

A HANDBOOK OF WEAVES

A HANDBOOK OF WEAVES

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TRANSLATED AND REVISED

BY

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TO WHICH THE TRANSLATOR HAS ADDED A SUPPLEMENT ON THE
ANALYSIS OF WEAVES AND FABRICS

WITH 1375 ILLUSTRATIONS

New York

THE MACMILLAN COMPANY

1915

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Set up and electrotyped. Published November, 1915.

Norwood Press
J. S. Cushing Co. — Berwick & Smith Co.
Norwood, Mass., U.S.A.

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A HANDBOOK OF WEAVES

DRAWING-IN DRAFTS

DRAWING the warp yarn into the harness is of special importance, as the production of the weave pattern depends upon this operation, called "drawing-in." In laying out the draft for a pattern, it is necessary to know what effect any particular drawing-in draft will have.

The order of drawing-in is so varied that it is difficult to give general directions. The number of threads in the weave pattern cannot be taken as a standard for determining the number of shafts to be used, as other conditions must be taken into consideration. When the number of shafts to be used is unavoidably large, the drawing-in draft must be arranged to keep the number as small as possible.

On the other hand, when the set of the warp is very close it is often necessary to increase the number of shafts to avoid bringing too many heddles on one shaft, which often causes difficulty in forming a clear shed.

It is frequently necessary to arrange the drawing-in draft for fancy goods, not only to make the work of drawing-in regular and convenient, but also to bring certain shafts into particular positions so as to adjust the strain to the strength of the yarn or to facilitate the formation of the shed. If the warp is composed of both cotton and wool yarn, the shafts carrying the wool warp should be placed nearest the reed. Like-

wise warp threads making abrupt and difficult intersections should be on shafts as near the reed as possible.

Oral instructions for drawing-in are sufficient only for straight drafts. To avoid errors a drawing-in draft should always be supplied to the operative. The shafts are represented in the draft either by horizontal lines or by spaces between the lines. In this book the spaces between the lines are used for this purpose. The numbering of the shafts on the draft must correspond with the shafts on the loom, and be understood by all the operatives who have occasion to refer to the drafts.

There are two methods of drawing-in :

1. From the reed toward the whip roll (from bottom to top, Fig. 1).

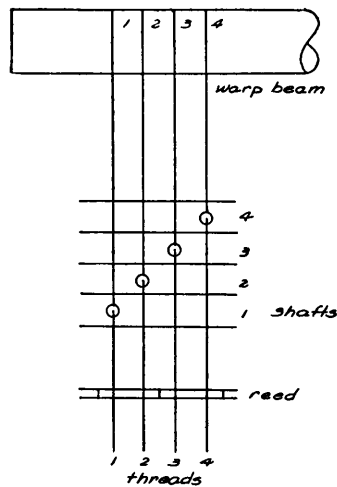


FIG. 1.

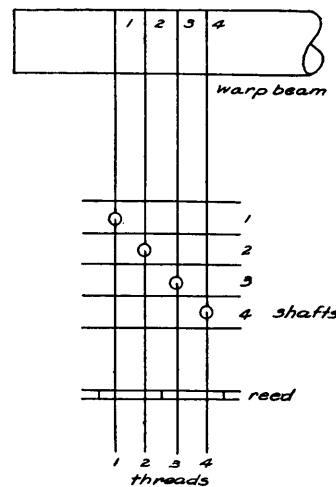


FIG. 2.

2. From the whip roll toward the reed (from top to bottom, Fig. 2).

The first method is designated by the expression "front to back"; the second, "back to front." Those who prefer the "front-to-back" order claim that the front shaft should be called the first as it is nearest to the weaver or drawer-in and is the first to meet the operative's eye. On the other hand, those who prefer the "back-to-front" order insist that the back

shaft should be called the first because the yarn from the warp beam reaches that shaft first.

The first thread is at the left in both cases. Neither of these methods has any advantage over the other, but the use of both in the same mill is frequently a cause of confusion.

The warp threads at Figs. 1 and 2 are indicated by the perpendicular lines, the first thread being at the left. The shaft on which the thread is drawn is indicated by a point, circle, cross or figure. Ordinarily the drawing-in draft is marked on drafting paper, along with the weave draft.



FIG. 3.



FIG. 4.

Fig. 3 is a straight draft on four harness from front to back. Fig. 4 is a straight draft on four harness from back to front.

The various drawing-in drafts may be classified as follows:

1. Straight.
2. Scattered or Satin.
3. Pointed.
4. Broken.
5. Intermittent.
6. Manifold or Corkscrew.
7. Grouped.
8. Divided.
9. Combination.

These are also classified as straight (1) and cross drafts (2 to 9).

1. STRAIGHT DRAFT

The straight drawing-in draft forms a basis for all others and proceeds in one direction only. It can be used with any number of shafts. Each succeeding thread is drawn on the succeeding shaft, the first thread

on the first shaft, the second thread on the second shaft, and in this regular order until the last shaft is reached, after which the operation is repeated, beginning with the first shaft. With eight shafts the threads will be drawn in as follows :

- On shaft 1 threads 1, 9, 17, 25, etc.
- On shaft 2 threads 2, 10, 18, 26, etc.
- On shaft 3 threads 3, 11, 19, 27, etc.
- On shaft 4 threads 4, 12, 20, 28, etc.
- On shaft 5 threads 5, 13, 21, 29, etc.
- On shaft 6 threads 6, 14, 22, 30, etc.
- On shaft 7 threads 7, 15, 23, 31, etc.
- On shaft 8 threads 8, 16, 24, 32, etc.

The number of threads in a straight draft is equal to the number of shafts, and each shaft carries one thread for every repeat of the draft. Fig. 5 is a straight

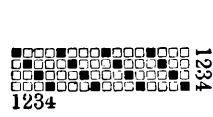


FIG. 5.

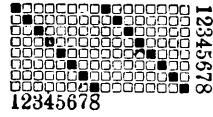


FIG. 6.

draft from back to front on four shafts. Fig. 6 is a straight draft from back to front on eight shafts.

2. SCATTERED OR SATIN DRAFT

In this draft the order of drawing-in is disconnected and scattered so that it resembles the draft for a satin weave, from which it has derived the name, satin.

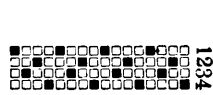


FIG. 7.

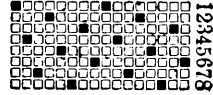


FIG. 8.

At least four shafts are required for this order of drawing-in. Fig. 7 is a satin draft on four shafts; Fig. 8, a satin draft on eight shafts.

3. POINTED DRAFT

This order of drawing-in results from running a straight draft first in one direction and then in the other. The shaft at each point of reversal receives but one thread, the other shafts each carrying two threads for the resulting double line. The number of threads in a pointed drawing-in draft in which the draft line runs the same distance in each direction, is two less than double the number of shafts. For example, the pointed draft on eight shafts, Fig. 9, covers 14 threads. The thread at either point of reversal is called the "point thread."

By varying the length of the lines in either direction two or more points can be brought into one draft. It is not necessary that the lines cover the same number of threads. By changing the direction at irregular intervals the point threads can be brought on different shafts, and, in fact, arranged so that each shaft carries the same number of threads as in the case of a straight draft.

FIG. 10.

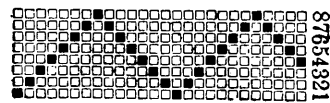
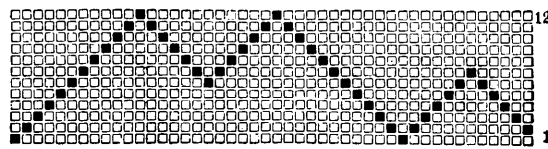


FIG. 9.

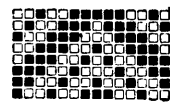


FIG. 11.

Attractive effects can be produced by varying the order in reversing a pointed draft, as shown in the draft on 12 shafts at Fig. 10. By using a twill weave with a pointed drawing-in draft the effect in the cloth is similar to that of the drawing-in draft. This causes the filling threads to float over several extra threads at the point of reversal, Fig. 11, which is objectionable in some classes of goods.

4. BROKEN DRAFT

Here one group of threads is drawn in straight in one direction and then another group is drawn in straight in the opposite direction. Where the direction is reversed the first thread of the new series is started higher or lower than the last thread of the preceding series. In a cloth woven with this draft the

FIG. 12.



FIG. 13.

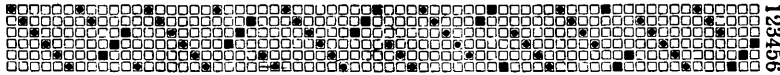
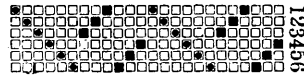


FIG. 14.

twill runs forward and backward in the order of drawing-in.

Instead of the symmetrical union of the two twill lines as obtained by the pointed drawing-in draft, a break occurs in the weave, making the point of junction distinct. The new twill line, especially in balanced twills, begins with a sharp break against the old line, Fig. 15. Where the twill reverses, the last thread of one twill line works in opposition to the first thread of the succeeding twill line. The risers of one thread come opposite the sinkers of the other thread. The twill can, of course, be run in either direction as far as desired. Figs. 12, 13 and 14 show three variations of the broken draft.

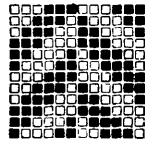


FIG. 15.

In most cases the broken draft is preferable to the pointed, and is much more frequently used. The former gives a better interlacing of the threads and a better junction of the twill lines than is possible with a pointed draft.

5. INTERMITTENT DRAFT

This is a straight draft with this difference, that at short intervals a certain number of shafts are skipped, the number depending on the weave to be used. Fig. 16 shows an intermittent draft on four shafts, in which

FIG. 16.



FIG. 18.

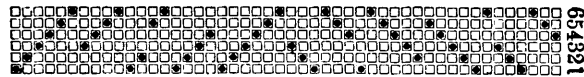
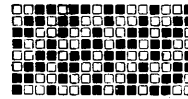


FIG. 17.

the draft is broken every four threads. This style of drawing-in enlarges the pattern to a greater or less extent, as compared with a straight draft. The direction of the intermittent draft can be changed, as illustrated at Fig. 17, which shows a draft on six shafts, reversed at the end of every twenty-four threads.

The number of shafts skipped to produce a break in an intermittent draft depends on the weave. Thus one shaft is skipped on a $2-2$ twill; two shafts on a

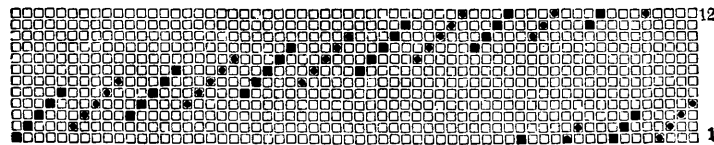


FIG. 19.

$3-3$ twill; and three shafts on a $4-4$ twill, to obtain the desired break. Fig. 18 is the weave pattern obtained with a $2-2$ twill and the drawing-in draft at Fig. 16. The first and last threads in an intermittent draft should break with each other.

Peculiar effects result from carrying each group of threads forward in progressive order, as shown at Fig. 19, in which the drawing-in of each group is begun 1 shaft in advance of the preceding group.

6. MANIFOLD OR CORKSCREW DRAFT

This draft is used where each twill line is formed by alternate threads, Fig. 23. It is especially effective where the warp is dressed 1 light, 1 dark, each color forming a separate twill. An even number of shafts is divided into two equal groups, one including the odd-numbered shafts, the other the even-numbered. With eight shafts each group consists of four shafts. The odd-numbered threads in the warp are drawn in straight on alternate shafts, beginning with shaft 1. The even-numbered threads are drawn in straight on alternate shafts beginning with shaft 5. Fig. 20 shows a manifold or corkscrew drawing-in draft on

FIG. 20.

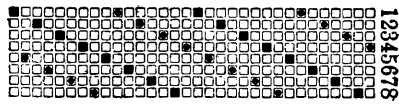


FIG. 21.

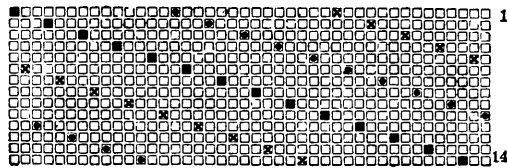
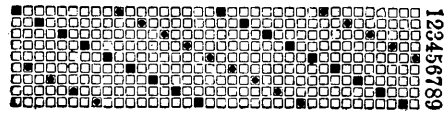


FIG. 22.

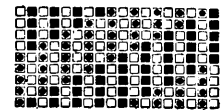


FIG. 23.

eight shafts, in which the two sets of shafts are distinguished by different marks.

A better junction of the two twill lines is obtained with an uneven number of shafts, 7, 9, 11, etc., because of the overlapping of the floats of adjacent warp threads. The drawing-in of the threads for one of the twills (threads 2, 4, 6, 8, etc.) is begun on the shaft following the larger division of the whole number of shafts. For example, when nine shafts are divided into two parts, 1 to 5 and 6 to 9, the first twill begins on shaft 1, the second twill on shaft 6, Fig. 21. Fig. 23 is the corkscrew weave obtained with a 9-leaf $5-4$ twill and the drawing-in draft shown at Fig. 21.

To combine three twills the shafts are divided into three parts; for example, 12 shafts into 3 divisions of 4 each. The drawing-in is begun with the first thread on the first shaft of the first group, the second thread on the first shaft of the second group, the third thread on the first shaft of the third group; as, 1, 5, 9, 2, 6, 10, 3, 7, 11, etc.

A better effect is obtained by using a number of shafts that cannot be divided into three equal groups, using the largest group for the first twill. Fig. 22 shows an example of such a draft on 14 shafts, beginning 1, 6, 11, etc. If the warp is dressed 1 black, 1 gray, 1 white, three twills of different colors will be formed in the cloth, the first black, the second gray and the third white. The three twills are distinguished on the draft, Fig. 22, by three different marks.

7. GROUPED DRAFT

This style of drawing-in is often used for the production of striped, checked and other fancy effects for which two weaves are used, the threads of one

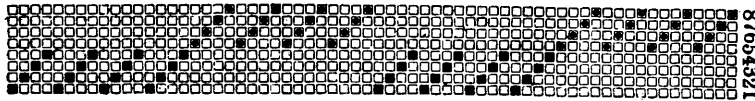


FIG. 24.

weave coming on one set of shafts, and those for another weave on a separate set. Fig. 24 shows a grouped draft on 8 shafts, 16 threads being drawn straight on each half (4) of the shafts to form the complete pattern.

8. DIVIDED DRAFT

This style of draft is much employed, both for double warp and double warp and filling fabrics. The face and back threads are drawn on separate groups of shafts. Fig. 25 shows a divided draft for which the warp is dressed 1 face, 1 back. The four

front shafts carry the face warp; the other eight shafts, the back warp.

If the warp is dressed 2 face, 1 back, with the face and back each carried by five shafts, the draft will be as shown at Fig. 26, the face warp coming on the

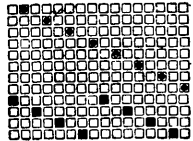


FIG. 25.

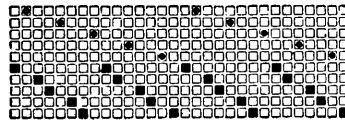


FIG. 26.

five front shafts, and the back warp on the five back shafts. The shafts carrying the face threads are usually hung next to the reed, as the weave for the back threads is generally easier than the face weave. If, however, the back warp is the weaker yarn, it should be drawn on the shafts nearest the reed.

9. COMBINATION DRAFT

The various methods of drawing-in are frequently combined in one draft for the production of weave patterns. The variety of these patterns is unlimited and it is, therefore, impossible to give a general idea of them from a few examples.

The nine classes of drawing-in drafts described above form the groundwork for all drafts. In the chapters which follow it will be shown how these methods of drawing-in should be employed. It must not be understood, however, that every possible weave pattern can be made with the examples given. Many variations, both in the number of the shafts and in the grouping of the threads, will be found necessary in practice.

Many requirements must be taken into consideration in deciding upon the number of shafts and the order of drawing-in for a particular pattern. Among them may be mentioned the following:

1. The drawing-in draft should be as simple as

possible in order to facilitate the work of the drawer-in and weaver.

2. The number of shafts should be as small as practicable. Closely set cloths require a larger number of shafts.

3. The distribution of the threads on the different shafts should be as uniform as possible.

FIG. 29.

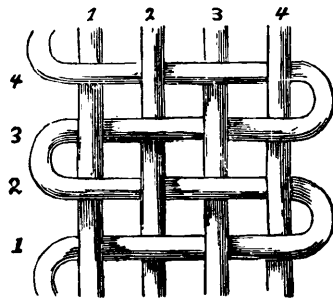


FIG. 27.

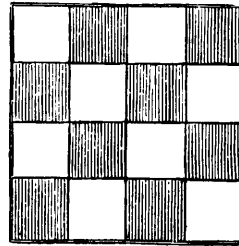


FIG. 28.

4. The draft should contribute to the formation of a clear shed.

5. Relieving the strain on the warp yarn. The threads with the least number of intersections in the weaves are drawn on the back shafts. The shafts carrying the least number of threads are placed as far back as possible. The best method of drawing-in for a particular fabric can be determined only by experience and a study of the various kinds of weaves.

DRAFTING WEAVES

The weave draft or plan for interlacing the warp and filling is drawn on cross section or "point" paper, which has upright and horizontal lines at regular intervals intersecting each other at right angles and forming small squares, each of which represents the intersection of a warp and a filling thread.

Each space between the upright lines represents a warp thread. Each space between the horizontal lines represents a filling thread. The marks or points in the small squares indicate whether the warp or filling comes to the face at that point.

Throughout this work a mark on a draft, unless otherwise stated, indicates that the warp is raised above the filling at that point of intersection. The exceptions to this rule are found when it is better to indicate the filling floats by marks, as for broché effects.

TWIST OF YARN

It is evident that a thread can be twisted in either one of two directions, Figs. 30 and 31. The simplest



FIG. 30.—Right or openband twist.



FIG. 31.—Left or crossband twist.

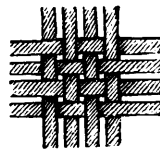


FIG. 32.

method of designating the direction of the twist is by the terms "right" and "left." Unfortunately the practice in this respect is not uniform. The same

direction is styled "right" by a part of the trade, and "left" by another part. The more common custom is to call the twist at Fig. 30 right-hand; that at Fig. 31, left-hand. This seems to be the almost exclusive practice on the continent of Europe and in the cotton and cordage industries elsewhere. This custom will be followed in this work when referring to "right" or "left" twist.

The twist at Fig. 30 is also called "openband"; that at Fig. 31, "crossband." This method of indicating the direction of twist was derived from the old method of spinning yarn by hand. The thread is twisted in one direction when the band running from the wheel to the spindle is straight or open, and in the opposite direction when the band is crossed. The spinner turns the wheel by hand so that the top of the wheel moves to the right or away from the spinning spindle.

SET OF THREADS

The set ordinarily should be as near as possible the same for both warp and filling. If the warp is set too close, it is impossible to drive the filling uniformly into the fabric, and the goods may show ribbed or grooved effects crossways of the cloth. This result also follows when the filling is materially heavier than the warp. On the other hand, if the warp is coarse with an open set, while the filling is fine with a close set, the streaks or ribs will run lengthways. Ribbed effects are sometimes made purposely by alternating coarse with fine yarn in warp or filling.

Broadcloth is woven very wide as the weight, handle and finish of the fabric is largely the result of shrinkage by fulling. The loom width of wool-dyed and piece-dyed broadcloths varies from 85 to 95 inches for 6/4 goods.

To facilitate the felting of broadcloths and improve the face it is better to make the warp and filling of opposite twist.

THE PLAIN WEAVE

This work will treat of the interlacing of two sets of threads intersecting each other at right angles. The yarn running lengthways of the cloth is the warp; that running crossways and carried by the shuttle is the filling or weft. The order in which the warp and filling interlace each other is the weave.

Weaves are divided into three primary classes:

1. Plain.
2. Twill.
3. Satin.

From these three classes are derived an innumerable number of other weaves, known as mixed or derivative

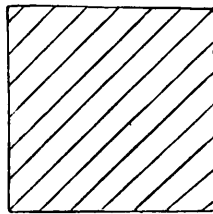


FIG. 33.

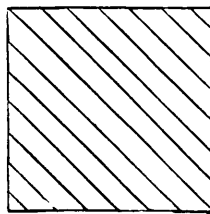


FIG. 34.

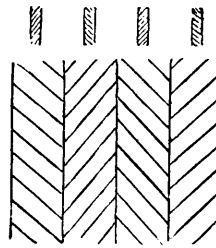


FIG. 35.

weaves. Where two or more weaves are used for the same fabric, the resulting weave is called a combination weave; and the fabric is called fancy, as distinguished from plain goods made with but one weave.

The plain weave is also called the taffeta weave in silk weaving, and is frequently designated as the "cotton" weave. It is balanced, that is, the warp and filling come to the face to the same extent. The weave covers two warp and two filling threads. At each pick each

alternate warp thread is raised above the filling thread, the other warp threads being under the filling. This order is reversed at the next pick. For example, at one pick, warp threads 1, 3, 5, 7, etc., are raised and threads 2, 4, 6, 8, etc., are lowered in the shed. At the next pick, threads 1, 3, 5, 7, etc., are lowered and threads 2, 4, 6, 8, etc., are raised.

Fig. 27 shows the manner in which the threads are interlaced in a plain weave. Fig. 28 is a draft corresponding to Fig. 27, and in which the shaded squares indicate that the warp is raised above the filling. The blank squares indicate that the warp lies under the filling. Fig. 29 is a longitudinal section of a cloth woven with a plain weave and showing two adjacent warp threads, marked 1 and 2. The black circles are the ends of the filling threads.

A warp set with 40 to 50 threads per inch can be woven easily with a plain weave on two shafts. A better shed can

be obtained and the strain and friction on the yarn reduced by increasing the number of shafts as the set becomes closer. A general rule is to have not more than 20 to 25 threads per inch on each shaft.

Cloth woven with a plain weave has a finer appearance and harder feel, and is smoother, but possesses less elasticity than fabrics woven with other weaves.

Fig. 32 shows a plain weave in which the warp twist is right or openband twist, Fig. 30, and the filling twist is left or crossband twist, Fig. 31.

Tricot effects can be made with a plain weave by arranging the threads in both warp and filling, 1 right twist, 1 left twist. To keep the two kinds of yarn separate in weaving, one is usually tinted slightly with aniline so it can be distinguished from the other.

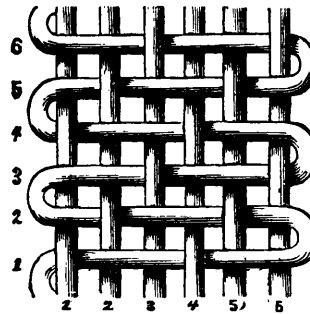


FIG. 36.

THE TWILL WEAVE

A characteristic of the simplest form of the twill weave is that the float of each filling thread is set one warp thread to the right or left of the float of the preceding filling thread. For example, the 3-shaft twill running to the right, Fig. 37, is formed by but one

FIG. 37.

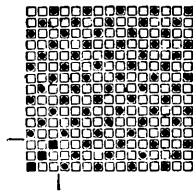


FIG. 38.

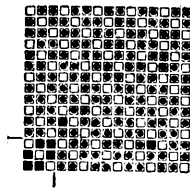


FIG. 39.

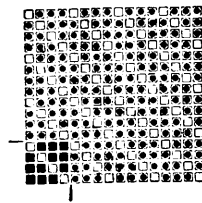
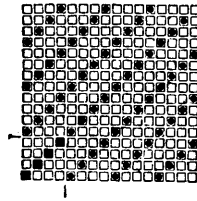


FIG. 40.

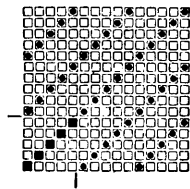


FIG. 41.

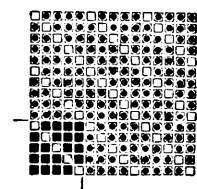


FIG. 42.

warp thread being raised in one place, the threads on both sides being lowered. The first warp thread is over the first filling thread, then the second warp thread is raised over the second filling thread, the third over the third, etc. Each filling float is one warp thread to the right of the float of the preceding pick. By this progressive order of interlacing the warp and filling, raised or ribbed lines are formed, running in a diagonal direction.

The slant of this twill line is influenced by the set

of the warp and filling. If the threads per inch in the warp are equal to the threads per inch in the filling, the line of this twill will be at an inclination of 45° . If the warp set is closer than that of the filling, the twill line will approach the perpendicular; if the filling set is closer, the twill line will approach the horizontal.

FIG. 43.

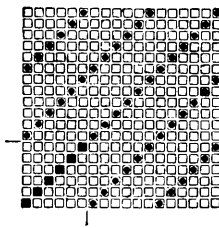


FIG. 44.

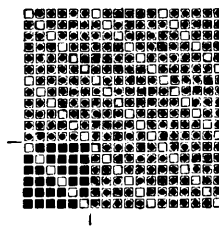


FIG. 45.

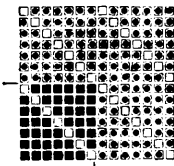
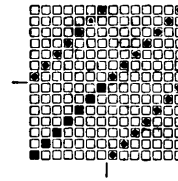


FIG. 46.

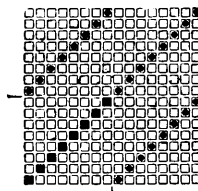


FIG. 47.

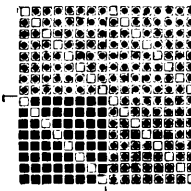


FIG. 48.

FIG. 49.

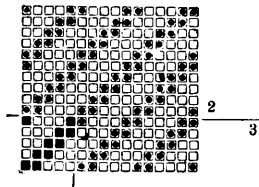


FIG. 50.

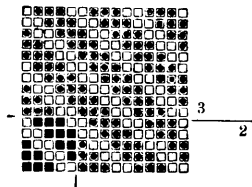


FIG. 51.

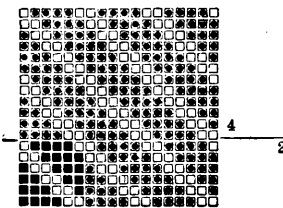
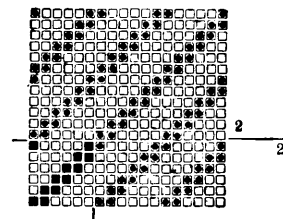


FIG. 52.

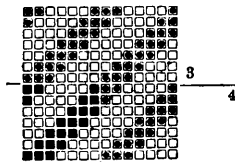


FIG. 53.

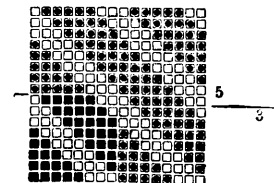


FIG. 54.

Twill weaves are classified as follows:

1. Uneven.
2. Balanced.

Uneven twills are those in which the warp comes to the surface to either a greater or less extent than does the filling. If the warp predominates on the face,

FIG. 55.

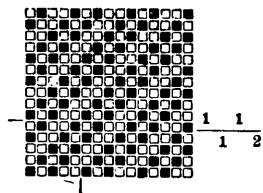


FIG. 56.

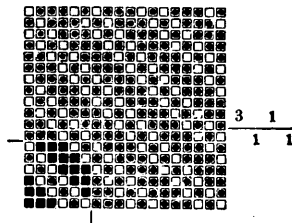


FIG. 57.

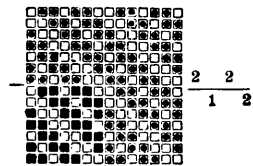
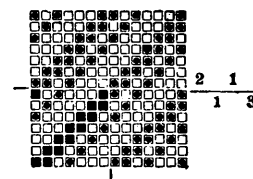


FIG. 58.

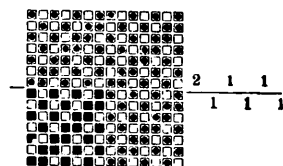


FIG. 59.

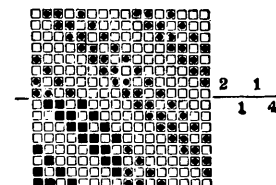


FIG. 60.

FIG. 61.

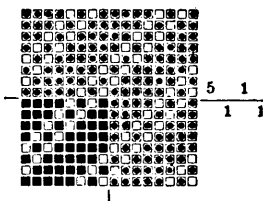


FIG. 62.

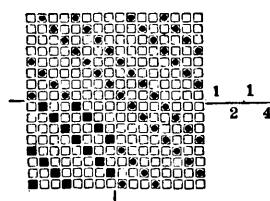


FIG. 63.

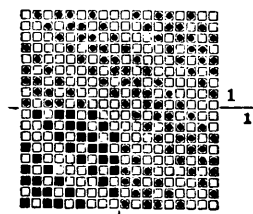
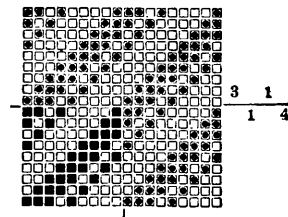


FIG. 64.

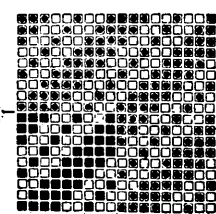


FIG. 65.

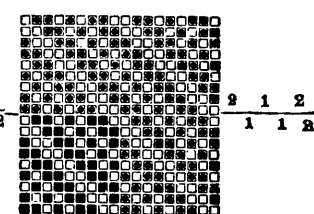


FIG. 66.

the weave is called a warp twill. If the filling predominates, it is called a filling twill.

Fig. 36 shows the intersection of the warp and fill-

FIG. 67.

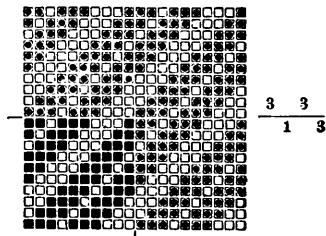


FIG. 68.

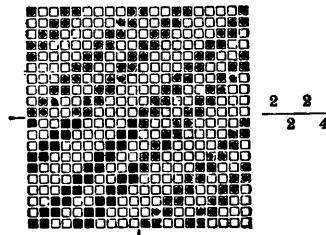
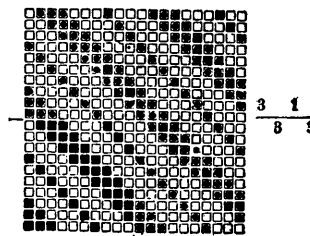


FIG. 69.

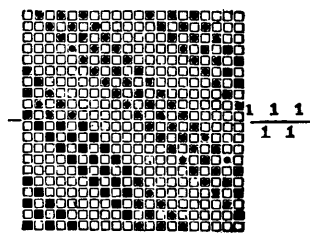


FIG. 70.

FIG. 71.

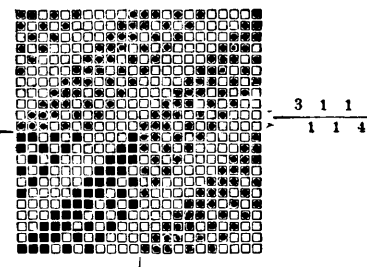


FIG. 72.

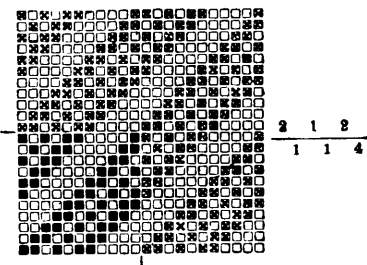
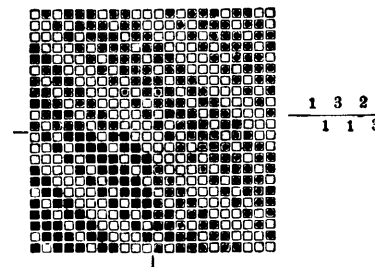


FIG. 73.

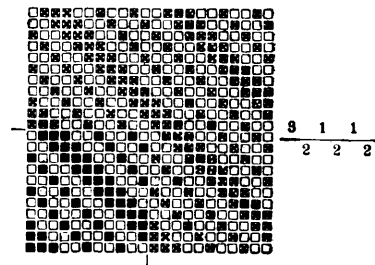


FIG. 74.

ing in the 3-leaf filling twill at Fig. 37. Other examples of uneven twills are shown at Figs. 37 to 82.

Balanced twills are those in which the warp and filling come to the surface to the same extent.

Fig. 83 shows the intersection of the warp and filling for the 4-leaf balanced twill at Fig. 84. Other examples of balanced twills are shown at Figs. 85 to 99.

All regular twills covering an uneven number of

FIG. 75.

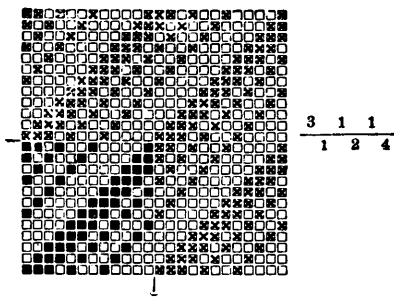


FIG. 76.

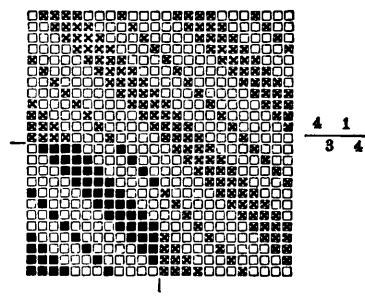


FIG. 77.

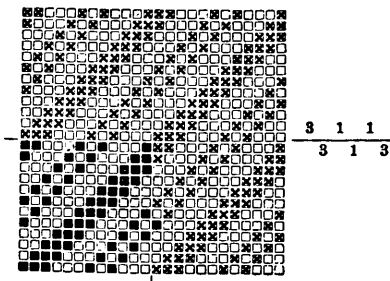
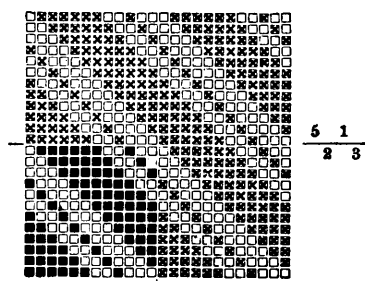


FIG. 78.



threads are necessarily uneven, and those with an even number may be made uneven. Regular balanced twills can be formed with only an even number of threads in the weave pattern.

The line of a twill can be run either to the right, Fig. 33, or to the left, Fig. 34. The directions of the twill and twist of the yarn have a great influence on the appearance of the cloth.

A twill to the right throws up and makes more prominent a left-twist warp; it throws down and makes less prominent a right-twist warp.

A twill to the left throws down and makes less prominent a left-twist warp ; it throws up and makes more prominent a right-twist warp.

A twill that runs to the right when the warp threads are in a perpendicular position will be found to run to the left when the cloth is turned one quarter around

FIG. 79.

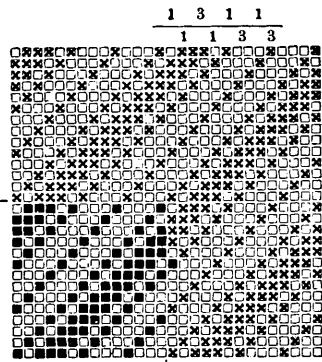
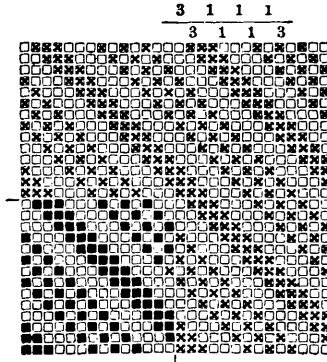


FIG. 80.



5 1 1 / 3 3 3

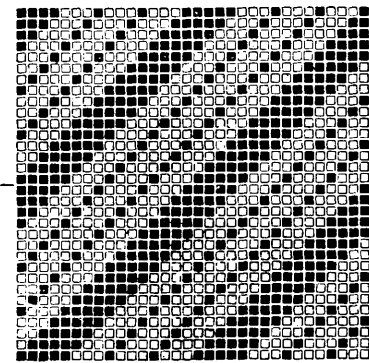


FIG. 81.

3 1 1 1 / 1 1 1 3 3

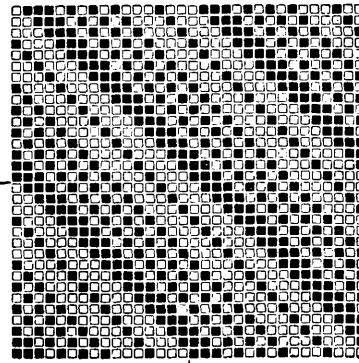


FIG. 82.

to bring the filling threads perpendicular. Thus a twill runs in one direction in relation to the warp and in the opposite direction in relation to the filling. It is the custom, however, to designate the direction of the twill as it runs when the warp is perpendicular. In this sense of the term, a right twill will have the opposite effect on the filling to that which it exerts on the warp. Thus a twill to the right will throw a left-

FIG. 83.

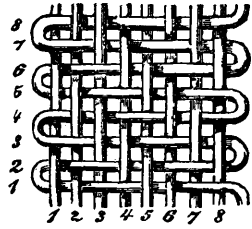


FIG. 84.

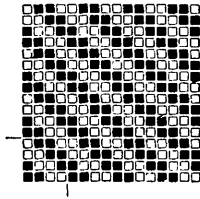


FIG. 85.

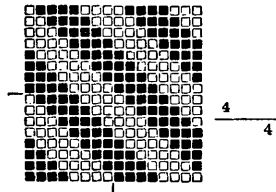
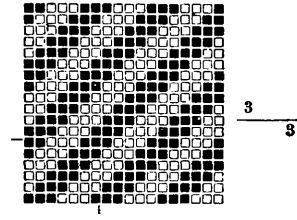


FIG. 86.

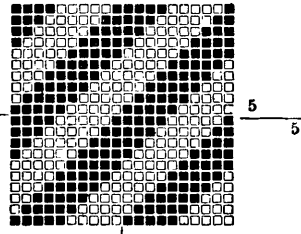


FIG. 87.

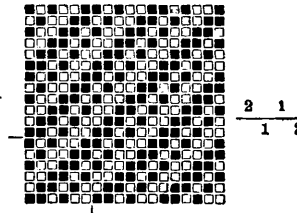


FIG. 88.

FIG. 89.

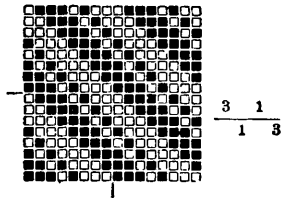


FIG. 90.

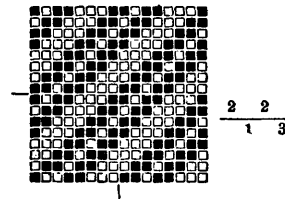


FIG. 91.

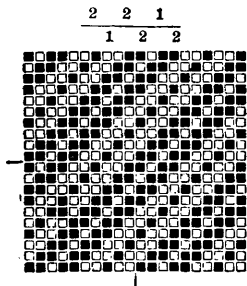
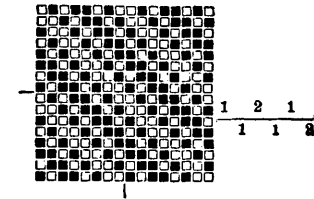


FIG. 92.

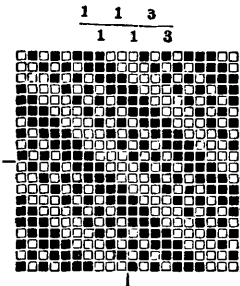


FIG. 93.

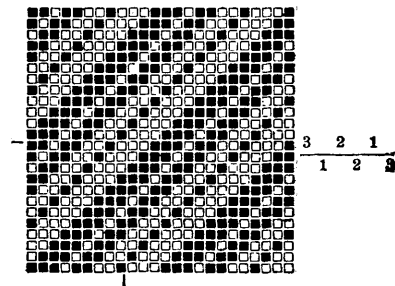


FIG. 94.

twist warp up and a left-twist filling down because the twill is in reality left hand in relation to the filling. The various combinations of twill and twist with their effects on the cloth are as follows:

	WARP TWILL	WARP TWIST	FILLING TWIST	EFFECT		
1.	Right	Left	Right	Warp thrown up	Filling thrown up	Twill not distinct
2.	Left	Left	Right	Warp thrown down	Filling thrown down	Twill not distinct
3.	Right	Right	Left	Warp thrown down	Filling thrown down	Twill not distinct
4.	Left	Right	Left	Warp thrown up	Filling thrown up	Twill not distinct
5.	Right	Left	Left	Warp thrown up	Filling thrown down	Warp twill distinct
6.	Left	Left	Left	Warp thrown down	Filling thrown up	Filling twill distinct
7.	Right	Right	Right	Warp thrown down	Filling thrown up	Filling twill distinct
8.	Left	Right	Right	Warp thrown up	Filling thrown down	Warp twill distinct

In practice these effects are greatly modified by the quality of the stock, amount of twist, size and character of the yarn, whether single or ply, set of the fabric and finish. As far as the mere direction of twill and twist is concerned, however, the effects are as indicated above.

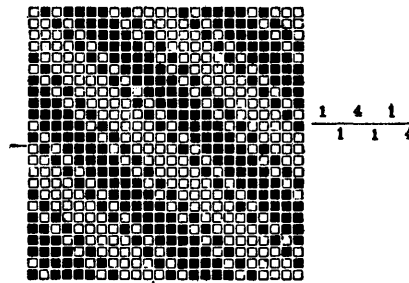


FIG. 95.

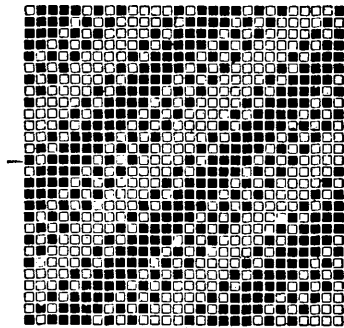
If the warp yarn is 2-ply, the two threads are ordinarily twisted to the left, Fig. 31. The twill should then run to the right, Fig. 33, to make the warp twill line more distinct.

If the twill in a pattern runs alternately to right and left and it is desired to have it equally distinct in both cases, right twist must be used for the warp yarn in

the left twill ; and left twist for the warp yarn in the right twill, Fig. 35.

The threads in a twill weave float farther than when a plain weave is used. The twilled cloth is more lustrous, softer, and more pliable than fabrics made with a plain weave.

FIG. 96.

$$\begin{array}{cccc} 1 & 4 & 1 & 1 \\ \hline 1 & 1 & 1 & 4 \end{array}$$


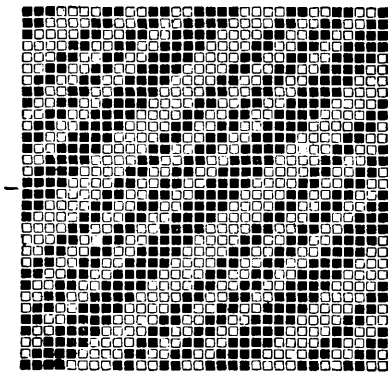
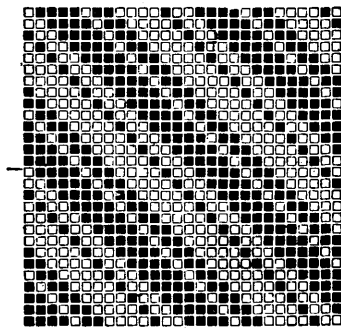
$$\begin{array}{ccc} 4 & 2 & 2 \\ \hline 4 & 2 & 2 \end{array}$$


FIG. 98.

FIG. 97.

$$\begin{array}{ccc} 4 & 2 & 1 \\ \hline 1 & 4 & 2 \end{array}$$


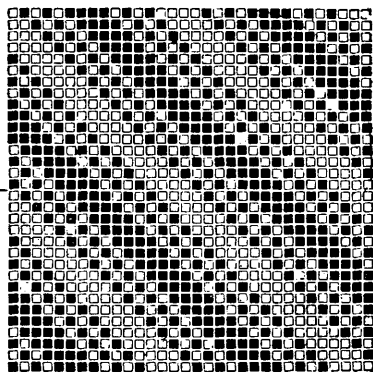
$$\begin{array}{cccccc} 1 & 1 & 4 & 1 & 1 \\ \hline 1 & 1 & 1 & 1 & 4 \end{array}$$


FIG. 99.

The number of shafts used for a twill is usually equal either to the number of threads in the twill weave or to a multiple of the latter number, making the drawing-in draft straight in either case.

Figs. 36 to 99 illustrate many of the different styles of twill weaves.

For wide twills the draft is often made out in the

following form: $4\text{---}_2\text{---}1\text{---}_2$. This is equivalent to 4 up, 2 down, 1 up, 2 down, producing the 9-shaft twill shown at Fig. 65. These illustrations, Figs. 36 to 99, give a good idea of the diversity of twill weaves and the methods of combination. Thousands of similar twills can be drafted. With a large number of shafts the number of twill weaves becomes practically unlimited. Twills take the filling much more easily than does the plain weave, and the set of twills can, consequently, be closer, making the cloth thicker and heavier.

THE SATIN WEAVE

The satin weave lacks the distinct diagonal line peculiar to the twill, and produces a smooth, lustrous face on the cloth. Adjacent threads in regular satin weaves must never be stitched on the same filling thread. The points or stitchers should be scattered as widely and as uniformly as possible. The farther they are removed from each other, the more indistinct do they become and the more attractive is the cloth.

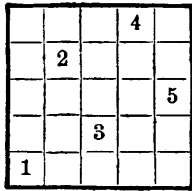


FIG. 100.

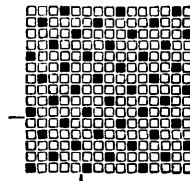


FIG. 101.

The particular draft to be used for a satin weave depends on the set of the fabric, the quality of the material and the size of the yarn. If the weave is too loose, the result will be a spongy fabric of poor appearance and handle and lacking durability. On the other hand if the weave is too tight for a closely set warp, it will be impossible to drive the required number of picks into the cloth, and the result will be a ribby appearance.

The satin weave requires at least five shafts and can be made on any number of shafts above five. Frequently the broken 4-leaf twill weave is called a satin, but strictly speaking it is a broken twill. The twill and satin weaves become merged on five shafts, the 5-shaft satin weave being sometimes called a satin

twill, because of the unavoidable twill line, as shown at Figs. 103 and 104. A twill effect is found in many satin weaves.

The following method is used for quickly determining the order of progression for the stitchers in satin weaves:

The number of threads in the pattern is divided into two unequal numbers, neither of which is divisible by the other (1 is not used). Beginning with

FIG. 102.

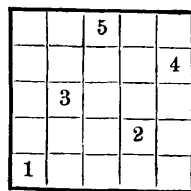


FIG. 103.

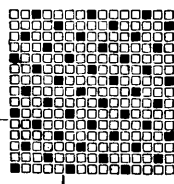


FIG. 104.

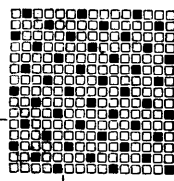
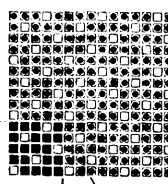


FIG. 105.

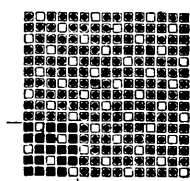


FIG. 106.

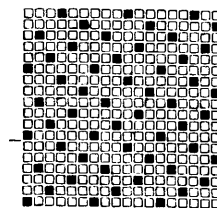


FIG. 107.

the first pick each filling thread is stitched a certain number of threads in advance of the stitcher on the preceding pick until every warp thread in the weave has been interlaced with the filling. This number of threads is called a rising number, being one of the two numbers into which the total number of threads was divided. It must be a number that will result in the stitching of every warp thread when used as a rising number.

For example, the number 5 is divisible into 2 and 3. Beginning with thread 1, Figs. 100 and 101, and progressing 2 warp threads to the right at each pick, the warp threads are stitched in the following order:

1, 3, 5, 2, 4. The first warp thread is stitched on the first pick; the third warp, on the second pick; the fifth warp, on the third pick; the second warp, on the fourth pick; and the fourth warp, on the fifth pick.

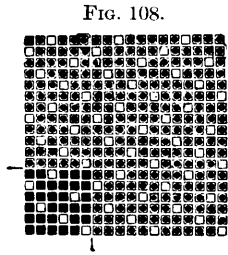


FIG. 108.

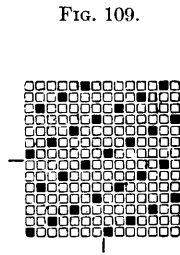


FIG. 109.

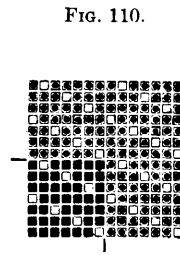


FIG. 110.

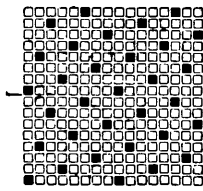


FIG. 111.

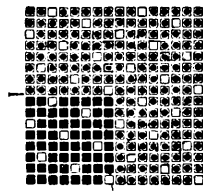


FIG. 112.

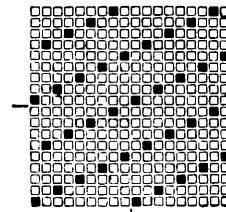


FIG. 113.

The same weave is obtained by using 3 instead of 2 as a rising number, the only difference being that the direction of the twill is reversed, Figs. 102 and 103. This is evident because the advance of 2 threads to

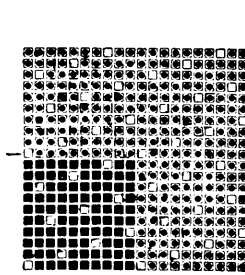


FIG. 114.

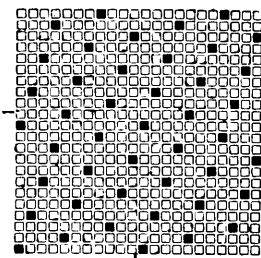


FIG. 115.

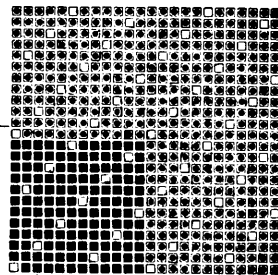


FIG. 116.

the right brings the stitcher 3 threads (the remaining number) to the left.

The order of progression can be carried upward instead of sideways. Thus in the 5-leaf satin weave,

Figs. 100 and 101, the first warp thread is stitched on the first pick ; the second warp, on the fourth pick ;

FIG. 117.

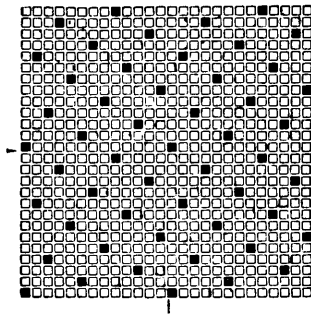


FIG. 118.

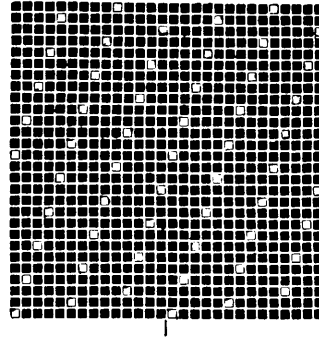


FIG. 119.

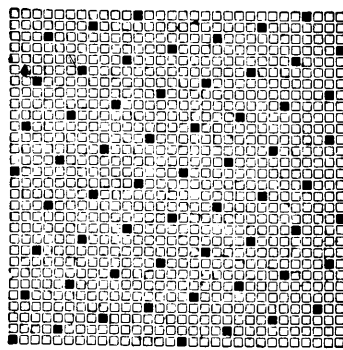
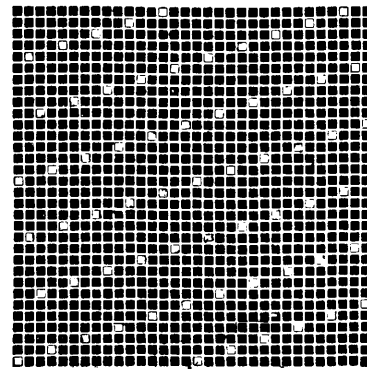


FIG. 120.



the third warp, on the second pick ; the fourth warp, on the fifth pick ; the fifth warp, on the third pick, the rising number being 3. The first method, however, is the one generally used.

The 5-shaft satin is used for both warp and filling

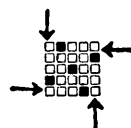


FIG. 121.



FIG. 122.



FIG. 123.

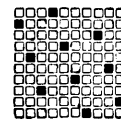


FIG. 124.

weaves. It is frequently desirable to have the twill line in a warp satin brought out distinctly. This can

be done by regulating the direction of the twill in the cloth and of the twist in the yarn. For example, right-twist warp, with the weave at Fig. 104, will make a distinct twill running to the left, as indicated by the slanting line below the draft. If the cloth is woven with the back up, the weave draft should be as shown at Fig. 105.

If it is desired to have the face of the goods as smooth as possible; as in the case of doeskins, the weave shown at Fig. 106 should be used with right-twist warp in

FIG. 125.

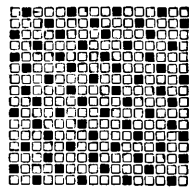


FIG. 126.

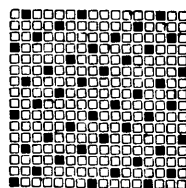


FIG. 127.

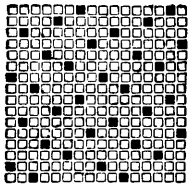
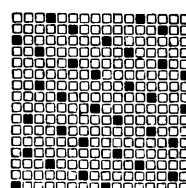


FIG. 128.

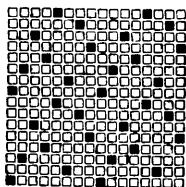


FIG. 129.

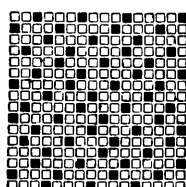


FIG. 130.

order to efface the twill effect as much as possible. If the cloth is woven face up with this weave, the weave draft, Fig. 101, should be used.

For the 6-shaft satin there is no regular order of progression, as 6 can be divided according to the rule only into 2 and 4, neither of which is suitable for a rising number. The following order is often used for the 6-shaft satin: 1, 3, 5, 2, 6, 4, Fig. 107; or 6, 4, 2, 5, 1, 3, Fig. 108.

For the 7-shaft satin there are two orders of interlacing available, as 7 can be divided into 2 and 5 or 3 and 4. With 2 for the riser the order is as follows: 1, 3, 5, 7, 2, 4, 6, Fig. 109. Fig. 110 shows a 7-shaft

warp satin with weave reversed by using 5 as the rising number: 7, 5, 3, 1, 6, 4, 2.

For the 8-shaft satin there is but one order available, as 8 can be divided according to the rule only into 3 and 5. With 3 as a riser the order is as follows: 1, 4, 7, 2, 5, 8, 3, 6, Figs. 111 and 112.

For the 9-shaft satin the rising numbers are 2 and 7 or 4 and 5. With 2 as a rising number the order is 1, 3, 5, 7, 9, 2, 4, 6, 8, Fig. 113.

For the 10-shaft satin, the only division is into 3 and 7. With 3 the order is 1, 4, 7, 10, 3, 6, 9, 2, 5, 8, Fig. 114.

For the 11-shaft satin there are four divisions:

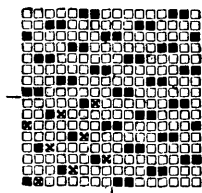


FIG. 131.

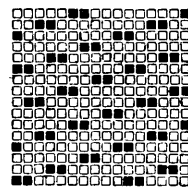


FIG. 132.

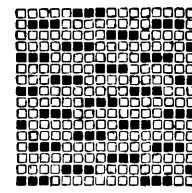


FIG. 133.

2 and 9, 3 and 8, 4 and 7, 5 and 6. With 4 the order is 1, 5, 9, 2, 6, 10, 3, 7, 11, 4, 8, Fig. 115.

For the 12-shaft satin there is one division only: 7 and 5. With 7 the order is 1, 8, 3, 10, 5, 12, 7, 2, 9, 4, 11, 6, Fig. 116.

For the 13-shaft satin there are five divisions: 2 and 11; 3 and 10; 4 and 9; 8 and 5; 7 and 6. With 5 the order is 1, 6, 11, 3, 8, 13, 5, 10, 2, 7, 12, 4, 9, Fig. 117.

For the 14-shaft satin there are two divisions: 3 and 11; 5 and 9. With 5 the order is 1, 6, 11, 2, 7, 12, 3, 8, 13, 4, 9, 14, 5, 10, Fig. 118.

For the 15-shaft satin there are three divisions: 2 and 13; 4 and 11; 7 and 8. With 4 the order is 1, 5, 9, 13, 2, 6, 10, 14, 3, 7, 11, 15, 4, 8, 12, Fig. 119.

For the 16-shaft satin there are three divisions: 3 and 13; 5 and 11; 7 and 9. With 3 the order is

1, 4, 7, 10, 13, 16, 3, 6, 9, 12, 15, 2, 5, 8, 11, 14,
Fig. 120.

A satin weave with an even number of shafts can be drafted by using as the rising number one less than half the number of shafts if the half number is even, or two less if it is an odd number. For example, to draft an 8-shaft satin, 4 less 1, or 3, is used for the riser. For a 10-shaft satin, 5 less 2, or 3, is used for the riser. For a 12-shaft satin the riser is 6 less 1, or 5. There is no advantage gained by this method of finding the riser and the first one described is decidedly the better.

FIG. 134.

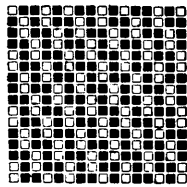


FIG. 135.

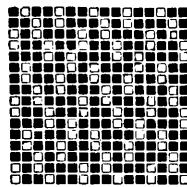


FIG. 136.

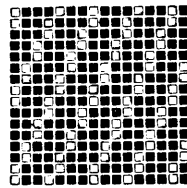
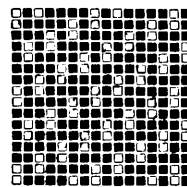


FIG. 137.

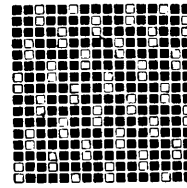


FIG. 138.

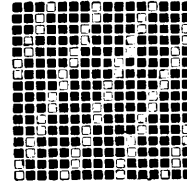


FIG. 139.

A third method of drafting satin weaves, which, however, is used but little, consists in writing the numbers of the shafts consecutively in columns. Following is the method applied to an 8-shaft satin, three numbers being placed in each column :

1	4	7	2	5	8	3	6
2	5	8	3	6	1	4	7
3	6	1	4	7	2	5	8

The upper horizontal row gives the order in which the stitchers are to be placed on successive filling threads. In the example given, the first warp thread

is stitched by the first pick ; the fourth warp by the second pick ; the seventh warp by the third pick ; the second warp by the fourth pick ; and so on in progressive order until every warp thread in the pattern has been stitched, Fig. 111. The same order is given in each of the other two rows, the only difference being in the point of commencement. This method cannot be recommended in preference to the first one given, as it is necessary first to determine the order in which

FIG. 140.

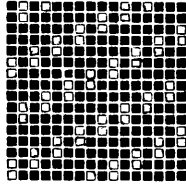


FIG. 141.

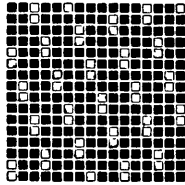


FIG. 142.

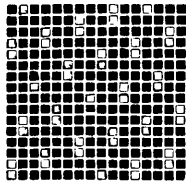
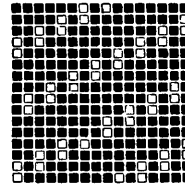


FIG. 143.

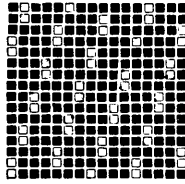


FIG. 144.

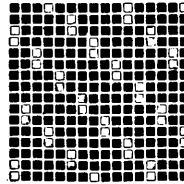


FIG. 145.

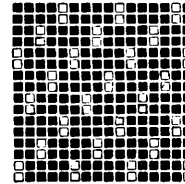


FIG. 146.

the figures are to be placed under each other in a column.

The order of stitching satin weaves, already given, is shown in tabular form as follows :

		ORDER OF STITCHING															
Weave																	
5-leaf	1	3	5	2	4												
6-leaf	1	3	5	2	6	4											
7-leaf	1	3	5	7	2	4	6										
8-leaf	1	4	7	2	5	8	3	6									
9-leaf	1	3	5	7	9	2	4	6	8								
10-leaf	1	4	7	10	3	6	9	2	5	8							
11-leaf	1	5	9	2	6	10	3	7	11	4	8						
12-leaf	1	8	3	10	5	12	7	2	9	4	11	6					

Weave																
13-leaf	1	6	11	3	8	13	5	10	2	7	12	4	9			
14-leaf	1	6	11	2	7	12	3	8	13	4	9	14	5	10		
15-leaf	1	5	9	13	2	6	10	14	3	7	11	15	4	8	12	
16-leaf	1	4	7	10	13	16	3	6	9	12	15	2	5	8	11	14

When goods are woven with warp and filling satin weaves combined to produce figured effects, the draft, to effect a good junction of the two weaves, must be arranged so that the last thread of the pattern is

FIG. 147.

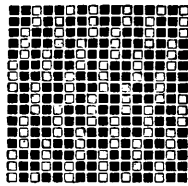


FIG. 148.

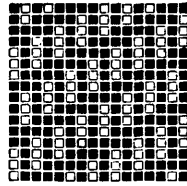


FIG. 149.

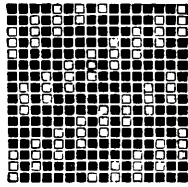
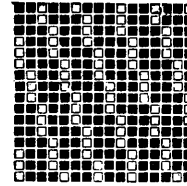


FIG. 150.

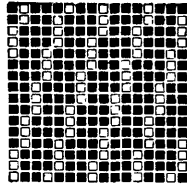


FIG. 151.

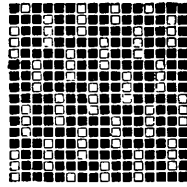


FIG. 152.

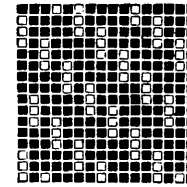


FIG. 153.

stitched in the reverse order from that of the first thread. Thus for a 5-shaft satin the order should be 4, 1, 3, 5, 2, Fig. 121; 6-shaft satin, 2, 6, 4, 1, 3, 5, Fig. 122; 8-shaft satin, 6, 1, 4, 7, 2, 5, 8, 3, Fig. 123; 10-shaft satin, 7, 10, 3, 6, 9, 2, 5, 8, 1, 4, Fig. 124.

With satin weaves either the warp or the filling color predominates on the face, the filling in warp satins and the warp in filling satins being hidden, providing the set of the fabric is close enough.

IRREGULAR SATINS

Satin weaves are often used in which the stitchers or risers are irregularly distributed, Figs. 125 to 130.

The weave pattern at Fig. 125 includes 4 warp threads and 12 picks; Fig. 126, 12 warp and 6 picks; Fig. 127, 8 warp and 16 picks; Figs. 128 and 129, 8 threads each way; Fig. 130, 13 threads each way.

DOUBLE-STITCHED SATINS

If two or more stitchers in a satin weave are brought together, one above the other, or side by side, or if stitchers are inserted regularly a short distance from the regular stitchers, the weave is called a double satin, and possesses certain characteristics and advantages.

In the single satin fabrics in which the warp lies on one side and the filling on the other, the stitchers are widely separated. This contributes to the smoothness and luster of the cloth, which is very desirable in

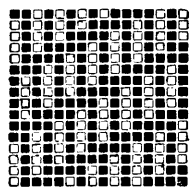


FIG. 154.

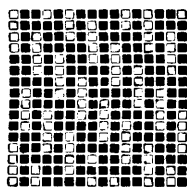


FIG. 155.

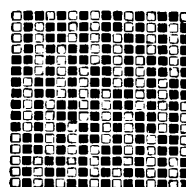


FIG. 156.

certain goods. It, however, lessens the durability of the fabric, and for this reason single satin weaves are better adapted for cloths in which luster and a smooth face are more desirable than wearing qualities. The durability of coatings and trouserings, which are subjected to hard wear, is increased by increasing the number of stitchers in the satin weave.

In double-filling satins 2, 3 or 4 risers are placed side by side on the same pick. In warp satins each warp thread is lowered below 2, 3 or 4 consecutive picks. In double-filling satins, stitchers are inserted at the right or left of each regular stitcher. In warp satins each warp thread is lowered below one or more picks before or after the single stitcher of the regular satin weave.

DOUBLE-STITCHED FILLING SATINS

Fig. 131 is an 8-shaft double-stitched filling satin. An extra stitchee, indicated by a cross in one repeat of the weave, is inserted at the right of each regular stitchee. Each pick floats over six warp threads, while the warp which floats on the back is woven 1—4—1—2. This weave is used for goods called "English leather."

Fig. 132 is a 10-shaft double-stitched filling satin.

Fig. 133 is an 11-shaft filling satin in which 2 risers have been placed at the side of the first one, bringing 3 risers together.

FIG. 157.

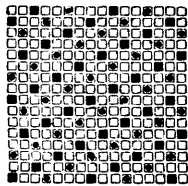


FIG. 158.

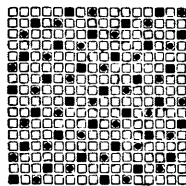


FIG. 159.

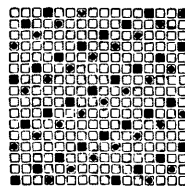


FIG. 160.

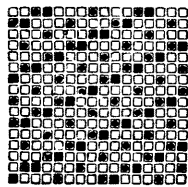
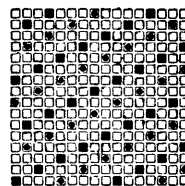


FIG. 161.

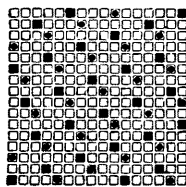


FIG. 162.

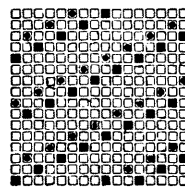


FIG. 163.

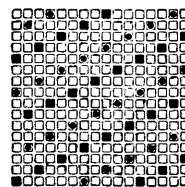


FIG. 164.

DOUBLE-STITCHED WARP SATINS

Figs. 134 to 145 are double-stitched warp satin weaves made by lowering each warp thread under two picks instead of one. The extra sinker is placed above the first, and stitches the filling thread, which floats on the back. These weaves are used chiefly for worsted cloths.

To reduce the number of shafts, a satin weave with half the number of shafts is sometimes woven with two picks in a shed. Fig. 146 shows a 5-shaft satin

woven in this way, and serving as a substitute for the 10-shaft double satin, Fig. 141.

By lowering each warp thread for 3, 4 or 5 picks instead of 1 or 2, the filling, floating on the back, is stitched more closely and the twill is made more pronounced. In Figs. 147 to 153 each warp thread passes under 3 picks; in Figs. 154 and 155, under 4 picks in succession; in Fig. 156, under 5 picks.

FIG. 165.

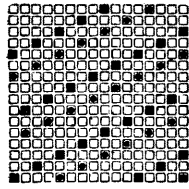


FIG. 166.

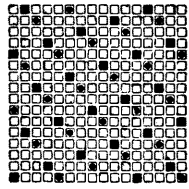


FIG. 167.

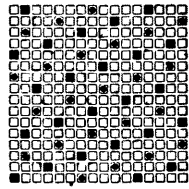


FIG. 168.

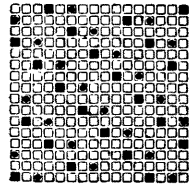
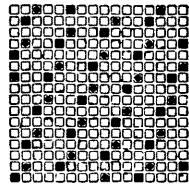


FIG. 169.

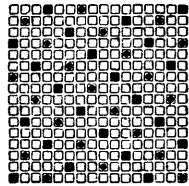


FIG. 170.

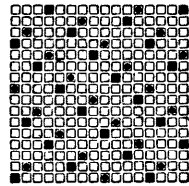


FIG. 171.

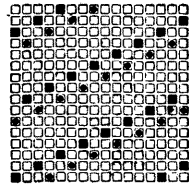


FIG. 172.

FIG. 173.

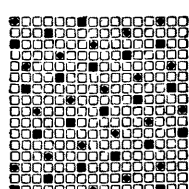


FIG. 174.

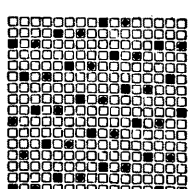


FIG. 175.

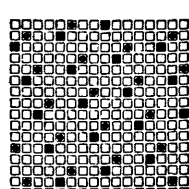


FIG. 176.

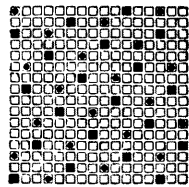
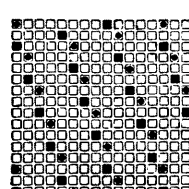


FIG. 177.

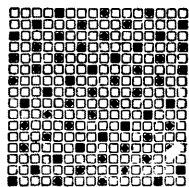


FIG. 178.

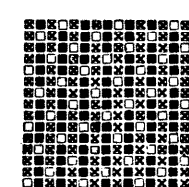


FIG. 179.

FILLING SATINS WITH EXTRA STITCHERS

Figs. 157 to 178 are satin weaves in which extra stitchers are placed regularly at short distances from the regular stitchers, and without regard to the tighter stitching of the warp threads floating on the back.

Attractive color effects can be produced with the satin weave. Fig. 179 shows a two-color diagonal obtained with a warp dressed 1 light, 1 dark and woven with a 5-leaf satin. Similar effects result from this warp pattern and a 7- or 9-leaf satin.

DERIVATIVE WEAVES

The great variety of elementary weaves has been shown by what has preceded. It will be readily understood that each elementary weave is capable of an almost endless number of modifications. An elementary weave becomes a modified or derivative weave when risers are added or removed. These alterations must, as a matter of course, be made uniformly throughout the weave pattern. Changes made in elementary weaves frequently necessitate alterations in the drawing-in draft.

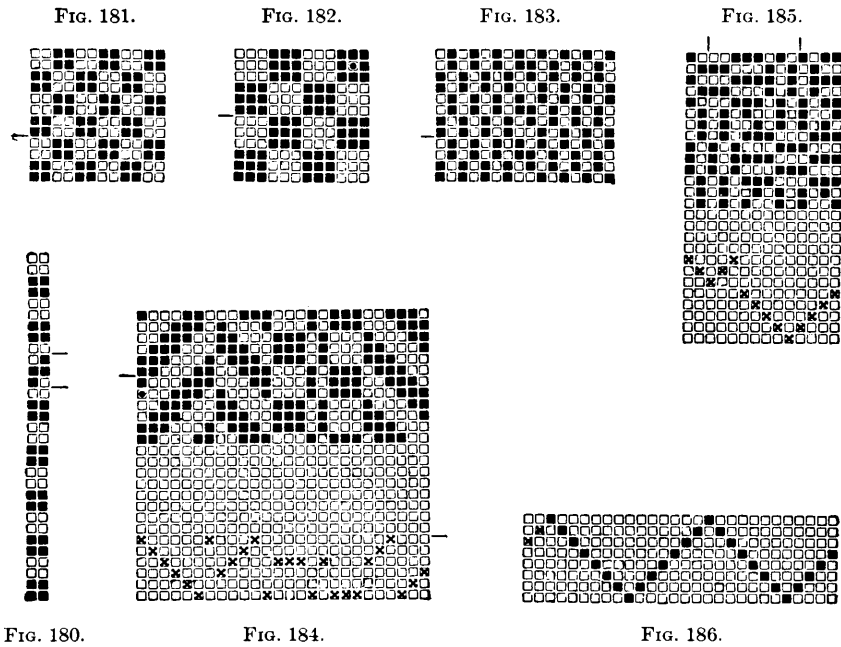
There can be drawn on the same shaft only those threads that interlace the filling in exactly the same order from the start to the finish of the weave. The occurrence of but one place in the draft at which one warp thread is above a pick while another is below the same pick prevents the two threads from being drawn on the same shaft. Fig. 180 shows two threads which must be drawn on separate shafts owing to the variation in the order in which they interlace the two picks between the lines at the right, although in other respects they interlace the filling in the same way.

It is readily seen that in Fig. 181 thread 2 may be drawn on the same shaft with thread 1, thread 4 with 3, etc. In Fig. 182 threads 2 and 3 may be drawn on the same shaft with 1; threads 5 and 6 with 4, etc. In Fig. 183 threads 3, 5 and 7 may be drawn on the same shaft with 1; threads 4, 6 and 8 with 2; threads 11, 13 and 15 with 9; also threads 12, 14 and 16 with 10.

Figs. 181 and 182 each have but two different orders

of intersection of the warp with the filling, consequently either can be woven with two shafts. Fig. 183 has four different orders of intersection of warp with filling, and can, therefore, be woven on four shafts with the following drawing-in draft: 1, 2, 1, 2, 1, 2, 1, 2, 3, 4, 3, 4, 3, 4, 3, 4.

The drawing-in draft is placed either below the weave draft, as in Fig. 184, or above the weave draft, as in Fig. 516. On a line with the first warp thread a



point is inserted in the first horizontal row of squares indicating that the first thread of the pattern is drawn on the first shaft. The second warp thread, if it interlaces the filling in a different order from the first, is then indicated by a point on the second horizontal row, which represents the second shaft. Each thread of the pattern is indicated successively, a new shaft being added when the thread intersects the filling in an order different from that of any of the preceding threads. If the intersection is the same as that of a

preceding thread, a point is marked in the horizontal row already used for that thread.

When the entire weave pattern has thus been drafted, the drawing-in draft is complete, indicating the number of heddles on each shaft in one pattern. The 26 threads in the pattern at Fig. 184 are drawn on the shafts in the following order :

Thread 1	. . . . .	on shaft 1
Thread 2	. . . . .	on shaft 2
Thread 3	. . . . .	on shaft 3
Thread 4	. . . . .	on shaft 4
Thread 5	. . . . .	on shaft 5
Thread 6	. . . . .	on shaft 6
Thread 7	. . . . .	on shaft 1
Thread 8	. . . . .	on shaft 4
Thread 9	. . . . .	on shaft 3
Thread 10	. . . . .	on shaft 2
Thread 11	. . . . .	on shaft 1
Thread 12	. . . . .	on shaft 6
Thread 13	. . . . .	on shaft 3
Thread 14	. . . . .	on shaft 3
Thread 15	. . . . .	on shaft 3
Thread 16	. . . . .	on shaft 6
Thread 17	. . . . .	on shaft 3
Thread 18	. . . . .	on shaft 6
Thread 19	. . . . .	on shaft 6
Thread 20	. . . . .	on shaft 6
Thread 21	. . . . .	on shaft 3
Thread 22	. . . . .	on shaft 2
Thread 23	. . . . .	on shaft 1
Thread 24	. . . . .	on shaft 6
Thread 25	. . . . .	on shaft 5
Thread 26	. . . . .	on shaft 4

This pattern can be woven on six shafts. The drawing-in draft is clearly shown below the weave at Fig. 184.

The drawing-in draft should be arranged so as to be readily understood and to facilitate the work of drawing-in. For example, the weave at Fig. 185 can be drawn in as follows: 1, 2, 3, 2, 1, 4, 5, 6, 7, 8, 7, 6, 5, 4, as shown below the weave draft. The draft, however, is simpler and more easily followed by both drawer-in and weaver when the order of drawing-in on the first three shafts is reversed, making the drawing-in draft as shown at Fig. 186.

BASKET WEAVES

A basket weave is a plain weave in which two or more adjacent warp and filling threads are raised and lowered together as if they were a single thread. This produces a checkerboard effect, the size of the squares depending on the number of threads worked together.

FIG. 187.

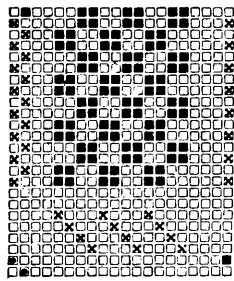


FIG. 188.

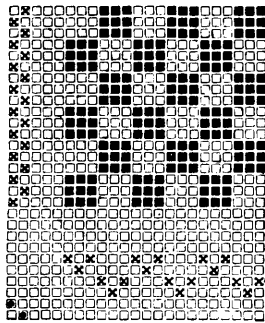


FIG. 189.

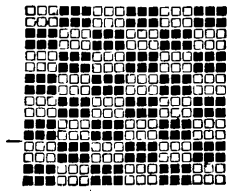
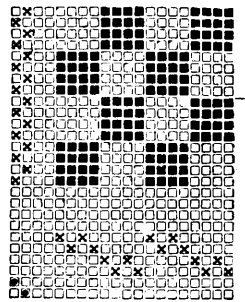


FIG. 190.

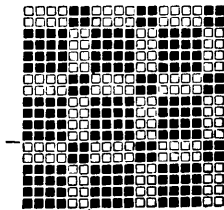


FIG. 191.

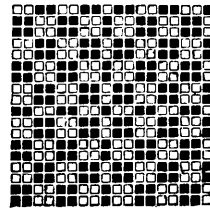


FIG. 192.

The warp threads working together side by side can be drawn on separate shafts or on the same shaft. It is sometimes found necessary when weaving coarse woolen goods to draw into one heddle the threads that work together side by side in order to prevent chafing of the warp yarn. It is also necessary at times to use

a binding thread woven with a plain weave at each side of the cloth to prevent the filling from being drawn in when weaving.

Fig. 187 shows a 4-thread basket weave. A plain weave for the selvage is shown at the left. A plain shaft for an outside binding thread is shown at the right of the draft; the latter is used when the body of the selvage is woven with the basket weave used in the body of the cloth.

FIG. 193.

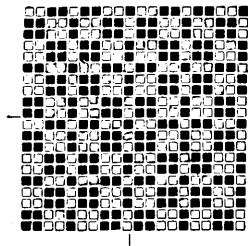


FIG. 194.

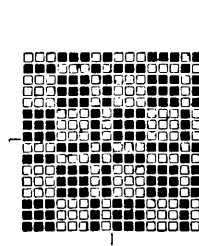


FIG. 195.

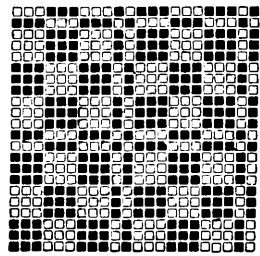
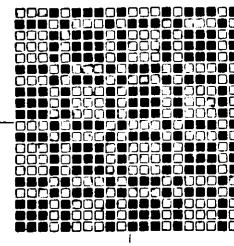


FIG. 196.

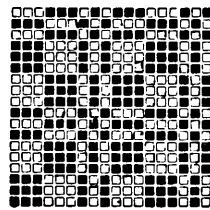


FIG. 197.

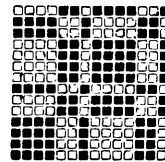


FIG. 198.

Fig. 188 is a basket weave in which three threads in warp and filling are woven together.

Fig. 189 is a basket weave in which four threads in warp and filling are woven together. Fig 187 is called a 4-leaf basket; Fig. 188, a 6-leaf; Fig. 189, an 8-leaf.

If the warp is set closer than the filling, a weave having more warp than filling threads working together is sometimes used in order to prevent the squares from becoming oblong. Fig. 190 shows such a weave having three threads woven together in the

warp, and two threads in the filling. Squares of different sizes can be woven in the same pattern, as shown at Fig. 191, in which four threads working together alternate with two threads.

Pleasing effects can be produced by inserting single threads between the threads working together to form the basket, especially when the color of the single threads contrasts with the ground. Figs. 192 to 198 show various weaves of this kind.

RIB WEAVES

A rib weave is a modification of the plain weave. The simplest rib weave is made by weaving two, three or more threads together as one end next to several warp threads which are woven with a plain weave. The former, lying side by side and interlacing the filling like a single thread, rise above the surface of the adjoining threads that are woven plain, forming a ridge or rib running lengthways of the cloth.

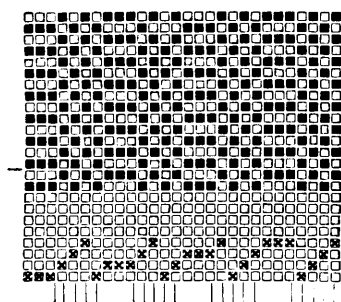


FIG. 199.

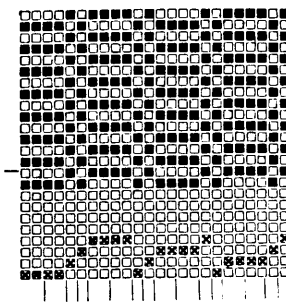


FIG. 200.

FIG. 203.

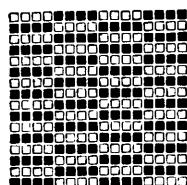


FIG. 205.

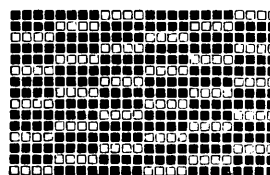


FIG. 201.



FIG. 202.

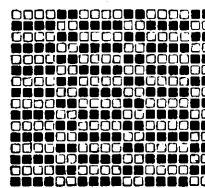


FIG. 204.

FIG. 206.

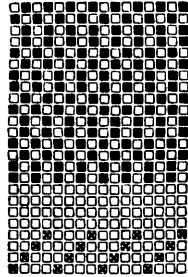


FIG. 207.

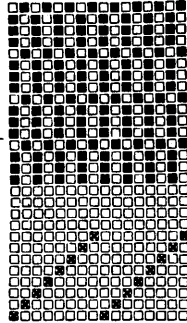


FIG. 208.

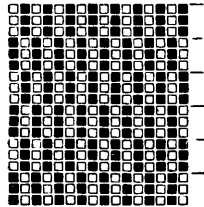
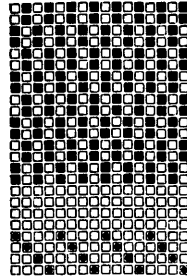


FIG. 209.

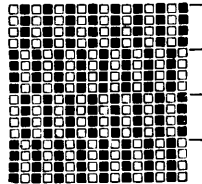


FIG. 210.

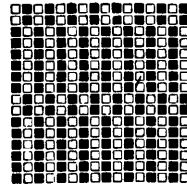


FIG. 211.

LONG RIBS

Ribs running lengthways of the cloth are called long ribs. Fig. 199 shows a pattern in which four warp threads woven plain alternate with three threads woven together as one end.

Generally the combined threads are drawn through the same dent in the reed, and can be drawn through the same heddle, if desired. If the combined threads are drawn through more than one dent in the reed, separate heddles must

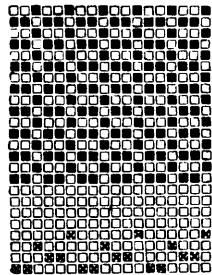


FIG. 212.

FIG. 214.

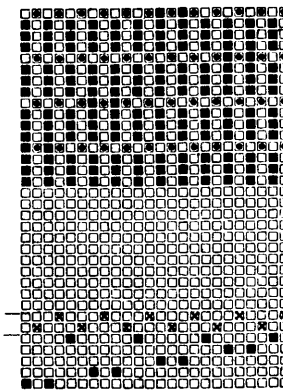


FIG. 213.

FIG. 216.

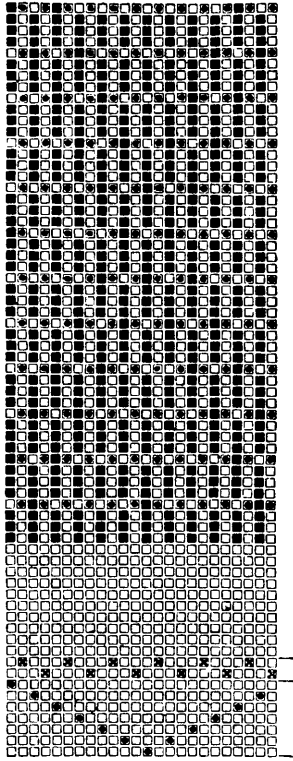


FIG. 215.

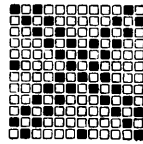


FIG. 218.

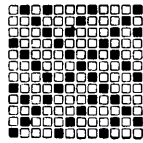
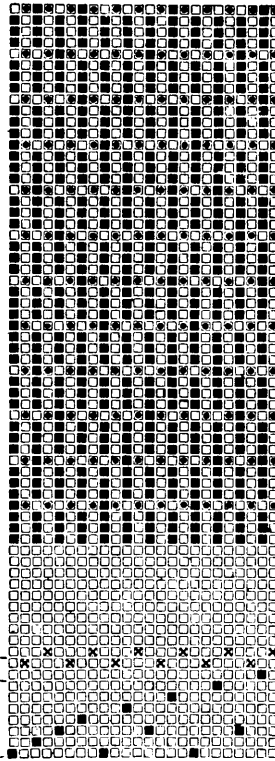


FIG. 217.

FIG. 219.

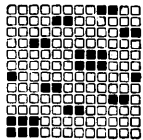


FIG. 221.

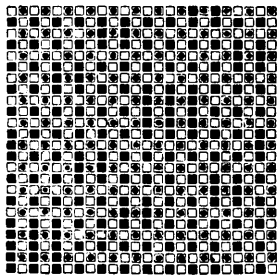
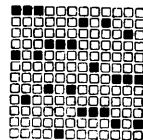


FIG. 220.

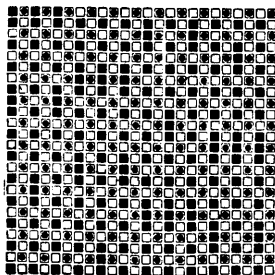


FIG. 222.

be used for the threads in each dent, otherwise the twisting of the threads in the heddle will result in their being broken by the reed. Fig. 200 shows four threads woven as one, alternating with two threads in a plain weave.

The lines below the drawing-in drafts at Figs. 199 and 200 indicate the order in which the warp is reeded.

Figs. 201 to 205 show weaves used for long ribs in fine worsted goods, in which, however, a very close

FIG. 223.

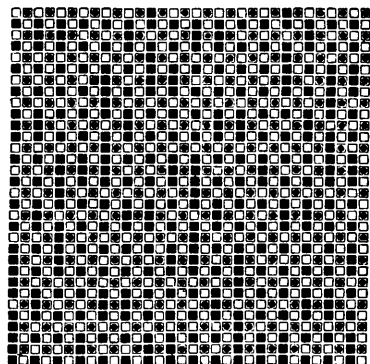
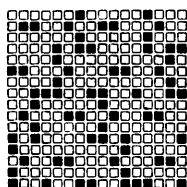


FIG. 224.

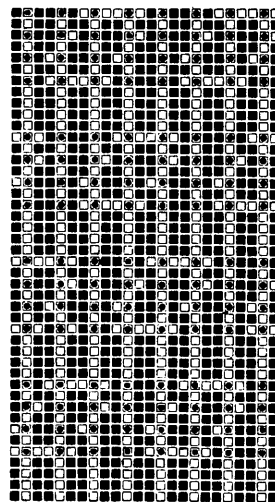


FIG. 225.

set is required in the filling. These are really plain weaves in which several warp threads are woven as one thread.

In the regular long-rib weaves, such as are shown at Figs. 201, 202 and 203, the warp is almost completely covered by the filling, hence the term "filling rib," applied to long-rib weaves.

CROSS RIBS

A second form of rib weave is found in the cross rib, which can be made by alternating a coarse filling thread with several fine threads in a plain weave.

In place of the coarse pick two or more single threads can be wound on a bobbin and woven as one. More or less twist is imparted to the threads in this way, however, giving an irregular appearance to the cloth. For this reason, when a very smooth face is desired, it is best

FIG. 227.

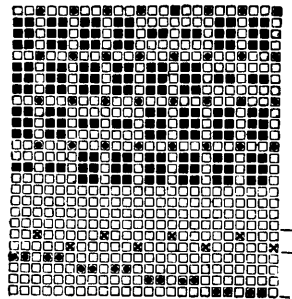
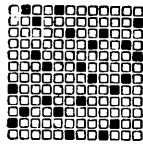


FIG. 226.

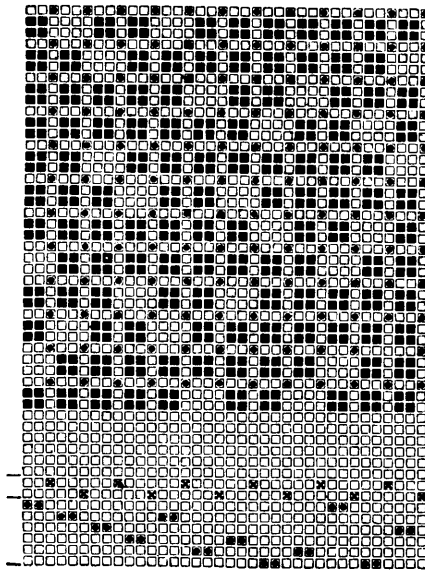


FIG. 228.

to have but one thread carried by the shuttle at each pick, inserting the desired number of picks in the same shed.

Fig. 206 shows two picks woven in every third shed; in Fig. 207 three picks are woven in every other shed.

A catch thread in the selvage is necessary with these weaves. The yarn forming the rib is sometimes made from cheaper material in order to reduce the cost of the goods.

Cross ribs are also made with the weaves shown at Figs. 208 to 211, in which two, three, four or six picks are woven in a shed. The lines of separation between the ribs are indicated by the lines at the side of draft.

In the regular cross-rib weaves, as shown at Figs. 207 to 211, the filling is almost completely covered

FIG. 229.

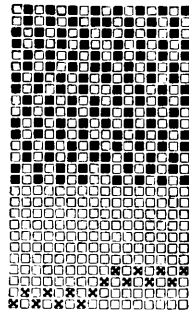


FIG. 230.

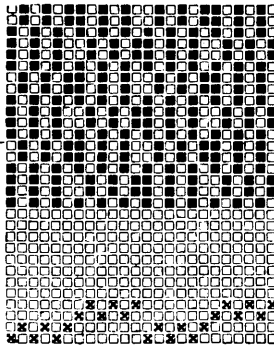


FIG. 231.

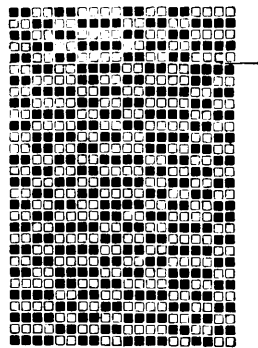
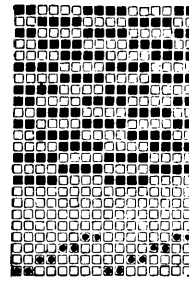


FIG. 232.

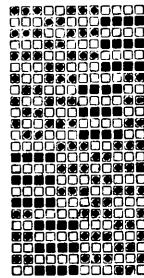


FIG. 233.

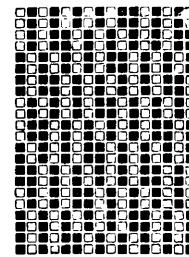


FIG. 236.

by the warp, for which reason cross-rib weaves are sometimes called warp ribs.

The third class of rib weaves is the full rib for which fine and coarse yarn is used in both warp and filling. Goods woven with these weaves are used chiefly for upholstery, vestings, etc., and are frequently made of wool and cotton or silk and cotton. They are generally woven with 2 warp threads working together, al-

ternating with a single thread, Fig. 212. For a wool and cotton fabric two threads of wool twist working together alternate with one thread of fine cotton twist. Two shafts only are required, but where the set is from 60 to 90 threads per inch four shafts are used.

The wool and silk warp should, if possible, be

FIG. 234.

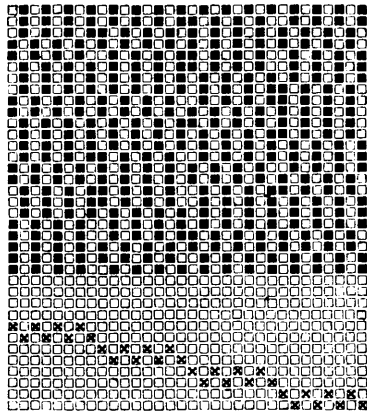
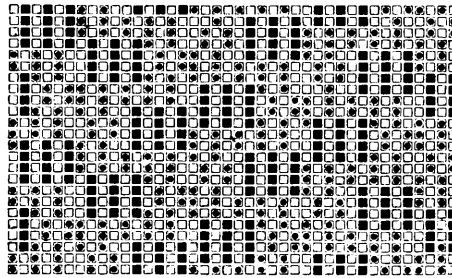


FIG. 235.

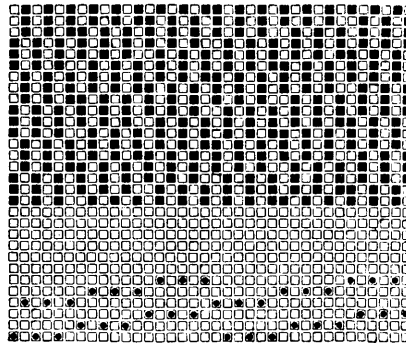


FIG. 237.

drawn on the front shafts to give a clear shed, the cotton warp coming on the back shafts. When the wool warp threads are raised, a coarse cotton pick is inserted; the latter is thus covered by the wool warp and is visible only on the back of the cloth. When the cotton warp is raised, a single cotton pick of the same kind of yarn is inserted. The fine filling is

woven when the wool warp is down, but is not prominent on the face, owing to its fineness.

In silk ribs the rib pick is also a coarse cotton thread, the other pick being a fine silk thread. The coarse cotton filling, which is hidden by the close-set warp, gives the cloth a better feel and reduces the cost.

The coarse rib warp and the fine warp must be woven from separate beams, as the former takes up

FIG. 238.

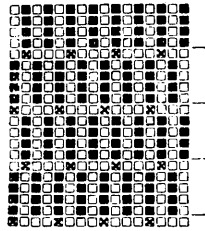


FIG. 239.

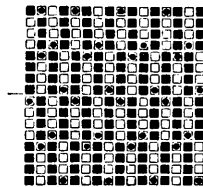


FIG. 240.

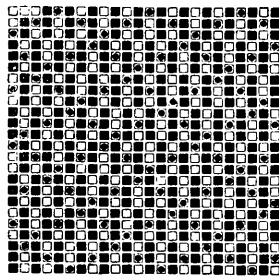
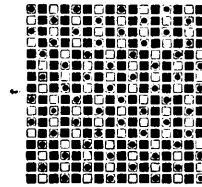


FIG. 241.

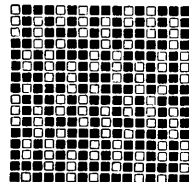


FIG. 242.

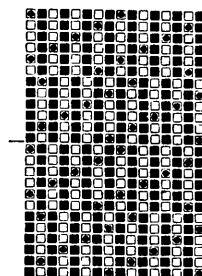


FIG. 243.

more rapidly in weaving. To make the rib more prominent, the fine division warp thread should be woven tight, and the coarse rib warp woven slack, the latter being weighted so that it will yield slightly when the lay beats in the coarse filling. On plain looms without the drop box these full ribs can be made by weaving two or more picks in a shed in place of the coarse rib pick, using but one kind of yarn in the filling. A weave for this method is shown at Fig. 207.

FIGURED RIBS

Figured effects are easily obtained on rib weaves by raising warp threads above the filling tie thread at certain places. This converts two warp floats into one, the warp thread being raised successively over a set of rib picks, a division pick and a second set of rib picks, as in threads 1 and 3, Fig. 214. In drafting figured ribs it is necessary first to select a motif for

FIG. 244.

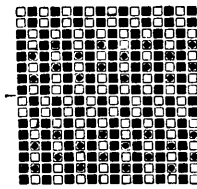


FIG. 245.

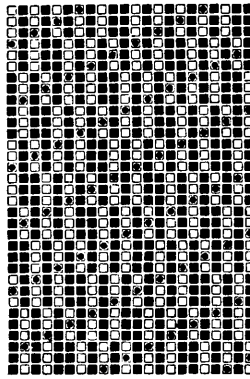


FIG. 246.

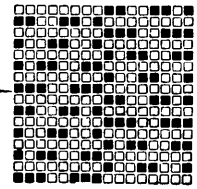
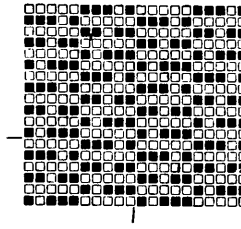


FIG. 247.

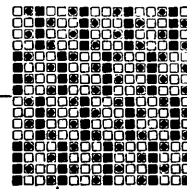


FIG. 248.

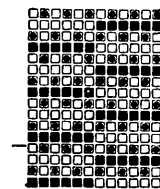


FIG. 249.

the design, which is then transferred to the weave draft. Figs. 213 to 225 are examples of figured ribs and motifs.

- Fig. 213 motif for Fig. 214
- Fig. 215 motif for Fig. 216
- Fig. 217 motif for Fig. 218
- Fig. 219 motif for Fig. 220
- Fig. 221 motif for Fig. 222
- Fig. 223 motif for Fig. 224

In Figs. 220, 222 and 224 the rib warp threads, drawn on one heddle, are, like the rib picks, represented as one thread, as is customary for this class of goods.

Another method of forming fancy ribs is to lower two or more adjacent rib warp threads to the back of the cloth under certain picks, each of which is thus brought to the face. This method is shown at Figs. 226 and 228. Fig. 213 is the motif for Fig. 226; Fig. 227, the motif for Fig. 228.

IRREGULAR RIBS

These are formed by offsetting the rib line at intervals. At the changing point the float forming the rib is raised slightly above the float of the preceding

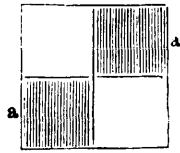


FIG. 250.

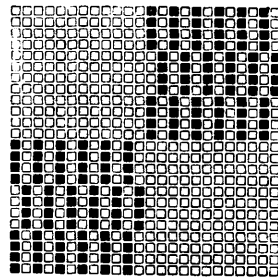


FIG. 251.

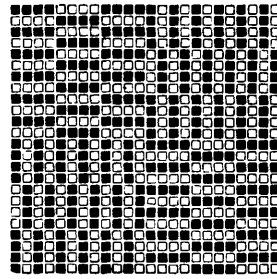


FIG. 252.

FIG. 253.

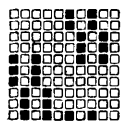


FIG. 254.

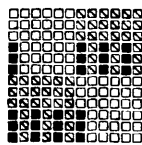


FIG. 255.

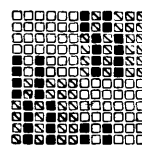


FIG. 256.

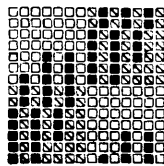
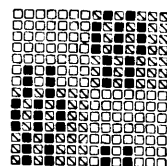


FIG. 257.

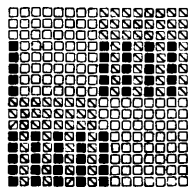


FIG. 258.

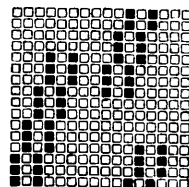


FIG. 259.

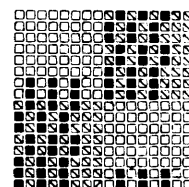


FIG. 260.

thread, and the rib is then continued on the new line until the pattern requires a change.

In Fig. 229 the rib is offset for one pick at the 1st and 9th warp threads. Each group with a regular rib includes eight warp threads.

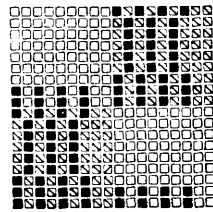


FIG. 261.

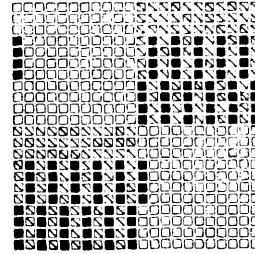


FIG. 262.

FIG. 263.

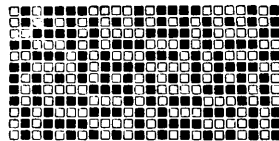


FIG. 265.

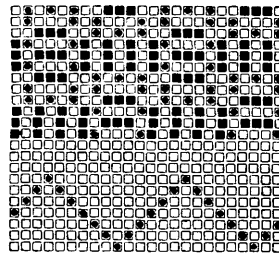
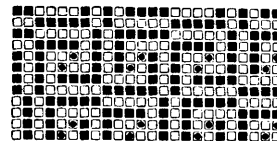


FIG. 264.

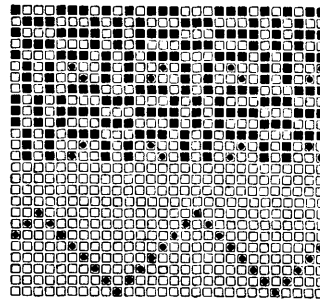


FIG. 266.

In Fig. 230 the rib is offset four times, the change being for three picks each time. Each group with a regular rib includes six threads.

Fig. 231 is a filling rib offset two threads every four picks.

Fig. 232 shows a $2-2$ filling rib with $4-4$ groups arranged in 5-leaf satin order. Pleasing effects are

obtained by combining floats of different lengths in irregular ribs.

Fig. 233 shows the weave ${}^4\text{---}_3\text{---}^2\text{---}_3$, in the filling; Fig. 234 shows the same order in the warp.

Fig. 235 shows ${}^5\text{---}_3$ groups arranged in 4-leaf broken twill order. Fig. 236 shows a diagonal effect produced by offsetting the ribs.

FIG. 267.

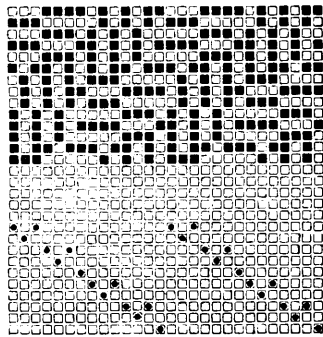


FIG. 268.

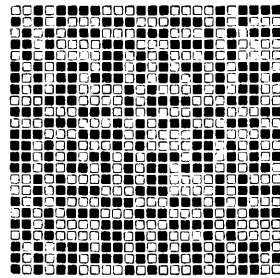
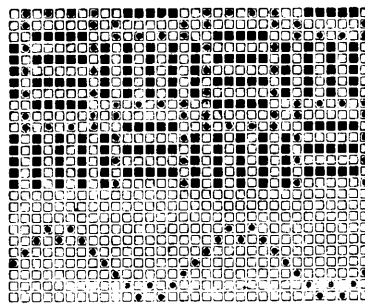


FIG. 269.

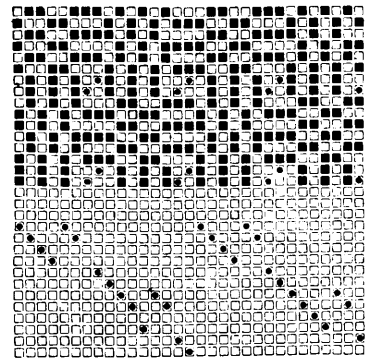


FIG. 270.

Fig. 237 shows a fancy rib weave in which the rib float is raised one pick at intervals of six warp threads; the pattern covers thirty-six warp and six filling threads.

In weaving cloth made of coarse carded woolen warp yarn with a rib weave it is often difficult to obtain a clear shed. Sometimes to facilitate the forming of a

shed only one half of the shafts are changed at a time. This necessitates forming two sheds when the threads are changed. At the first of these two sheds half the warp threads that are to be raised are lifted and half of those to be lowered are dropped and no pick is inserted. At the next shed the remaining threads are lifted and dropped to complete the change and a pick is woven, as shown in Fig. 238. This requires a special attachment for the loom. A method of avoiding its use is by the weave shown at Fig. 239, in which half the threads to be raised are lifted on the preceding

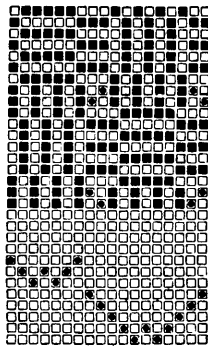


FIG. 271.

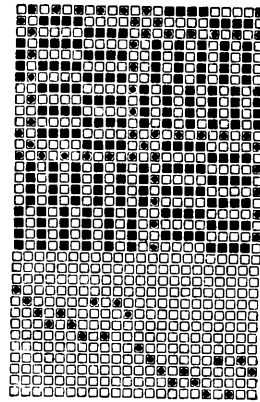


FIG. 272.

pick, and half of those to be lowered are raised for one pick more. This, however, causes the break in the rib to be less sharp than with the regular rib weave.

STITCHED RIBS

To increase the solidity and durability of rib fabrics the warp threads are often interlaced with the filling where the warp floats on the back. This makes the weave tighter and increases the solidity of the cloth.

Fig. 240 is a warp rib stitched with a plain weave. This style of weave is much used for ladies' dress goods.

Figs. 241 and 242 show 6-and-8-pick warp rib weaves stitched to produce a figured effect.

Fig. 243 is a 12-pick rib weave in which the threads floating on the back are stitched in the form of a broken twill, $1-3$.

Fig. 244 is an 8-pick rib weave with the threads on the back stitched plain. This weave is often used for dress goods with the warp dressed 1 light, 1 dark.

Fig. 245 shows an irregular rib weave with the threads on the back stitched in diagonal form.

Stitched filling ribs are shown at Figs. 246 and 247.

FIG. 273.

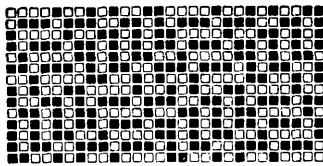


FIG. 274.

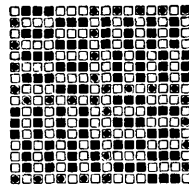


FIG. 275.

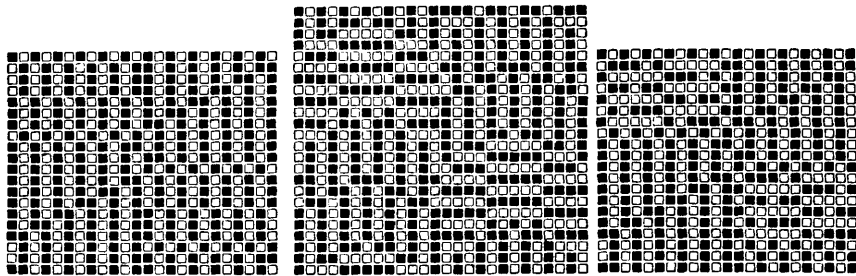
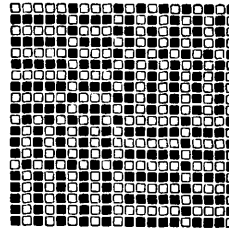


FIG. 276.

FIG. 277.

FIG. 278.

The filling of Fig. 246 is woven $5-5$ and the floats on the back are stitched on each rib in a straight twill form. The filling at Fig. 247 is woven $8-3$ and stitched in a reversed twill order.

Ribs are sometimes produced with special threads which are not to show on either side of the cloth, and which, therefore, must be very fine yarn. Fig. 248 shows a weave with special warp threads; Fig. 249, a weave with special filling threads. In both weaves the fine threads are woven with a plain weave.

COMBINATION RIBS

Under this head are included all rib weaves in which warp and filling ribs are combined to form a figure. The simplest order of combination is that of a plain weave. The space to be occupied by the pattern is divided into four equal parts, as shown at Fig. 250. The shaded parts are then filled in with the warp rib, Fig. 251, and the draft is completed by filling in the

FIG. 279.

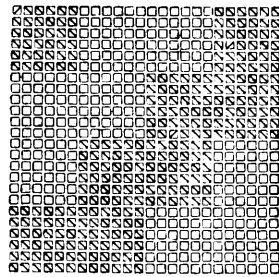


FIG. 280.



FIG. 281.

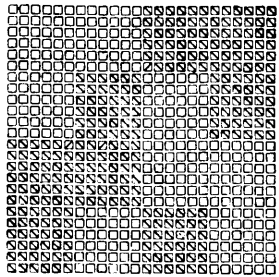
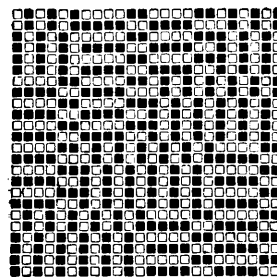


FIG. 282.

FIG. 283.

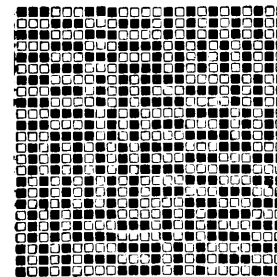


FIG. 284.

remainder of the square with the filling rib weave, Fig. 252.

If the motif selected is larger than the allotted space, the figure must be extended into the adjoining space. Several cases of this kind are shown at Figs. 253 to 262.

These patterns, Figs. 253 to 262, are developed in Figs. 263 to 272, in which the relative position of the warp and filling ribs is readily seen. The threads in

the spaces not covered by the motif are woven with a plain weave and serve to separate the warp and filling ribs.

Following are the motifs and corresponding weaves :

MOTIF	WEAVE
Fig. 253, 10 threads	Fig. 263, 10 shafts, 10 picks
Fig. 254, 12 threads	Fig. 264, 7 shafts, 12 picks
Fig. 255, 12 threads	Fig. 265, 12 shafts, 12 picks
Fig. 256, 14 threads	Fig. 266, 8 shafts, 14 picks
Fig. 257, 14 threads	Fig. 267, 10 shafts, 14 picks
Fig. 258, 16 threads	Fig. 268, 7 shafts, 16 picks
Fig. 259, 16 threads	Fig. 269, 16 shafts, 16 picks
Fig. 260, 16 threads	Fig. 270, 12 shafts, 16 picks
Fig. 261, 18 threads	Fig. 271, 8 shafts, 18 picks
Fig. 262, 22 threads	Fig. 272, 10 shafts, 22 picks

FIG. 286.

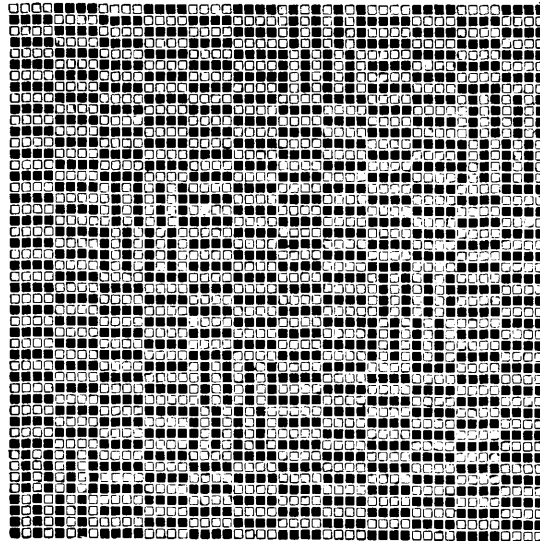


FIG. 285.

Several examples of irregular ribs with a plain weave for the motif are shown at Figs. 273 to 278.

If a 4-leaf twill is selected for the motif, the draft is first divided each way into four parts and shaded to develop the motif. Fig. 279 shows a 24 end pattern shaded in accordance with a balanced 4-leaf $2\text{---}2$ twill, Fig. 280. The warp and filling rib weaves are next inserted, being transposed to conform to the

FIG. 287.

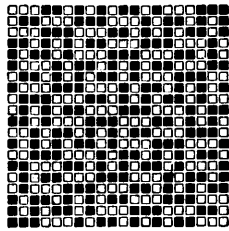


FIG. 288.

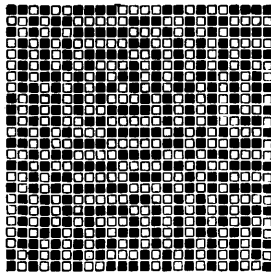


FIG. 289.

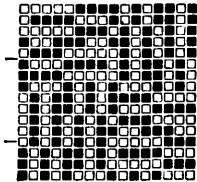
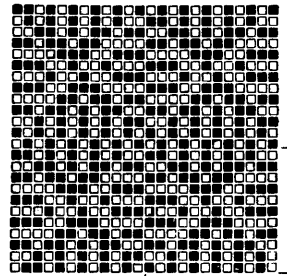


FIG. 290.

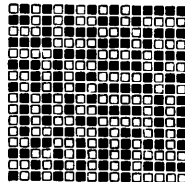


FIG. 291.

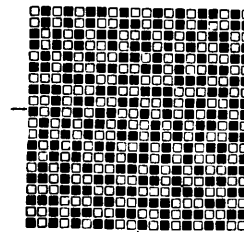


FIG. 292.

pattern. Fig. 281 shows the pattern at Fig. 279, developed by transposing $4\text{---}2$ warp and filling rib weaves.

Figs. 282 and 284 are respectively outline and weave drafts derived from the 4-leaf broken $2\text{---}2$ twill motif, Fig. 283. This motif is developed on 24 threads by transposing warp and filling rib $3\text{---}3$ weaves. In this case the draft is divided into 4 parts to correspond with the 4-leaf twill motif.

Fig. 285 shows a weave draft of 48 threads on which has been developed the 6-leaf satin motif, Fig. 286,

FIG. 293.

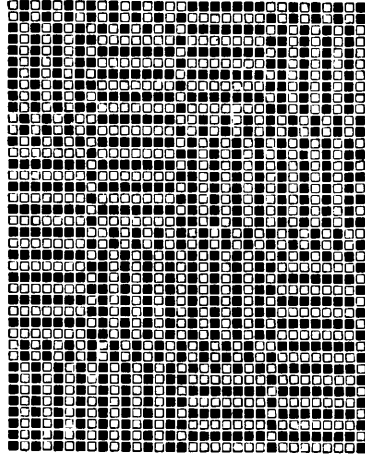


FIG. 294

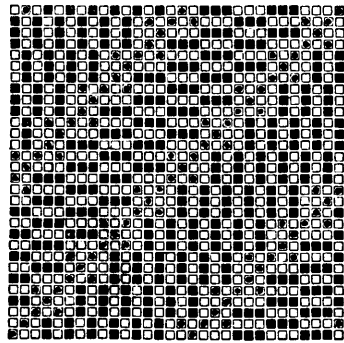
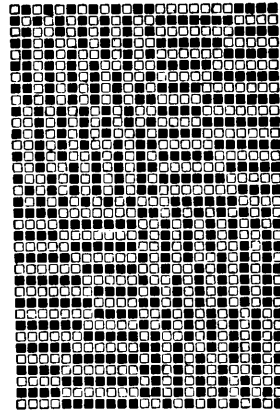


FIG. 295.

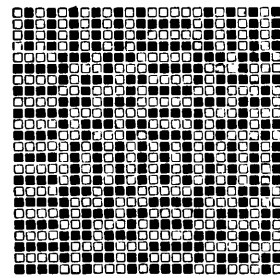


FIG. 296.

FIG. 297.

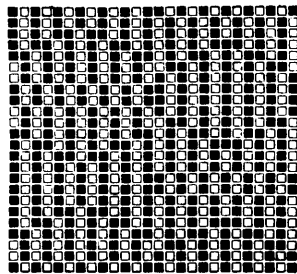
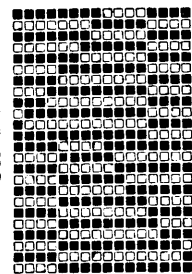


FIG. 298.

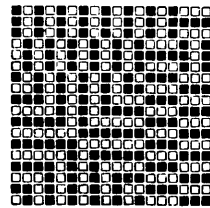


FIG. 299.

by transposing $1-4$ warp and filling ribs. The draft is divided each way into six parts of 8 threads each.

From the examples already given it is evident that any desired motif can easily be developed with rib weaves. Additional examples are shown at Figs. 287 to 299.

Fig. 287	20 × 20
Fig. 288	14 × 14
Fig. 289	12 × 12
Fig. 290	16 × 16
Fig. 291	16 × 16
Fig. 292	10 × 10
Fig. 293	32 × 40
Fig. 294	24 × 40
Fig. 295	30 × 30
Fig. 296	24 × 24
Fig. 297	24 × 16
Fig. 298	26 × 16
Fig. 299	18 × 18

STEEP TWILLS

A peculiar form of twill, known as a steep twill, is obtained when the warp float of each thread rises two or more picks instead of one pick above the float of the preceding thread. A steep twill can be made by drafting in succession the alternate threads of a regular twill. For example, Fig. 301 shows a steep twill

FIG. 300.

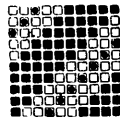


FIG. 301.

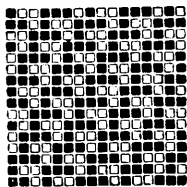
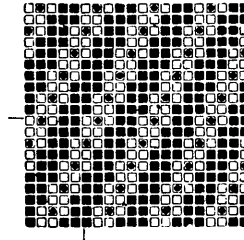


FIG. 302.

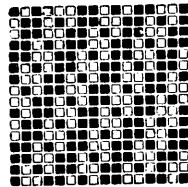


FIG. 303.

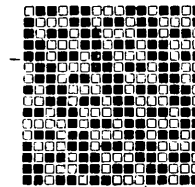


FIG. 304.

obtained by drafting successively threads 1, 3, 5, 7 and 9 of the 10-leaf twill, Fig. 300. This is equivalent to removing every other thread from the regular twill.

Raising the warp float two threads higher at each warp thread brings the twill line nearer the perpendicular. On the other hand, if the filling floats are set two or more threads to the right or left at each pick, the twill line is brought nearer to the horizontal,

forming what is styled a flat twill. The steep twill is the more popular form.

The twill lines in steep twills are closer to each other,

FIG. 305.

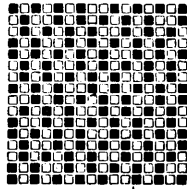


FIG. 306.

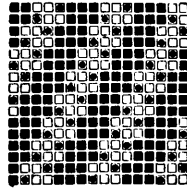


FIG. 307.

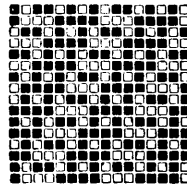
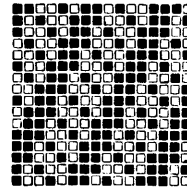


FIG. 308.

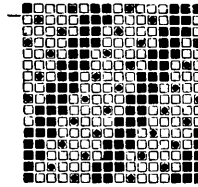


FIG. 309.

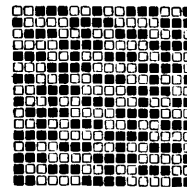


FIG. 310.

FIG. 311.

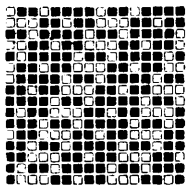


FIG. 312.

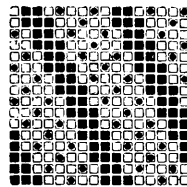


FIG. 313.

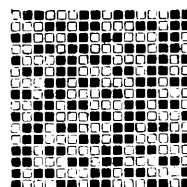
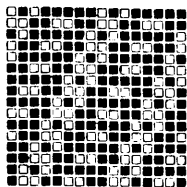


FIG. 314.

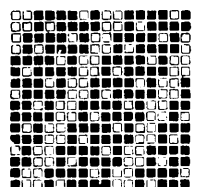


FIG. 315.

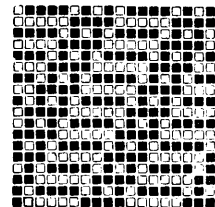


FIG. 316.

but frequently, owing to the filling floats on the back, are more prominent than in regular twill weaves.

If a regular twill having an even number of shafts, say 10, 12, 14, 16, etc., is selected for the construction

of a steep twill, only one half of the threads are used, and consequently, only one half as many shafts are needed for the steep twill weave.

If, however, the regular twill has an uneven number of shafts, the resulting steep twill will have the same

FIG. 317.

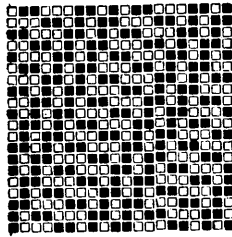


FIG. 318.

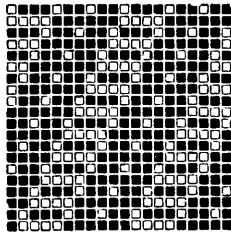


FIG. 319.

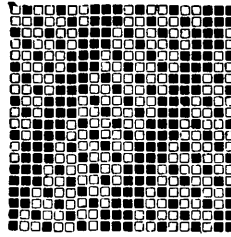


FIG. 320.

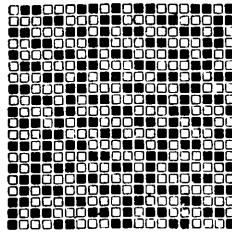


FIG. 321.

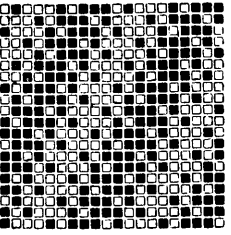


FIG. 322.

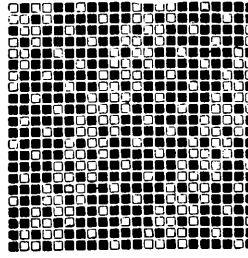


FIG. 323.

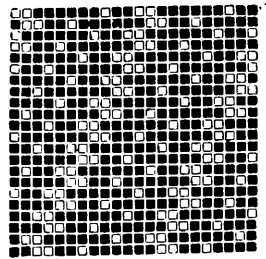
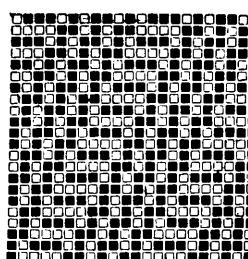


FIG. 324.



number of threads or shafts in the pattern as there are in the ground weave.

Figs. 302 to 353 show a number of different forms of steep twills in which the warp float rises two picks at each thread :

Fig. 302	7 × 7
Fig. 303	9 × 9
Fig. 304	11 × 11
Fig. 305	11 × 11
Fig. 306	12 × 12
Fig. 307	13 × 13
Fig. 308	14 × 14
Fig. 309	15 × 15

FIG. 325.

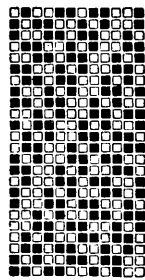


FIG. 326.

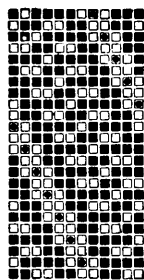


FIG. 327.

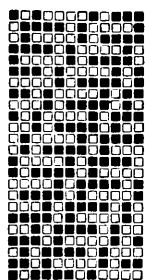


FIG. 328.

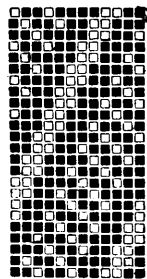
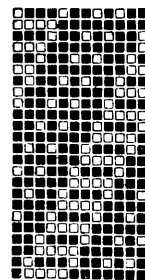


FIG. 329.

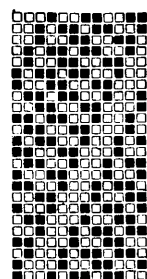


FIG. 330.

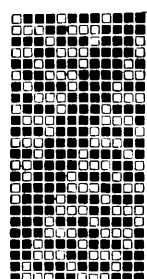


FIG. 331.

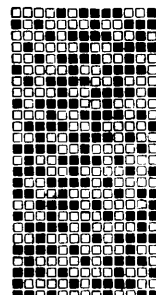


FIG. 332.

Fig. 310	16 × 16
Fig. 311	16 × 16
Fig. 312	16 × 16
Fig. 313	16 × 16
Fig. 314	16 × 16
Fig. 315	16 × 16
Fig. 316	18 × 18
Fig. 317	10 × 20
Fig. 318	10 × 20

Fig. 319	10 × 20
Fig. 320	10 × 20
Fig. 321	10 × 20
Fig. 322	11 × 22
Fig. 323	11 × 22
Fig. 324	11 × 22

FIG. 333.

FIG. 334.

FIG. 335.

FIG. 336.

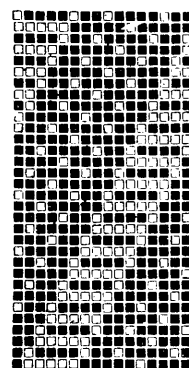
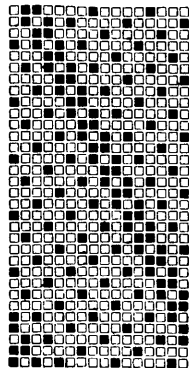
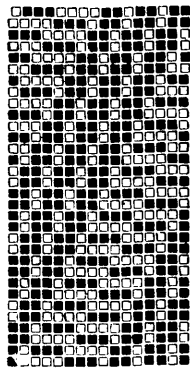
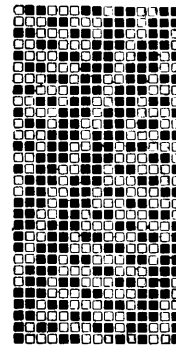
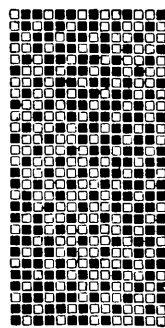
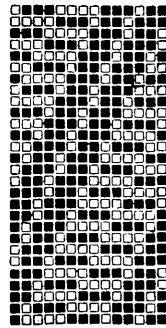
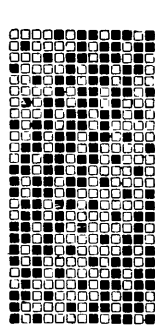


FIG. 337.

FIG. 338.

FIG. 339.

Fig. 325	12 × 24
Fig. 326	12 × 24
Fig. 327	12 × 24
Fig. 328	12 × 24
Fig. 329	12 × 24
Fig. 330	12 × 24
Fig. 331	12 × 24
Fig. 332	13 × 26

Fig. 333 13 × 26
 Fig. 334 14 × 28
 Fig. 335 14 × 28
 Fig. 336 15 × 30
 Fig. 337 16 × 32

FIG. 340.

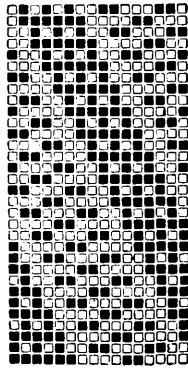


FIG. 341.

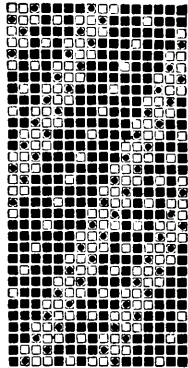


FIG. 342.

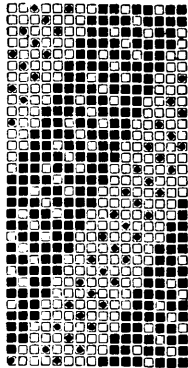
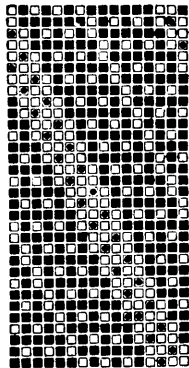


FIG. 343.

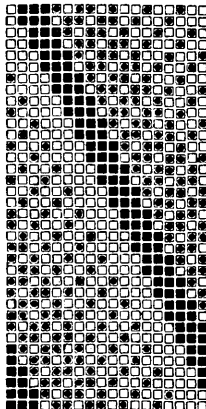


FIG. 344.

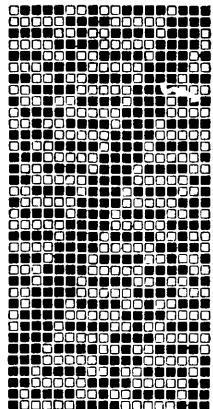


FIG. 345.

Fig. 338 16 × 32
 Fig. 339 16 × 32
 Fig. 340 16 × 32
 Fig. 341 16 × 32
 Fig. 342 16 × 32
 Fig. 343 16 × 32

Fig. 344	18 × 36
Fig. 345	18 × 36
Fig. 346	20 × 40
Fig. 347	23 × 23
Fig. 348	20 × 40
Fig. 349	24 × 48

FIG. 346.

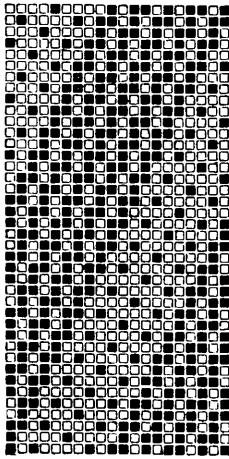


FIG. 347.

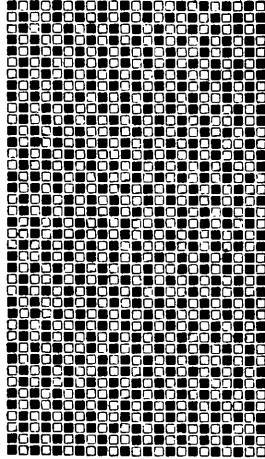


FIG. 348.

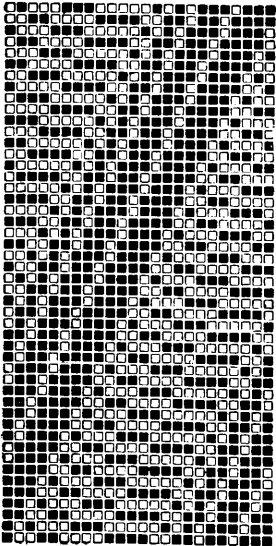
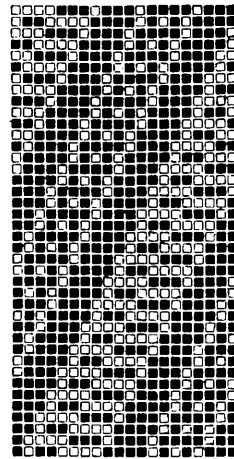


FIG. 349.

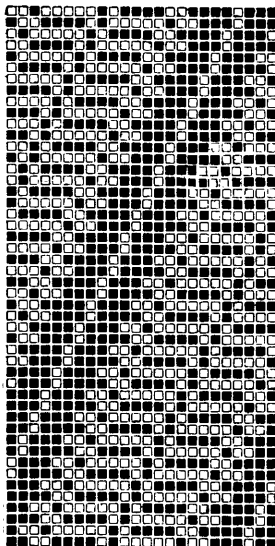


FIG. 350.

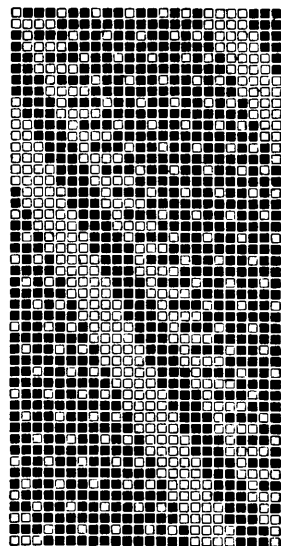


FIG. 351.

Fig. 350	24 × 48
Fig. 351	24 × 48
Fig. 352	26 × 52
Fig. 353	27 × 54

Figs. 302 to 353 show the effects obtained in steep twills made with different ground weaves. The

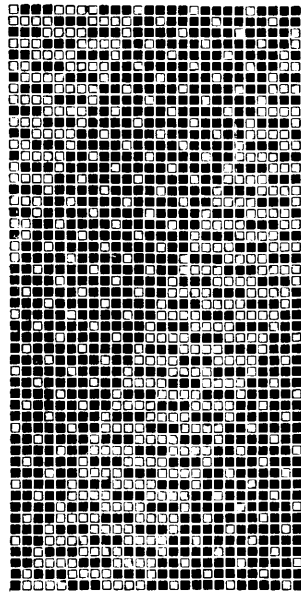


FIG. 352.

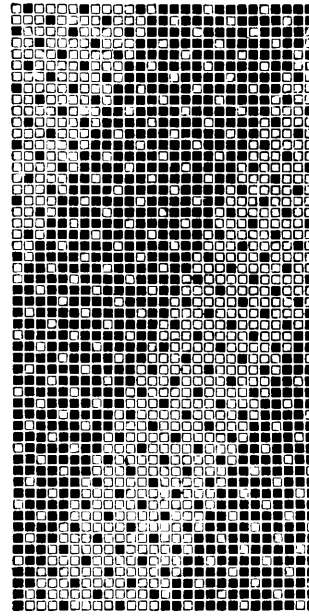


FIG. 353.

changes should be clearly understood when drafting new diagonals.

The examples given show that in drafting a steep twill with the float rising two picks:

1. Filling ribs are obtained when the warp in the ground twill is stitched plain, $^1-1$, several times in succession, Figs. 310, 316, 318, 324, 328, 339 and 345.

2. The filling ribs are offset when two risers or two sinkers are inserted after the plain stitchers, Figs. 334, 337, 348, 349, 350 and 352.

3. A 45° twill running in the opposite direction is obtained by interlacing the warp in $^2-1$ or $^1-2$ order,

Figs. 307, 312, 319, 322, 325, 329, 330, 332, 335, 343 and 344.

4. A $3-1$ order gives a plain weave with a float on the back on alternate picks, Figs. 316, 328, 340, 342 and 348.

5. A $4-1$ order results in a 5-shaft satin, Figs. 311, 315, 321, 322, 323, 338, 339, 352 and 353.

6. From a $3-2$ order is obtained a 5-shaft double-warp satin, Figs. 317, 324 and 346.

7. From a $1-1-1-2$ order is derived a 5-shaft double-filling satin, Figs. 314, 317, 320, 336 and 340.

8. A $5-1$ order gives a 3-shaft twill on alternate picks, the intermediate threads floating on the back, Figs. 318 and 351.

FIG. 354.

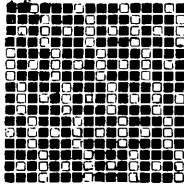


FIG. 356.

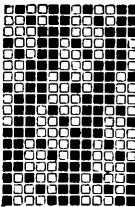
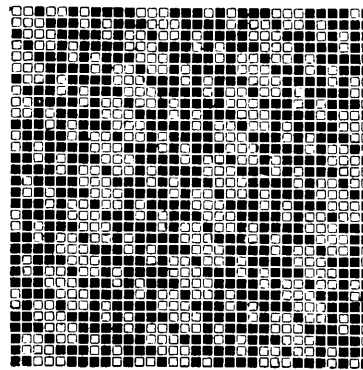


FIG. 357

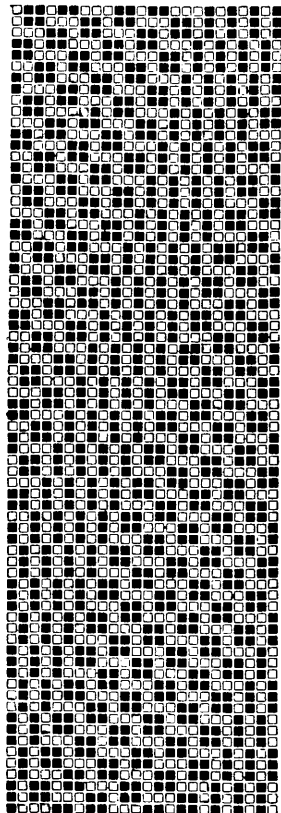


FIG. 355.

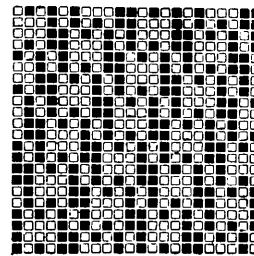


FIG. 358.

In Figs. 354 to 362 the warp float rises either three or four picks at each thread.

Fig. 354	4 × 12
Fig. 355	24 × 72
Fig. 356	32 × 32
Fig. 357	6 × 18
Fig. 358	11 × 22
Fig. 359	15 × 45
Fig. 360	13 × 39
Fig. 361	8 × 32
Fig. 362	16 × 48

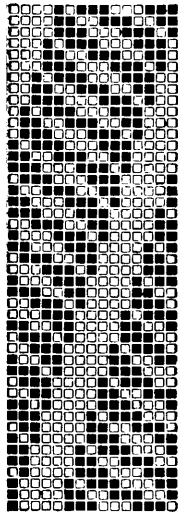


Fig. 359.

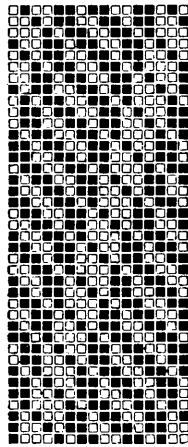


Fig. 360.

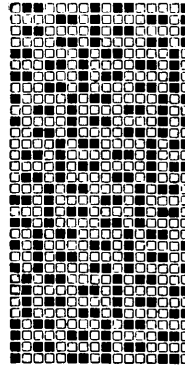


Fig. 361.

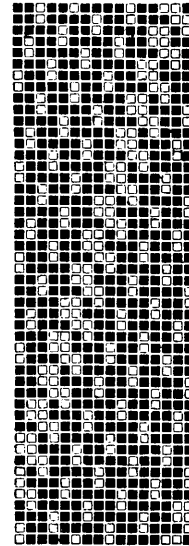


Fig. 362.

A steep twill with the warp floats rising three picks at each thread requires only one third as many shafts as are required for a base weave in which the number of shafts is divisible by 3.

Fig. 359, for example, shows a 15-shaft steep twill derived from one covering 45 threads; Fig. 360, a 13-shaft steep twill derived from a 39-shaft twill; Fig. 362, a 16-shaft steep twill derived from a 48-shaft twill.

If the original number of shafts is not divisible by 3, the resulting steep twill will require the same number of shafts as the base weave, as shown at Fig. 356, both base weave and steep twill being 32 shaft.

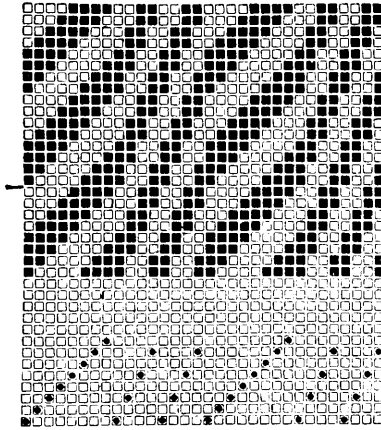


FIG. 363.

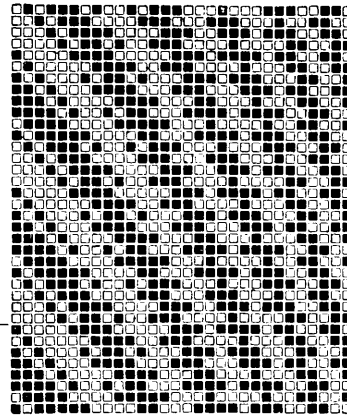


FIG. 364.

FIG. 365.

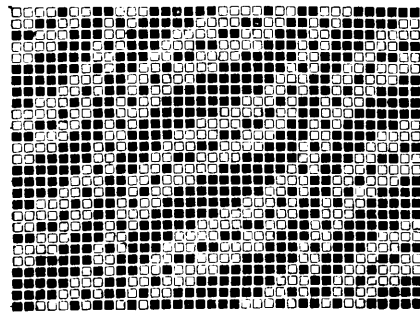
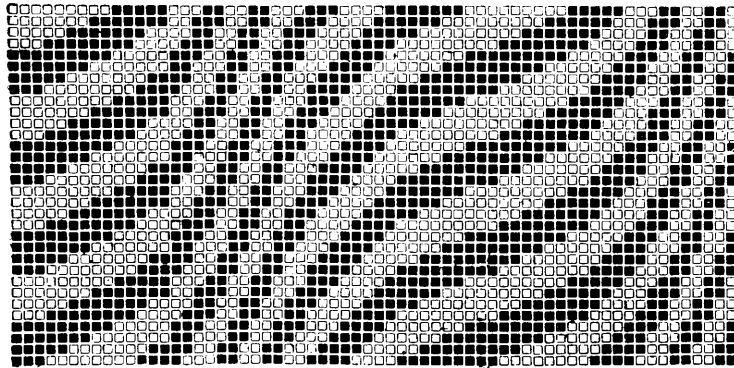


FIG. 366.

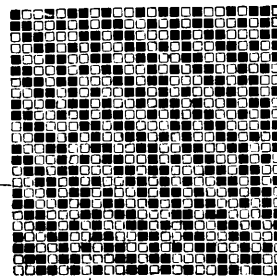


FIG. 367.

UNDULATING TWILLS

Undulating twills are formed by an irregular off-setting of the warp and filling floats; for example, by moving the float 3 threads at one place and 4 threads at another, either vertically or horizontally.

The same effect can be obtained with a regular twill weave by combining groups of fine and coarse

FIG. 368.

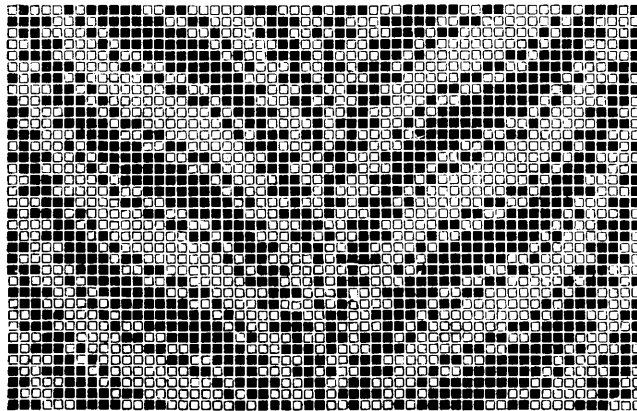
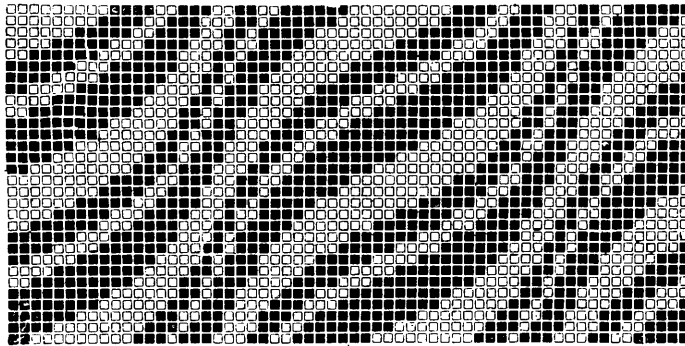


FIG. 369.

yarns, reeding them irregularly; for example, the fine threads 4 in a dent, the coarse threads 3 in a dent.

Figs. 363 to 379 are undulating effects produced by the weave.

Fig. 363	16 ends, 8 picks
Fig. 364	30 ends, 12 picks
Fig. 365	40 ends, 8 picks

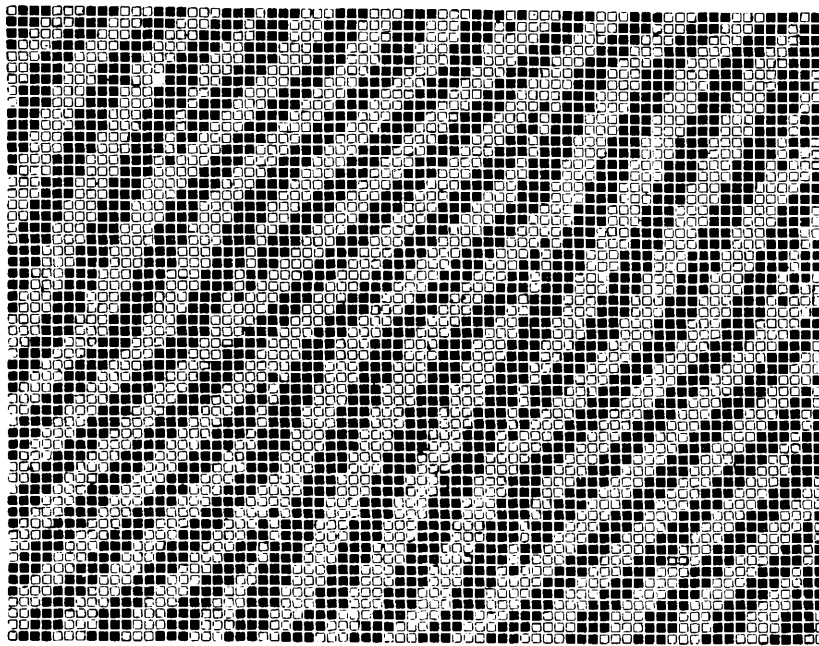


FIG. 370.

Fig. 366	18 ends, 9 picks
Fig. 367	8 ends, 8 picks
Fig. 368	30 ends, 15 picks
Fig. 369	56 ends, 12 picks
Fig. 370	48 ends, 48 picks
Fig. 371	16 ends, 16 picks
Fig. 372	16 ends, 16 picks
Fig. 373	16 ends, 16 picks
Fig. 374	16 ends, 16 picks
Fig. 375	24 ends, 48 picks

FIG. 371.

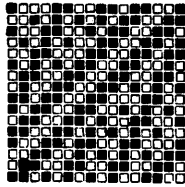


FIG. 372.

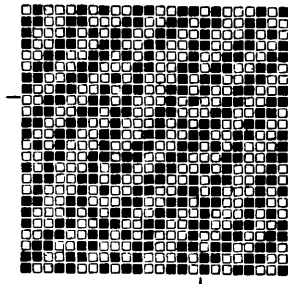
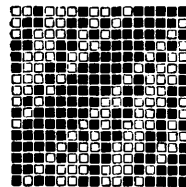


FIG. 373.

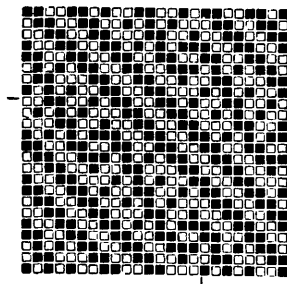


FIG. 374.

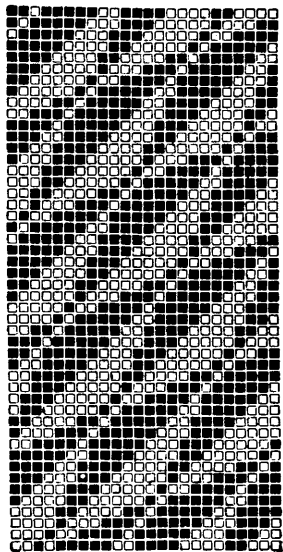


FIG. 375.

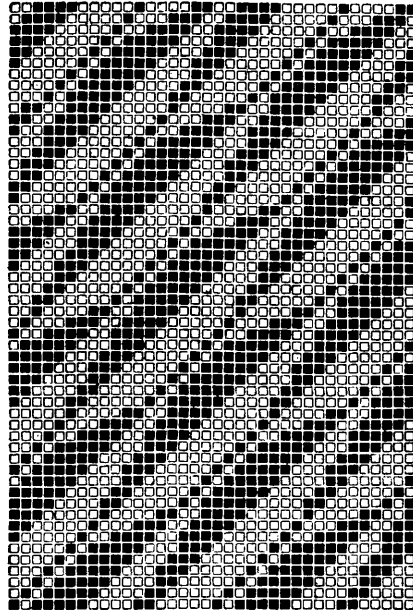


FIG. 376.

Fig. 376	18 ends, 54 picks
Fig. 377	40 ends, 40 picks
Fig. 378	16 ends, 16 picks
Fig. 379	16 ends, 16 picks

As the twill line is less distinct when the float is offset two threads instead of one, a twill with a longer float is often used in combination with a regular twill

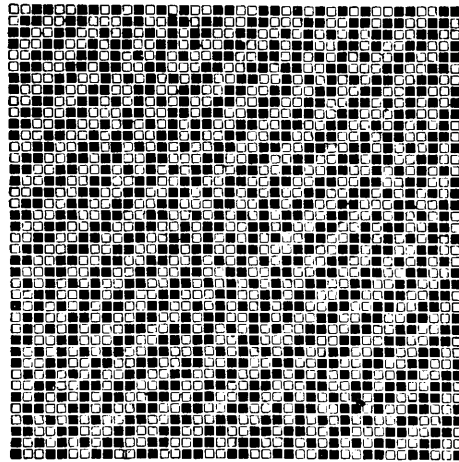


FIG. 377.

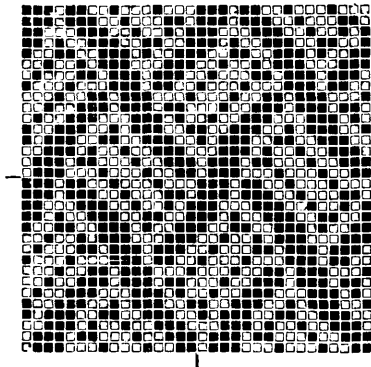


FIG. 378.

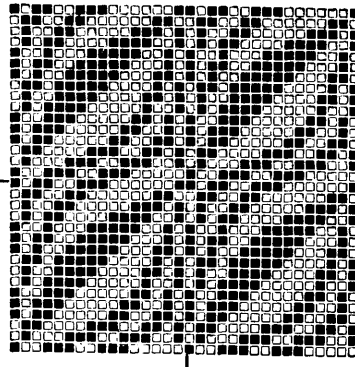


FIG. 379.

for undulating twill effects. Thus, Fig. 367 is formed by a $2-2$ twill offset one pick combined with a $3-2-1-2$ twill offset two picks; the weave pattern covers eight shafts and eight picks.

Another example is shown at Fig. 370, in which are combined a $^3\text{---}_3$ twill, offset one pick, and a $^6\text{---}_6$ twill, offset two picks. Each twill covers 24 threads in each direction. The two twills are combined in plain weave order, the whole pattern covering 48 threads.

Attractive patterns can be obtained by using other motifs than the plain weave. Fig. 377 shows a weave pattern obtained by transposing two twills with a 5-shaft double satin as a motif.

BROKEN OR REVERSED TWILLS

Broken or reversed twills are formed by reversing the direction of the twill at intervals. The twill can be reversed in either the warp or filling. If the twill is broken in the warp, as shown at Fig. 382, a longitudinal stripe effect is obtained. The filling is stitched more closely and becomes less prominent. In Fig.

FIG. 380.

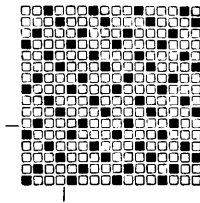


FIG. 381.

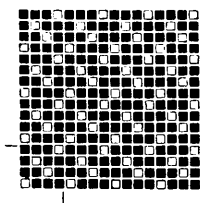


FIG. 382.

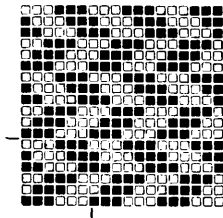
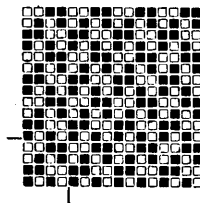


FIG. 383.

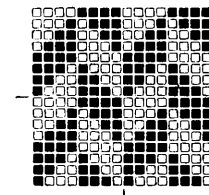


FIG. 384.

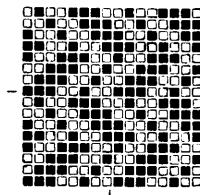


FIG. 385.

382 a $2-2$ twill is reversed every two warp threads. The warp threads are still woven $2-2$, but the reversing of the twill causes every alternate pick to interlace the warp in plain weave order.

If, on the other hand, the twill is reversed in the direction of the filling, as in Fig. 383, the filling becomes more prominent than the warp, which is then stitched more closely than the filling. These remarks apply to balanced twills, such as $2-2$, $3-3$, $4-4$, etc.

FIG. 386.

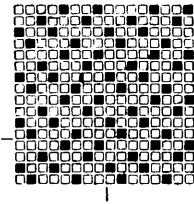


FIG. 387.

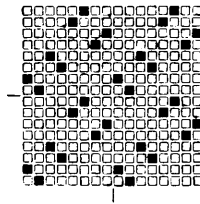


FIG. 388.

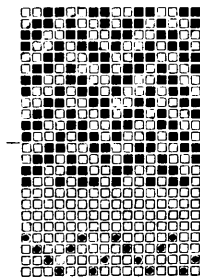
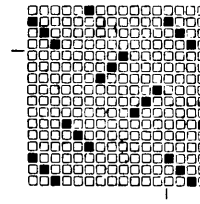


FIG. 389.

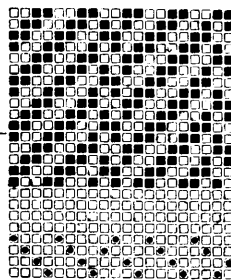


FIG. 390.

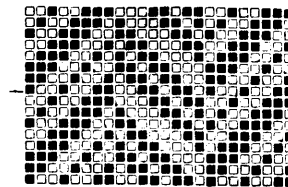


FIG. 391.

FIG. 392.

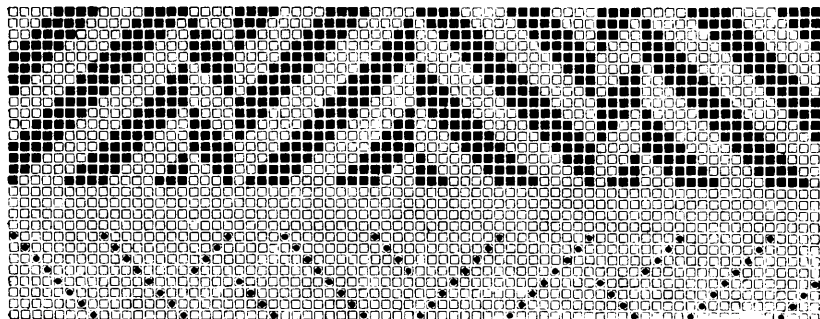
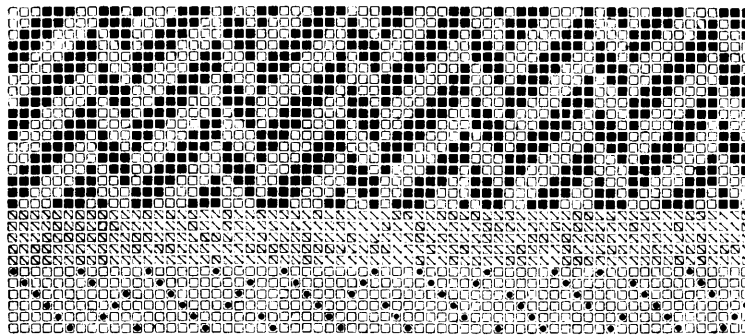


FIG. 393.

Among reversed or broken twills is classed the $1-3$ weave stitched 1, 2, 4, 3, Fig. 380. This weave is sometimes styled a satin and frequently substituted for the regular satin. It is extensively used for a great variety of goods and is usually stitched in 1, 3, 2, 4, order. The same result is obtained in both cases, as well as with the order 1, 4, 2, 3.

FIG. 394.

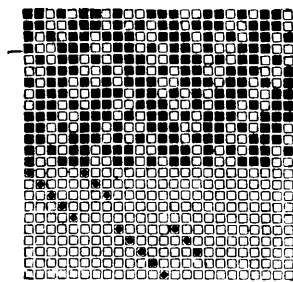


FIG. 395.

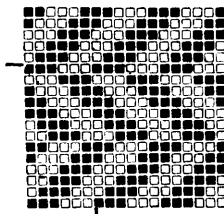
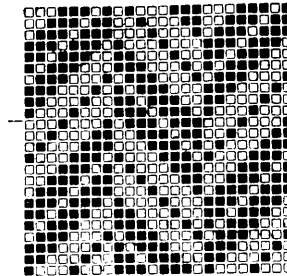


FIG. 396.

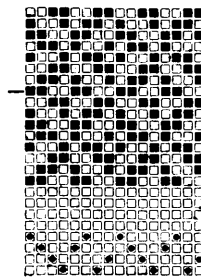


FIG. 397.

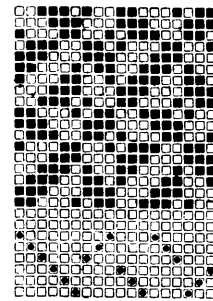


FIG. 398.

Fig. 381 is a $3-1$ reversed or broken twill, stitched in 1, 3, 2, 4 order.

Fig. 382 is a $2-2$ twill, reversed warp ways and often called *croisé*. Fig. 382 is well suited for woolen frieze fabrics, as it shows no twill.

Fig. 383 is a $3-3$ twill reversed filling ways.

Fig. 384 is a $4-4$ twill reversed warp ways.

Fig. 385 shows an 8-leaf twill, $3-2-1-2$, reversed filling ways.

Motifs for attractive designs can be obtained by rearranging the parts of a twill so that two groups of threads with the twill running in the same direction alternate with two groups having the twill running in

FIG. 399.

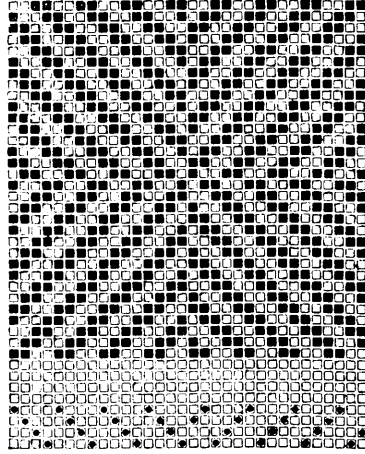


FIG. 400.

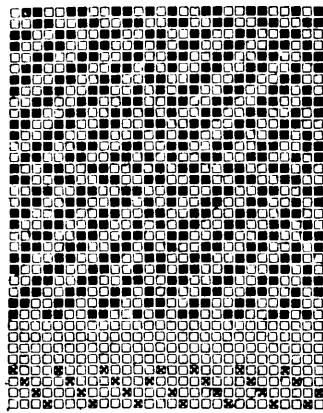
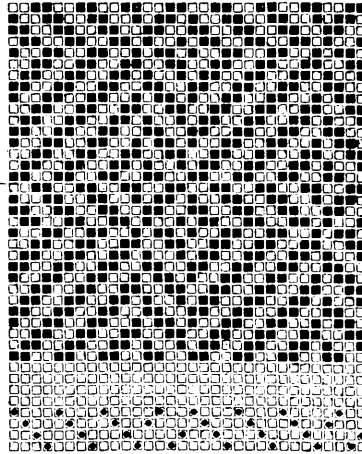


FIG. 401.

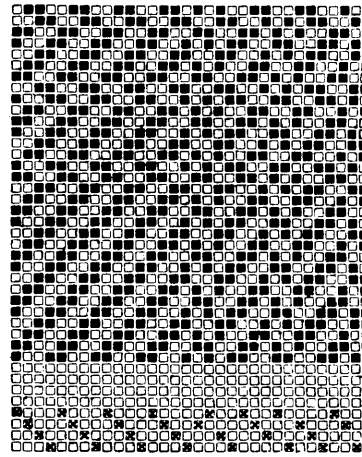


FIG. 402.

the opposite direction, Figs. 386, 387 and 388. The twill in either direction may include more than half the weave, making the two groups of unequal size. Care must be taken to have a sharp break at the junction

of the right and left twills, the risers of one twill coming opposite the sinkers of the other.

Figs. 389 to 419 are weave patterns with the twill reversed, some warp ways, some filling ways, and others in both warp and filling.

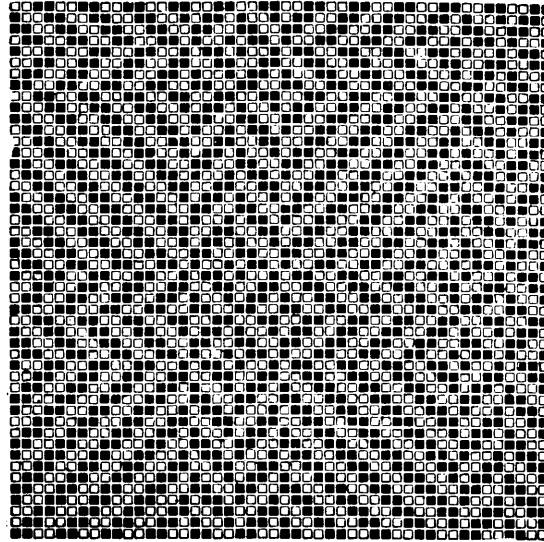


FIG. 403.

The following are reversed warp ways, forming longitudinal stripes :

Fig. 389, twill $2-2$ divided 4 and 4.

Fig. 390, twill $2-2$ divided 8 and 2.

Fig. 392, twill $3-3$ divided 8 and 3.

Fig. 393, twill $4-4$ divided 16, 4, 16, 4 and 16.

Fig. 394, steep twill $5-2-1-2$ divided 8 and 8.

Fig. 395, twill $3-1-3-3-1-3$ divided 8 and 8.

If a twill weave does not permit of a sharp break at the point of reversal, another twill is formed by substituting risers for the sinkers, and sinkers for the risers of the first twill, Fig. 391. One is then used for the right twill ; the other for the left. This method, however, necessitates an increase in the number of shafts.

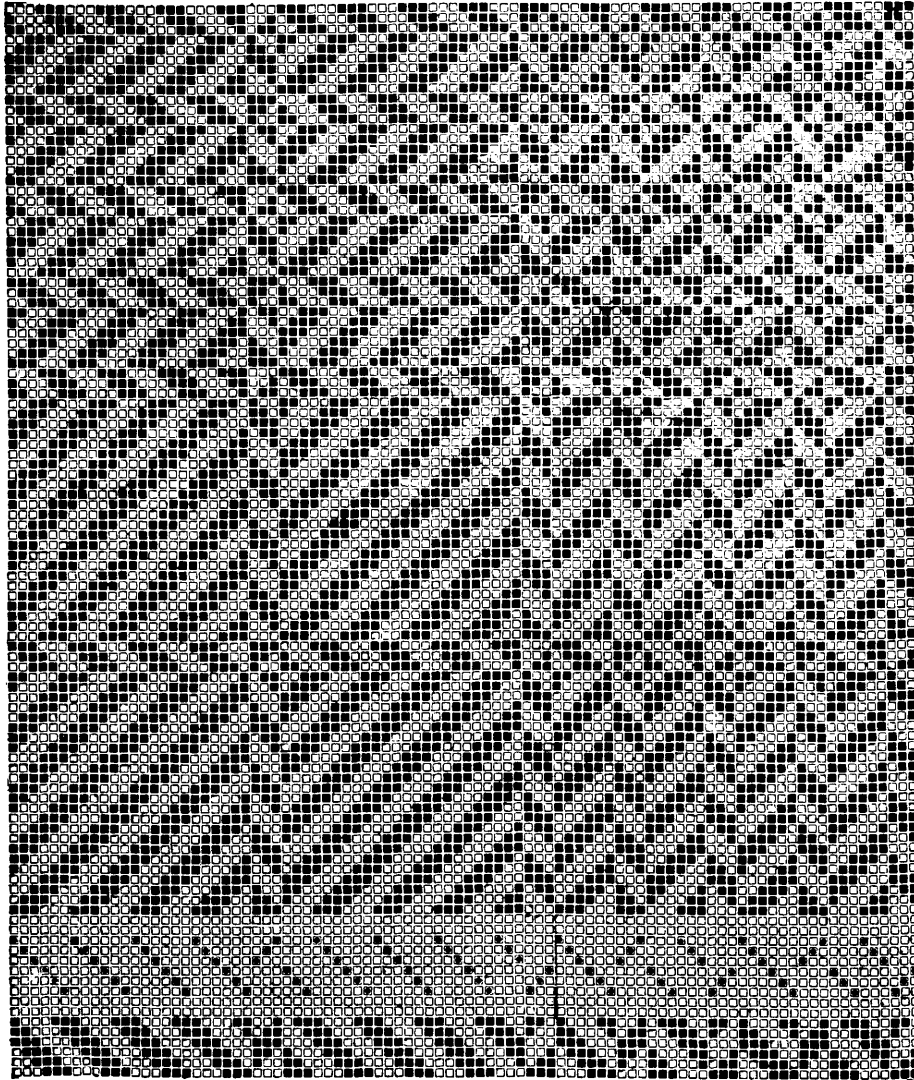


FIG. 404.

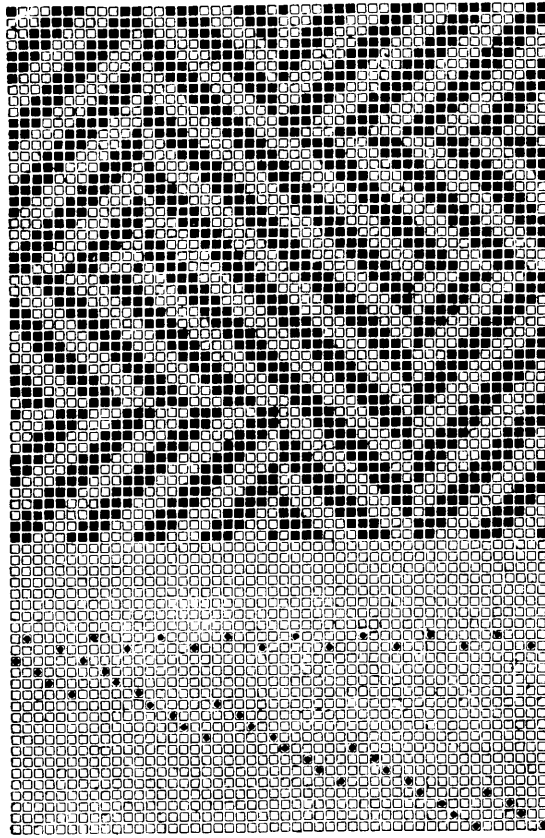


FIG. 405.

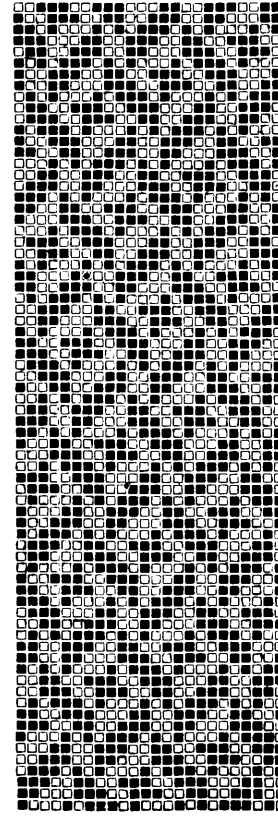


FIG. 406.

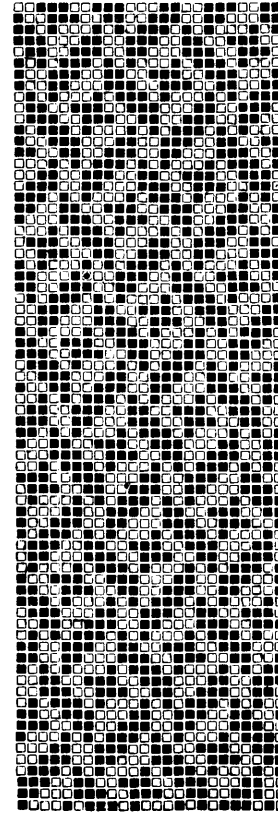


FIG. 407.

FIG. 408.

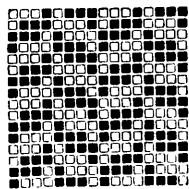


FIG. 409.

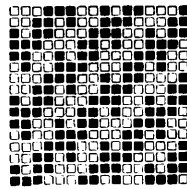


FIG. 410.

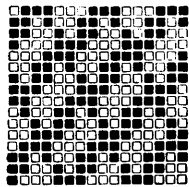
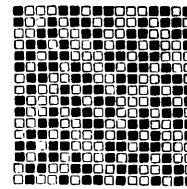


FIG. 411.

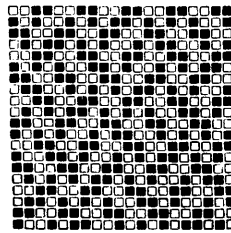


FIG. 412.

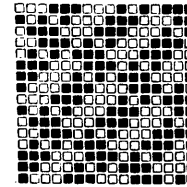


FIG. 413.

Fig. 396 shows a $3-3$ twill reversed filling ways.

In Figs. 397 to 404 the twill is reversed in both warp and filling.

FIG. 414.

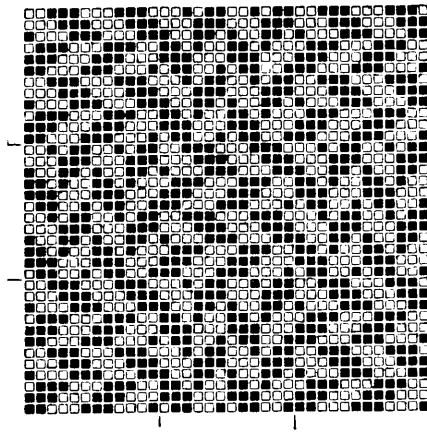


FIG. 415.

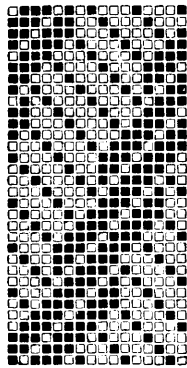
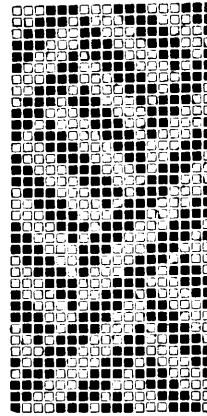


FIG. 416.

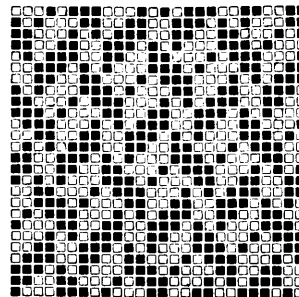


FIG. 417.

This arrangement is used for the production of a great variety of designs.

Fig. 397, twill $2-2$ divided 4 and 4 each way.

Fig. 398, twill $3-3$ divided 6 and 3 each way.

Fig. 399, twill $2-2$ divided 16 and 16 each way.

Fig. 400, twill $2-2$ divided 12 and 4 each way.

Fig. 401, twill $2-2$ divided 12 and 2 each way.

Fig. 402, twill $2-2$ divided 16, 2, 5, 2, 5, 2 each way.

Fig. 403, twill $2-2$ divided 16, 4, 4, 16, 4, 4 each way.

Fig. 404, twill $3-3$ divided 24, 3, 24, 3, 6, 3, 6, 3, 6, 3, 6, 3 each way.

Very attractive patterns are made by reversing the twill in accordance with previously selected motifs.

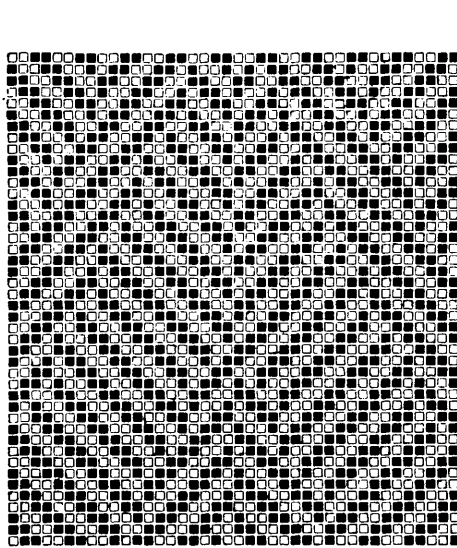


FIG. 418.

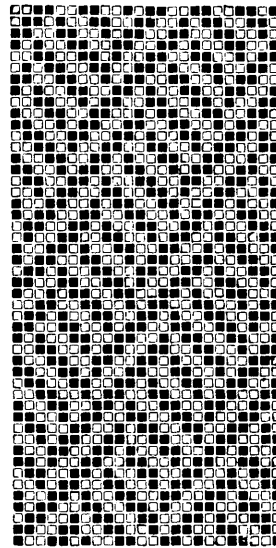


FIG. 419.

An example is shown at Fig. 405, which is developed from the motif, Fig. 406, with a $3-3$ twill.

Another design is shown at Fig. 414, in which isolated squares of 12 threads each are formed by reversing the twill alternately in warp and filling. In this particular pattern the twill is reversed every 3 threads.

Figs. 407 to 419 show several variations of this class of weave effects, of which the number is unlimited :

Fig. 407, pattern 24 warp, 72 filling threads.

Fig. 408, pattern 8 warp, 4 filling threads.

Fig. 409, pattern 12 warp, 6 filling threads.

Fig. 410, pattern 8 warp, 8 filling threads.

Fig. 411, pattern 6 warp, 12 filling threads.

- Fig. 412, pattern 20 warp, 20 filling threads.
Fig. 413, pattern 16 warp, 8 filling threads.
Fig. 414, pattern 24 warp, 24 filling threads.
Fig. 415, pattern 18 warp, 36 filling threads.
Fig. 416, pattern 16 warp, 32 filling threads.
Fig. 417, pattern 26 warp, 26 filling threads.
Fig. 418, pattern 40 warp, 44 filling threads.
Fig. 419, pattern 24 warp, 48 filling threads.

OFFSET TWILLS

Twills may be broken without reversing the direction. In balanced twills the risers of the first thread of a group are usually, but not necessarily, brought opposite the sinkers of the last thread of the preceding group.

The intermittent drawing-in draft, No. 5, Fig. 16, is required for these effects. The break may be in either or both directions (warp and filling). The direction of the twill may be reversed at intervals, if desired, in which case the intermittent drawing-in draft, No. 5, Fig. 17, is required. Examples of offset twills are shown at Figs. 420 to 454.

The following are broken in the warp :

Fig. 420, twill 1---_3 divided 2 and 2.

Fig. 421, twill 2---_2 divided 2 and 2.

FIG. 420.

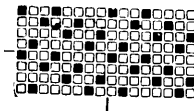


FIG. 421.

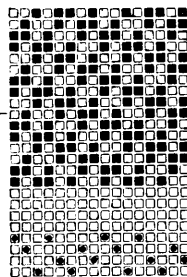


FIG. 422.

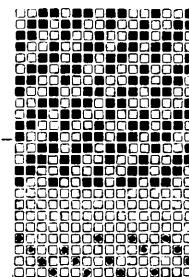


FIG. 423.

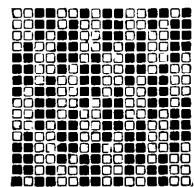
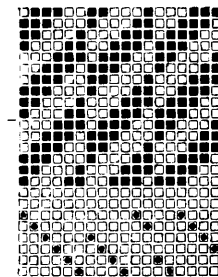


FIG. 424.

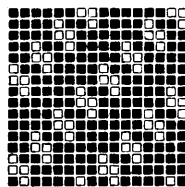


FIG. 425.

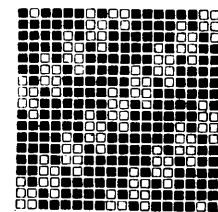


FIG. 426.

FIG. 427.

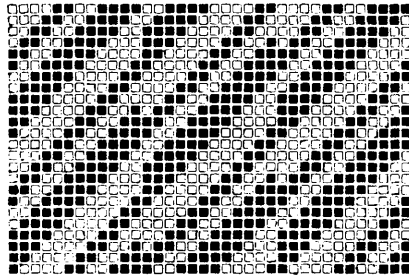


FIG. 428.

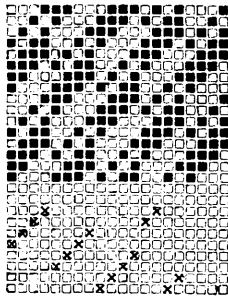
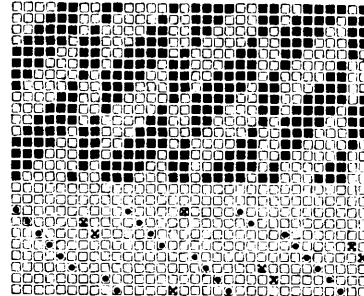


FIG. 429.

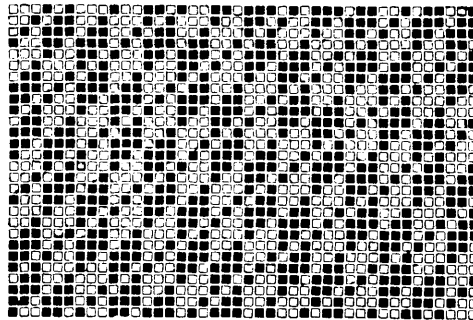


FIG. 430.

FIG. 431.

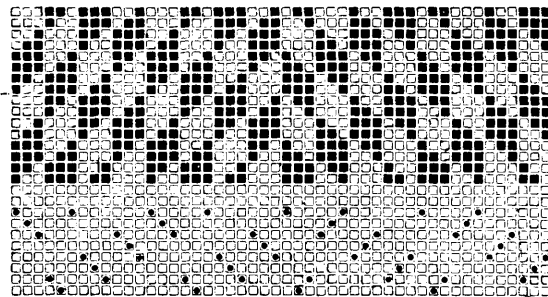


FIG. 432.

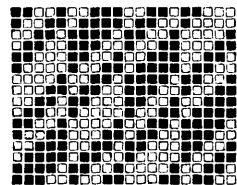
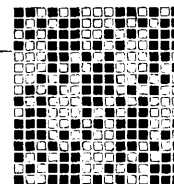


FIG. 433.

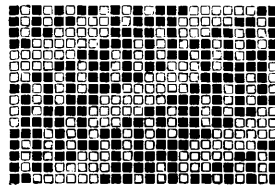


FIG. 434.

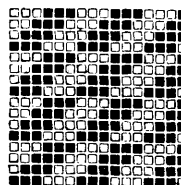


FIG. 435.

- Fig. 422, twill $2-2$ divided 4 and 4.
 Fig. 423, twill $3-3$ divided 6 and 6.
 Fig. 424, twill $4-4$ divided 2 and 2.
 Fig. 425, twill $6-2$ divided 2 and 2.
 Fig. 426, twill $6-3$ divided 2 and 2.
 Fig. 427, twill $4-2-2-4$ divided 12 and 12.

FIG. 438.

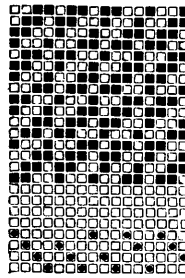


FIG. 439.

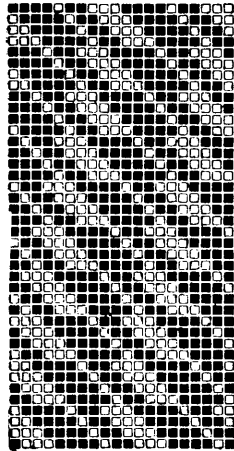
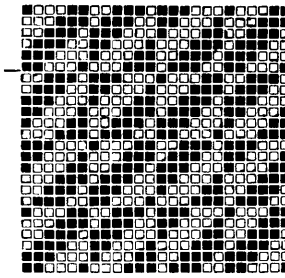


FIG. 436.

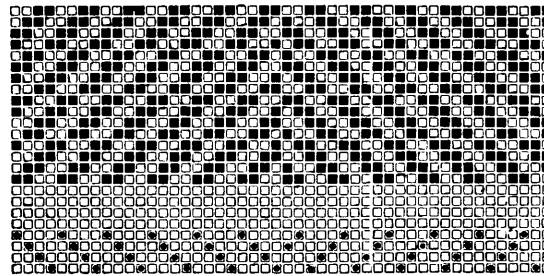


FIG. 437.

- Fig. 428, twill $4-4$ divided 6 and 2.
 Fig. 429, twill $3-1-1-3$ divided 4 and 4.
 Fig. 430, twill $3-1-3-3-1-3$ divided 3 and 3.
 Fig. 431, twill $4-4$ divided 3 and 3; twill reversed every 24 threads.
 Fig. 432, twill $1-4-1-1-4-1$ divided 3 and 3.
 Fig. 433, twill $4-2-2-4-2-2$ divided 5 and 5.
 Fig. 434, twill $5-3-1-3$ divided 1 and 1.
 The following are broken in the filling:
 Fig. 435, twill $3-3$ divided 4 and 4.
 Fig. 436, twill $4-1-2-3$ divided 4 and 4.
 Fig. 437, twill $2-2$ divided 4 and 4; twill reversed every 24 threads.

FIG. 440.

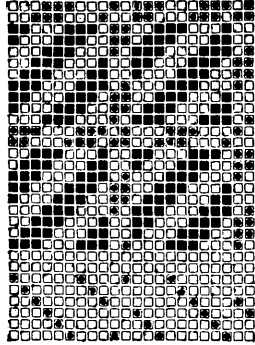


FIG. 441.

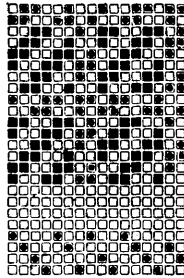


FIG. 442.

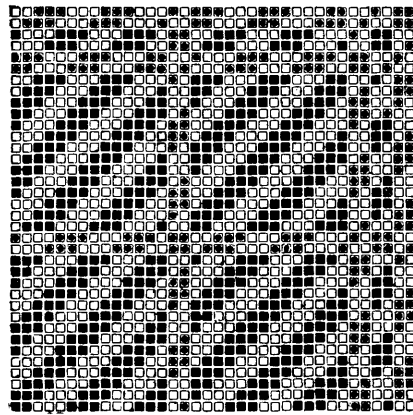
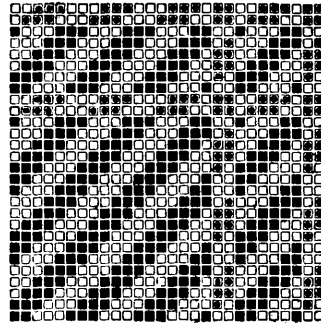


FIG. 443.

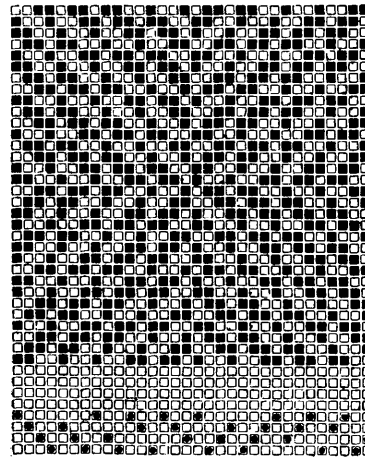


FIG. 444.

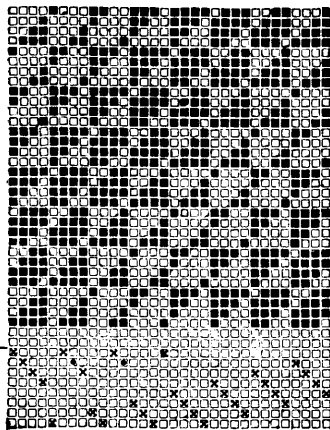


FIG. 445.

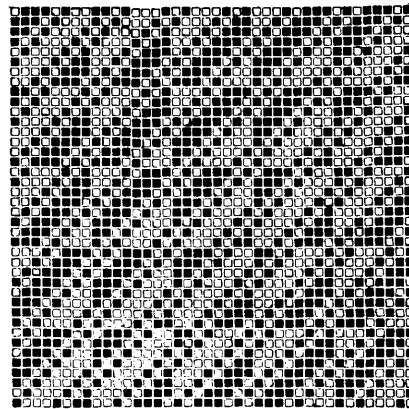


FIG. 446.

By the arrangement shown at Fig. 435 the twill is started at the same place at the beginning of each group of 4 picks. This produces a longitudinal groove effect which is very attractive in fine worsted fabrics.

The following twills are broken in both warp and filling:

Fig. 438, twill $2-2$ divided 4 and 4.

Fig. 439, twill $3-3$ divided 6 and 6.

FIG. 447.

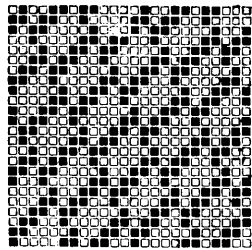


FIG. 448.

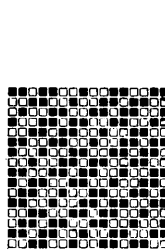


FIG. 449.

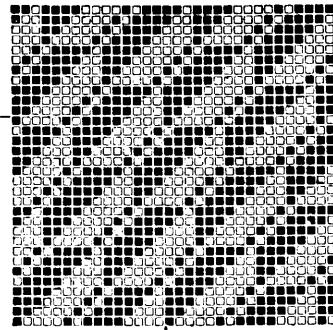
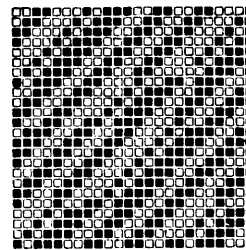


FIG. 450.

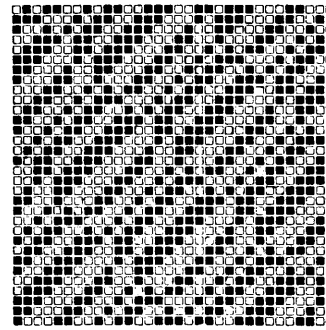


FIG. 451.

Fig. 440, twill $3-3$ divided 9 and 2.

Fig. 441, twill $2-2$ divided 6 and 2.

Fig. 442, twill $3-3$ divided 18, 2, 6, 2.

Fig. 443, twill $3-3$ divided 14, 2, 14, 2, 2, 2.

Fig. 444, twill $2-2$ divided 4 and 4; twill reversed in both warp and filling every 16 threads.

Fig. 445, twill $4-4$ divided 4 and 4.

Fig. 446, twill $1-1-3-1-1-3$ divided 8 and 8.

Various patterns made by breaking the twill in both warp and filling are shown in Figs. 447 to 454.

Fig. 447	24 × 24
Fig. 448	14 × 14
Fig. 449	16 × 24
Fig. 450	15 × 20
Fig. 451	32 × 32
Fig. 452	32 × 16
Fig. 453	40 × 40
Fig. 454	80 × 16

FIG. 452.

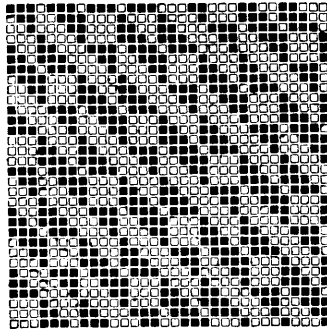


FIG. 453.

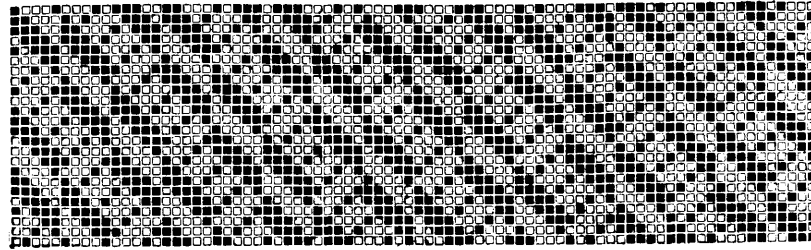
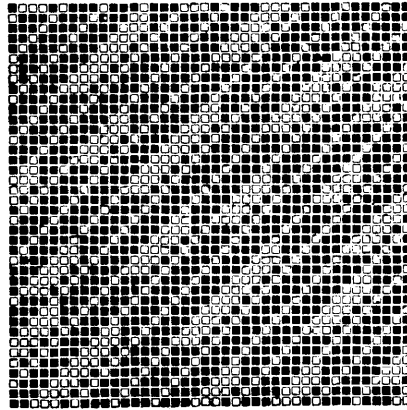


FIG. 454.

FIG. 455.

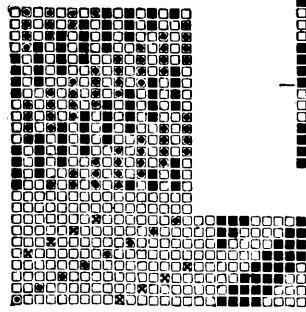


FIG. 456.

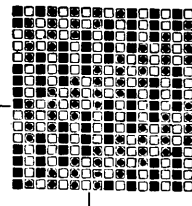


FIG. 457.

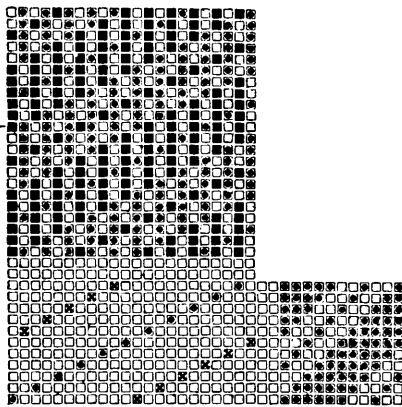
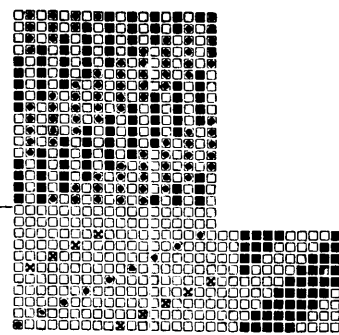


FIG. 458.

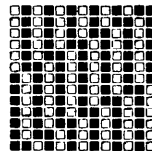


FIG. 459.

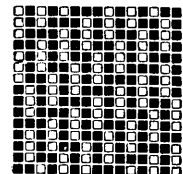


FIG. 460.

FIG. 462.

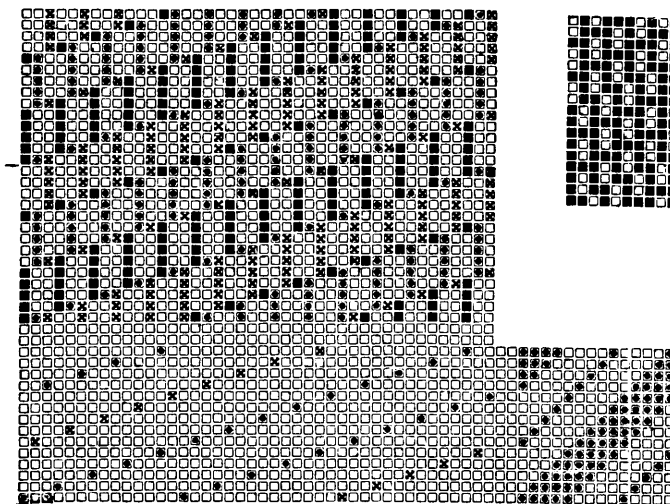


FIG. 461.

CORKSCREW TWILLS

These weaves, also called diagonal ribs, require the manifold drawing-in draft, No. 6, Figs. 20, 21 and 22. The peculiar feature of corkscrew weaves is the combination of two or more distinct twill lines, which may be of different colors.

Corkscrew fabrics, which are usually made of fine worsted, should be set close in the warp, otherwise the twill will look thin and ragged. Examples of corkscrew weaves are given at Figs. 455 to 509.

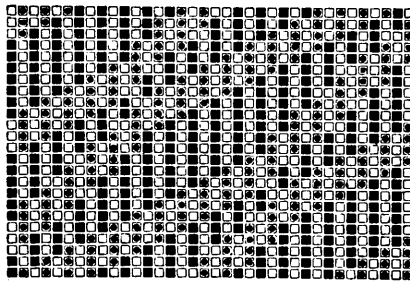


FIG. 463.

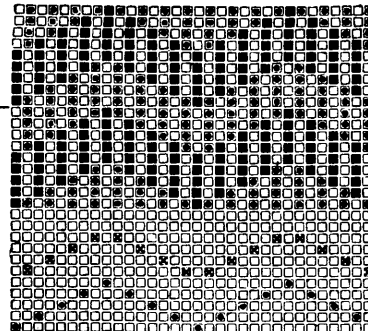


FIG. 464.

- Fig. 455, 8-shaft, 2 twills.
- Fig. 456, 7-shaft, 2 twills.
- Fig. 457, 9-shaft, 2 twills.
- Fig. 458, 11-shaft, ${}^6\text{---}_2\text{---}1\text{---}_2$, 2 twills.
- Fig. 459, 13-shaft, 2 twills.
- Fig. 460, 15-shaft, 2 twills.
- Fig. 461, 14-shaft, ${}^5\text{---}_4\text{---}1\text{---}_4$, 3 twills.
- Fig. 462, 17-shaft, 2 twills.

The single risers which are separated from the warp floats in Figs. 458, 460, 461 and 462 are intro-

duced to stitch the floats on the back of the cloth. Corkscrew twills can be reversed, deflected or made in

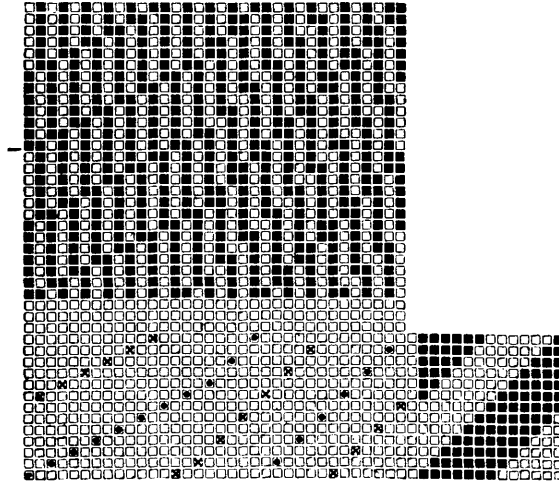


FIG. 465.

wavelike or undulating form, as shown by Figs. 463, 464 and 465.

FIG. 466.

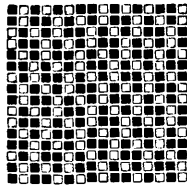


FIG. 467.

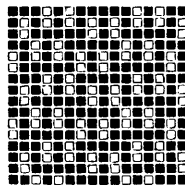


FIG. 468.

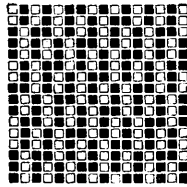
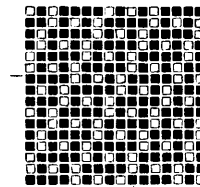


FIG. 469.

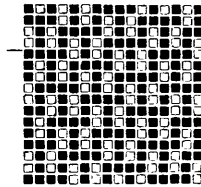


FIG. 470.

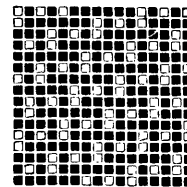


FIG. 471.

Fig. 463, 36 warp, 24 filling threads, twill deflected.

Fig. 464, 9 shafts, twill $5-4$, reversed.

Fig. 465, 13 shafts, twill $7-6$, deflected.

Other variations are shown at Figs. 466 to 478.

Fig. 466	7-shaft
Fig. 467	8-shaft
Fig. 468	9-shaft
Fig. 469	11-shaft
Fig. 470	11-shaft
Fig. 471	11-shaft
Fig. 472	13-shaft
Fig. 473	13-shaft
Fig. 474	15-shaft
Fig. 475	17-shaft
Fig. 476	13-shaft
Fig. 477	19-shaft
Fig. 478	23-shaft

FIG. 472.

FIG. 473.

FIG. 474.

FIG. 475.

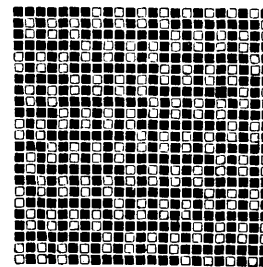
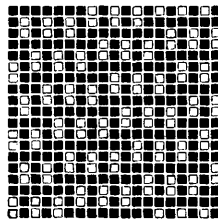
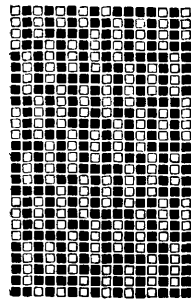
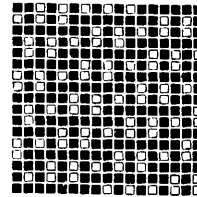
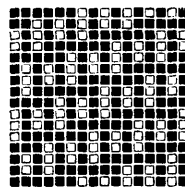
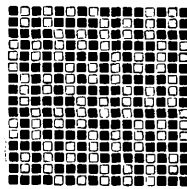
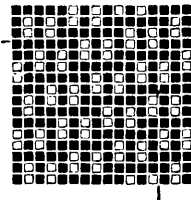


FIG. 476.

FIG. 477.

FIG. 478.

Corkscrew twills may be developed with filling as well as with warp floats. Two-filling corkscrews are shown at Figs. 479 and 480. Woven 1 light, 1 dark, the cloth shows two distinct filling twills, one of which is light, the other dark.

At Fig. 481 is shown a filling corkscrew in which the

FIG. 479.

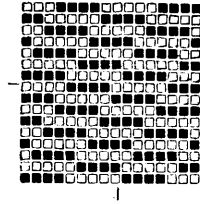


FIG. 480.

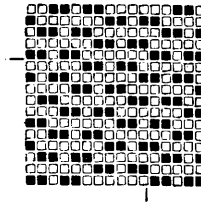


FIG. 481.

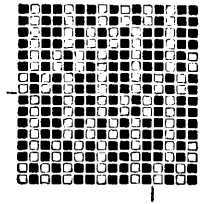
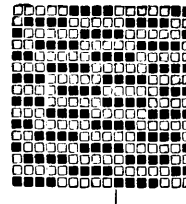


FIG. 482.

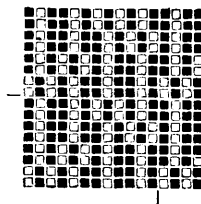


FIG. 483.

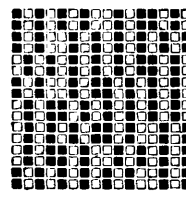


FIG. 484.

twill is run alternately to right and left, to give an undulating effect suitable for stripes in worsted goods.

Corkscrews, particularly the warp variety, are fre-

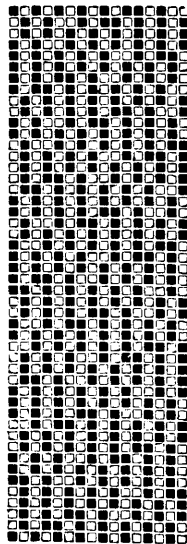


FIG. 485.

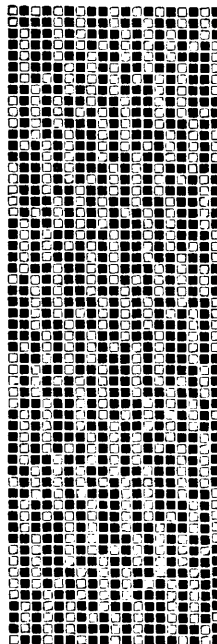


FIG. 486.

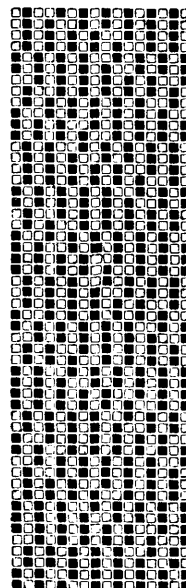


FIG. 487.

FIG. 488.

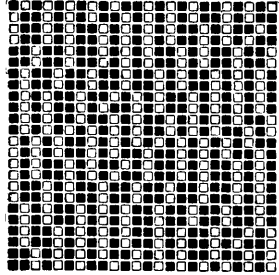


FIG. 489.

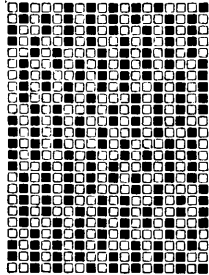


FIG. 490.

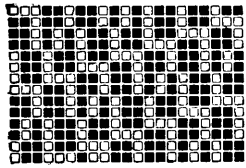
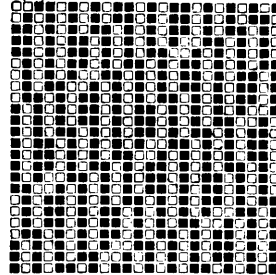


FIG. 491.

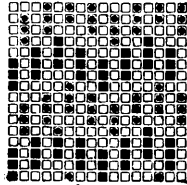


FIG. 492.

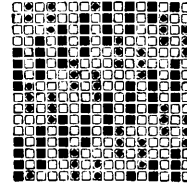


FIG. 493.

quently arranged to produce fancy effects, of which a few examples are given at Figs. 482 to 509.

Fig. 482 12 warp, 8 filling

Fig. 483 12 warp, 8 filling

FIG. 494.

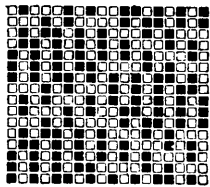


FIG. 495.

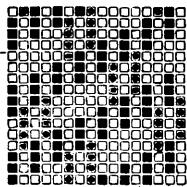


FIG. 496.

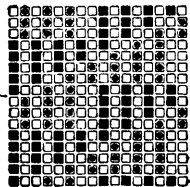
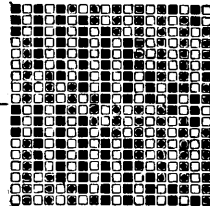


FIG. 497.

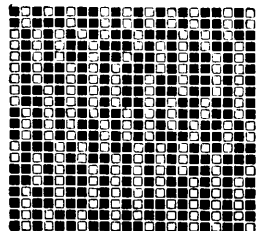


FIG. 498.

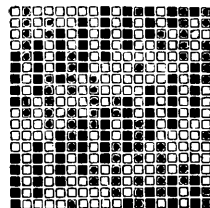


FIG. 499.

Fig. 484	. . . . .	16 warp, 16 filling
Fig. 485	. . . . .	16 warp, 48 filling
Fig. 486	. . . . .	19 warp, 57 filling
Fig. 487	. . . . .	13 warp, 52 filling
Fig. 488	. . . . .	24 warp, 24 filling
Fig. 489	. . . . .	18 warp, 24 filling
Fig. 490	. . . . .	24 warp, 24 filling
Fig. 491	. . . . .	21 warp, 14 filling

FIG. 500.

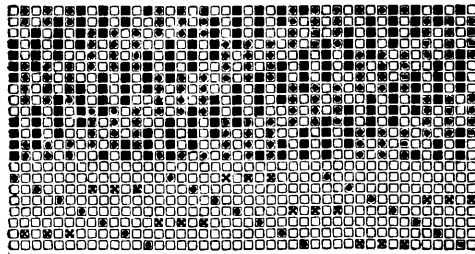


FIG. 501.

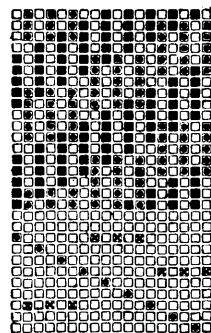
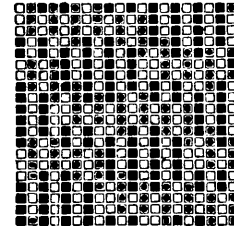


FIG. 502.

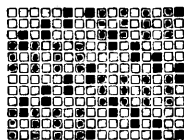


FIG. 503.

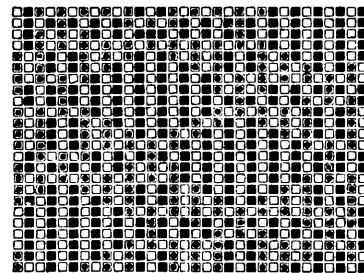


FIG. 504.

Fig. 492	. . . . .	8 warp, 8 filling
Fig. 493	. . . . .	16 warp, 8 filling
Fig. 494	. . . . .	18 warp, 9 filling
Fig. 495	. . . . .	12 warp, 12 filling
Fig. 496	. . . . .	18 warp, 9 filling
Fig. 497	. . . . .	16 warp, 8 filling
Fig. 498	. . . . .	22 warp, 20 filling
Fig. 499	. . . . .	18 warp, 18 filling

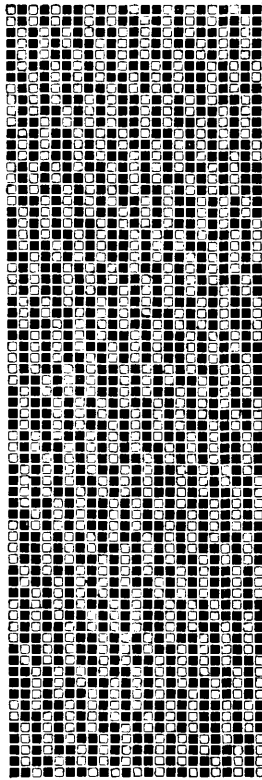


FIG. 505.

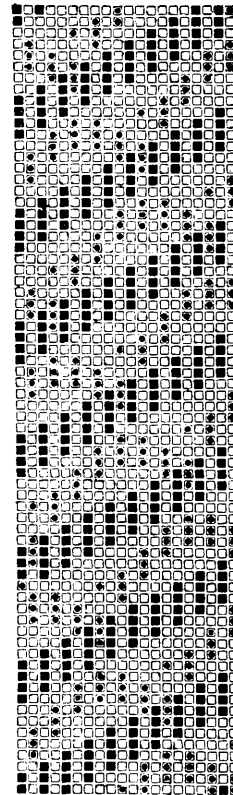


FIG. 506.

Fig. 500	. . . . .	42 warp, 7 filling
Fig. 501	. . . . .	20 warp, 20 filling
Fig. 502	. . . . .	18 warp, 9 filling
Fig. 503	. . . . .	12 warp, 6 filling
Fig. 504	. . . . .	32 warp, 24 filling

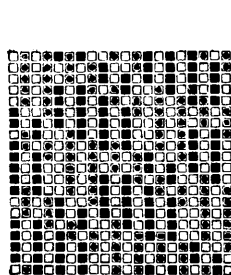


FIG. 507.

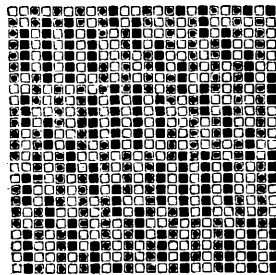


FIG. 508.

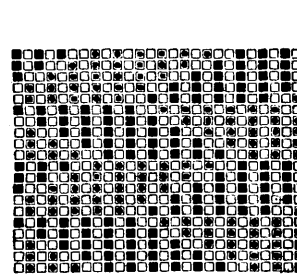


FIG. 509.

Fig. 505	. . . . .	23 warp, 69 filling
Fig. 506	. . . . .	20 warp, 70 filling
Fig. 507	. . . . .	20 warp, 20 filling
Fig. 508	. . . . .	24 warp, 24 filling
Fig. 509	. . . . .	26 warp, 10 filling

INTERLOCKING TWILLS

These twills are formed in two ways:

1. By interlocking a twill with itself, one draft of this twill coming on the even-numbered threads, and

FIG. 510.

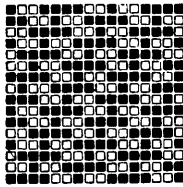


FIG. 511.

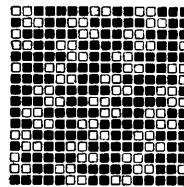


FIG. 512.

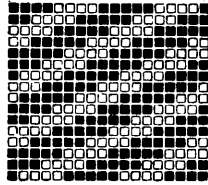
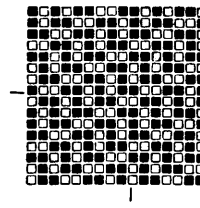


FIG. 513.

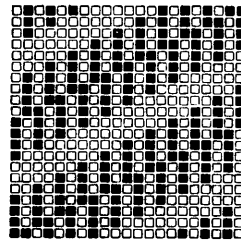


FIG. 514.

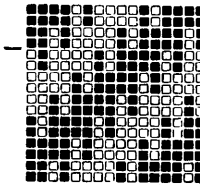


FIG. 515.

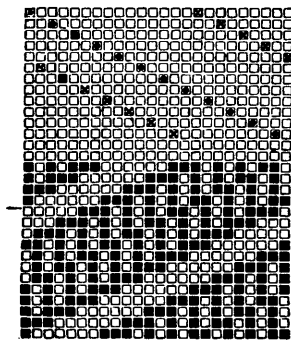


FIG. 516.

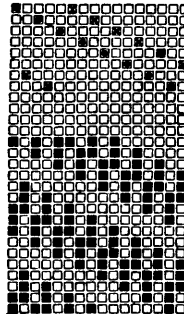


FIG. 517.

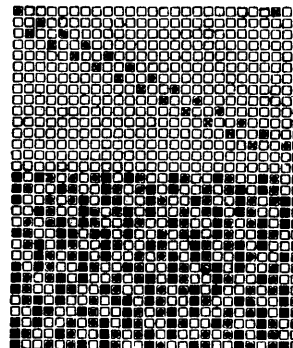


FIG. 518.

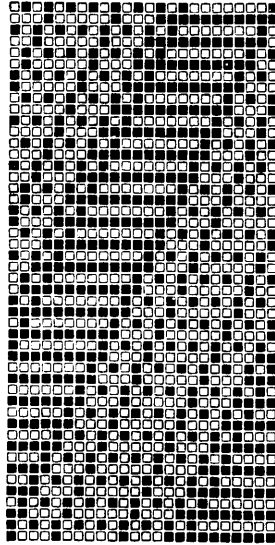


FIG. 519.

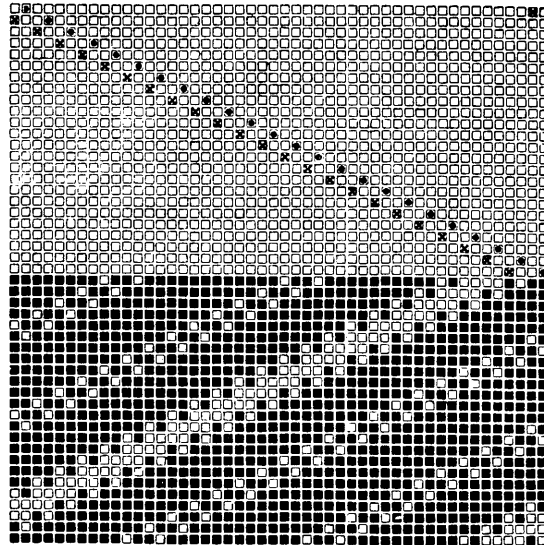


FIG. 520.

FIG. 521.

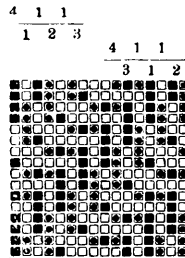


FIG. 522.

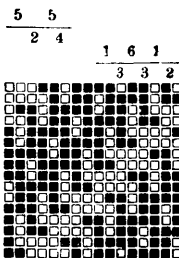


FIG. 523.

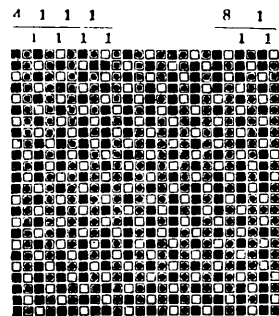
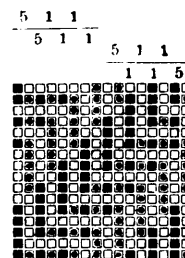


FIG. 524.

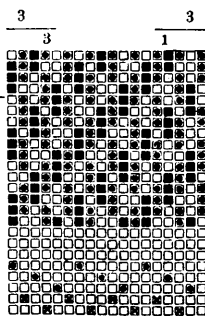


FIG. 525.

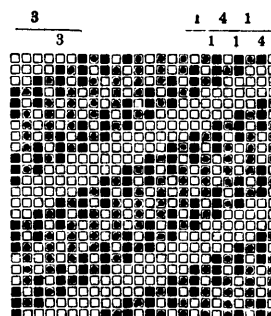


FIG. 526.

the other draft of the same weave coming on the odd-numbered threads, Figs. 510 to 520.

2. By interlocking two twills, bringing one of the weaves on the even-numbered threads, and the other on the odd-numbered threads, Figs. 521 to 539.

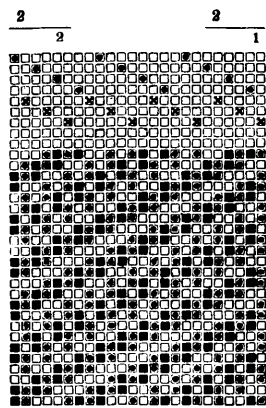


FIG. 527.

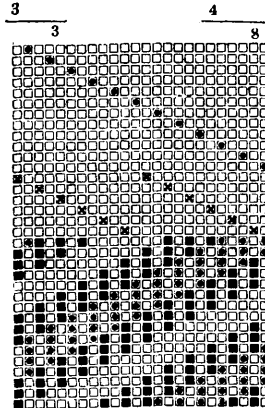


FIG. 528.

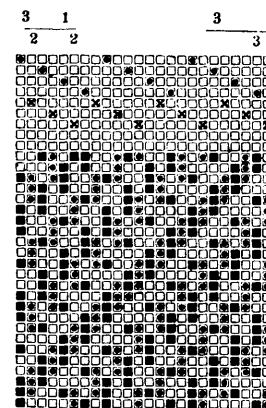


FIG. 529.

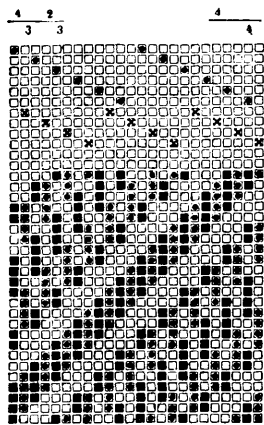


FIG. 530.

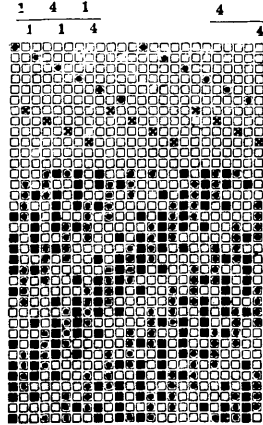


FIG. 531.

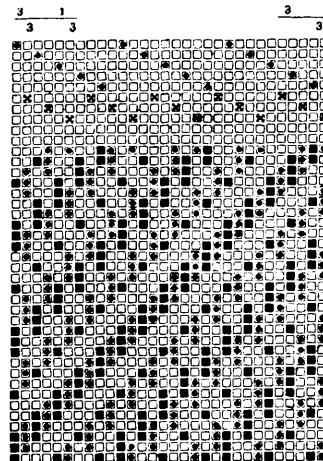


FIG. 532.

The objects of interlocking twills may be summarized as follows:

1. To obtain wide diagonals with a small number of shafts.

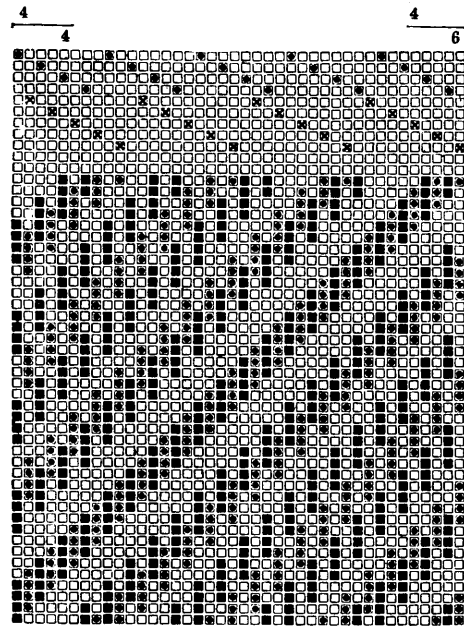


FIG. 533.

2. To produce new weave designs.

3. To obtain a weave structure in which a ground weave is brought on alternate picks and the pattern is developed on the other picks, Fig. 519.

4. To increase the filling-absorbing capacity of the weave, Figs. 510 and 511.

An unlimited number of new patterns can be obtained by interlocking weaves in warp

and filling. Like the kaleidoscope, a change of position results in an entirely new effect.

Examples are shown at Figs. 510 to 520, in each of which a weave is interlocked with itself.

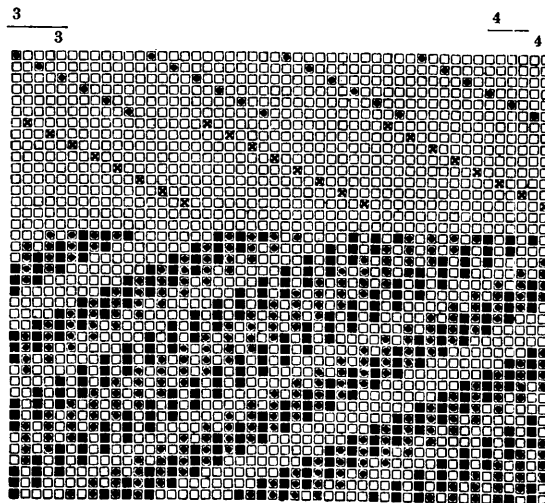


FIG. 534.

- Fig. 510 9-shaft
- Fig. 511 11-shaft
- Fig. 512 9-shaft
- Fig. 513 9-shaft
- Fig. 514 21-shaft
- Fig. 515 12-shaft
- Fig. 516 24 warp, 12 filling
- Fig. 517 16 warp, 8 filling
- Fig. 518 26 warp, 13 filling
- Fig. 519 24 warp, 48 filling
- Fig. 520 48 warp, 24 filling, 24 shafts

Figs. 521 to 539 show interlocking twill weaves each obtained from two twills, the threads being taken alternately from each.

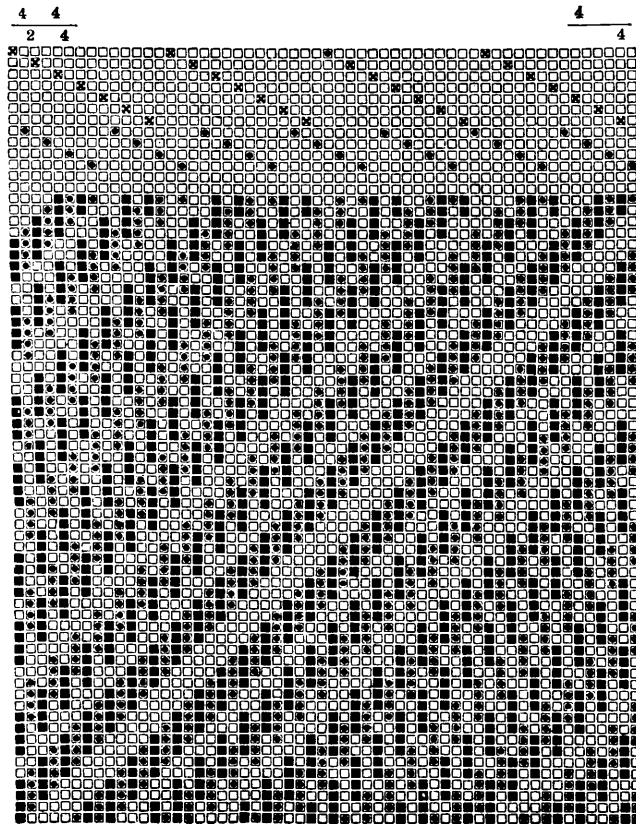


FIG. 535.

- Fig. 521, twill $4_{-1-1-2-1-3}$, twill $4_{-3-1-1-1-2}$.
- Fig. 522, twill 5_{-2-5-4} , twill $1_{-3-6-3-1-2}$.
- Fig. 523, twill $5_{-5-1-1-1-1}$, twill $5_{-1-1-1-1-5}$.
- Fig. 524, twill $4_{-1-1-1-1-1-1-1}$, twill $8_{-1-1-1-1-1-1-1-1}$.
- Fig. 525, twill 3_{-3} , twill 1_{-3} , 5 shafts, 12 picks.

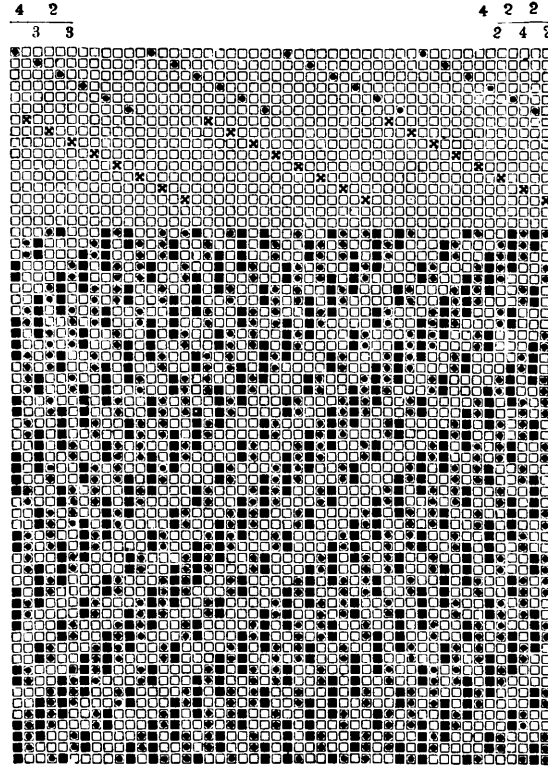


FIG. 536.

- Fig. 526, twill 3_{-3} , twill $1_{-1-1-1-1-4}$, 18 shafts, 12 picks.
- Fig. 527, twill 2_{-2} , twill 2_{-1} , 7 shafts, 12 picks.
- Fig. 528, twill 3_{-3} , twill 4_{-8} , 18 shafts, 12 picks.
- Fig. 529, twill 3_{-1-1-2} , twill 3_{-3} , 17 shafts, 24 picks.
- Fig. 530, twill 4_{-3-2-3} , twill 4_{-4} , 10 shafts, 24 picks.
- Fig. 531, twill $1_{-1-1-1-1-4}$, twill 4_{-4} , 10 shafts, 24 picks.

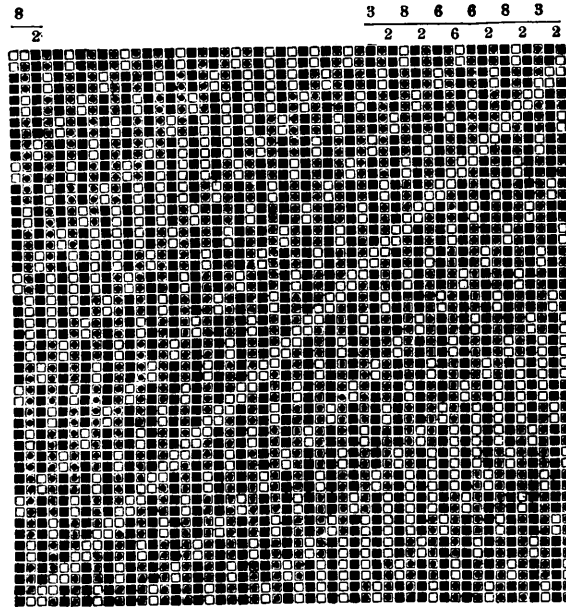


FIG. 537.

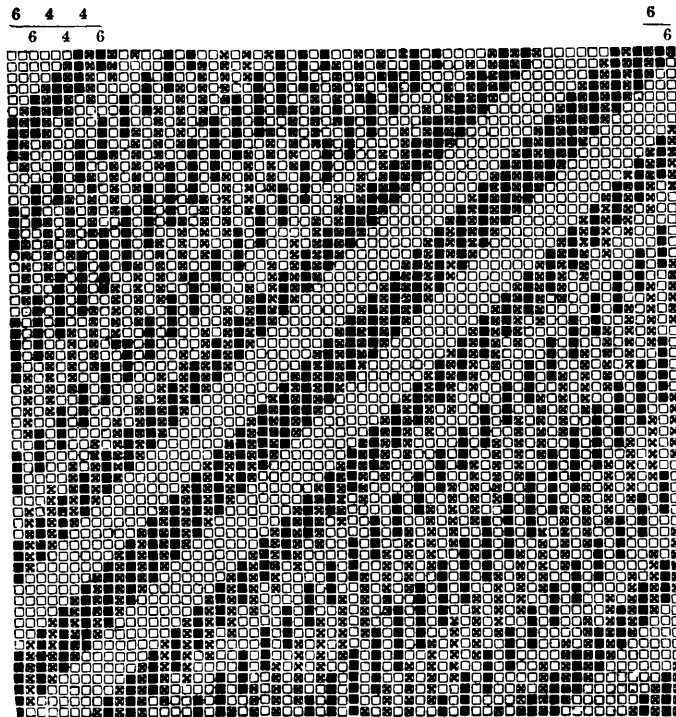


FIG. 538.

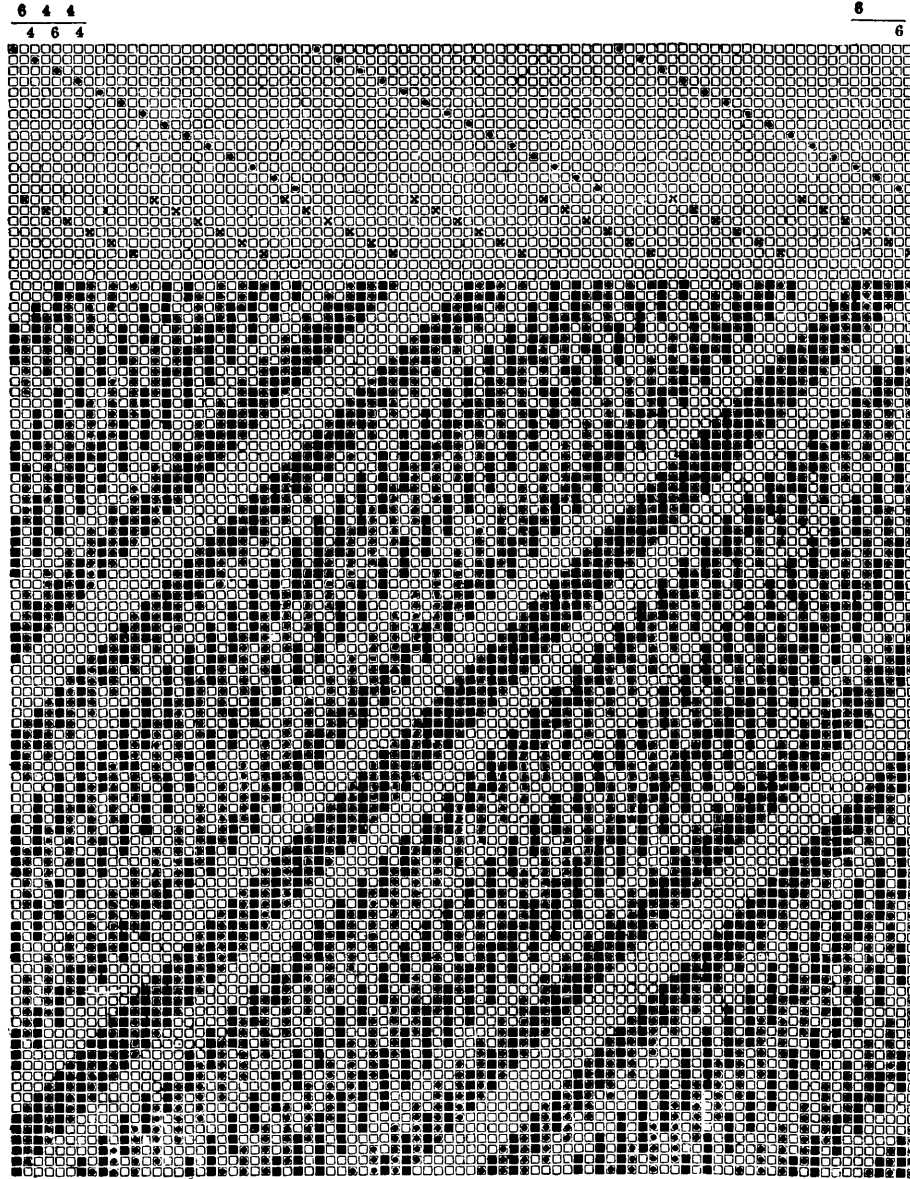


FIG. 539.

Fig. 532, twill $3-3-1-3$, twill $3-3$, 8 shafts, 30 picks.

Fig. 533, twill $4-4$, twill $4-6$, 9 shafts, 40 picks.

Fig. 534, twill $3-3$, twill $4-4$, 14 shafts, 24 picks.

Fig. 535, twill $4-2-4-4$, twill $4-4$, 11 shafts, 56 picks.

Fig. 536, twill $4-3-2-3$, twill $4-2-2-4-2-2$, 14 shafts, 48 picks.

Fig. 537, twill $8-2$, twill $3-2-3-2-6-6-6-2-8-2-3-2$, 30 shafts, 50 picks.

Fig. 538, twill $6-6-4-4-4-6$, twill $6-6$, 21 shafts, 60 picks.

Fig. 539, twill $6-4-4-6-4-4$, twill $6-6$, 20 shafts, 84 picks.

In drafting interlocking twills, two steep twills with the warp floats rising two picks at each thread are generally combined, the object being to obtain a 45° twill in the interlocked weave, Figs. 521 to 523, 525, 529 to 533 and 535 to 539.

FIG. 540.

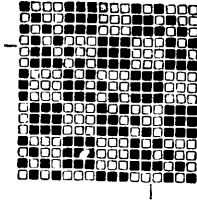


FIG. 541.

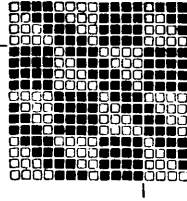


FIG. 542.

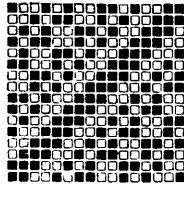


FIG. 543.

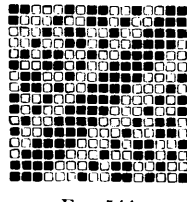
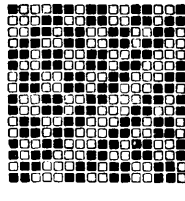


FIG. 544.

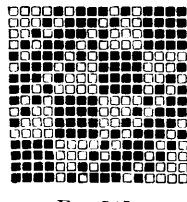


FIG. 545.

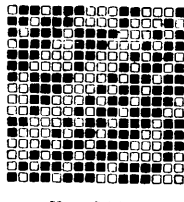


FIG. 546.

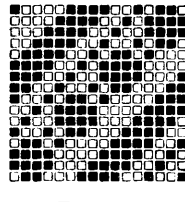


FIG. 547.

FIG. 548.

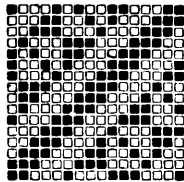


FIG. 549.

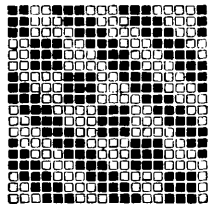
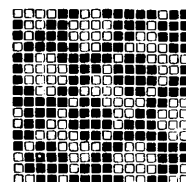


FIG. 550.

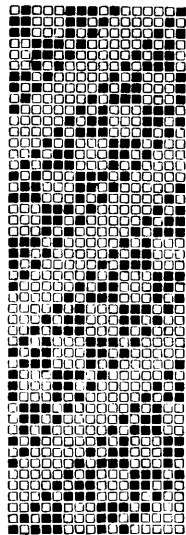


FIG. 551.

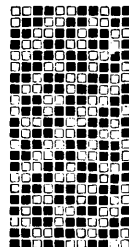


FIG. 552.

FANCY TWILLS

An endless variety of attractive twill effects can be obtained by combining basket, rib and other weaves to form a twill line, or by arranging a twill to form braided effects. Such patterns, however, require a large number of shafts, and frequently can be made only with a jacquard attachment. The weaves are drafted by first inserting the twill which is to form the main feature of the pattern and then filling the re-

FIG. 553.

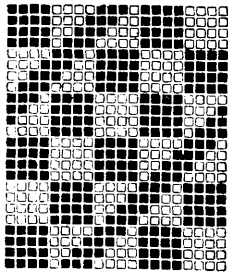


FIG. 554.

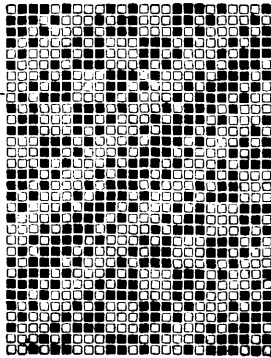
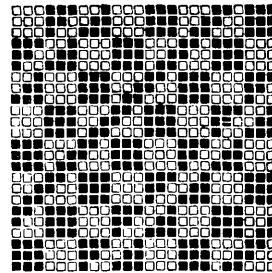


FIG. 555.

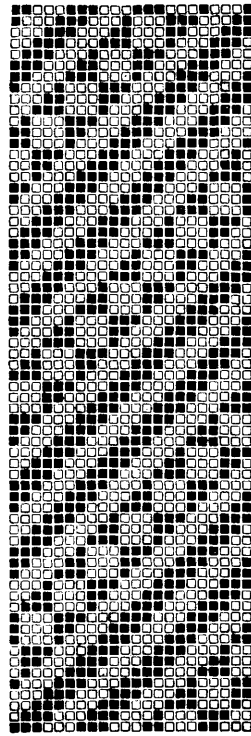


FIG. 556.

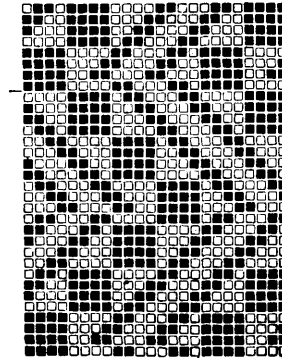


FIG. 557.

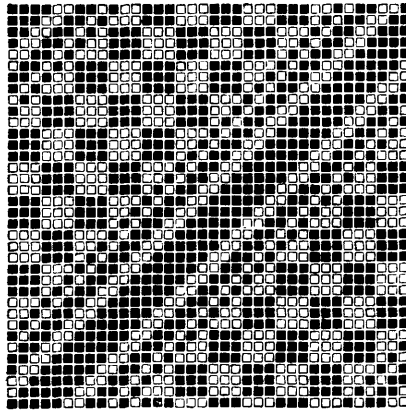


FIG. 558.

FIG. 559.

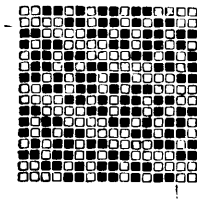


FIG. 560.

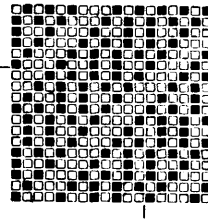


FIG. 561.

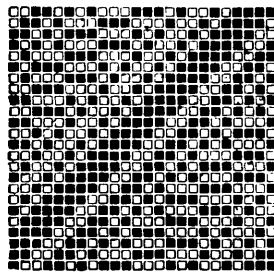
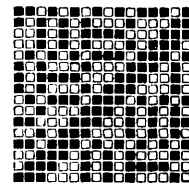


FIG. 562.

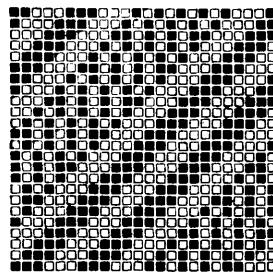


FIG. 563.

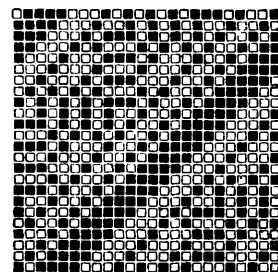


FIG. 564.

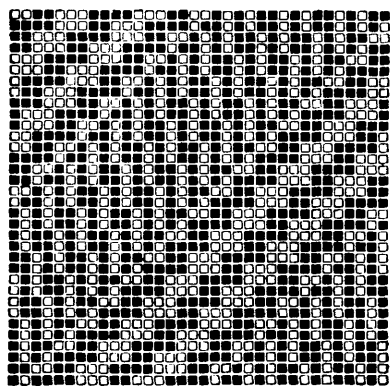


FIG. 565.

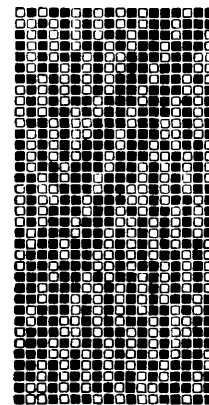


FIG. 566.

maining space with the basket, rib or other weave as desired. Examples are shown at Figs. 540 to 623.

The following are twills combined with basket weaves :

- Fig. 540 12 warp, 12 filling
- Fig. 541 12 warp, 12 filling
- Fig. 542 16 warp, 16 filling

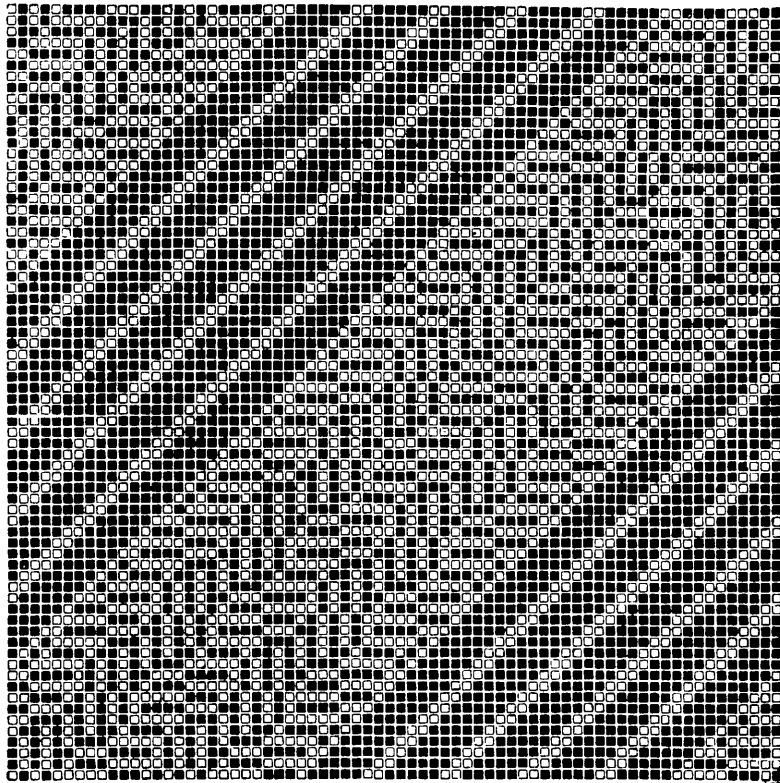


FIG. 567.

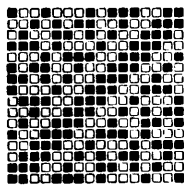


Fig. 568.

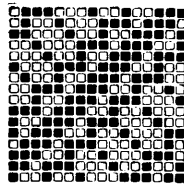


FIG. 569.

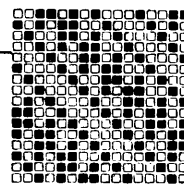


FIG. 570.

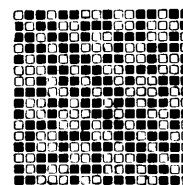


FIG. 571.

Fig. 543	. . . . .	16 warp, 16 filling
Fig. 544	. . . . .	16 warp, 16 filling
Fig. 545	. . . . .	16 warp, 16 filling
Fig. 546	. . . . .	16 warp, 16 filling
Fig. 547	. . . . .	16 warp, 16 filling
Fig. 548	. . . . .	16 warp, 16 filling
Fig. 549	. . . . .	16 warp, 16 filling
Fig. 550	. . . . .	18 warp, 18 filling
Fig. 551	. . . . .	16 warp, 48 filling
Fig. 552	. . . . .	11 warp, 22 filling

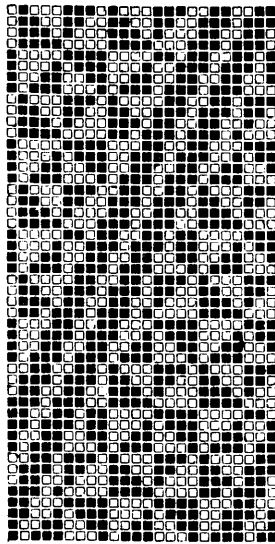


FIG. 572.

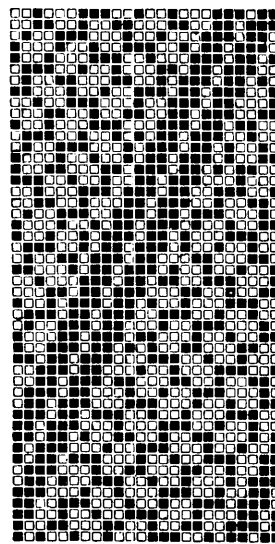


FIG. 573.

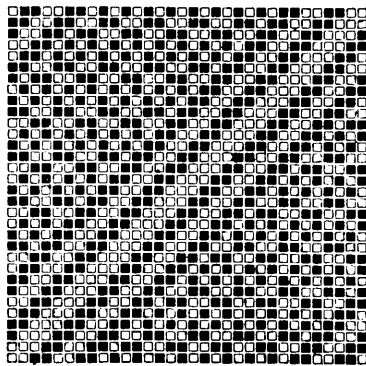


FIG. 574.

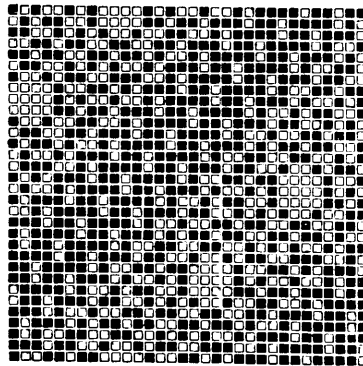


FIG. 575.

FIG. 576.

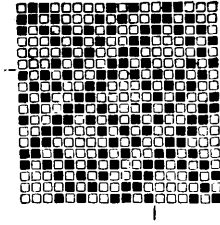


FIG. 577.

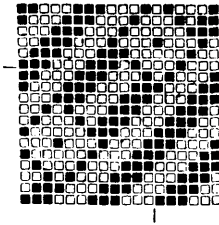


FIG. 578.

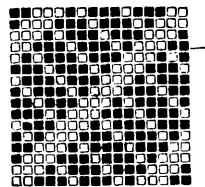
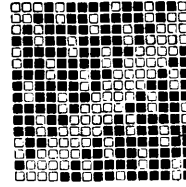


FIG. 579.

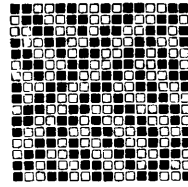


FIG. 580.

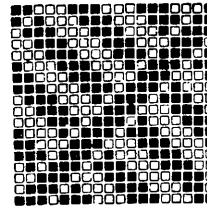


FIG. 581.

FIG. 582.

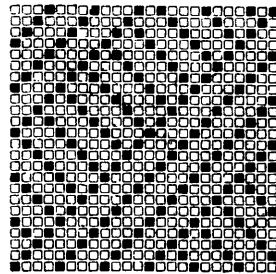


FIG. 583.

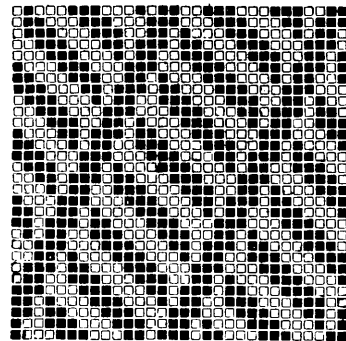
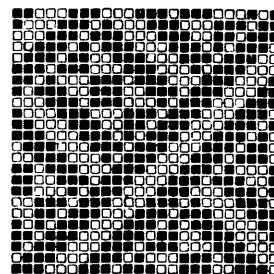


FIG. 584.

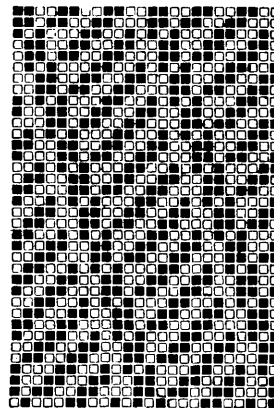


FIG. 585.

FIG. 586.

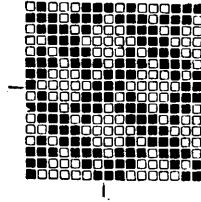


FIG. 587.

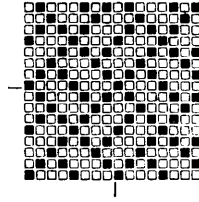


FIG. 588.

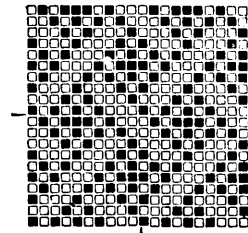
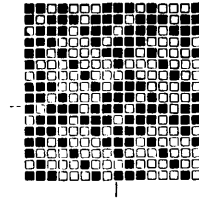


FIG. 589.

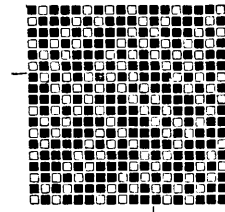


FIG. 590.

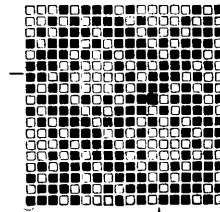


FIG. 591.

FIG. 592.

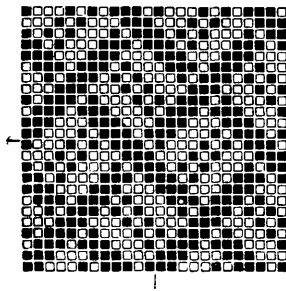


FIG. 593.

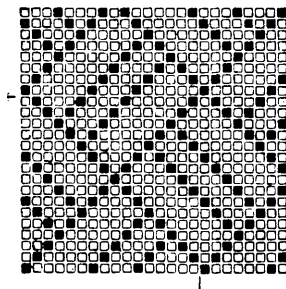
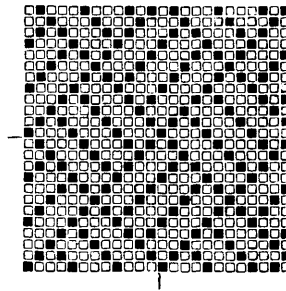


FIG. 594.

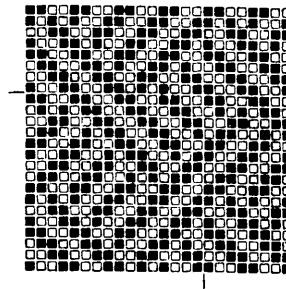


FIG. 595.

Fig. 553	. . . . .	20 warp, 20 filling
Fig. 554	. . . . .	24 warp, 24 filling
Fig. 555	. . . . .	24 warp, 24 filling
Fig. 556	. . . . .	22 warp, 66 filling
Fig. 557	. . . . .	16 warp, 24 filling
Fig. 558	. . . . .	36 warp, 36 filling

The following are twills combined with rib weaves :

Fig. 559	. . . . .	14 warp, 14 filling
Fig. 560	. . . . .	12 warp, 12 filling
Fig. 561	. . . . .	16 warp, 16 filling
Fig. 562	. . . . .	24 warp, 24 filling
Fig. 563	. . . . .	24 warp, 24 filling
Fig. 564	. . . . .	24 warp, 24 filling
Fig. 565	. . . . .	34 warp, 34 filling

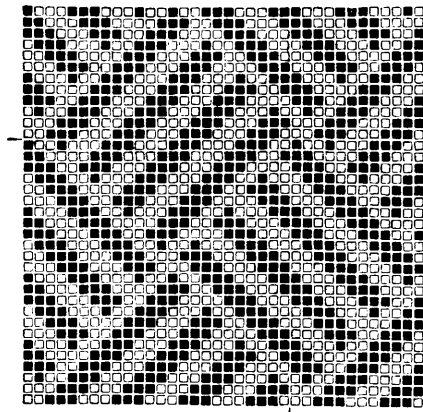


FIG. 596.

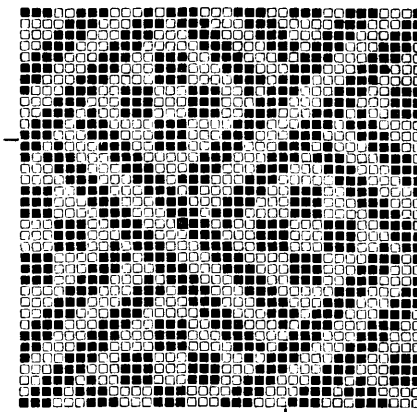


FIG. 597.

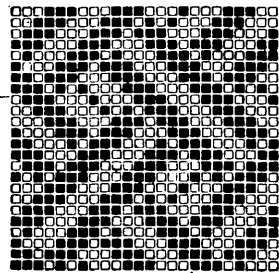


FIG. 598.

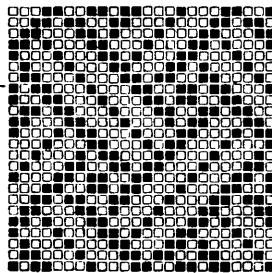


FIG. 599.

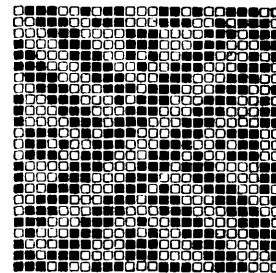


FIG. 600.

Fig. 566 18 warp, 36 filling

Fig. 567 70 warp, 70 filling

The following are twills combined with crêpe weaves :

Fig. 568 16 warp, 16 filling

Fig. 569 16 warp, 16 filling

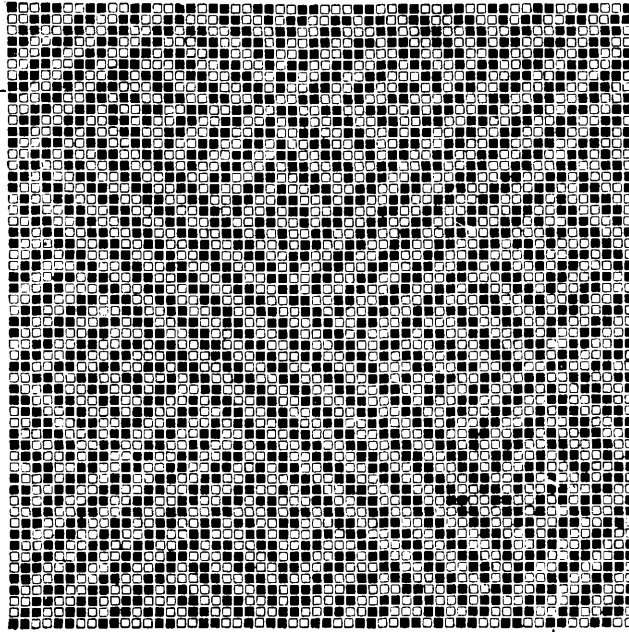


FIG. 601.

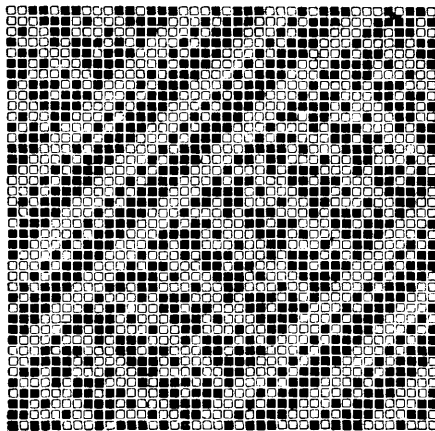


FIG. 602.

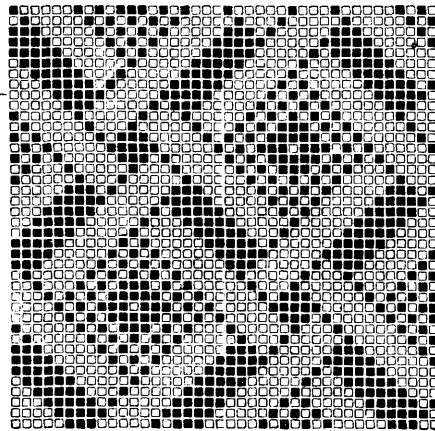


FIG. 603.

Fig. 570	. . . . .	12 warp, 12 filling
Fig. 571	. . . . .	16 warp, 16 filling
Fig. 572	. . . . .	24 warp, 48 filling
Fig. 573	. . . . .	24 warp, 48 filling
Fig. 574	. . . . .	32 warp, 32 filling
Fig. 575	. . . . .	32 warp, 32 filling

The following effects are produced by twills running in opposite directions :

Fig. 576	. . . . .	12 warp, 12 filling
Fig. 577	. . . . .	18 warp, 18 filling
Fig. 578	. . . . .	16 warp, 16 filling
Fig. 579	. . . . .	12 warp, 12 filling
Fig. 580	. . . . .	16 warp, 16 filling
Fig. 581	. . . . .	18 warp, 18 filling
Fig. 582	. . . . .	24 warp, 24 filling
Fig. 583	. . . . .	24 warp, 24 filling
Fig. 584	. . . . .	30 warp, 30 filling
Fig. 585	. . . . .	12 warp, 36 filling

FIG. 604.

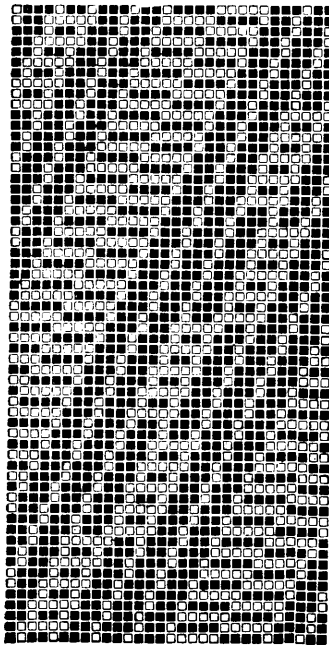


FIG. 605.

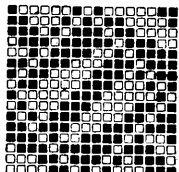
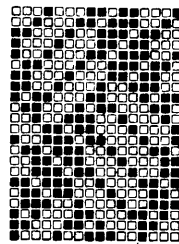


FIG. 606.

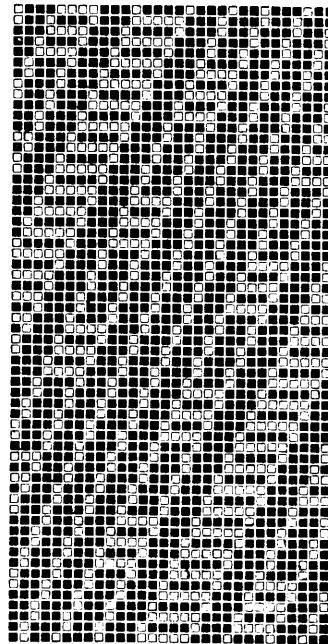


FIG. 607.

The following weaves show twills arranged to produce basket or braided effects :

Fig. 586 8 warp, 8 filling

Fig. 587 8 warp, 8 filling

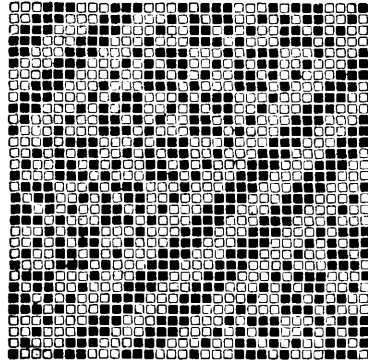


FIG. 608.

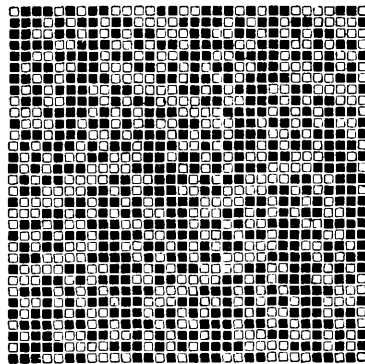


FIG. 609.

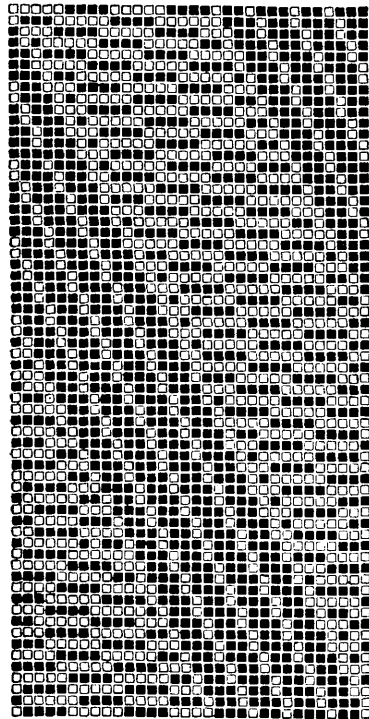


FIG. 610.

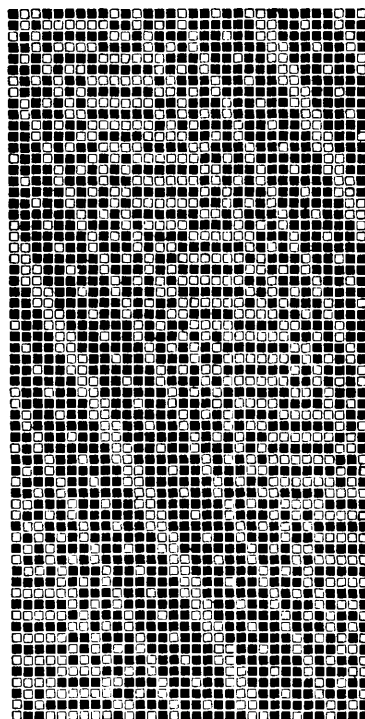


FIG. 611.

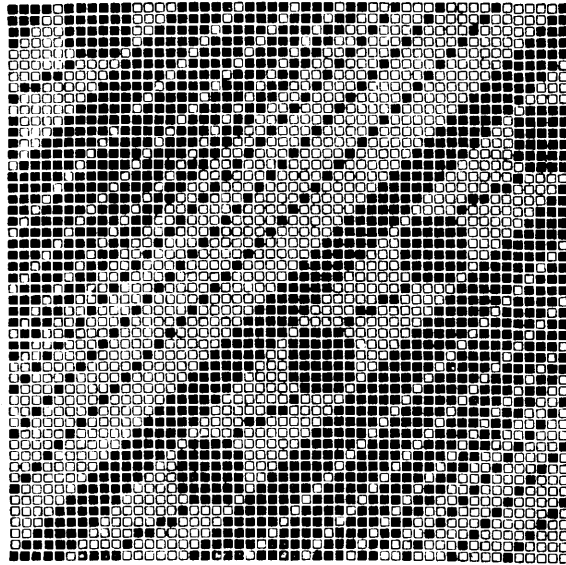


FIG. 612.

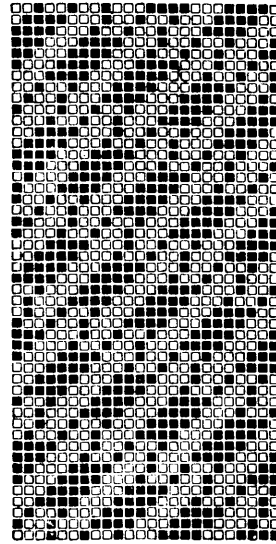


FIG. 613.

FIG. 614.

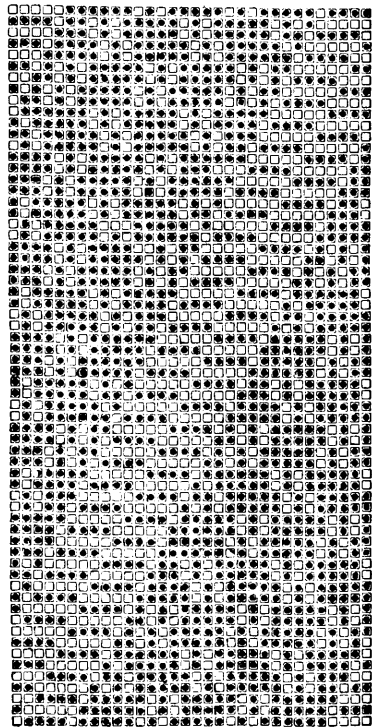


FIG. 615.

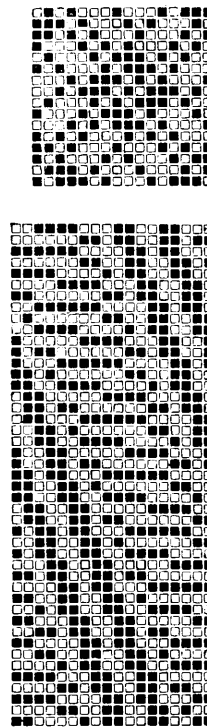


FIG. 616.

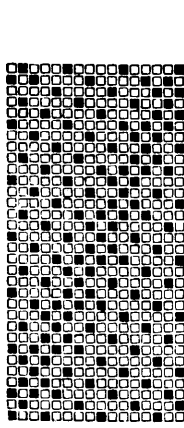


FIG. 617.

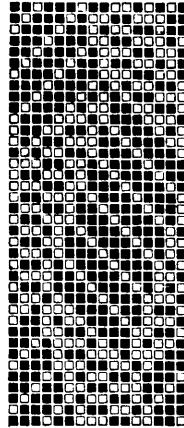


FIG. 618.

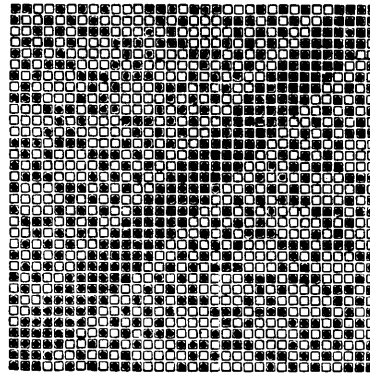


FIG. 619.

Fig. 588	. . . . .	8 warp, 8 filling
Fig. 589	. . . . .	10 warp, 10 filling
Fig. 590	. . . . .	12 warp, 12 filling
Fig. 591	. . . . .	12 warp, 12 filling
Fig. 592	. . . . .	12 warp, 12 filling
Fig. 593	. . . . .	12 warp, 12 filling
Fig. 594	. . . . .	16 warp, 16 filling

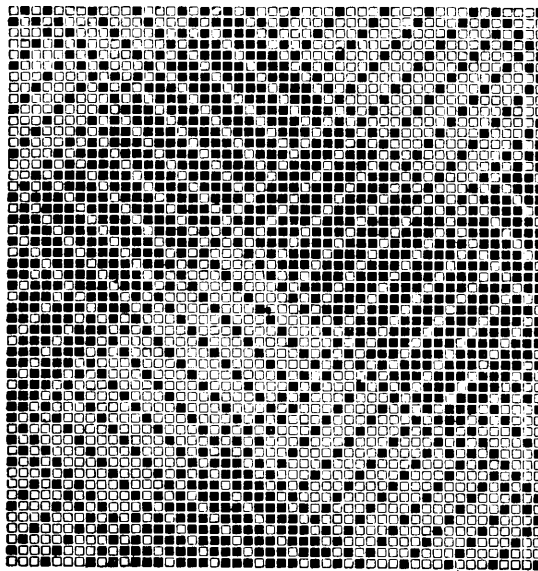


FIG. 620.

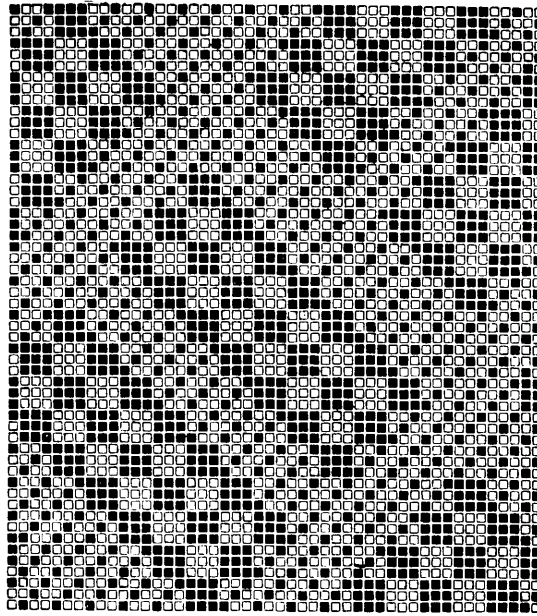


FIG. 621.

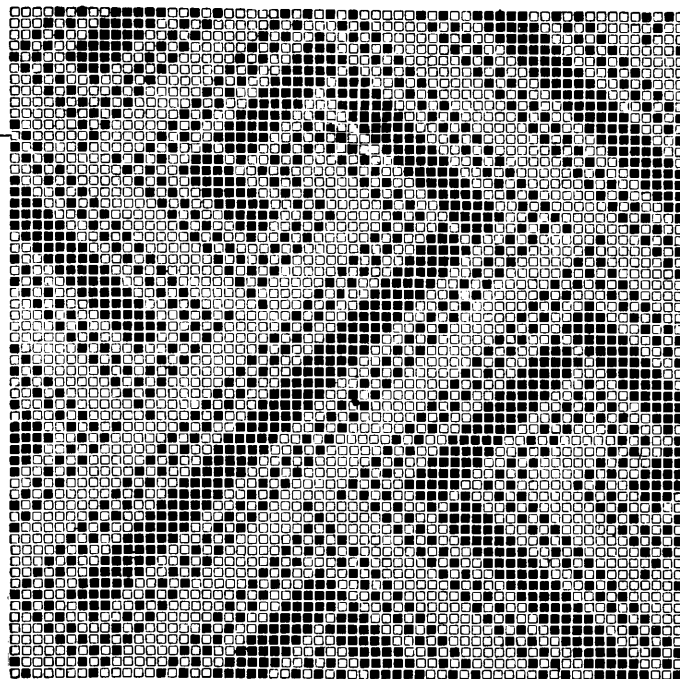


FIG. 622.

Fig. 595	. . . . .	16 warp, 16 filling
Fig. 596	. . . . .	24 warp, 16 filling
Fig. 597	. . . . .	24 warp, 24 filling
Fig. 598	. . . . .	16 warp, 16 filling
Fig. 599	. . . . .	16 warp, 16 filling
Fig. 600	. . . . .	24 warp, 24 filling
Fig. 601	. . . . .	48 warp, 48 filling

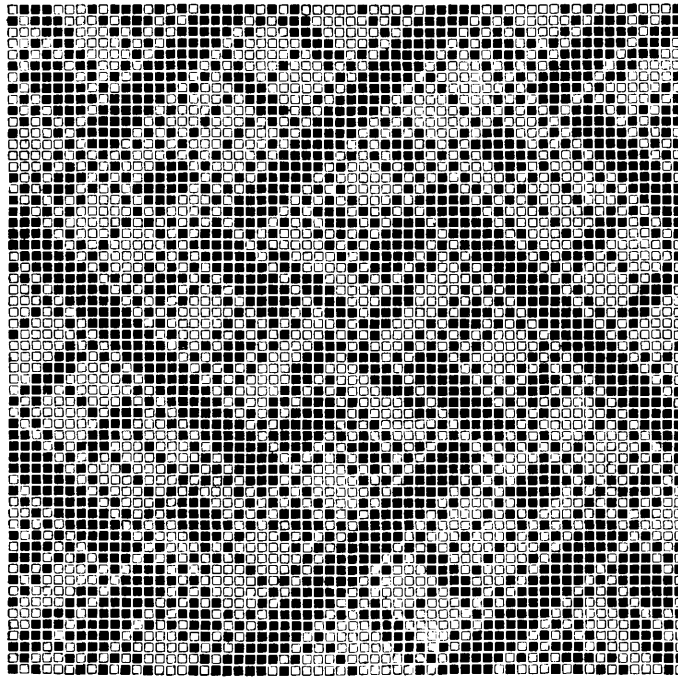


FIG. 623.

Figs. 602 to 623 show fancy twills formed by combinations of twill lines with various other weaves :

Fig. 602	. . . . .	40 warp, 40 filling
Fig. 603	. . . . .	30 warp, 30 filling
Fig. 604	. . . . .	12 warp, 22 filling
Fig. 605	. . . . .	30 warp, 60 filling
Fig. 606	. . . . .	16 warp, 16 filling
Fig. 607	. . . . .	30 warp, 60 filling
Fig. 608	. . . . .	32 warp, 32 filling

Fig. 609	. . . . .	16 warp, 32 filling
Fig. 610	. . . . .	32 warp, 64 filling
Fig. 611	. . . . .	32 warp, 64 filling
Fig. 612	. . . . .	50 warp, 50 filling
Fig. 613	. . . . .	24 warp, 48 filling
Fig. 614	. . . . .	16 warp, 16 filling
Fig. 615	. . . . .	32 warp, 64 filling
Fig. 616	. . . . .	18 warp, 45 filling
Fig. 617	. . . . .	16 warp, 32 filling
Fig. 618	. . . . .	16 warp, 38 filling
Fig. 619	. . . . .	33 warp, 33 filling
Fig. 620	. . . . .	40 warp, 40 filling
Fig. 621	. . . . .	48 warp, 54 filling
Fig. 622	. . . . .	60 warp, 48 filling
Fig. 623	. . . . .	60 warp, 60 filling