The weave

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repeats on two ends and four picks. The first shed, through which the first pick passes, is the half-leno; the second shed, the one into which the second pick enters, is the open (see Fig. 129); the third, the one for the third pick, is the full-leno; and the fourth, the one for the fourth pick, is another open shed.

This class of weaves is used for

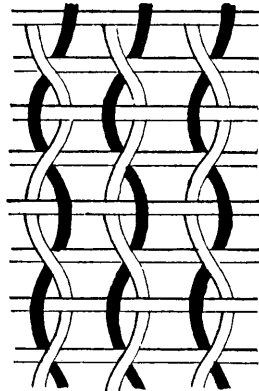


Figure 133

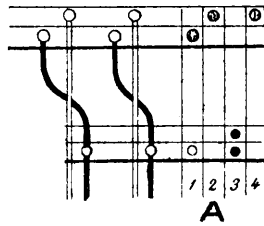


Figure 133 A

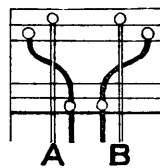


Figure 134

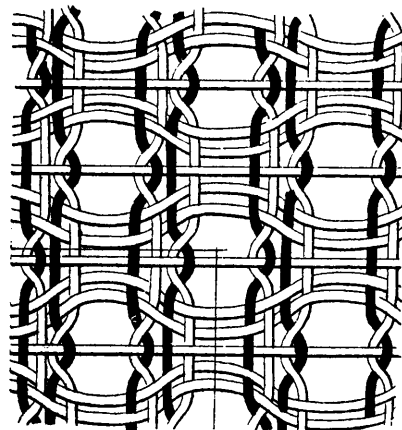


Figure 135

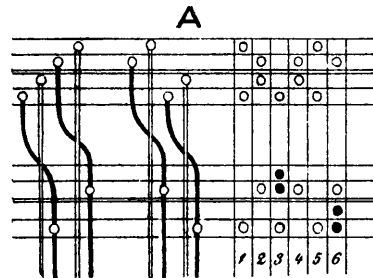


Figure 135 A

heavier gauze fabrics. The extra picks, those entering the open sheds, are put in to increase the weight.

Two kinds of doups ends are generally distinguished: those which are drawn on the ground harness *before*, *i.e.*, on the left-hand side of the standard end and from there passed over to the right-hand side; and those which are drawn on the ground harness *after*, *i.e.*, on the right-hand side of the standard end

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and passed over to the left-hand side. The first, or those passing from left to right, are termed right-hand; the second, or those passing from right to left, are termed left-hand doup ends.

Fig. 134 illustrates the left and right-hand doup ends, *A* being the right-hand, and *B* the left-hand one.

Fig. 135 illustrates a doup (leno) weave of a more elaborate nature. This repeats on eight ends and six picks. It is woven on four ground and two doup harness. The drawing-in and chain drafts are illustrated by *A*. The numbers 1, 2, 3, 4, 5, and 6 indicate the picks, and the dots between the lines (those which inclose the different numbers) indicate the raising of the harness.

On the different combinations of doup (leno) effects alone, an entire book can be written, but in this the gauze, leno, or doup weaves are described and illustrated only sufficiently for the student to understand them, so that he may create weaves of this nature on his own account.

Fig. 136 illustrates another leno, one known as a snake effect, carried out on point paper, designed to be woven face up. *A* is the drawing-in, *B* the chain draft, and *C* is the reeding.

Upon examining Fig. 128, the full-lenno shed, it can be seen that the doup end undergoes considerable strain, as it passes from under the standard end directly up, at an angle of about seventy-

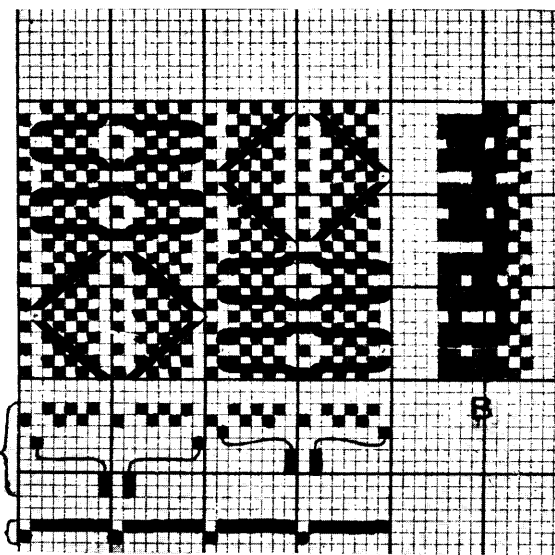


Figure 136

five degrees. In order to lessen this strain a device has been constructed known as the *slackener*. This is constructed in various ways, various appliances answering the same purpose.

The oldest method used for slackening the doup ends, so that

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they will not break when forming the full-leno shed, is to draw all the doup ends through a harness-frame before they are drawn through the ground harness. This extra harness-frame is then placed behind the ground harness and as near to the whip roll as possible; the eyes of the heddles (which are longer than those of the regular heddles), being several inches below the eyes of the heddles on the ground harness. In this manner the doup ends are pulled down. Whenever the full-leno shed is formed, this extra harness is raised so that the eyes of its heddles come on a level with those on the other harness-frames, thus bringing up

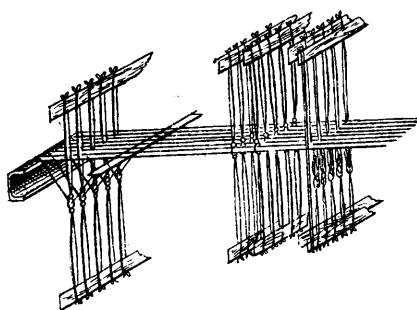


Figure 137

and slackening the doup ends. Fig. 137 illustrates one of these slackeners. This method of slackening the doup warp is used to good advantage on hand looms.

The modern slackeners consist of a rod (one rod for every doup harness), which runs across the loom, in the rear of the ground harness and as near to the whip roll as possible, and sometimes

beyond it. The proper position for this rod when at rest is above the whip roll. Another rod, which forms the axle for the first, runs parallel with it. To this rod a lever is fastened which is connected with the head of the loom. This lever is raised every time the full-doup shed is formed, which brings down the first rod (over which the doup ends are passed), thus slackening them.

Although lenos are also woven on the Jacquard loom, no description of them will here be made. To understand them a student would require a thorough explanation of the Jacquard machine, which cannot be undertaken in the limits of this book. Suffice it to say that the *principle* of lenos made on the Jacquard loom is exactly the same as that explained in the connection with the harness loom.

CHAPTER NINE.

TRIPLE AND MORE PLY CLOTHS.

59. Triple Cloths. Triple cloths are made up of three independent fabrics. They are termed face, middle, and back; each one of them has its own warp and filling. They are combined by stitching the back fabric to the middle, and the middle fabric to the face. At times an extra warp is employed for the stitching.

Fig. 138 illustrates the section cut of a three-ply fabric in which the stitching is done by the back warp interlacing with the

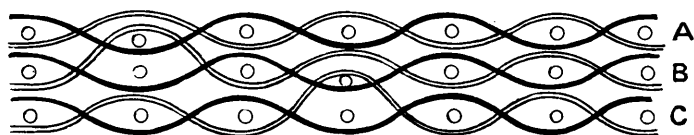


Figure 138

middle filling, and the middle warp interlacing with the face filling at certain intervals. *A* is the face fabric, *B* the middle, and *C* is the back fabric. All three fabrics interlace according to the plain weave.

When laying out a weave for triple cloths, three warps and three fillings must be considered; namely face warp and face filling, which constitute the face fabric; middle warp and middle

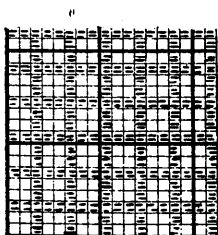


Figure 139

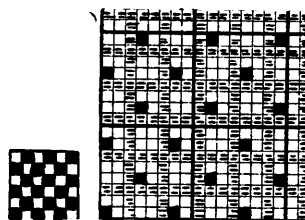


Figure 140

filling, which form the middle fabric; and back warp and filling, which constitute the back fabric. In order to lay out one of these weaves correctly on point paper, the following rules should be followed:

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Rule 1. Indicate the face, middle, and back warps and fillings. This is best done by indicating the back threads only. See Fig. 139. In this weave the warps and fillings are arranged one face, one middle, and one back.

Rule 2. Place the face weave on the face threads. See Fig. 140.

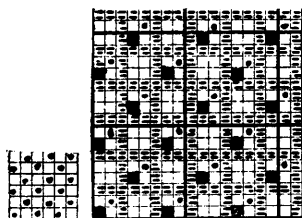


Figure 141

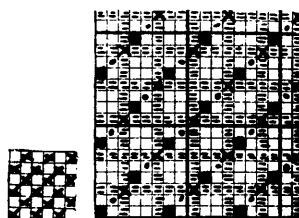


Figure 142

Rule 3. Place the middle weave on the middle threads. See Fig. 141.

Rule 4. Place the back weave on the back threads. See Fig. 142.

Rule 5. Raise all the face warp over the middle and back picks. See Fig. 143.

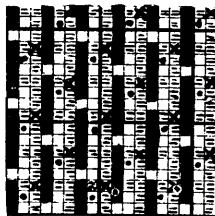


Figure 143

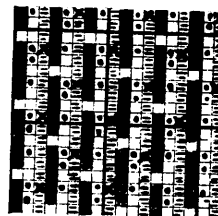


Figure 144

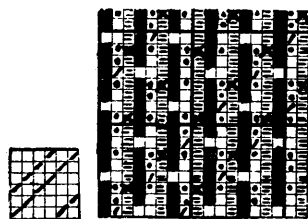


Figure 145

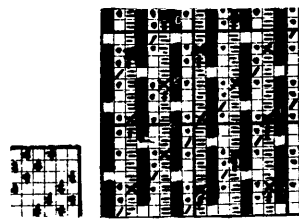


Figure 146

Rule 6. Raise all the middle warp over the back picks. See Fig. 144.

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Rule 7. Stitch the middle to the face fabric. See Fig. 145. In this illustration the stitching of these two fabrics is done by raising the middle ends over the face picks according to the $\begin{smallmatrix} 1 & 1 \\ 3 & 1 \end{smallmatrix}$ twill.

Rule 8. Stitch the back to the middle fabric. See Fig. 146. In this illustration the stitching of these two fabrics is done by raising the back ends over middle picks according to the $\begin{smallmatrix} 1 & 1 \\ 1 & 1 \end{smallmatrix}$ twill.

For the illustration of the above rules a weave has been constructed in which all three fabrics are interlaced according to the plain weave. The stitching is done so that it will be least noticeable on the face and back of the goods. Triple cloths can also be stitched by lowering the face warp under middle picks, and the middle warp under back picks; or by lowering the face warp under middle picks, and raising the back warp over middle picks. Of course the stitching should always be done so as to least interfere with the appearance of the face and back of the goods; *i.e.*, an invisible stitch (as explained in Chapter Seven, the Principle and Construction of Double Cloths), should always be used.

In this manner, *i.e.*, weaving one fabric on top of another, four and more ply cloth can be constructed. When constructing four-ply cloths it must be remembered that four independent fabrics are being dealt with, requiring four warps and four fillings, etc. The same rules may be followed as in the construction of triple cloths, raising all the warp of the top fabrics over all the fillings of the fabrics underneath; *i.e.*, the face warp will be raised over the second, third and fourth or back fillings; the second warp will be raised over the third and back fillings; and the third warp will be raised over the back picks. (In this case the different fabrics are termed face or first, second, third, and fourth or back.)

Fig. 147 illustrates the weave for a four-ply fabric. In this case the finished weave only has been illustrated. The warps and fillings are arranged one face, one second, one third, and one back. The plain weave is used for the interlacing of each fabric; the plain weave arrangement is also used for the stitching. The first and second fabrics are stitched together by raising the second warp over the first filling; the second and third fabrics are stitched by raising the third warp over the second filling; and the third and fourth fabrics are stitched by raising the back warp over the third filling.

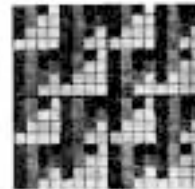


Figure 147

These three and more ply cloths are used for producing fabrics of a very heavy nature; they are also used in the production of three, four, and more colored fabrics.

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60. Figured Triple Cloths. By making each fabric of a different color, and by having the different fabrics exchange places with one another, cloths are produced which are figured by means of three solid colors; in other words, fabrics of a three-colored face can be produced.

Fig. 148 illustrates a motive for one of these weaves. Every



Figure 148

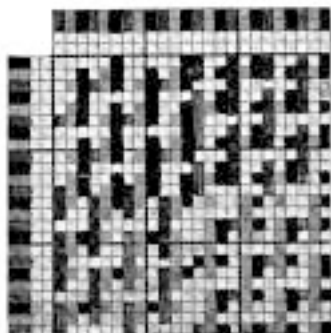


Figure 149

block in the motive represents one face end and one face pick. The plain weave is used for the interlacing of the different fabrics; all stitching is omitted as the fabrics passing from face to middle, and from there to the back, etc., will do all the stitching necessary.

Fig. 149 is the weave which will produce the effect required by motive Fig. 148.

This figuring may be made more complicated and elaborate by using a different interlacing for each fabric; also by having the first warp and first filling weave on the face and then change, so that the first warp and middle filling will weave on the face; etc., etc. There are many possible ways of figuring by means of three-ply fabrics.

CHAPTER TEN.

PILE FABRICS.

61. Corduroys. Among pile fabrics two separate classes are distinguished: first, pile fabrics in which the pile is produced by means of the filling; second, those in which the pile is produced by means of the warp. The first class is known as "Filling Pile," and the second class as "Warp Pile." Both are characterized by the soft velvety surface, on the face of the goods (this does not apply to uncut pile fabrics), covering to a certain extent, and at times altogether, the interlacing of the warps and fillings.

Corduroys belong to the filling pile fabrics and require, for their construction, one warp and two fillings. The fillings may be of the same material and size; they are known as the ground and pile.

The arrangement of the fillings is usually one pile to one pick ground, two pile to one ground, etc. There should never be as much ground filling (in bulk) as there is pile, as the pile filling is destined to form the face of the fabric and cover up all the other threads; therefore the arrangement of two of pile to one of ground is mostly used.

The ground filling weaves with the warp to form the body or ground of the goods, while the pile filling forms the face, interlacing with the warp sufficiently to keep it from pulling out, and at the same time producing the effect required. The plain weave, or some other tightly interlaced one, is used for the interlacing of the warp and ground filling, the pile filling interlacing with one, two, or more ends after floating over three, five or more ends; this filling interlaces with the same ends throughout the goods.

After the goods have been woven, the pile filling is cut in the middle of its floats, thus causing grooves or ribs, which run lengthwise in the fabric; the highest points of the ribs are where the pile filling is interlaced with the warp. The cutting is done on a table with a knife, which is run along the centre of the floats, the knife being guided by hand. Recently machines have been constructed for the cutting of these pile fabrics and they have met with more or less success. Before cutting, the goods are often treated with a process of

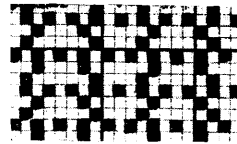


Figure 150

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sizing to strengthen the pile filling and hold it in its place. This size is made of flour-paste and gives a disagreeable odor to the goods.

Fig. 150 illustrates a corduroy weave in which the fillings are arranged, two of pile to one of ground. The ground filling weaves with the warp according to the plain weave, and the first pile pick weaves $\frac{1}{2} \frac{1}{3} \frac{1}{3}$; the second pile pick weaves $\frac{1}{7} \frac{1}{3} \frac{1}{2}$. The entire weave repeats on ten ends and six picks.

62. Velveteens. These are another class of filling pile weaves and are constructed much after the principle of corduroys. Instead of the pile filling interlacing with the same ends throughout, as in corduroys, it interlaces with the warp according to some loose weave of a twilled nature, or to any other of a loosely constructed sort. The cutting is carried on in exactly the

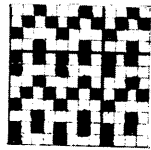


Figure 151

same manner as in corduroys, there being more rows to cut, as velveteens, as a rule, are of a closer construction.

Fig. 151 illustrates a weave for a common velveteen, which repeats on four ends and six picks. The fillings are arranged two of pile to alternate with one of ground; the ground weaving plain, and the pile according to an arrangement of $\frac{1}{3}$, every other pile pick interlacing in the same manner.

Corduroys and velveteens are mostly made of cotton warp and cotton fillings.

63. Chenille. By this class of weaves, another class of filling pile fabrics is represented. They differ from corduroys and velveteens in many respects, the main difference being in the manner in which the pile is produced. Chenille itself is a fringed thread, used for filling purposes. It is woven on the loom by having the warp reeded so that three or four ends will come into the same dent, and that two, three or more dents are skipped after every one used (according to the thickness of the chenille thread required), thus having the filling interlace with sets of ends, at intervals, across the width of the loom.

Every set of these ends forms one chenille thread. These may be cut apart either during the weaving, or after the fabric comes from the loom by means of the chenille cutting machine.

This machine consists of a series of rollers around which the fabric travels, and knives placed in front of combs cut the different threads apart.

These chenille threads are used for filling in fabrics known as chenille rugs, pillow covers, etc. The plain weave is generally

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employed, the fuzzy chenille thread forming the pile. From this it can be seen that the larger the spaces between the different sets of ends (during the weaving of the chenille threads), the higher the pile will be in the goods.

A large variety of colors may be used in the manufacture of chenille threads. When using such it is customary first to lay out the design of the fabric for which the chenille threads are to be used, then cut this design into strips, each strip representing one pick (one chenille thread). According to the colors of every one of these strips, the colors in the filling, used in the weaving of the chenille threads, are arranged.

Chenille threads are also used for fringes, etc.

After the chenille threads have been cut, they are wound on spools during which process some twist is put in the threads, about two or three turns being the limit. This twist strengthens them and keeps the filling, after being cut, from pulling out. They are woven with the plain weave.

64. Warp Pile Fabrics. Under this heading fabrics are considered in which the pile is produced by means of the warp. They are made of two warps and two fillings. The warps are termed pile and ground, and the fillings temporary and ground. The temporary filling is either narrow steel wires, with cutting tools on one side (on the side which first enters the shed), spoken of as wires, or plain wires, without the cutting edges. When a temporary pick is to enter the shed, either all or a part of the pile warp is raised, thus forming loops; this pick is pulled out again after five or six temporary picks have followed, and then they are pulled out in turn. When wires are used which have cutting edges, the pile ends which have been raised over the wires will be cut; if, on the other hand, plain wires are used, the pile warp will not be cut. The *cut* pile is technically known as *velvet*, and the *uncut* as *terry* pile.

The pile warp being raised over wires, naturally has a larger take-up, therefore it must be beamed onto a separate beam from that of the ground warp. When, however, only part of the pile ends are raised over the different temporary picks, so that they will obtain a different amount of take-up, then more than one beam is required for the pile warp. In some classes of goods, such as Brussels Carpet, every pile end is on a separate beam (spool).

The arrangement of the fillings may be one temporary pick, one ground pick; one temporary pick, two ground picks, etc. When the pile ends are raised over a temporary pick, they are generally lowered under the ground picks preceding and following the temporary pick, or they are lowered under the one follow-

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ing the temporary pick only. The pile warp interlaces with the ground filling (the ground warp and filling forming the body of the goods), to receive some hold on the body of the goods, and naturally, the more the pile warp interlaces with the ground filling, the stronger the face of the fabric will become, and the less the pile, either velvet or terry, will be apt to pull out.

The ground warp and filling usually interlace according to some close weave, such as the plain, 2 and 2 rib, 2 and 1 rib, 2 and 2 basket, $\frac{2}{2}$ twill, etc., etc. The pile warp interlaces with the temporary filling according to the fabric required; sometimes all of the pile warp is raised over every wire, and at other times the pile ends are raised over the different wires according to some weave or motive.

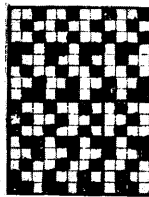


Figure 152

Velvet and Plush. For the construction of these fabrics the same weaves can be employed, the difference being in the length of the pile, plush fabrics having the longer and velvets the finer and shorter pile.

They are generally made with silk or cotton, for the ground warp and filling, and silk for the pile warp, this latter forming the face.

Fig. 152 illustrates a weave for one of those fabrics; the warps are arranged two ground and one pile, and the fillings, three ground picks to every temporary pick (wire). The ground threads interlace according to the 2 and 2 warp-rib weave. The pile ends are lowered under the ground picks preceding and following the temporary picks.



Figure 153

Fig. 153 illustrates the cut for weave Fig. 152.

In recent years, these fabrics have been woven double; *i.e.*, one fabric on top of the other. This is done by having one beam for the ground warp of the top cloth, one beam for the ground warp of the bottom cloth, and one beam for the warp which interlaces with both the top and bottom fabrics. They are cut apart during the weaving by means of a knife-blade, which passes to and fro across the loom above the breast-beam. The top cloth is wound onto a roll above, and the bottom cloth is wound upon a roll below the breast-beam.

A special loom is employed for the weaving of velvets in this manner. A double banked lay is employed, on which two shuttles can pass at the same time through the shed (two sheds

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being formed at the same time, one for each fabric) one on top, and the other right below the top one.

Velvets and plushes can be figured by raising the pile warp over the temporary picks according to some prearranged design; *i.e.*, raising only certain pile ends at places to form a velvet pile and at others no ends are raised, thus forming a low or depressed place in the goods. These effects are mostly woven with the help of a Jacquard machine although some of a less elaborate nature can be woven on the harness looms. They can also be figured by introducing high and low wires into the sheds for the temporary filling, thus forming a high and low pile.

Astrakhans. This is a fabric somewhat related to velvets and is constructed according to the same principles; *i.e.*, warp-pile fabrics. They are constructed of pile and ground warps, and temporary and ground fillings. The pile warp, in this case, is made from a curly yarn, thus giving a curly, crimped appearance to the face of the fabric. Both velvet and terry pile is used in the production of these goods; the entire fabric may be of either, or it may be made of a ground of terry figured by means of velvet pile, or vice versa.

Tapestry Carpet. This is another sort of warp pile fabrics composed of pile, ground and stuffer warps, and temporary and ground filling.

In this case the color design is printed on the pile warp before it goes into the loom, a sufficient amount of take-up being allowed so that it will give the required effect in the woven goods; *i.e.*, by printing the design on the warp so that it will be twice (or thereabouts) as long as required by the design. These carpets are of a cheap character and are made in imitation of Brussels. A coarse worsted yarn is used for the pile warp, cotton flax (linen), or jute for the ground, and flax or jute for the stuffer.

When designing tapestry carpets, the design is generally laid out on point paper which has 8 x 8 blocks per inch; this size of paper is best adapted for a texture of eight pile ends, and eight wires per inch. From this design an enlargement is made for the printer; *i.e.*, the design is enlarged lengthwise, because the warp takes up in that direction.

The warps are generally arranged one ground, one stuffer, one pile, and one ground; this forms one set and is reeded into one dent, the two ground ends being parted by means of the reed. The fillings are arranged two ground, one temporary. The 2 and 2 basket is used for the ground weave; all the pile warp is raised over every wire. The ground weave is started so that the adjoining ends will weave opposite; *i.e.*, when one end is up, the other is down.

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Brussels and Wilton Carpets. Both of these are woven on the same principle, and, in fact, are the same fabric, Brussels being uncut and Wiltons cut; *i.e.*, Brussels have the terry pile while Wiltons are made of velvet pile.

This class of goods is constructed somewhat differently from the velvet pile fabrics where but one pile warp is considered. In this case every color means a different warp, and one end of each color must be reeded into one dent; therefore, to make a five-colored Brussels, five pile ends must reed into the same dent. One set of pile ends (one end of every color used), and two ground ends are reeded into every dent.

In the weaving of these goods, every pile end is wound upon a separate spool. All spools with the same colored ends are placed upon a rack on the back of the loom, termed a frame. Therefore for every color used in the weaving of these fabrics (those belonging to the pile), there must be one frame, and according to the number of these frames required, the goods are named. When speaking of a three-frame Brussels, one is meant which is made with a three-colored design; a four-frame Brussels is one with a four-colored design, etc. The most elaborate Brussels has about six frames.

The ground warp is of either linen, cotton, or jute; the filling of jute; the pile warp of worsted, of a better and finer quality than that used for tapestry carpets. The pile warp, when not raised over the temporary picks, lies in the middle and partially on the back of the goods, thus increasing its bulk and weight.

As mentioned above, one end of every color required for the

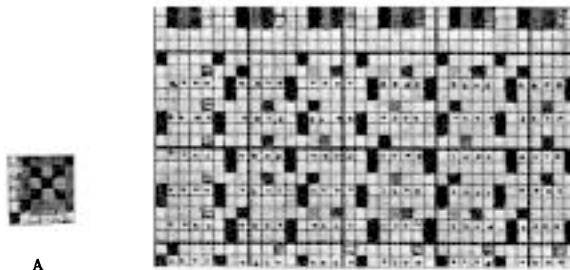


Figure 154

production of these fabrics is placed side by side in every dent. When a different set of colors is used for the centre from that used for the borders, we need not have ends of the colors, used in the borders, in the centre of the fabric, unless they are required there. When any one of these pile ends is raised over a wire, it covers up all the other pile ends in the same dent, therefore we raise only

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those ends which are of the color required by the design, at the places where this color is shown.

In the three-frame Brussels we have a warp arrangement of one ground to three pile (one of every color), and one ground. In a four-frame Brussels we have a warp arrangement of one ground, four pile (one of each color), and one ground, etc.

Fig. 154, *A* illustrates a motive (color design) for a four-frame Brussels while *B* illustrates the weave carried out from motive *A*.